IBM SYSTEM/3

IBM System/3
Communications Control Program
Programmer's Reference Manual

Program Numbers:

5702-SC1	(Model 10 Disk System)
5704-SC1	(Model 15)
5704-SC2	(Model 15)
5705-SC1	(Model 12)

Feature 6033

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This is a major revision of, and obsoletes, GC21-7579-3 and Technical Newsletter GN21-5442. Information has been added to support Program Number 5704-SC2 for the IBM System/3 Model 15. Because the changes and additions are extensive, this manual should be reviewed in its entirety.

This edition applies to the IBM System/3 Communications Control Program for:

- Version 13, modification 00, of Program Number 5702-SC1 for the IBM System/3 Model 10
- Version 05, modification 00, of Program Number 5704-SC1 for the IBM System/3 Model 15
- Version 01, modification 00, of Program Number 5704-SC2 for the IBM System/3 Model 15
- Version 02, modification 00, of Program Number 5705-SC1 for the IBM System/3 Model 12

This edition also applies to all subsequent versions and modifications until otherwise indicated in new editions or technical newsletters.

Changes to the information herein are made periodically. Before using this publication to operate an IBM system, refer to the latest *IBM System/3 Bibliography,* GC20-8080, for the editions that are applicable and current.

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A form for readers' comments is provided at the back of this publication. If the form has been removed, comments concerning manual content may be addressed to IBM Corporation, Publications, Department 245, Rochester, Minnesota 55901.

Preface

This publication describes how to write telecommunications application programs to run under control of the communications control program (CCP). The CCP is a feature of disk system management that facilitates the implementation of telecommunications applications on the Model 10 Disk System and Models 12 and 15.

This manual is intended for programmers who use one or more of the following System/3 programming languages:

- RPG II
- Subset American National Standard (ANS) COBOL
- FORTRAN IV
- Basic Assembler

The introduction to this manual summarizes the purpose and operation of the CCP. Subsequent chapters describe the standard application program interface to the CCP, examples of typical application program logic, application programming in COBOL, FORTRAN IV, RPG II, and Basic Assembler, preparing source programs to run under the CCP, program testing, and use of the optional 3270 display format facility of the CCP.

System/3 Model 8

The System/3 Model 8 is supported by System/3 Model 10 Disk System control programming and program products. The facilities described in this publication for the Model 10 are also applicable to the Model 8, although Model 8 is not referenced. However, the integrated communications adapter (ICA) and local display adapter are available on the Model 8. If you have the ICA or local display adapter, it is always designated on BSCA line 2. Therefore, you must specify line 2 whenever it is required, or enter the BSCA OCL statement (// BSCA LINE-2) at execution time.

It should be noted that not all devices and features which are available on the Model 10 are available on the Model 8. Therefore, Model 8 users should be familiar with the contents of *IBM System/3 Model 8 Introduction*, GC21-5114.

Prerequisites

The CCP application programmer need not have extensive previous knowledge of telecommunications networks, data link control, and the characteristics of specific terminal devices. This manual assumes, however, that the programmer has a working knowledge of his programming language and is familiar with the configuration of the CCP system in his installation.

This manual has no specific prerequisite publications; however, many references are made to the following manuals that are required by the programmer using the Model 10 Disk System and Model 12, and Model 15 respectively:

- *IBM System/3 Models 10 and 12 Communications Control Program System Reference Manual,* GC21-7588
- *IBM System/3 Model 15 Communications Control Program System Reference Manual,* GC21-7620

Also, in order to fully utilize the display format facility of the CCP, the programmer must have a basic understanding of the concepts and operation of the IBM 3270 Information Display System as given in *IBM 3270 Information Display System Component Description,* GA27-2749.

Other publications that are useful to the programmer are listed in *Appendix C: Bibliography.*

Contents

How To Use This Manual

In order to gain an overall understanding of the requirements for writing application programs under the CCP, read chapters 1, 2, and 3 before reading the chapter that applies to your programming language. These chapters contain:

Chapter 1: Summary of the purpose and operation of the CCP.

Chapter 2: Description of the application program interface to the CCP, independent of any particular programming language.

Chapter 3: General description of terminal classes, program types, and CCP application program logic.

After you have read the first three chapters, read thoroughly the chapter that applies to your programming language:

Chapter 4: COBOL

Chapter 5: FORTRAN IV

Chapter 6: RPG II .

Chapter 7: Basic Assembler

If your program will use the 3270 Display Format Facility of the CCP to communicate with components of the IBM 3270 Information Display System, read chapter 8 after you have an understanding of CCP application programming in your language.

Before attempting to write a CCP application program, be sure to read *Chapter 9: Program Preparation,* since that chapter contains important disk and unit record file considerations you must be aware of.

Reference Aids

The appendixes provide convenient summaries of application program operation codes and return codes as well as a glossary of terms and a bibliography.

Use the index at the end of the manual to locate specific subjects.

Chapter 1: Introduction

The Communications Control Program (the CCP) is a system control program feature of the IBM System/3 Model 10 Disk System, IBM System/3 Model 12, and IBM System/3 Model 15 designed to facilitate the development and implementation of telecommunications applications. The CCP serves as the control program of a telecommunications subsystem, operating in conjunction with disk system management (referred to by the abbreviation DSM in this manual).

Under the CCP, an online network of terminals can call application programs as needed and access a common set of disk files. If sufficient main storage is available, the CCP permits several application programs to be executing concurrently under its control.

Communications application programs to be run under control of the CCP can be written in any of the high-level languages available with Models 10, 12, and 15 – RPG II, COBOL, and FORTRAN IV – and in Basic Assembler. Individual application programs can be written without detailed knowledge of the requirements for programming under a telecommunications system and, with few exceptions, as though they are to be run individually, with access to all system resources.

With the facilities provided by the CCP, the System/3 can be used either as a host system or as a subhost system:
Host System: The System/3 is the central controller of a network of start-stop and/or binary synchronous terminals.
Subhost System: The System/3, while directly controlling a group of terminals, is itself a tributary station to a large central processor, such as System/370.

Note: For an introduction to the CCP that includes more detailed descriptions of CCP services and relationships between the CCP and other System/3 programs, see the *CCP System Reference Manual,* GC21-7588 for Models 10 and 12, GC21-7620 for Model 15. If you are not acquainted with terms and abbreviations used in this manual, you can find definitions either in *Appendix B. Glossary* at the end of this manual, or in *IBM Data Processing Glossary,* GC20-1699.

CCP STAGES

Establishing and operating the CCP in a particular environment is accomplished in three stages:

- Generation
- Assignment
- Operation

Generation Stage

CCP generation is the process whereby your installation creates its individual version of the CCP. The purpose of generation is to establish the required capabilities of the CCP by creating a set of CCP object modules and subroutines, unique to the requirements of your installation. The process of generation involves:

1. Describing the type of equipment to be used by the communications system and other permanent features of the CCP system.
2. Creating a set of control routines whose specific content may be unique to your installation.
3. Joining the routines by a link-editing process.
4. Copying appropriate additional supporting routines.
5. Initializing the control file that the assignment stage and the operational stage use ($CCPFILE).

CCP Generation is described in *CCP System Reference Manual,* GC21-7588 for Models 10 and 12, GC21-7620 for Model 15.

Assignment Stage

CCP assignment stage is a brief process by which one or more *sets* of specific environments in which the CCP can run are defined. Each set includes:

- Specific items of information pertaining to the entire CCP, such as the current password.
- Programs that may be run under the CCP and the resources that each requires.
- Files that are accessible to each program.
- The current line/terminal configuration.
- Symbolic terminal names and the actual terminals to which they apply.
- Terminal attributes.

The assignment run need be repeated only when some of the specific information given in a previous assignment run must be changed. For example, CCP assignment must be repeated when new programs and files are to be used under the CCP.

As a programmer, you must be familiar with the contents of the CCP assignment sets, since you must be aware of characteristics of files, terminals, and communication lines available to programs you write. You can determine the contents of assignment sets from the listing produced by the Assignment List program.

See *CCP System Reference Manual,* GC21-7588 for Models 10 and 12, GC21-7620 for Model 15, for detailed information about CCP Assignment.

Operational Stage

The operational stage begins with *operational startup,* when the CCP is loaded into main storage. During startup, CCP routines open disk files, adapters, and communication lines and complete various tables and control blocks. During *operation*, the CCP supervises the environment in which your application programs run and provides communications services to your programs. The operational stage is concluded by shutdown, which is initiated by the system operator. During *shutdown,* the CCP allows programs that are currently executing, or that are currently scheduled or chained, to finish processing, then it closes communication lines, adapters, and files.

See *CCP System Operator's Guide,* GC21-7581 for Models 10 and 12, or GC21-7619 for Model 15 for a detailed description of CCP operation.

TERMINALS AND FEATURES SUPPORTED

The following terminals may be used with the communications control program.

Through the multiple line terminal adapter:

- 1050 Data Communication System
    - Switched
    - Multipoint nonswitched
- 2740 Communication Terminal Model 1
    - Basic
    - Checking
    - Dial
    - Dial with checking
    - Dial with transmit control
    - Dial with transmit control and checking
    - Station control
    - Station control with checking
- 2740 Communication Terminal Model 2
    - Station control
    - Station control, checking
    - Station control, buffered receive
    - Station control, buffered receive, checking
- 2741 Communication Terminal
    - Basic
    - Switched
- 3767 Communication Terminal (when simulating a 2740 Model 1)
    - Checking
    - Dial with checking
    - Station control, checking

  (when simulating a 2740 Model 2)
    - Station control, checking
- 3767 Communication Terminal (when simulating a 2741)
    - Basic
    - Switched
- Communicating Magnetic Card SELECTRIC® Typewriter (appears identical to a 2741 switched)
    - Point-to-point switched
- System/7 (appears identical to a 2740 Model 1)
    - Checking
    - Dial with checking
    - Station control with checking
- 5100 Portable Computer (when simulating a 2741)
    - Basic
    - Switched
- 5230 Data Collection System (appears identical to a 3741 Model 2 or 4)
    - Point-to-point switched
    - Point-to-point nonswitched

With the binary synchronous communications adapter:

- 3270 Information Display System
    - Multipoint nonswitched
- 3275 Information Display Station
    - Switched
- 3735 Programmable Terminal
    - Switched
    - Multipoint nonswitched
- 3741 Data Station Model 2, Programmable Work Station Model 4
    - Point-to-point nonswitched or switched
    - Multipoint
- System/3
    - Point-to-point switched
    - Point-to-point nonswitched
    - Multipoint with the CCP as control station
    - Multipoint with the CCP as a tributary
- System/7 Feature 2074 or RPQ (see *Note*)
    - Point-to-point switched
    - Point-to-point nonswitched
    - Multipoint with the CCP as control station
- System/360, System/370
    - Point-to-point switched
    - Point-to-point nonswitched
    - Multipoint with the CCP as tributary

Terminals that are equivalent to those explicitly supported may also function satisfactorily. The customer is responsible for establishing equivalency. IBM assumes no responsibility for the impact that any changes to the IBM-supplied products or programs may have on such terminals.

Note: Under BSCA, the System/7 is supported only as it is supported by the Multiline/Multipoint BSCA IOCS — see *IBM System/7 (RPQ) Binary Synchronous Module Programming Guide and Reference Manual,* SC34-1510.

Chapter 2: Standard Application Program Interface To The CCP

The *standard interface* (that is, the procedures and common data areas) used by application programs to request the CCP to perform communications operations with remote terminals or the system operator's console is composed of the following basic elements:

- Communications Service Subroutine
- Parameter List
- Record Area
- A set of communications operations that can be issued to the CCP

The details of this interface differ slightly among the programming languages—RPG II, COBOL, FORTRAN IV, and Basic Assembler—but the functions performed by the basic elements remain essentially the same. Where the interface for a particular language differs from the standard interface, you are referred to the chapter covering that language.

In order to perform a communications operation, such as writing a message to a terminal, an application program must do the following:

1. Provide storage space within itself for a parameter list and record area and specify the format of these areas.
2. Prepare the record area for the operation.
3. Set the contents of the parameter list.
4. Invoke the communications service subroutine to perform the operation.
5. Check appropriate return codes to determine the result of the operation.

Since your program may be competing with other programs for system resources such as terminals, disk files, and unit record devices, the CCP ensures that these resources are available to your program before your program is allowed to run. Each terminal required by your program is allocated exclusively to your program until your program releases it (see index entry *Release Terminal Operation*) or until the execution of your program has ended. When either of these events has occurred, the terminal is free to be allocated to another program (or to enter commands, if it is a command terminal). Because the CCP also allocates the use of unit record devices, you can code I/O operations using these devices as though your program has exclusive control of them. (Exception for Model 15 CCP: Your program can share use of the 1403 printer with another program running concurrently if PRINTER–SHR is specified in the PROGRAM assignment statement for your program [see *CCP System Reference Manual*]. You should consider in the design of your program that you do not have exclusive control of the printer.)

CCP may receive a request for a program that uses:

- A terminal that is presently allocated to another program.
- A disk file that is allocated to another program in such a manner that the access methods conflict. For example, a currently executing program adds consecutively to a file and the program being requested adds to the same file.
- A disk file is specified as NOSHR on the FILES parameter of the PROGRAM assignment statement or as SHARE-NO on the FILE OCL statement.

The CCP rejects such a program request or queues it, depending on the queue status of the terminal (see /Q and /NOQ commands in *CCP Terminal Operator's Guide,* GC21-7580). When the previous program has terminated, terminals and disk files used by that program are available to subsequent programs.

Note: Model 10 and Model 12 CCPs can also queue (/Q) a request for a program that uses a unit record device that is temporarily unavailable. Model 15, however, normally rejects requests for programs that require a unit record device that is unavailable. The exception is if the requested program uses the printer and the printer is either permanently allocated to the CCP partition, or spool is intercepting the CCP partition, and the requested program uses no other unit record devices or terminals.

COMMUNICATIONS SERVICE SUBROUTINE

Since RPG II, COBOL, and FORTRAN IV, do not include special statement types for general purpose terminal I/O operations and other communications services (see *Operations*), the CCP provides one or more communications service subroutines to application programs written in each language. (For Basic Assembler Programs, a macro instruction is provided – see index entry *$NCIO macro.*) The communications service subroutine converts the application program's request into a standard request to the CCP communication facilities.

The communication service subroutine (RPG II programs may actually use more than one) must be link edited to each application program prior to using the program under the CCP. Thus, the communication service subroutine, although provided by the CCP, actually becomes a part of the application object program. See *Chapter 9: Program Preparation* for procedures for preparing an application program to run under the CCP.

In COBOL and FORTRAN IV, the application program initiates a communications operation by issuing a CALL statement to the communications service subroutine. In RPG II, the program can initiate an operation and invoke the communications service subroutine either through the SPECIAL or EXIT/RLABL facilities of the language.

PARAMETER LIST

You must provide a parameter list within your program with each request for a communications operation. The parameter list specifies the details of the communications operation and provides locations within itself where the CCP returns information about the results of the operation. This chapter describes the parameter list as it is presented by the communications service subroutine to the CCP communications facilities. In RPG II, the parameter list as defined in the user program is somewhat different (see *Chapter 6: RPG II*).

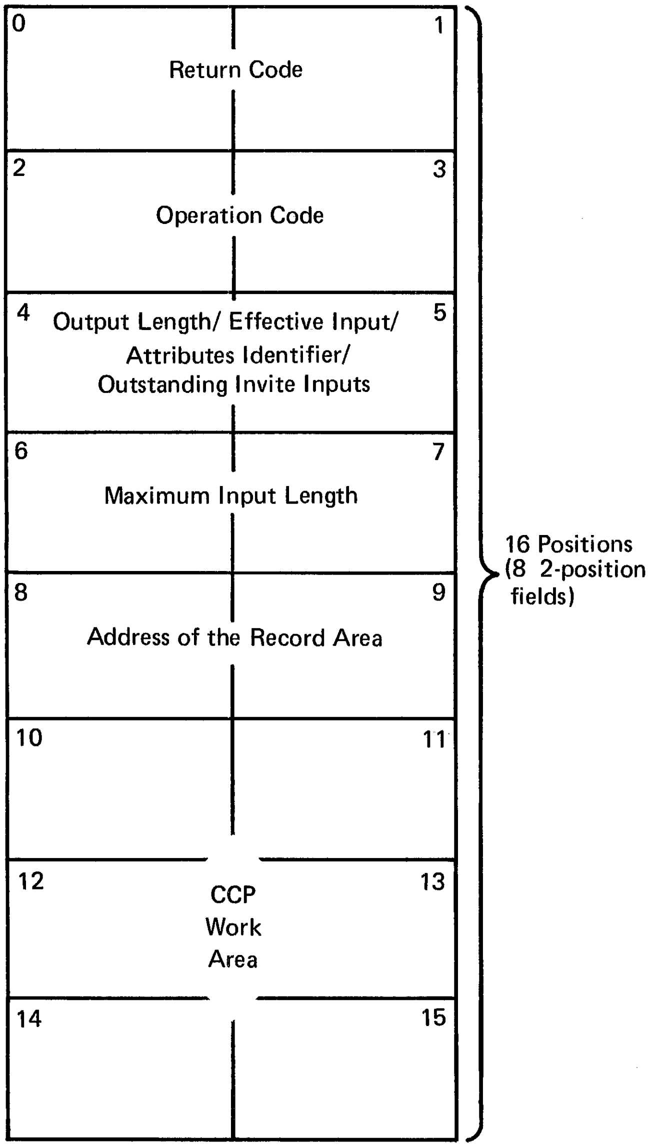
The parameter list is 16 positions long, consisting of eight two-position fields, as shown in Figure 2-1.

Return Code (Positions 0-1)

Although this field (see Figure 2-1) must be provided in the parameter list, the CCP ignores the contents at the beginning of the operation. At the completion of each operation, before returning control to the application program, the CCP places a value in this field indicating the status of the operation:

- Operation completed normally (value of zero).
- Operation resulted in an I/O error (negative value).
- Operation resulted in an exception condition (positive value).

Specific return code values and meanings are given in *Appendix E: Return Codes.*



Note: In RPG II, the format of the parameter list is somewhat different (see *Chapter 6: RPG II*).

Figure 2-1. Parameter List

In order to determine the results of a communications operation, you must include coding in your program to test the return code. The degree of return code checking and the actions taken based on return code checking will vary in different applications, however, it is strongly recommended that return code checking at the level of normal completion (zero return code) or abnormal completion (non-zero return code) be done in all programs.

Examples of testing return codes are given in chapters 4 through 6. Recommended actions to be taken by your program for each return code are given in *Appendix E.* RPG II programmers should see *Chapter 6: RPG II* for additional information concerning handling of return codes in that language.

Operation Code (Positions 2-3)

For each communications operation (except some RPG II operations), this field must contain a code that indicates the specific operation to be performed. The contents of this field are the same after completion of the operation as when the operation began. See *Operations,* later in this chapter, for descriptions of the valid operations and operation modifiers that can be issued to the CCP by an application program.

Third Field (Positions 4-5)

This field in the parameter list can contain four different kinds of information:

1. *Output Length* – provided by your program for output operations (see *Output Operations,* following)
2. *Effective Input Length* – returned by the CCP (see *Input Operations,* following)
3. *Terminal Attributes Identifier* – provided by your program (see *Acquire Terminal Operation,* following)
4. *Count of Outstanding Invite Input Operations* – returned by the CCP (see *Input Operations and Release Terminal Operation,* following)

Output Operations: This field must contain the length of the data to be transmitted from your program, that is, the number of characters of data you wish to write from the record area in your program, not including the six positions for the symbolic terminal name and not including line control characters, which are added to your data by the CCP. (In RPG II, the output length is placed in the output record area; see Chapter 6.)

Input Operations: On each completed input operation, the CCP calculates and places into this field the actual length of the input data passed to the application program. This effective input length does not include the symbolic terminal name, line control characters, backspace characters, or data which the CCP cannot pass to the application program when the amount of data received exceeds the size of the record area (see *Maximum Input Length*, the next field in the parameter list). However, the effective input length does include record separator characters (see index entry *record separators*). The CCP ignores the contents of this field at the start of an input operation.

If *data mode escape* is allowed in your CCP system (see index entry) and a terminal enters the /RELEASE command after entering the data mode escape characters, your program will receive a 08 return code from any of the following input operations: Get, Accept Input, Put-Then-Get, and Stop Invite Input (see index entries). The 08 return code indicates that the terminal to which the input operation was issued is no longer available to your program. In this case, CCP places the current number of outstanding *Invite Inputs* for your program (see index entry) in positions 4-5 of the parameter list. This information is important in *multiple requesting terminal (MRT) programs* (see index entry).

Acquire Terminal Operation: If you issue an *Acquire Terminal* operation (see index entry) which sets the attributes of the terminal to be acquired, this field must identify the attribute set you want to assign to the terminal. The terminal attribute set is defined in the TERMATTR assignment statement – see *CCP System Reference Manual.*

Release Terminal Operation: If your program releases a terminal (see index entry *Release Terminal operation*) and receives a zero return code from the operation, CCP places the current number of outstanding Invite Inputs for your program (see index entry) in the third field (positions 4-5) of the parameter list.

Maximum Input Length (Positions 6-7)

On each operation involving input data, you must enter a value into this field representing the maximum number of bytes of input data you expect to receive. This value does not include the six characters for the terminal name. This value must be greater than zero and no larger than the size of the record area provided by your program. The CCP does not alter this value during the operation.

Address of the Record Area (Positions 8-9)

This field is set by the communications service subroutine (except in Basic Assembler, where this field is set by the $NCIO macro) to contain the main storage address of the record area (see *Record Area*). This field addresses the first (leftmost) position of the name field in the record area, not the first position of data; therefore, the data actually begins at the address given, plus six. For operations not involving data transfer, this field may point to a record area containing only the name field.

This field is not present in the parameter list used by RPG II application programs.

CCP Work Area (Positions 10-15)

These positions are used for a work area by the CCP. Your program must not use these positions.

RECORD AREA

With each communications operation your program issues to the CCP (except Shutdown Inquiry), it must provide a *record area.* A record area is an area in the application program that consists of two parts. The standard record area for operations involving data transfer consists of a six-position *name field* followed by a *data area* (Figure 2-2). Exceptions to this standard format occur for RPG II (see *Chapter 6: RPG II*) and when the *3270 Display Format Facility* (see index entry) is used.

The name field contains either the name of the program (if a chained task operation), or the symbolic terminal name that is to be involved in the operation.

The parameter list field containing the record area address (Figure 2-1) always points to the leftmost position of the name field. Data transfer, however, always occurs into and out of the data area segment of the record area. Lengths specified in the parameter list for operations involving data transfer refer to the length of the data area portion of the record area, except in certain RPG II output operations.

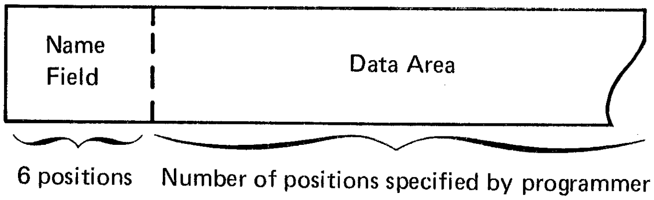


Figure 2-2. Standard Record Area

Program Name

The program name is the name of the program to be called on a Chain Task Request operation (5704-SC2 only). For a task chain operation, your program must place the name of the program to be chained in the first six positions of the record area (left-justified and padded with blanks if less than six characters). If data is to accompany the chain request, the data follows the program name in the record area, and PGMDATA-YES must be specified on the PROGRAM assignment statement (see the *Model 15 CCP System Reference Manual,* GC21-7620) for the requested program.

Symbolic Terminal Name

The terminal with which a communications operation is performed is identified by a symbolic terminal name in the first six positions of the record area (left justified). In most operations, the application program must place the name into the name field of the record area to specify the terminal with which to operate; in certain operations, however, the CCP places the name into the record area to inform the program with which terminal the operation took place. Each symbolic terminal name refers to a specific physical terminal device.

Three classes of terminal names are available for use in application programs:

1. *User-Defined Names:* These are the terminal names defined in TERMNAME statements during CCP assignment. The structure of these names must conform to the following rules:

   - The first character must be alphabetic (including #, $, and @).
   - Each succeeding character can be either alphabetic or numeric.
   - One to five of the six possible positions in the name can be blank, but no blanks may be embedded between other characters. For example, the following names are valid: TERMƀƀ,

Tƀƀƀƀƀ; the following are invalid: TERMƀ2, ƀTERM2.

- Each terminal name must be unique.
- The names CONSOL, ALL, and a name consisting of six blanks cannot be user-defined.

2. *CONSOL:* On the System/3 Model 10 and Model 12, the symbolic name CONSOL refers to the system operator's 5471 Printer/Keyboard. On the Model 15, the symbolic name CONSOL refers to the system operator's keyboard and 3277 Display Station, referred to as the CRT/Keyboard. Application programs can communicate with the system operator's console at any time; however, the console is never allocated to the program. Operations issued to the console by programs running under the CCP must be issued as communications operations; if issued in any other way, the results are unpredictable. The only operations that can be issued to the console are:

   - Put
   - Put-No-Wait (handled as a Put by the CCP)
   - Put-Then-Get
   - Get Attributes
   - Accept Input (to accept only data that accompanies the program request)

   The CCP automatically releases the console from any program it requests as follows:

   - If the console requested the program and the PROGRAM assignment statement (see *CCP System Reference Manual*) specifies PGMDATA-NO, the console is released when the program is loaded.
   - If the console requested the program and the PROGRAM assignment statement specifies PGMDATA-YES, the console is released after an Accept Input operation results in the console program data being passed to the user program.

   Note to Model 10 and 12 users: Programs that use *symbolic files* (see index entry) must allow data to be entered with the program request if they could be requested by the console (see *program request command* in *CCP System Operator's Guide*). These programs must also open all physical files to be referenced by a symbolic file prior to issuing an Accept Input operation. (In RPG II, these files are automatically opened prior to the first input operation.)

3. *Blanks:* Programs that handle only one requesting terminal per execution (designated *single requesting terminal (SRT) programs,* see index entry), can issue communications operations with six EBCDIC blanks (hexadecimal 40) in the symbolic terminal name portion of the record area. The CCP interprets the blank name as a reference to the terminal that requested the program. Upon completion of such an operation, the CCP sets the first six positions of the record area to contain the name of the requesting terminal. The program cannot use blanks after it has released the requesting terminal (see index entry *Release Terminal* operation).

The use of symbolic names for terminals allows programs to be relatively independent of the specific terminals. However, the programmer must be aware of the type of terminal he is using since he must know the record length of the device; whether the terminal is capable of input only, output only, or both input and output; and other information (see index entry *Get Attributes*). The system operator can reassign a symbolic name of a terminal (perhaps the terminal is out of order or offline) to a different terminal during operation of the CCP to allow execution of programs using that terminal name.

Of those operations requiring a six-position symbolic terminal name area in the record area (only Shutdown Inquiry does not) only *Accept Input* does not require that the area contain a valid symbolic terminal name. The contents of the terminal name field for that operation are not used by the CCP.

Whenever you specify a symbolic terminal name other than CONSOL in an operation, you must ensure that the terminal is allocated to your program under that defined name. The only exceptions to this rule are the *Acquire Terminal* operation, (see index entry) which is a request to obtain a terminal, and Get *Terminal Attributes,* (see index entry) which can be requested for any defined terminal name in the system.

Multicomponent Terminal Considerations

Multicomponent terminals are a special class of terminals that can have more than one input and/or output device attached. The 1050 Data Communications System is the only terminal currently supported by the CCP that is considered to be a multicomponent terminal. (Each component of the 3270 Information Display System is considered a separate terminal and has its own name.)

A 1050 system is treated by CCP as if it were one terminal regardless of the number of components attached. For example, the entire 1050 system is always allocated to a program; it is impossible for one component to be allocated to one program while another component of the same 1050 system is allocated to another program. Therefore, any program in control of a 1050 system has access to *all* components of that particular 1050 system.

As with every other terminal in the CCP system, the 1050 has a symbolic terminal name. However, this symbolic terminal name has a principal input and principal output component associated with it. When the symbolic terminal name is used in an operation, it refers to the principal components.

You can address other than the principal input and/or principal output component of a 1050 system. In addition to the symbolic terminal name, you can assign symbolic names to a component or pair of components. These are called symbolic sub-terminal names. To direct an operation to a specific component, use the symbolic sub-terminal name associated with that component.

The following special rules apply to use of multicomponent terminals:

- Only one *Invite Input operation* (see index entry) may be outstanding to the terminal at one time, regardless of the number of input components attached to the terminal.
- When an operation is issued in which CCP returns a symbolic terminal name, such as Accept Input, the name returned is always the master terminal name, never a symbolic sub-terminal name.
- The Acquire Terminal operation must specify a symbolic terminal name, not a symbolic sub-terminal name.
- The Release Terminal operation must specify a symbolic terminal name, not a symbolic sub-terminal name.

DATA TRANSFER AND TRANSLATION

The CCP either moves data into your record area or out of your record area during a communications operation, according to the operation you specify in the *Operation Code* field of your parameter list. In order to know how data is transferred to or from a specific terminal, what the CCP does with the data, and what your program must do with the data, you must know what attributes are assigned to the terminal (for example, whether or not a 3270 is using the Display Format Facility).

Terminal Attributes

TERMATTR assignment statements (see *CCP System Reference Manual*) define terminal attribute sets for terminals used under the CCP. Each attribute set is assigned an identification number. This number is then referenced in a BSCATERM or MLTATERM assignment statement to assign a particular set of attributes to a terminal. A terminal may have different attributes at different times and a single attribute set can be used by more than one terminal. See *Get Attributes* and *Acquire Terminal* for additional information about terminal attributes.

The terminal attribute sets specify the following information about terminals:

For BSCA and MLTA terminals:

- Whether or not the CCP will translate data sent to or received from the terminal.
- If data is to be translated, whether to force the data to uppercase EBCDIC.
- Whether the terminal is auto or manual answer (if on a switched line).

For BSCA terminals only:

- Record length
- Block length
- Input data mode (record, block, or message)
- Whether or not the EBCDIC transparency feature is used
- ITB (intermediate text blocks) used
- Variable length or spanned records used
- 3270 Display Format Facility used

For BSCA terminals on switched lines only:

- Whether or not the CCP will verify exchange identification sequences
- Whether the terminal is auto or manual call

Input Data Transfer

Data received from a terminal as the result of an input operation (see *Operations*) is moved by CCP from the communication line buffer to your program's record area. Data is received in the seventh and succeeding positions of your record area (the program or symbolic terminal name resides in positions 1-6 of the record area), except in the following instances:

- In RPG II, data may begin in a different position (see *Chapter 6: RPG II*).
- In 3270 Display Format Facility operations, the format of the record area varies with different operations (see *Chapter 8: 3270 Display Format Facility*).

CCP removes all teleprocessing line control characters from terminal input data it moves to your record area, except in the following cases:

1. For BSCA terminals, the ITB (intermediate text block) character is not removed from input data unless fixed length records are being processed in ITB record mode, with the correct record length. When using variable length records, the record separator character is returned in the record area as the last character of data. The effective input length returned in the third field of the parameter list includes the record separator character.
2. Programs that communicate with 3270 terminals without using the Display Format Facility will receive and must send the actual data and display control characters necessary for the 3270, such as Escape Command, Set Buffer Address, Start Field, buffer addresses, and others (see *Example 1* in chapters 4, 5, and 6 for specific examples in COBOL, FORTRAN, and RPG II).
3. For programs not using PRUF (program request under format) that are requested by 3270 terminals, the data appended to the program request is not processed by the Display Format Facility but is passed directly to the user program. See *Chapter 3: Communications Programming Topics,* for further description of PRUF. The data is provided in the program record area as a continuous string, but with no 3270 display control characters.

The length of the data depends on the value specified in the SYSTEM assignment statement (see *Assignment Stage* in the *IBM System/3 CCP System Reference Manual* for your system). The maximum length of the data appended to the program request is the value of the PGMREQL parameter minus the length of the program name and one blank. Since 80 is the maximum value of PGMREQL, the maximum length of data that can be appended to the program request is 78 characters; any further data in the 3270 buffer at the time of the program request is not sent to the program. A positive input return code is posted if the data length exceeds the length specified. The return code can be tested and appropriate action taken.

For PRUF programs, more than 78 characters of program request data can be sent to the user program. The length of the data sent to the program can be up to the maximum length specified in the PRUFLNG parameter of that program's PROGRAM statement (see *Assignment Stage* in the *IBM System/3 Models 10 and 12 Communications Control Program System Reference Manual,* GC21-7588, or the *IBM System/3 Model 15 Communications Control Program System Reference Manual,* GC21-7620). If the program being requested is a PRUF program, CCP will pass the entire 3270 text stream, control characters and data, to the user program at program request time. If PRUF$Z was specified on the PROGRAM statement at assignment time, PRUF program request data is handled by the display format facility. See *Chapter 3: Communications Programming Topics* for a further description of PRUF.

For chain task requests with data, the maximum amount of data that can be transferred is determined by the size of the teleprocessing buffer. If other users are active or the teleprocessing buffer is fragmented, the area for a chain task request with data can be further reduced. If the chained task is a sort program, the maximum amount of data that can be passed by the requesting program is 80 characters.

Input Data Translation

The attribute set associated with a terminal specifies whether or not data received from that terminal is to be translated from the line transmission code (if other than EBCDIC) to EBCDIC. If translation is specified, the attribute set also indicates whether or not to force to upper case all alphabetic characters received.

Note: All input, including PRUF input, received from a terminal in command mode is forced to upper case.

EBCDIC Transmission Code Used or Translation Requested

If the transmission code is EBCDIC, or if translation is requested, data is presented in EBCDIC in the record area. (If translation is requested, the data is converted to EBCDIC by the CCP.) No teleprocessing line control characters are included in the data except for the BSCA ITB character mentioned under *Input Data Transfer*. For MLTA, backspace characters sent from the terminal are not received in the data area; rather, the input data is received with all backspacing resolved. Also, if the last character of the input is a carriage return, the CCP removes it from the input data.

All other device control characters (such as 3270 control characters, tab key, carriage return in the middle of text) are treated as input data characters. Whether or not lower case alphabetic characters are translated to their corresponding upper case characters is determined by the attribute set currently associated with the terminal. If upper case translation is specified, all alphabetic data input appears in upper case EBCDIC in your program's record area.

If the length of the data received is greater than the maximum input length specified, the excess data is lost (truncated) and the effective input length equals the maximum input length. If the data length received is less than the maximum input length, the effective input length is set to equal the data length received, and the remainder of your record area is cleared to blanks up to the maximum input length.

Transmission Code Not EBCDIC and Translation Inhibited

If the transmission code is not EBCDIC and the terminal attributes do not specify translation, the CCP places data into the record area as it is received, including backspace characters, but not including line control characters. The application program must be prepared to translate data to EBCDIC if the data is to be processed by the program. If more data is received than was specified as maximum input length in the parameter list, the excess data is lost and the CCP sets the effective input length equal to the maximum input length. If the data received is less than the maximum specified, the CCP sets the effective input length to the number of input characters received. The record area positions beyond the effective input length are set to blanks (X'40') (except for MLTA terminals under Model 10 and Model 12 CCP, when the content is unpredictable).

Output Data Transfer

On output operations, the CCP moves data from your record area to the communication line buffer and transmits it to the terminal you specify. The data must begin in position 7 of the record area, following the symbolic terminal name, (except in some RPG II operations and when 3270 DFF is used). No teleprocessing line control characters are needed, since CCP adds the necessary line control characters before transmitting the data. However, you may include in your data any device control characters you desire (see *Device Control Characters*).

Note: For BSCA record mode output operations, if the output record length is less than the record length specified in the terminal attributes set, the number of characters specified as the output length (third field of the parameter list) is sent, followed by the number of blanks necessary to satisfy the record length specified in the terminal attributes set.

Output Data Translation

The attribute set associated with a terminal specifies whether or not the data to be transmitted to that terminal is to be translated from EBCDIC to the line transmission code.

Translation

If translation is specified in the terminal attributes, the CCP converts data from EBCDIC to the appropriate line transmission code. Any device control characters are treated as data; thus, if you include device control characters in your record area, they must be in EBCDIC form. If invalid characters are found during the translation of the data, data transfer does not occur and the CCP places a return code indicating translation error in the parameter list. If more data is sent in one output operation than the line buffer for the terminal can hold (in BSCA record mode operations, if the output length exceeds the record length specified in the terminal attributes set), then the excess data is lost (truncated). The return code indicates if there was either a translation error or a data truncation.

Translation Inhibited

If translation is not specified, output data is taken from your record area and transmitted as is, except for the addition of line control characters. If more data is to be sent in one operation than the size of the line buffer can hold (in BSCA record mode operation, if the output length exceeds the record length specified in the terminal attributes set), then the excess data is lost (truncated). All the data that can fit into the line buffer (or record area, for BSCA record mode) is sent and a return code indicating the data has been truncated is placed in the parameter list.

Transmitting 3735 FDPs on an ASCII Line

You must use a special procedure to transmit FDPs (form description programs) to a 3735 terminal under the following conditions:

- Transmitting on an ASCII line.
- CCP to translate input and/or output data.

This special procedure is necessary because the FDPs, themselves, must not be translated, but all other data, including the FDP header and trailer, must be translated.

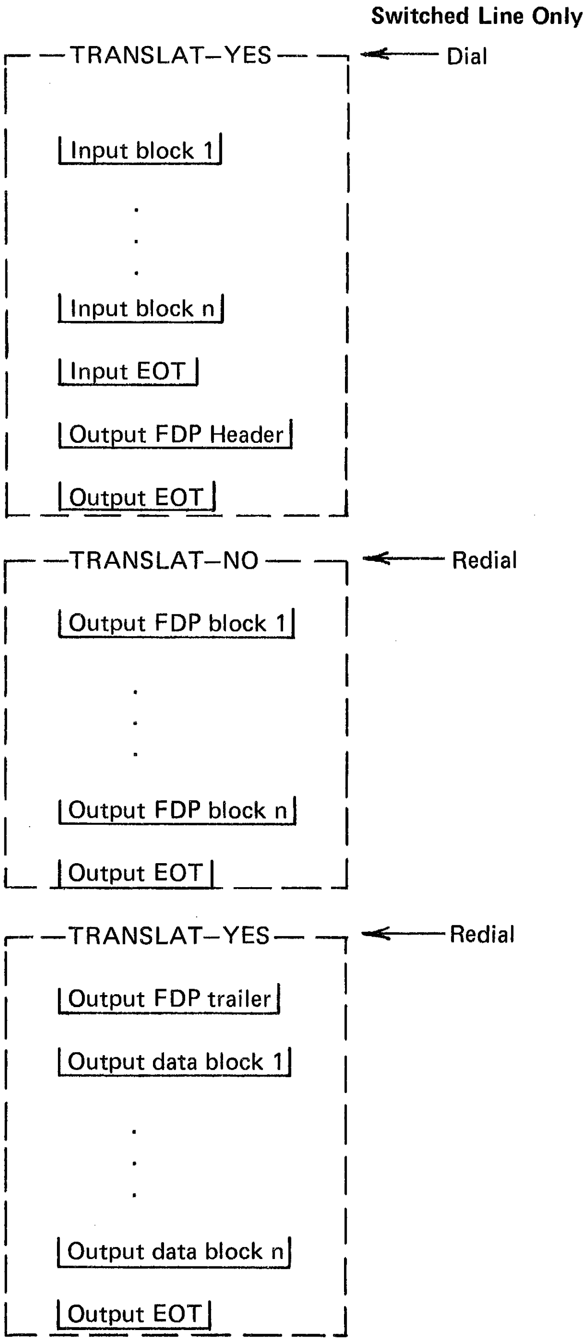
The procedure is as follows:

1. Define two attribute sets for the 3735 terminal at assignment time (TERMATTR statements), one specifying TRANSLAT—YES and the other specifying TRANSLAT—NO.
2. Initially, use the terminal attribute set that specifies TRANSLAT—YES for all input from the 3735 (until EOT is received).
3. Send the FDP header and an EOT using the same assignment set (TRANSLAT—YES).
4. Issue a Release Terminal (Keep-Line) operation followed by an Acquire Terminal (Set Terminal Attributes) operation, specifying the attribute set with TRANSLAT—NO.
5. Transmit all blocks of FDPs, followed by an EOT.
6. Issue a Release Terminal (Keep-Line) operation followed by an Acquire Terminal (Set Terminal Attributes) operation, specifying the attribute set with TRANSLAT—YES.
7. Transmit the FDP trailer in a block by itself.
8. Transmit all blocks of data, followed by an EOT.

On switched (dial) lines, sending an EOT to the 3735 causes the lines to be disconnected. Redialing is necessary to continue operations on the line. It is necessary to send an EOT before the attributes of the line can be changed.

If no data is to be read from the 3735, or no data is to be sent to the 3735 other than the FDPs, you can code the FDP header and/or trailer in ASCII, thereby eliminating the need for step 4 or 6 and the EOT in step 3 or 5 of the previous procedure. This also eliminates the need to redial after sending EOT.

The data stream to and from the 3735 appears as follows:



Record Separators (Variable Length and Spanned Records)

Record separator characters for variable length and spanned records can be processed by the CCP on record mode input operations and on any mode of output operations (record, block, message). The BSCA terminal (other than the 3270) transmitting variable length or spanned records must be defined as supporting record separators at assignment time (see *TERMATTR* statement) and must be defined as record mode for input operations.

The CCP automatically provides record separator characters at the end of each record to indicate the end of the record. The normal character provided is X'1E'; however, an alternate character may be chosen during CCP generation (see *$EBSC* statement in *CCP System Reference Manual*). The record separator character is considered a device control character, not a line control character.

Note: When sending blocks of field descriptor programs to a 3735 terminal for which RECSEP-YES is specified in the // TERMATTR assignment statement, you must specify a block length less than 476, because a record separator character is automatically added to the end of your data before it is sent.

Variable Length Records

When using variable length records, no record (including its record separator character) can be longer than the block size defined for the terminal. The record separator must be considered a data position when determining block sizes and/or line buffer sizes.

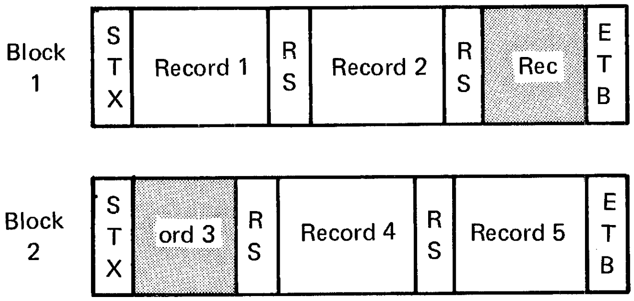
Input: When using variable length records, you must specify a maximum input length in your parameter list that is equal to or greater than the longest record you expect to receive. The record separator character is reflected as part of the effective input length in the parameter list.

For variable length, nonspanned input records, the last record separator character may be omitted. In this case, the ETB/ETX line control character suffices as a record separator, and is received in the user program record area in place of the normal record separator.

Output: The CCP automatically adds record separator characters after each record. Do not include the record separator in the output length field of your parameter list.

Spanned Records

Spanned records can be used under the CCP only if record separators are used. A spanned record is not completely contained within a single block, but is continued in the next contiguous block, as shown in the following example of a data format (without ITB and without text transparency):



STX } BSCA control characters - see *Components*
ETB } *Reference Manual.*
RS - Record separator.

Record length, including the record separator, may not exceed block length.

DEVICE CONTROL CHARACTERS

Device control characters are data characters that control certain aspects of terminal operation, such as carriage return for typewriter-like terminals and screen formatting for the 3270 terminal. Device control characters must be included in data that is transmitted to or from certain terminals. Certain device control characters can be automatically inserted into output data by the CCP:

- Carriage return and idle characters for control of MLTA typewriter terminals.
- 3270 screen format characters, when the Display Format Facility is used (see *Chapter 8: 3270 Display Format Facility*).

In all other cases, your program must provide the appropriate device control characters (such as tab characters and 3270 screen format control characters, when the 3270 Display Format Facility is not used). Therefore, before writing a program to communicate with any terminal, you must understand the device control required by the terminal and the physical characteristics and capabilities of the terminal as described in the component description manual for the terminal (see *Appendix C: Bibliography*). See index entries for specific terminal types for additional information about the unique requirements of specific terminals.

MLTA Typewriter Terminals

As part of the operation code in the parameter list, you can indicate whether you want the CCP to insert special device control characters into your data for the terminals with typewriter characteristics. The terminals considered to possess typewriter characteristics include the following:

- 2740, all models or equivalent (including System/7)
- 2741, all models or equivalent (including the Communicating Magnetic Card SELECTRIC® Typewriter)
- 1050 with typewriter component (1051/1053).

Note: If the 1050 multicomponent terminal number specifying all output components is specified, the 1050 is not treated as a typewriter device.

Unless you specify otherwise in your operation code, the CCP inserts a carriage return and idle characters at the beginning of an output record (New Line), if needed to assure the output starts on a new line, and at the end of an output record (End Line). By means of operation code modifiers, you can suppress New Line control characters (Not New Line), End Line control characters (Not End Line), or both sets of control characters (Not New Line and Not End Line).

You need not suppress New Line and End Line for non-typewriter terminals. The CCP ignores the indication in the operation codes and does not insert the typewriter control characters. Also, the CCP inserts New Line and End Line characters, unless suppressed, whether or not translation is specified.

New Line

New Line causes a transmitted message to begin on a new line at the typewriter terminal. CCP does this by transmitting a carriage return and 15 idle characters before your data, if the typewriter is not already positioned at the beginning of a new line. The idle characters allow the typewriter time to reposition itself as a result of the carriage return. It is not always necessary to insert the typewriter control characters, since the typewriter may already be positioned at the beginning of a new line. CCP attempts to keep track of the position of the typewriter and considers the typewriter to be positioned at a new line under the following conditions:

- The last operation was an input operation in which the last character received was carriage return.
- The last operation was an output operation which specified End Line.

If you specify New Line under either of these conditions, CCP does not insert the typewriter control characters. If your program is exchanging messages with a typewriter terminal, the terminal operator can decrease transmission time by keying a carriage return as the last character of his input to the program. Thus, when your program responds with a Put, CCP will not have to insert the additional control characters at the beginning of your output message.

Note: For a 2740 Model 2 terminal with the buffered receive feature, CCP sends the carriage return without idle characters, since this terminal allows for completion of the carriage return before continuing the printout.

End Line

End Line causes the typewriter to be positioned at the beginning of a new line after receiving a message. The CCP does this by appending a carriage return and 15 idle characters to the end of your data.

Message Length Considerations

You should not allow space for New Line and End Line control characters in your record area. When you provide an output message in your record area, the CCP must build the actual output data stream in the teleprocessing line buffer before transmission can occur. Any additional control characters added by the CCP must be in the line buffer along with your message. (The size of the line buffer is specified at assignment time, in the TERMATTR statement for BSCA and in the MLTALINE statement for MLTA, see *CCP System Reference Manual*.) Thus, if you want to transmit a 40-character message and you specify New Line and End Line, a 72-byte data stream is built in the line buffer by the CCP. If the data stream is larger than the line buffer, your message is truncated while all typewriter control characters remain appended to the message.

BSCA Terminals

The CCP performs the following device control for BSCA terminals:

- The CCP inserts record separators for data transmission involving variable length or spanned records, if specified in the terminal attribute set associated with the terminals (see index entry *record separators*).

- If the *3270 Display Format Facility* (see index entry) is used with 3270 terminals, the CCP provides screen format control based on the descriptions of fields in the Display Format Specifications.

In communicating with other communications systems via the BSCA, you need not provide device control characters; however, the communications interface between the sending and receiving programs may require that you provide certain control data in your program that is understood by both programs, such as data delimiters and record identifiers. See Appendix A for additional considerations.

LINE CONTROL CHARACTERS

Line control characters are the signals which control communication on either an MLTA or BSCA line. Line control characters are always removed from or added to data by the MLTA and BSCA communications IOCS facilities of the CCP. You need not provide space for line control characters in your record area and you need not manipulate line control characters in your program. MLTA line control is described in the *MLTA RPQ Program Reference and Component Description Manual,* GC21-7560; BSCA line control is described in the *Components Reference Manual.*

COMMUNICATING WITH MLTA TERMINALS

In this discussion, the term "MLTA terminals" refers to any of the terminals listed in Appendix A as supported by the multiple line terminal adapter (MLTA) RPQ or their equivalents. MLTA terminals perform asynchronous (start/stop) communications with programs through the CCP and the MLTA input/ output control system (IOCS), which is included in the generated CCP if MLTA terminals are to be used. See *MLTA RPQ Program Reference and Component Description Manual,* GC21-7560, for a complete description of the MLTA IOCS.

Programs communicate with MLTA terminals in a record-by-record manner; that is, each I/O operation in a program results in a record being sent or received. The program has effective control of the line only while a record is being sent or received. After the record has been sent or received, another program and/or terminal can use the line.

COMMUNICATING WITH BSCA TERMINALS

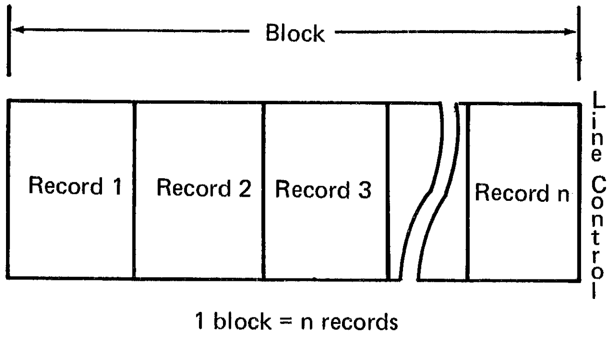
The term *BSCA terminals* refers to any of the terminals (including host and subhost systems) listed in *Chapter 1: Introduction* as supported by the binary synchronous communications adapter (BSCA). BSCA terminals perform binary synchronous communications with the Model 10 Disk System, the Model 12, and the Model 15 through the CCP and the multiline/multipoint (MLMP) BSCA IOCS, which is included in the generated CCP if BSCA terminals are to be used. See *IBM System/3 Multiline/Multipoint Binary Synchronous Communications Reference Manual,* GC21-7573, for a complete description of the MLMP IOCS. Additional information regarding binary synchronous communications can be found in publications listed in *Appendix C: Bibliography.*

Note: BSCA conversational line control is not supported by the CCP.

Blocking

When communicating with BSCA terminals, programs send or receive *blocks* of data. A block is the physical unit of data that is actually sent or received in each individual transmission on a BSCA line.

A block of data can be composed of one or more data records (Figure 2-3). Collecting records into blocks saves time when similar operations are performed on each record, since it is faster to send and receive more than one record at a time than to send and receive records individually.

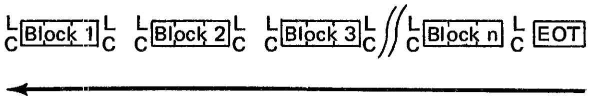


In binary synchronous communications, a block of data can contain one or more records.

Figure 2-3. Blocking in Binary Synchronous Communications

End of Transmission (EOT)

When communicating with a BSCA terminal, your program must perform Get operations until it receives an end-of-transmission (EOT) signal from the terminal (Figure 2-4) or until a transmission error occurs (resulting in a negative return code – See *Appendix E*). The EOT signal indicates the terminal has completed its current transmission. Likewise, your program must send an EOT signal when it has finished transmitting to a BSCA terminal (see *Put Message* under *BSCA Output Operations*), unless a transmission error has resulted in a negative return code.



In binary synchronous communications, each block of data is transmitted separately. The program retains control of the line until EOT indicates that all transmission is complete.

Legend: ← = Direction of transmission

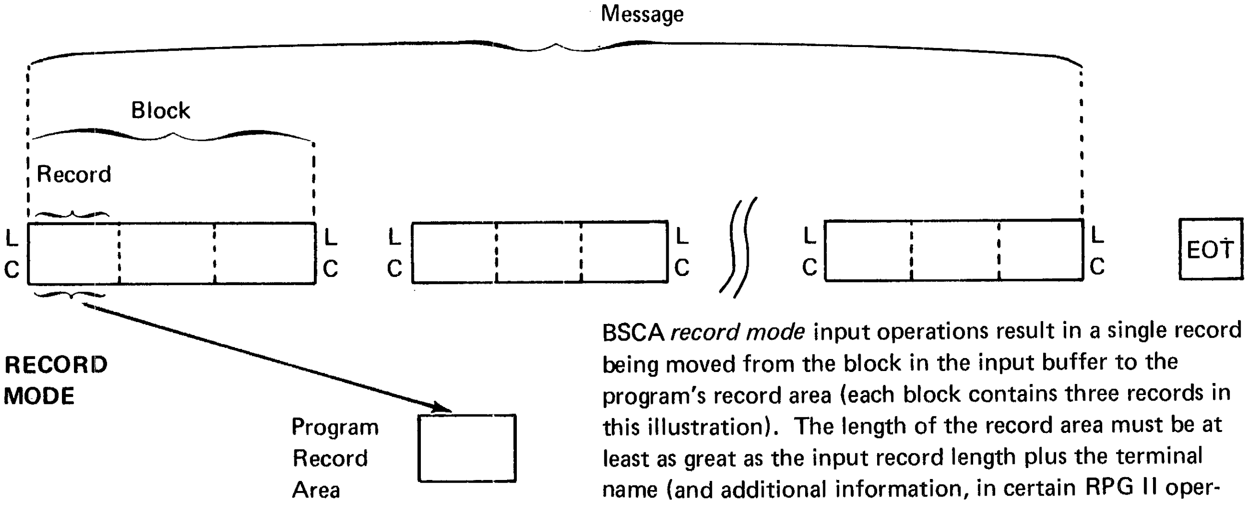
L/C = Line control characters

Figure 2-4. Data Transmission on BSCA Lines

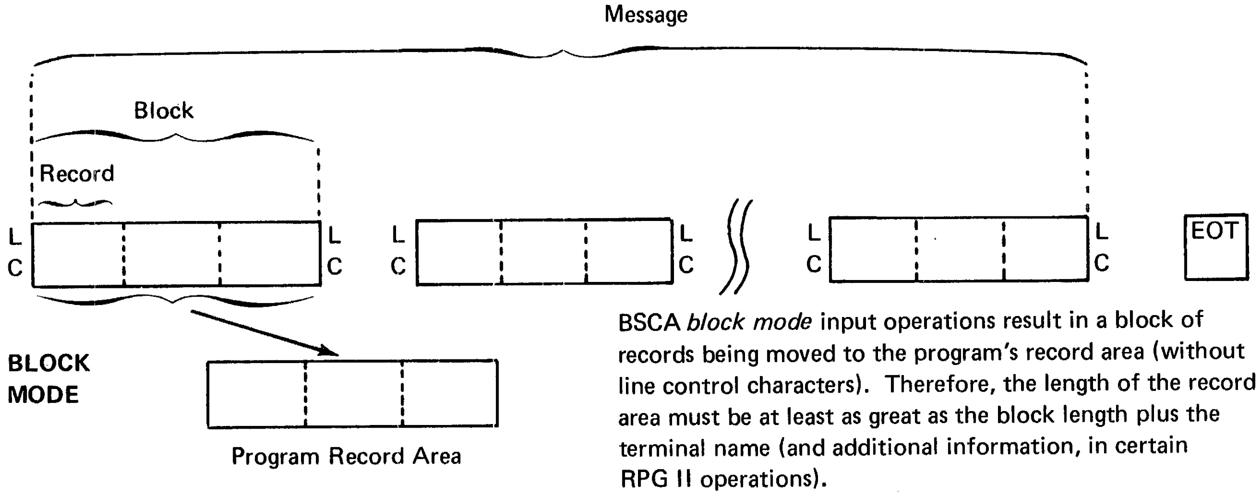
A BSCA line is dedicated to a program and a terminal once communication is initiated and is not freed for use by another program or terminal until EOT is transmitted (or a negative return code is received from an operation). Other terminals on a multipoint line may be allocated to other programs; however, a program can only be transmitting or receiving with one terminal at a time. A program that is receiving data from a BSCA terminal cannot transmit data to the terminal or communicate with any other terminal on that line until the terminal sends EOT (or a negative return code is received). Likewise, when a program is transmitting to a terminal on a BSCA line, that line cannot be used by any other program or terminal until either EOT is sent by the program or a negative return code is received by the program.

BSCA Input Operations

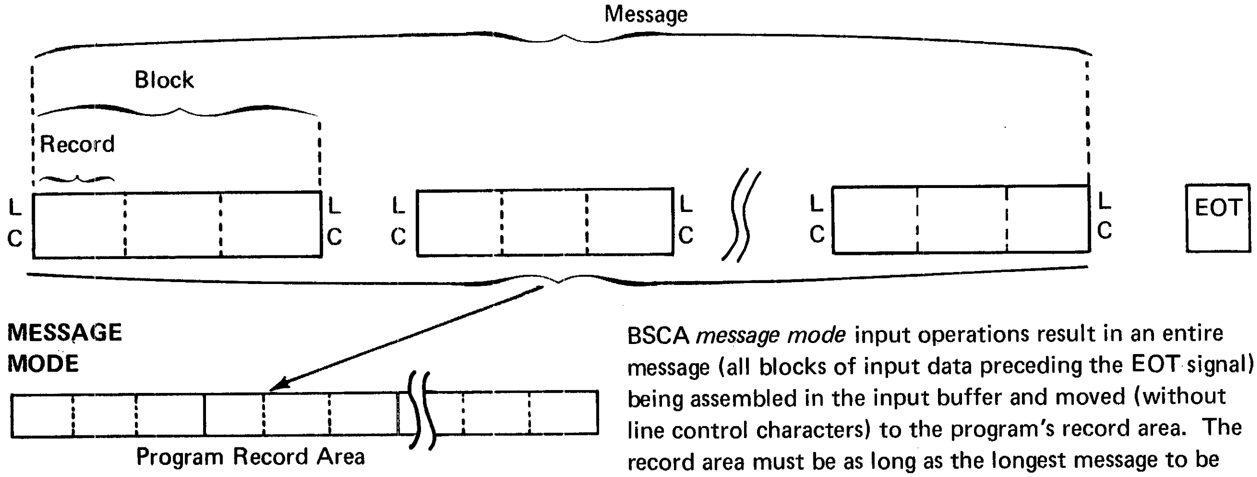
The CCP provides three levels (modes) of input operations for communication with BSCA terminals corresponding to three basic units of data: record mode, block mode, and message mode (Figure 2-5). The mode of input used by a program with a terminal is specified during the CCP assignment stage (see *TERMATTR* statement in *CCP System Reference Manual*). The actual input operations are used as described under *Operations* (see index entry).



BSCA *record mode* input operations result in a single record being moved from the block in the input buffer to the program's record area (each block contains three records in this illustration). The length of the record area must be at least as great as the input record length plus the terminal name (and additional information, in certain RPG II operations).



BSCA *block mode* input operations result in a block of records being moved to the program's record area (without line control characters). Therefore, the length of the record area must be at least as great as the block length plus the terminal name (and additional information, in certain RPG II operations).



BSCA *message mode* input operations result in an entire message (all blocks of input data preceding the EOT signal) being assembled in the input buffer and moved (without line control characters) to the program's record area. The record area must be as long as the longest message to be received plus the terminal name (and additional information, in certain RPG II and 3270 DFF operations), or the excess portion of the message is truncated.

Figure 2-5. BSCA Input Operation Modes

Blocking has already been described (see Blocking). A message consists of a limited number of blocks of data, followed by an EOT, that constitute a complete span of information that can be received by a program as the result of a single input operation. In message mode input operations, the CCP attempts to read all input data until it receives EOT before moving the data to the program's record area. In this way, the BSCA line is freed for use by another terminal as quickly as possible. Thus, message mode should be used when a limited quantity of data is expected (ideally, a single block) on each input operation.

Message mode is always used with the 3270 Display Format Facility.

Note: Input modes do not affect output operations.

BSCA Output Operations

The CCP provides three types of Put operations for use with BSCA terminals: *Put Record, Put Block,* and *Put Message.* Use of these operations in your program is not restricted by your program's mode of input operations (see *BSCA Input Operations*). See *Operations* later in this chapter, for complete descriptions of all Put operations.

Your program must always send an EOT when it has finished transmitting to a BSCA terminal, unless a transmission error occurs (resulting in a negative return code), when the CCP forces an EOT condition and terminates the operation. The CCP automatically sends the EOT after a Put Message operation and after the Put portion of a Put-Then-Get operation.

Put Record

The Put Record (or Put-No-Wait Record) operation causes a record to be sent to the terminal you specify in your program's record area. If block length equals record length, each Put Record operation results in a record being transmitted on the BSCA line. If each block contains several records (specified in the terminal attribute set), the block is transmitted when it does not have space for another record. Thus, your program may issue several Put Record operations before a block of data is actually transmitted. (The CCP will automatically issue a Put Block operation when a block is complete – see *Put Block.*) In order to send EOT following Put Record operations, your program must issue a Put Message operation (see *Put Message*).

In fixed-length record processing, CCP either pads a record with blanks or truncates a record if the record length does not equal the record length specified in the terminal attribute set (TERMATTR assignment statement). For example, if the attribute set defines the record length as 50, and you issue a Put Record with an output length of 40, CCP actually sends 50 characters; the last 10 characters are blank characters. Similarly, if you issue a Put Record with an output length of 60, a record of 50 characters is sent; the last 10 characters are truncated.

Put Block

The Put Block operation causes the current block in the output buffer to be transmitted, whether or not the block contains all the records it can hold. The next record Put by your program starts a new block. A Put Block operation may either be:

- Accompanied by the final data to be placed in the block before it is sent, or
- Issued with a record length of zero, which simply causes the block to be sent (if there is no data to be sent, the operation is ignored by the CCP).

When processing fixed-length records (see *Put Record*), if the Put Block operation is used to force transmission of a short block, a data length of zero is suggested. If data is to accompany the operation, it should be exactly one record length, as defined by the terminal attributes set, because the normal record truncating or padding is not performed by the Put Block operation.

Put Message

Put Message causes all data to be transmitted, followed by an EOT. A Put Message operation can be:

- Accompanied by the final data to be sent before EOT
- Issued with a message length of zero, which simply sends the EOT signal to the terminal.
- Program Request Under Format (PRUF), which indicates that the Put Message operation is transmitting a program request format out to the 3270 terminal.

When processing fixed-length records (see *Put Record*), if the Put Message operation is used to indicate the end of data, a data length of zero is suggested. If data is to accompany the operation, it should be exactly one record length, as defined by the terminal attributes set, because the normal record truncating or padding is not performed by the Put Message operation.

Put-Then-Get and Put-No-Wait Operations

These operations have the same basic function as described under *Operations.* Put-Then-Get causes data (record, block, or message) to be transmitted to a specific terminal, followed by EOT and a Get operation for the terminal. The result of the Get portion of the operation depends on the mode of input specified at assignment time (TERMATTR statement); the result may be the equivalent of a Get Record, Get Block, or Get Message to the terminal. Put-No-Wait can be issued at the record, block or message level. A Put-No-Wait Record or Put-No-Wait Block are identical to Put Record or Put Block. On a Put-No-Wait Message, your program neither waits for nor receives a return code.

3284/3286 Printer Consideration

When issuing operations to a 3284 or 3286 printer (components of the IBM 3270 Information Display System), the following situation should be considered: The user program issues an operation which starts the printer. Before the print operation is complete, the user program issues another operation to the printer, resulting in a "device busy" condition, for which CCP returns a -14 return code.

The user program should be written to recognize a -14 return code from the 3284 or 3286 printer and take some appropriate action. Some possible courses of action are:

- Retry the print operation a number of times under control of a counter in the program. If the operation is not accepted after a number of retries, go on to other processing or inform the system operator. See index entry *Return Codes, Negative (DFF)* for special considerations when using the 3270 Display Format Facility. This kind of action makes heavy use of the communication line and adversely affects the performance of other terminals using the line.

- Perform other operations in the program, such as disk I/O or console I/O, to allow some time for the device busy condition to clear. For example, sending a message to the system operator requesting a response is a way of delaying a retry of the printer operation without using system resources needed by other programs. The system operator can be asked, for example, to respond when the printer is free or after a specified period of time.

- (Model 15 only) After receiving a device busy return code, set the interval timer via the $SIT macro to pause your task for a specified amount of time before retrying your Put operation. This method requires use of an assembler.

- (Model 15 only) Use the RPG II operation code TIME to obtain the time of day. Repeat the TIME operation code until the desired time period has elapsed from the initial TIME operation; then reissue the Put operation to the printer. This method requires use of the DSM transient area and may, therefore, adversely affect system performance through heavy use of the transient area and disk access mechanism.

Note: Waiting for the "device busy" condition to clear by looping in your program (not issuing CCP operations) prohibits other user programs from executing during the loop, and is therefore not recommended.

OPERATIONS

This section describes the valid teleprocessing operations that can be issued by application programs running under the CCP. Each description of an operation contains the following information:

Purpose: A brief description of the purpose of the operation.

Operation Code(s): Decimal value, hexadecimal value, and RPG II form of each variation of the operation code. A summary chart of operation code values is provided in Appendix D.

Additional Requirements: Information your program must provide in addition to the operation code and record area.

Information Returned: Information the CCP provides to your program as a result of the operation, including all positive return code values. Descriptions of all return codes and a summary chart of return codes by operation type are provided in Appendix E.

Function and Use: A detailed description of the results of the operation and rules, considerations, and recommendations for using the operation.

Program Errors

The CCP checks every operation issued by an application program for validity before it performs the operation. Certain conditions are considered to be program logic errors, which result in termination of the application program. The CCP informs the system operator of the termination by printing a message that contains a *program termination code* identifying the error condition, the name of the program, and other information. The contents of this message and the meanings of the program termination codes are given in the *IBM System/3 Communications Control Program Messages Manual,* GC21-5170.

3270 Display Format Facility Operations

Requests for 3270 DFF operations are issued in the same manner as other requests for terminal operations; that is, each request is issued through a communications service subroutine and is accompanied by a parameter list and a record area. For certain 3270 DFF operations, however, you must supply additional information in the record area, besides the terminal name. For example, when the display format is written to a 3270, the name of the format is given in the record area following the terminal name.

Three operations are unique to 3270 DFF: Copy, Erase, and Put Override. These operations are described in *Chapter 8: 3270 Display Format Facility.* Considerations for using other CCP operations with 3270 DFF are summarized in that chapter and are also included in the descriptions of CCP operations in this chapter.

GET

The purpose of the Get operation is to read a unit of data (record, block, or message) from a specific terminal into the record area.

Operation Codes:

Hex	Dec	RPG II	Meaning
0001	1	b̸b̸b̸A	Normal Get operation
0011	17	b̸b̸AA	Get operation with reverse interrupt (RVI) (See *Function and Use of Get* for an explanation of RVI.)

Additional Requirements

- Set value of the Maximum Input Length field in the parameter list.
- Provide a symbolic terminal name (or blanks) in the record area.

Information Returned

- Effective Length of Input Data, in parameter list.
- Input data, in record area.
- Count of outstanding Invite Inputs in the third field of the parameter list, if the 08 return code is received.
- Return Codes:

0	Successful
1	Data truncated
2	EOT
3	Data truncated and EOT
5	Data pending (BSCA)
7	3270 CLEAR (No AID is returned in the record area)
8	Terminal no longer available (/RELEASE command was successfully entered by the terminal operator).
9	Terminal offline
-n	Negative return codes (I/O errors - see explanations in Appendix E).

Function and Use of Get

The Get operation, reads a unit of data (record, block, or message) from a specific terminal and places the data in the record area. After issuing a Get operation, an application program waits for the CCP to complete the operation. The program resumes execution either after the CCP has moved the unit of data received from the specified terminal to the record area or after the CCP has terminated the operation because data transfer cannot succeed.

If the length of the input data actually received is greater than the maximum input length allowed, the data is truncated. If the data received is less than that specified, the CCP places blanks in the remainder of the record area.

The attributes of the data, which determine how the input data is handled, and the unit of data (record, block or message) are specified by the terminal attribute set currently associated with the terminal (see index entry *terminal attributes*). For an MLTA terminal, the unit of data is always record.

For BSCA terminals that acknowledge the receipt of reverse interrupts (RVI), the Get operation can be used to send an RVI to a terminal while receiving data from that terminal. *RVI* (see index entry) is generally used as a signal from a receiving device to a device that is transmitting to interrupt its transmission as soon as possible, usually because the receiving device wishes to transmit to the sending device.

Get Operation with 3270 DFF

When you are using the 3270 DFF, you must issue a Put Message or Copy operation to format the display before you issue a Get operation to the 3270. See *Field Concepts* and *Record Concepts* in Chapter 8 for special requirements in handling input data. Also see index entry *Get operation, 3270 DFF.*

Specifying the Terminal

You may, for a Get operation, specify either a defined symbolic terminal name or blanks in the record area. A defined terminal name must be either the name under which the referenced terminal was allocated to the program, or, if this is a *multicomponent terminal* (see index entry), a sub-terminal name subordinate to that name. A symbolic terminal name which is not assigned to a terminal cannot be used with this operation.

This operation must not be issued to the CONSOL (5471 Printer/Keyboard on Models 10 and 12; CRT/Keyboard on the Model 15).

A program can use a blank symbolic terminal name for this operation only if the program is a *single requesting terminal (SRT) program* (see index entry). A blank name references the terminal that requested the currently executing copy of the program. The CCP returns the name of the requesting terminal in the record area before returning control to the program. In the case of an SRT program, once the requesting terminal has been released (either by using its symbolic name or a blank name), the use of a blank terminal name in the record area is no longer valid.

Considerations

- The Get operation must not be issued as the initial data-transfer operation to a requesting terminal which entered data as part of the program request. The only valid operation which may be issued to such a terminal at that time is an Accept Input (see *Accept Input* operation).
- The Get operation must not be issued as the initial data-transfer operation in a program that was loaded by a chain task request. The only operation that can be issued in this situation is an Accept Input operation.
- This operation can be issued only to a terminal capable of transmitting data.
- A maximum input length greater than zero must be specified in the parameter list for this operation.
- The Get operation must not be issued to a terminal which has an Invite Input outstanding to it. Should it be necessary to read data from such a terminal, perform a Stop Invite Input operation. If the Stop Invite Input is successful, the Invite Input is cancelled and a Get may then be issued to the terminal. If the Stop Invite Input fails, then the operation is treated as a Get from the specified terminal.
- When communicating in record or block mode to a BSCA terminal that is on the same multipoint line with other BSCA terminals, it is recommended that, once input is received from the terminal, Get operations should be issued to that terminal until EOT is received (or the operation terminates with a negative return code). This procedure will free the line for use by other terminals as quickly as possible. An alternate procedure is to issue an Invite Input to the terminal, followed by Accept Input operations until the transmission is complete (EOT or a negative return code is received.
- In message mode, the EOT return code is never returned.

PUT

The purpose of the Put operation is to write a unit of data (record, block, message) to a specific terminal. Carriage returns are performed for MLTA typewriter terminals before and after writing the data (*New Line* and *End Line,* respectively), unless a modified form of the operation code is used to suppress carriage returns. New Line and End Line are ignored for BSCA operations.

The Put operation may specify that the unit of data is to be written as the last in the current block (Put Block), that is, an EOB (end of block) signal is to be issued following the data and the next unit of data is to begin a new block. The Put operation may also specify that the unit of data is the last to be Put in the current transmission (Put Message), that is, the EOT (end of transmission) signal is to be issued following the data.

Put Block and Put Message are intended for use with BSCA terminals; however, these operations are valid for MLTA terminals and have the same effect as a Put operation without EOB or EOT (Put Record).

Put Message can be followed by additional input or output operations to the same terminal.

Operation Codes

			Meaning: Perform Put operation as follows:		
Hex	**Dec**	**RPG II**	**New Line**	**End Line**	**Unit of Data**
0002	2	b̸b̸b̸B	yes	yes	Record
0102	258	b̸Ab̸B	yes	no	
0202	514	b̸Bb̸B	no	yes	
0302	770	b̸Cb̸B	no	no	
0022	34	b̸b̸BB	yes	yes	Block
0062	98	b̸b̸FB	yes	yes	
0122	290	b̸ABB	yes	no	
0222	546	b̸BBB	no	yes	
0322	802	b̸CBB	no	no	
0032	50	b̸b̸CB	yes	yes	Message
0072	114	b̸b̸GB	yes	yes	
0132	306	b̸ACB	yes	no	
0232	562	b̸BCB	no	yes	
0332	818	b̸CCB	no	no	
0832	2098	b̸HCB	yes	yes	Put overrides message used only with DFF.
0872	3162	b̸HGB	yes	yes	

Additional Requirements

- Set value of output length field in the parameter list (see exception under RPG II for SPECIAL files).
- Provide a symbolic terminal name (or blanks) in the record area.
- See index entry *Put Overrides* for special requirements of that operation.

Information Returned

- Return Codes:

0	Successful (no exception conditions)
1	Data truncated
5	Data pending (BSCA)
6	Terminal interrupt (MLTA) or RVI (BSCA)
9	Terminal offline
-n	Negative return codes (I/O errors and device status conditions – see explanations in Appendix E).

Function and Use of Put

The Put operation writes a unit of data to a terminal (record, block, or message). On Put operations to MLTA terminals, the application program waits for completion of the transmission to the terminal. For BSCA devices, the program resumes execution upon acceptance of the operation by the CCP, except for Put Message. On Put Message, control is not returned to the program until either the data is transmitted successfully and the EOT sent out, or until an error condition occurs.

Put Operation with 3270 DFF

With 3270 DFF, you must use a Put Message to write the initial display format to the 3270 terminal. To override data at the terminal, use the Put Overrides operation. See index entry *DFF operations* for additional information and requirements.

Specifying the Terminal

You can specify either a defined symbolic terminal name or blanks in the record area for a Put operation. A defined terminal name must be either the name under which the terminal was allocated to the program, or, if this is a multicomponent terminal, a sub-terminal name subordinate to that name. A symbolic terminal name which is not assigned to a terminal can not be used with this operation.

A Put operation can be issued to the CONSOL. The maximum length of output is:
Models 10 and 12 – 80
Model 15 – 107

You can use a blank symbolic terminal name for this operation only if your program is an SRT program (see index entry). A blank name references the terminal that requested the currently executing copy of the program. The CCP returns the name of the requesting terminal in the record area before returning control to the program. In the case of an SRT program, once the requesting terminal has been released (either by using its symbolic name or a blank name), the use of a blank terminal name in the record area is no longer valid.

Considerations

- The Put operation must not be issued as the initial data-transfer operation to a requesting terminal which entered data as part of the program request. The only valid operation which may be issued to such a terminal at that time is an Accept Input (see *Accept Input* operation).
- The Put operation can be issued only to a terminal capable of receiving data.
- An output length greater than zero must be specified for this operation if transmitting to an MLTA terminal. However, a zero output length may be specified on Put Block operations and Put Message operations to BSCA terminals (except on the first such operation) to force sending of the current block or message.
- This operation must not be issued to a terminal which has an Invite Input outstanding to it.
- Put operations to the console, regardless of the form of Put operation code used, cause the data (message) to be sent to the console.
- PRUF Put operations issued to the console are invalid.
- When using block mode or record mode input with BSCA terminals, the following situation can occur and must be programmed for:
  1. The program issues an Accept Input; two terminals have outstanding Invite Inputs.
  2. The first terminal (T1) provides input data.
  3. The program issues input operations to T1 until EOT is received, then issues a Put to T1.

4. Prior to the Put to T1, the second terminal (T2) provides input data. Since T2 now has control of the BSCA line, the Put operation issued to T1 results in a 05 return code (data pending on the BSCA line).

- When transmitting fixed length data to a BSCA terminal using Put Record, any Put Block or Put Message operation should not have data specified unless the data is exactly one record as specified in the terminal attribute set. Truncation or padding of record data is not performed for Put Block or Put Message operations (see index entry *Put Record*).

PUT-THEN-GET

The Put-Then-Get operation transmits a unit of data to a specific terminal and then reads data from the same terminal. Optionally, carriage returns are performed for MLTA typewriter terminals before and/or after writing the data (*New Line* and *End Line,* respectively). Put-Then-Get is more efficient than separate Put and Get operations.

Put-Then-Get is the *only* operation that can be used to read data from CONSOL except when an Accept Input is used to receive data entered with the program request.

Operation Codes

Hex	Dec	RPG II	Meaning
0003	3	ƀƀƀC	Put (Record) -Then-Get operation including New Line and End Line on Put.
0033	51	ƀƀCC	Put (Message) -Then-Get
0103	259	ƀAƀC	Put (Record) -Then-Get including New Line, but suppressing End Line.
0203	515	ƀBƀC	Put (Record) -Then-Get including End Line, but suppressing New Line.
0303	771	ƀCƀC	Put (Record) -Then-Get with neither New Line nor End Line.

Notes: 1. New Line and End Line are ignored for BSCA terminals and the console.

2. This operation cannot be used with DFF terminals.

Additional Requirements

- Set value of Output Length field in parameter list (see exception under RPG II for SPECIAL files).
- Set value of Maximum Input Length field in parameter list.
- Provide a symbolic terminal name (or blanks) in the record area.

Information Returned

- Input data in the record area.
- Effective Input Length value in parameter list.
- Count of outstanding Invite Inputs in the third field of the parameter list, if the 08 return code is received.
- Return Codes:

0	Successful (no exception conditions)
1	Data Truncated - this return code indicates that input data was truncated
2	EOT - applies to the Get, not returned to the program if Get was message mode (input mode is determined by *terminal attributes* — see index entry)
3	Data Truncated and EOT - applies to the Get (MLTA terminals only)
5	Data Pending - BSCA terminals only
6	Terminal interrupt (MLTA) or RVI (BSCA)
7	3270 CLEAR - applies to the Get. No AID is returned in the record area.
8	Terminal no longer available - applies to the Get only (/RELEASE command was successfully entered by the terminal operator)
9	Terminal offline - applies to the Put, since Get is not performed
-n	Negative return codes (I/O errors and device status conditions — see explanations in Appendix E) — see *Error Return Codes* under *Function and Use* of *Put-Then-Get* for additional information

Function and Use of Put-Then-Get

This operation is a combination of a Put operation and a Get operation. First, the Put operation is issued to a specific terminal. Upon completion of the Put, a Get operation is issued to the same terminal. The application program resumes execution upon completion of the Get, when the input data resides in the record area. The same record area is used for both the Put and the Get (except with RPG II SPECIAL – see index entry *Put-Then-Get, RPG II SPECIAL*).

For BSCA terminals, the operation works as follows:

- For Put(Record)-Then-Get, the output data is padded or truncated according to normal record processing (see index entry *Put Record*). After the record is sent, EOT is sent, followed by the Get operation.
- For Put(Message)-Then-Get, either the output data is the only data sent (if this is message output only), or the output data is the last data sent (if the previous operation was a Put Record or Put Block operation). No record padding or truncating is performed by the Put(Message)-Then-Get operation (see index entry *Put Message*). After the output data is sent, EOT is sent, followed by the Get operation.

The mode of input (record, block, message) specified by the terminal attribute set which is currently associated with this terminal (see index entry *terminal attributes*) determines the unit of data received. For an MLTA terminal, the unit of data is always record.

Specifying the Terminal

You can specify either a defined symbolic terminal name or blanks in the record area for Put-Then-Get. A defined terminal name must be either the name under which the terminal was allocated to the program or, if this is a multicomponent terminal, a sub-terminal name subordinate to that name. A symbolic terminal name which is not assigned to a terminal cannot be used with this operation.

The use of a blank symbolic terminal name is valid for this operation only if the program is an *SRT program* (see index entry). A blank name references the terminal that requested the currently executing copy of the program. The CCP returns the name of the requesting terminal in the record area before returning control to the program. In the case of an SRT program, once the requesting terminal has been released (either by using its symbolic name or a blank name), use of a blank terminal name is no longer valid.

Put-Then-Get is the only operation that can be used to get data from the system operator's console (CONSOL), except when an Accept Input is used to receive data entered with the program request. The maximum input and output lengths for this operation are:

Models 10 and 12 – 80
Model 15 – 71

Error Return Codes

When I/O errors occur on an input operation, the CCP sets the effective input length in the parameter list to zero and clears the record area to blanks. When errors occur during the execution of the Put-Then-Get operation, the operation is terminated immediately. Thus, if the error occurs on the Put portion of the operation, the CCP does not perform the Get, but returns control to your program. In order to determine whether an I/O error (negative return code) occurred on the Put or the Get, you can examine the effective input length in the parameter list. If the value of this field is the same as the output length value specified for the operation, then the I/O error occurred on the Put. However, if the value has been set to zero, the I/O error occurred on the Get.

Considerations

- This operation must not be issued as the initial data-transfer operation to a requesting terminal which entered data as part of the program request. The only valid operation which may be issued to such a terminal at that time is an Accept Input (see *Accept Input* Operation).
- This operation can be issued only to a terminal capable of both transmitting and receiving data.
- A maximum input length greater than zero must be specified for this operation.
- An output length greater than zero must be specified for this operation if transmitting to an MLTA terminal or if this is the initial block being transmitted to a BSCA terminal.
- This operation must not be issued to a terminal which has an Invite Input outstanding to it.
- This operation must not be used with the 3270 DFF.

PUT-NO-WAIT

The Put-No-Wait operation allows overlap of the output operation with continued program execution. Put-No-Wait writes a unit of data (record, block, or message) to a specific terminal. For MLTA operations and for BSCA message operations, your program resumes execution immediately upon acceptance of the operation by the CCP. Optionally, a carriage return is performed for MLTA typewriter terminals before and/or after writing the data (*New Line* and *End Line,* respectively). New Line and End Line are ignored for BSCA operations.

Operation Codes

Hex	Dec	RPG II	Meaning: Perform Put-No-Wait as follows:		
			New Line	**End Line**	**Unit of Data**
0006	6	ƀƀƀF	yes	yes	Record
0106	262	bAƀF	yes	no	
0206	518	ƀBƀF	no	yes	
0306	774	ƀCƀF	no	no	
0026	38	ƀƀBF	yes	yes	Block
0126	294	ƀABF	yes	no	
0226	550	ƀBBF	no	yes	
0326	806	ƀCBF	no	no	
0036	54	ƀƀCF	yes	yes	Message
0076	118	ƀƀGF	yes	yes	
0136	310	ƀACF	yes	no	
0236	566	ƀBCF	no	yes	
0336	822	ƀCCF	no	no	
0836	2102	ƀHCF	yes	yes	Put overrides message used only with DFF
0876	2166	ƀHGF	yes	yes	

Additional Requirements

- Set value of Output Length field in the parameter list (see exception in RPG II for SPECIAL files).
- Provide a symbolic terminal name (or blanks) in the record area.

Information Returned

- Return codes (see explanations in Appendix E):

0	Operation accepted by CCP
5	Data pending (BSCA)
9	Terminal offline

Function and Use of Put-No-Wait

This operation causes the data in the Put record area to be Put to a specific terminal. The requesting program resumes execution upon acceptance of the operation by the CCP.

The Put-No-Wait operation may specify:

- A record is to be written in the current block (see index entry *blocking*).
- An EOB (end of block) signal is to be issued following the record and the next record is to begin a new block (Put Block).
- A record is the last to be Put in the current transmission; that is, the EOT (end of transmission) signal is to be issued following the data (Put Message).

Put-No-Wait with EOB, Put-No-Wait with EOT, and PRUF Put-No-Wait with EOT are intended for use with BSCA terminals; however, these operations are valid for MLTA terminals and have the same effect as a Put-No-Wait operation without EOB or EOT (Put Record), or without PRUF.

On Put-No-Wait (record) and Put-No-Wait (block) operations to a BSCA terminal, the requesting program does not resume execution until the specified terminal has gained control of the BSCA line.

Put-No-Wait Operation with 3270 DFF

If Put-No-Wait is used with 3270 DFF to put a format on the display, the CCP changes the operation to a Put Message and your program does not regain control until the operation is complete.

Specifying the Terminal

You can specify either a defined symbolic terminal name or blanks in the record area with a Put-No-Wait. A defined terminal name must be either the name under which the referenced terminal was allocated to the program, or, if this is a multicomponent terminal, a sub-terminal name subordinate to that name. A symbolic terminal name which is not assigned to a terminal cannot be used with this operation. Put-No-Wait can be issued to the console, but it is treated as a Put (with wait).

You can use a blank symbolic terminal name for this operation only if your program is an SRT program. A blank name references the terminal that requested the currently executing copy of the program. The CCP returns the name of the requesting terminal in the record area before returning control to the program. In the case of an SRT program, once the requesting terminal has been released (either by using symbolic name or a blank name), the use of a blank terminal name is no longer valid.

Considerations

- The Put-No-Wait operation must not be issued as the initial data-transfer operation to a requesting terminal which entered data as part of the program request. The only valid operation which may be issued to such a terminal at that time is an Accept Input (see *Accept Input* operation).
- This operation can be issued only to a terminal capable of receiving data.
- An output length greater than zero must be specified for this operation if transmitting to an MLTA terminal or if this is the initial block being transmitted to a BSCA terminal.
- This operation must not be issued to a terminal which has an Invite Input outstanding to it.
- Since control is returned to the user program before completion of the data transfer, no indication as to the success or failure or the data transmission is returned to the user program.

INVITE INPUT

The purpose of the Invite Input operation is to make a specific terminal eligible to send input data. The invited input is not made available to your program except as the result of a subsequent Accept Input operation (see next operation).

Operation Code

Hex	Dec	RPG II	Meaning
0005	5	ƀƀƀE	Invite Input

Additional Requirements

- Set value of Maximum Input Length in parameter list.
- Provide a symbolic terminal name (or blanks) in the record area.

Information Returned

Return Codes:

0	Successful
9	Terminal offline

Function and Use of Invite Input

This operation causes CCP to make a specific terminal eligible to transmit data to the application program. The program resumes execution after acceptance of the Invite Input operation by CCP.

More than one Invite Input may be outstanding at one time, but not to the same terminal. As each terminal completes transmission, the data is queued as input to the user program. An Accept Input operation (see next operation), causes the first completed input to be made available to the application program.

The attributes of the data and the unit of data (record, block, or message) for this operation are those specified in the terminal attribute set currently associated with the terminal. For an MLTA terminal, the unit of data is always record.

Invite Input Operation with 3270 DFF

This operation must not be issued to a terminal under 3270 DFF until a Put Message or Copy operation has placed a format on the display.

Specifying the Terminal

You can specify either a defined symbolic terminal name or blanks in the record area for the Invite Input operation. A defined terminal name must be either the name under which the terminal was allocated to the program, or, if this is a multicomponent terminal, a subterminal name subordinate to that name. A symbolic terminal name which is not assigned to a terminal cannot be used with this operation. This operation must not be issued to CONSOL.

You can use a blank symbolic terminal name for this operation only if your program is an SRT program. A blank name references the terminal which requested the currently executing copy of the program. The CCP returns the name of the requesting terminal in the record area before returning control to the program. In the case of an SRT program, once the requesting terminal has been released (either by using a symbolic terminal name or a blank name), the use of a blank terminal name is no longer valid.

Considerations

- An Invite Input operation must not be issued as the initial data-transfer operation to a requesting terminal which entered data as part of the program request. The only valid operation which may be issued to such a terminal at that time is an Accept Input (see *Accept Input* operation).
- This operation can be issued only to a terminal capable of transmitting data.
- A maximum input length greater than zero must be specified for this operation.
- The maximum input length must not be greater than the size of the entire teleprocessing buffer (minus 4) defined in the current assignment set, or redefined during Startup (four bytes are required for control information used by the main storage allocation routines).
- This operation must not be issued to a terminal which has an Invite Input outstanding to it.

ACCEPT INPUT

The purpose of the Accept Input operation is to gain access to the earliest completed record from the terminals to which Invite Input operations were previously issued, and to obtain the data received with a program request or a chain task request. Invite Inputs to the other terminals remain in effect.

Operation Code

Hex	Dec	RPG II	Meaning
0004	4	b̸b̸b̸D	Accept Input

Additional Requirements

- Set value of Maximum Input Length field in the parameter list.

Information Returned

- Input data in the record area.
- Effective length of Input Data, in the parameter list.
- Symbolic name of terminal from which data was received, in the record area.
- Count of outstanding Invite Inputs in the third field of the parameter list, if the 08 return code is received.
- Return Codes:

0	Successful
1	Data Truncated
2	EOT or non-PRUF request to a PRUF program
3	Data truncated and EOT
4	Shutdown requested
7	3270 CLEAR (No AID is returned in the record area)
8	Terminal no longer available (/RELEASE command was successfully entered by the terminal operator)
9	Terminal offline
14	An accept operation for chain task data was successful
15	Chain task data was truncated
-n	Negative return codes (I/O errors – see explanations in Appendix E)

Function and Use of Accept Input

This operation makes data available to your program from one of three sources:

1. A terminal to which an Invite Input operation was previously issued by the program (*program* invite operation).
2. A terminal that presents data along with the program request. In this case, the Invite Input is done by CCP (*system* invite operation).
3. A CCP program that presents data along with a chain task request.

A successful Accept Input operation satisfies the previous Invite Input to the terminal from which data was received so that there is no longer an Invite Input outstanding to that terminal. However, Invite Inputs to other terminals remain in effect and can be satisfied by subsequent Accept Inputs.

Your program resumes execution after data from a terminal has been made available in the record area.

On an Accept Input operation, CCP ignores the data in the name field of the record area. However, the CCP places the name of the terminal from which the data was received in this area before returning control to your program. On a chain task request operation, CCP places the name of the requesting program in the name field.

Accept Input Operation with 3270 DFF

For systems without program request under format or when using the 3270 DFF, you must issue a Put Message or Copy operation to format the display before you use Invite Input and Accept Input operations with the 3270. See *Field Concepts* and *Record Concepts* in Chapter 8 for special requirements in handling input data. See also index entry *Accept Input Operation, 3270 DFF.*

DFF non-PRUF programs that use the AID byte position to set record identifying indicators on Accept Input operations must take into consideration that an Accept Input that satisfies a *system* invite operation does not return the AID byte to your record area. The first byte of the program request input data is in the AID byte field (position 15 if using SUBR92) and could duplicate a valid AID character, causing the corresponding record identifying indicator to be set on.

Accept Input Operation for Program Request Data

When input data is appended to the program request for non-PRUF programs, that data is not processed by the DFF, but is passed directly to the user program. In this case, the Accept Input must not be preceded by a Put Message or Copy operation to format the screen.

The input data is entered into the dynamic TP buffer area in a continuous string. If the data is from a 3270 terminal, the first 8 bytes are the control unit and device addresses, the AID byte, and the 3270 control characters. The length allocated to the dynamic TP buffer is determined by the PGMREQL value (maximum 80 bytes) of the SYSTEM assignment statement plus 8 bytes. When the input data is passed to the program record area, the 8 bytes and the program name information are also stripped from the input data, leaving a maximum of 78 bytes of actual program data. Any additional data in the 3270 buffer at the time of the program request is not sent to the program.

When input data is appended to the request for PRUF programs (identified by the PRUFLNG keyword given on the assignment PROGRAM statement), that data may or may not be processed by DFF. The maximum length of this data may exceed 78 characters, up to the value specified in the PRUFLNG keyword. This data will be processed by DFF if the PRUF$Z keyword was included in the assignment PROGRAM statement. The data stream returned to the program for PRUF non-DFF program requests differs from that for non-PRUF programs.

Program area examples of program request data:

- Non-PRUF:

```
|data
position 1 . . .                (up to 78 chatacters)
(position 15 if RPG II)
```

- PRUF non-DFF:

```
|cu |dev| aid| c@ |sba |  @@|
position 1   2   3   4-5   6   7-8
(position 15 if RPG II)

| pgmnamb̸   data  sba  @@  data . . .
  9 . . .           (up to PRUFLNG parameter)
```

- PRUF DFF:

```
|aid  pgmnam field2 . . .
position 1    2 . . .     (up to PRUFLNG parameter)
(position 15 if RPG II)
```

See Chapter 3 for an explanation of the 3270 control characters, aid, sba, etc.

If the PRUFLNG keyword was given in the PROGRAM statement for the requested program, but the last successful user Put was not a PRUF Put, the CCP will return a 02 return code to the PRUF program being requested. This indicates that non-PRUF data accompanies the program request.

Accept Input Operation for Chain Task Requests with Data

When data is appended to a chain task request for a DFF program, the data is not processed by DFF but is sent directly to the input area in the program. This data does not contain any 3270 control characters.

When a program has been loaded via a chain task request with data, the program must issue an Accept Input operation before attempting any other CCP operation.

Considerations

- You should specify a maximum input length in the parameter list (and a corresponding record area) large enough to accommodate the largest amount of data that can be received from an outstanding Invite Input, because, if several Invite Inputs are outstanding, you do not know which Invite Input will be the first to satisfy the Accept Input.
- Use caution when issuing Accept Input or Get operations after receiving a Shutdown return code (04). If the terminal operators do not key in data to satisfy the operations, the program remains in main storage until cancelled by the system operator. Stop Invite Input operations are recommended to cancel outstanding Invite Inputs and still permit processing of any data that may be received.
- An Accept Input can be issued only under the following conditions:
    1. There are one or more Invite Inputs outstanding for the program (including any implied Invite Inputs due to program requests with accompanying data).
    2. There are no outstanding Invite Inputs and
        a. The program is defined as a never-ending program, and
        b. The defined maximum number of requesting terminals that the program can handle concurrently is greater than the current number of requesting terminals the program is handling.
- An input length greater than zero must be specified for this operation.
- Accept Input is valid to the console only when issued for data with the program request. Any subsequent Invite Input to the console results in program termination.

Shutdown Requested by Operator

A return code indicating that shutdown has been requested by the System Operator may be returned to this operation. In this case, the parameter list remains unchanged except for the return code field; no input data is received. If you still wish to have the operation performed, you must reissue the Accept Input. The shutdown-requested return code can only occur when there are no completed Invite Inputs to satisfy the Accept Input. A shutdown-requested return code will be issed to an operation other than Shutdown Inquiry only once during the execution of the program.

Every program that uses Accept Input should check for the shutdown-requested return code.

Note: Only the Accept Input need be reissued if you still want to have the operation performed, because the Invite Input is still in effect.

STOP INVITE INPUT (OR GET)

The purpose of this operation is to stop an Invite Input previously issued to a specific terminal and, if the Invite Input cannot be stopped, to accept (Get) the input. Stop Invite Input is used when some event has occurred in the program such that the program no longer wants input from the terminal.

Operation Code

Hex	**Dec**	**RPG II**	**Meaning**
0401	1025	ƀDƀA	Stop Invite Input

Additional Requirements

- Provide a symbolic terminal name (or blanks) in the record area.
- Set value of the Maximum Input Length field in parameter list.

Information Returned

- Input data (if Invite Input is not stopped)
- Effective Input Length value in parameter list (if Invite Input is not stopped)
- Count of outstanding Invite Inputs in the third field of the parameter list, if the 08 return code is received.

- Return Codes:

0	Get successful (no exception conditions)
1	Data truncated
2	Get successful with EOT
3	Data truncated with EOT
7	3270 CLEAR (No AID is returned in the record area)
8	Terminal no longer available (/RELEASE command was successfully entered by the terminal operator)
9	Terminal offline
10	Stop Invite Input successful
-n	Negative return codes (I/O errors and device status conditions — see explanations in Appendix E)

Function and Use of Stop Invite Input

Stop Invite Input causes the CCP to attempt to cancel an Invite Input that has been previously issued to a specific terminal. If the Invite Input is stopped successfully, the terminal no longer has an Invite Input outstanding. However, if the Invite Input cannot be stopped, your program must be ready to handle any data received from the terminal as though your program issued a Get to the terminal. Thus, when requesting a Stop Invite Input, your program must present all the information needed for a Get operation. Your program resumes execution either when the Invite Input has been cancelled or when the Get has been completed.

This operation can only be issued to a terminal which has an Invite Input outstanding to it.

If the operation becomes a Get, the attributes of the data and the unit of data (record, block, message) for this operation are those specified in the terminal attribute set currently associated with this terminal (see index entry *terminal attributes*). For an MLTA terminal, the unit of data is always record.

Specifying the Terminal

You can specify either a defined symbolic terminal name or blanks in the record area for this operation. A defined terminal name must be either the name under which the terminal was allocated to the program, or, if a multicomponent terminal, a sub-terminal name subordinate to that name. A symbolic terminal name which is not assigned to a terminal cannot be used with this operation. This operation must not be issued to the system operator console (CONSOL).

You may use a blank symbolic terminal name with this operation if your program is an SRT program. The blank name references the terminal which requested the currently-executing copy of the program. The CCP returns the name of the requesting terminal into the record area before returning control to your program. In the case of an SRT program, once the requesting terminal has been released (either by using a symbolic terminal name or a blank terminal name), the use of a blank name is no longer valid.

Considerations for Using Stop Invite Input

- This operation must not be issued as the initial data-transfer operation to a requesting terminal which entered data as part of the program request. The only valid operation which may be issued to such a terminal at that time is an Accept Input.
- This operation can be issued only to a terminal capable of transmitting data.
- A maximum input length greater than zero must be specified for this operation.

GET TERMINAL ATTRIBUTES

The purpose of this operation is to determine the attributes of a specified terminal.

Operation Code:

Hex	Dec	RPG II	Meaning
0008	8	ƀƀƀH	Get Terminal Attributes

Additional Requirements

- Provide a symbolic terminal name (or blanks) in the record area.
- Set value of the maximum input length field in the parameter list.

Information Returned

- Effective input length value in the parameter list.
- Special information in positions 10-15 of the parameter list (see *Special Information Returned in the Parameter List* following).
- Terminal attributes, in the record area (see *Special Information Returned in the Parameter List* following).
- Return codes (see explanations in Appendix E):

0	Success
1	Data truncated

Special Information Returned in the Parameter List

Get Attributes returns the following information in the last three fields of the parameter list. This is the only situation in which you may want to reference information in these fields. These fields are not returned by the RPG II Get Attributes operation.

Positions 10-11: (Work Area A)

Contains the address of the Terminal Unit Block (TUB) for the terminal specified. The Terminal Unit Block is an internal CCP control block used to maintain control information for each terminal defined in the system with a MLTATERM or BSCATERM statement during the Assignment run.

Positions 12-13: (Work Area B)

BSCA Terminal: Contains the block length specified in the terminal attributes set associated with this terminal.

MLTA Terminal: Contains the record length specified in the terminal attributes set for the terminal.

Positions 14-15: (Work Area C)

BSCA Terminal: Contains the record length specified in the terminal attributes set associated with this terminal.

MLTA Terminal: Contains the record length specified in the terminal attributes set for the terminal.

Information Returned in the Record Area

As a result of a successful Get Attributes operation, the following information is returned in the first 21 positions of the data portion of the record area (all information is in EBCDIC).

Position 1 - Allocation Status: Position 1 contains a single character that indicates the following information about the terminal specified:

EBCDIC Character	Meaning
1	Allocated to this program. All the attribute data is provided.
2	Allocated to another program. All the attribute data is provided.
3	Not allocated to a program. All the attribute data is provided.
J K L	The specified name was a sub-terminal name. The master symbolic terminal name has been returned in record area. All attribute data applies to the master terminal. J = Master is allocated to this program. K = Master is allocated to another program. L = Master is not allocated to a program.
X	The specified symbolic terminal name is not assigned to a terminal. No other attribute data is provided.
Z	Terminal name not defined in the system.

Position 2 - Terminal Class: Position 2 contains a single character representing the class of terminal as follows:

EBCDIC Character	Terminal Class
0	CONSOL 5471 Printer/Keyboard (Models 10 and 12), CRT/Keyboard (Model 15)
1	MLTA terminal other than 1050
2	1050
3	3277M1 (480-character), 3284M1, or 3286M1
4	3277M2 (1920-character), 3284M2, or 3286M2
5	3275M1 (480-character), with or without 3284M3
6	3275M2 (1920-character), with or without 3284M3
7	3735
8	Another computer system (CPU) on a BSCA line.
9	3741 Data Station, 5231 Controller Model 2

Position 3 - Line Number: Position 3 contains the MLTA line or BSCA adapter number to which the terminal is attached. Determine whether MLTA or BSCA by checking position 2.

EBCDIC Character	Meaning
1	MLTA line 1/BSCA adapter 1
2	MLTA line 2/BSCA adapter 2
3	MLTA line 3
4	MLTA line 4
5	MLTA line 5
6	MLTA line 6
7	MLTA line 7
8	MLTA line 8

Position 4 - Online: Position 4 contains a single character that indicates whether the terminal is logically online or offline. This logical status of the terminal can be controlled by the system operator by use of the /VARY command (see *CCP System Operator's Guide*).

The value 'Y' indicates the terminal is online; the value 'N' indicates that the terminal is offline.

Position 5 - Line Type: Position 5 contains a character that indicates the type of line on which the terminal resides:

EBCDIC Character	Meaning
P	Point-to-Point
C	Control Station
M	Multi-point Tributary (BSCA only)
S	Switched
W	Control Station - Switched (MLTA only)

Positions 6 - 21 - Terminal Attribute Set: These 16 characters represent the 16 bit settings of the terminal attribute set currently associated with the terminal. (See index entry *terminal attributes;* also see the TERMATTR assignment statement in *CCP System Reference Manual.*)

Record Area Position	EBCDIC Character-Meaning	Corresponding Bit in Attribute Set
6	0 - Translate data 1 - Do not translate data	0
7	0 - Upper case translate 1 - Lower case translate	1
8	0 - Answer switched line 1 - Call switched line	2
9	0 - Manual switched line 1 - Auto switched	3
10	Reserved	4
11	Reserved	5
12	Reserved	6
13	0 - DFF not used for this terminal 1 - DFF used for this terminal	7
14	0 - Data format not record mode 1 - Data format is record mode	8
15	0 - Data format not block mode 1 - Data is block mode	9
16	0 - Data format not message mode 1 - Data format is message mode	10
17	0 - No ITB support 1 - Support ITB characters	11
18	0 - Non-transparency mode data 1 - Transparency mode data	12
19	0 - Verify switched line exchange ID 1 - No exchange ID verification	13
20	0 - No spanned record support 1 - Support spanned records	14
21	0 - No variable length record support 1 - Support variable length records (record separators)	15

Function and Use of Get Attributes

This operation is used to determine the attributes of any terminal defined by a BSCATERM or MLTATERM assignment statement (see CCP System Reference). It is not necessary that a terminal be allocated to a particular program for that program to issue a Get Attributes request to that terminal. The attributes of the specific terminal requested are available in the parameter list and the record area when the program resumes execution.

You might use a Get Attributes operation, for example, to determine which component of a 3270 is being used or whether or not the attribute set defined specifies DFF.

As a result of the Get Attribute operation, 21 characters of information are returned in the record area. If the maximum input length in the parameter list is less than 21, then only the number of characters indicated are returned. The effective input length field in the parameter list indicates the number of characters of information returned; the return code indicates data truncation occurs.

Specifying the Terminal

Issuing this operation with a terminal name that is not defined causes CCP to return a Z in position 1 of the record area.

You may use a blank symbolic terminal name with this operation if your program is an SRT program. The blank name references the terminal which requested the currently-executing copy of the program. The CCP returns the name of the requesting terminal into the record area before returning control to the program.

In the case of an SRT program, once the requesting terminal has been released (either by using a symbolic terminal name or blanks), the use of a blank terminal name is no longer valid.

If a sub-terminal symbolic name is given with this operation, then the attributes of the master terminal are returned along with the name of the master terminal to which the sub-terminal name is subordinate.

Considerations

- If an RPG II program uses position 15 of the input record area as the AID byte to set record identifying indicators, data from a previous operation can be lost or overwritten when a Get Attributes operation is performed.

- The PF 1, PF 2, and PF 3 keys return the characters 1, 2, and 3 respectively as the AID character in position 15 of the record area. A Get Attributes operation can also return the characters 1, 2, and 3 as valid allocation status information in the same position of the record area.

ACQUIRE TERMINAL

This operation enables a program to request a specific terminal to be allocated to itself and to change the attributes of the terminal.

Operation Code :

Hex	Dec	RPG II	Meaning
0009	9	ƀƀƀI	Acquire Terminal — use the attribute set currently associated with the terminal (defined in TERMATTR statement)
0019	25	ƀƀAI	Acquire Terminal — change the attributes to the set identified in third field of the parameter list
0029	41	ƀƀBI	Acquire a command-mode, non-PRUF terminal (5704-SC2 only)

Additional Requirements

- Provide a symbolic terminal name in the record area.

- Provide an attributes identifier in the parameter list, if attributes are to be set by the operation.

Information Returned

Return Codes:

0	Successful
11	Acquire failed

Function and Use of Acquire Terminal

Application programs can issue teleprocessing operations only to those terminals that are allocated to them. One way to allocate terminals is to specify the terminals in the PROGRAM assignment statement (see *CCP System Reference Manual*). However, there may be times when a program wishes to have a terminal dynamically allocated to it. This can be done with the Acquire Terminal operation.

The Acquire Terminal operation causes the CCP to attempt to allocate a specific terminal to a program. If the terminal is online, not already allocated to a program, and not in command mode (signed on), it is eligible for allocation. If operating under control of 5704-SC2, an Acquire Terminal operation can acquire a command-mode, non-PRUF terminal. A non-PRUF terminal is a 3277 or 3275 that is not formatted with a PRUF display.

Along with this operation you may identify a specific set of operational attributes to apply to that terminal while allocated to your program. If an Acquire Terminal operation is to set terminal attributes, then the identifier value of the terminal attribute set (as given in the TERMATTR assignment statement) must be given in the third field of the parameter list (in decimal for RPG II; in hexadecimal for other languages). The CCP checks the attribute set specified against the terminal type for validity.

The Acquire Terminal operation is valid if the terminal is already allocated to your program only if the Acquire Terminal with Set Attributes modifier is issued to change the attribute set. (On a BSCA line, the last transmission must have completed a message; that is, EOT must have been sent or received.)

Your program resumes execution upon the completion of the allocation or upon recognizing that the terminal is not available for allocation.

Specifying the Terminal

For this operation, you must specify a defined symbolic terminal name in the record area. The following names may *not* be specified for the operation:

- The name of a terminal already allocated to the program (except the requesting terminal, immediately after the first successful Accept Input).
- A symbolic sub-terminal name.
- A symbolic terminal name that is not assigned to a terminal.
- CONSOL
- Blank terminal name.

Considerations

When both DFF and non-DFF programs can be requested from the same 3270 terminal, at least two TERMATTR statements (DFF3270-YES and DFF3270-NO) must be defined in the assignment set for these programs. The first terminal attributes set defined in the ATTRID parameter of the BSCATERM statement is the default attribute set for the terminal. A program that uses the requesting terminal in a manner other than that defined by the default attribute set must perform an Acquire Terminal operation with the appropriate attributes identifier to modify the terminal attributes.

CHAIN TASK REQUEST (5704-SC2 Only)

This operation allows a program to request a second program that is to execute as an unrelated task. Data can optionally be passed with the request.

Operation Code

Hex	Dec	RPG II	Meaning
002A	0042	ƀƀBK	Set up a program request from this program.

Additional Requirements

- Provide the name of the requested program in the name field of the record area.
- Specify either the output length or 0 (if no data with the chain request) in the parameter list (see exception under RPG II for SPECIAL files).

Information Returned

Return Codes:

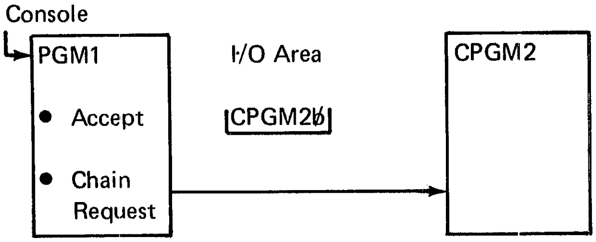
0	Successful operation (Chain Task Request accepted)
12	Request rejected (maximum number of chain task requests already queued)
13	Request rejected (insufficient TP buffer available)

Function and Use of the Chain Task Request

When successfully executed by a CCP program, the Chain Task Request operation causes a second program to be loaded and executed. If the resources (files, terminals, or storage) required by the second program are not available, the second program is automatically queued. If data is presented with the Chain Task Request and PGMDATA-YES was specified on the PROGRAM assignment statement, the data is passed to the second program when that program issues its first Accept Input operation.

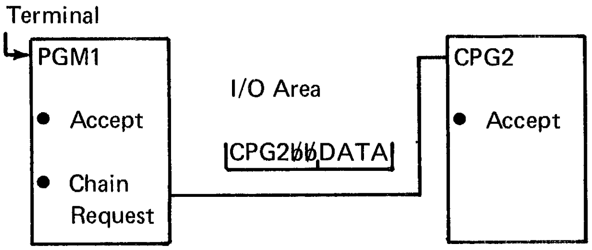
Following are some examples of Chain Task Request operations.

Task Chaining from a Program Loaded from the Console: PGM1 is loaded from the system operator's console by entering the program request: PGM1b̸CPGM2. PGM1 issues an Accept Input operation and receives the data CPGM2, and sets up the chain request.



Note: The output length is zero in this example because no data is passed between programs.

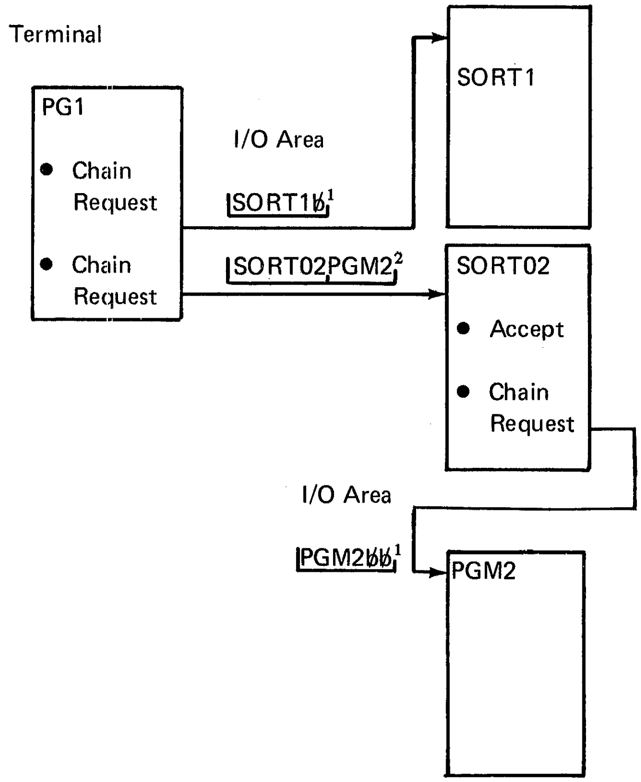
Task Chaining with Data From A Program Loaded From a Terminal: PGM1 is loaded from a terminal by entering the program request: PGM1b̸CPG2b̸b̸DATA. When PGM1 issues an Accept Input operation, the program receives CPG2b̸b̸DATA as data, sets up and issues the chain request for CPG2, and passes the characters DATA to the requested program. When CPG2 is loaded, it issues an Accept Input operation to receive the characters DATA. If both accept operations are successful, PGM1 receives a 00 return code, CPG2 receives a +14 return code.



Note: In this example, the output length is set to four.

Multiple Task Chaining Involving Sort Programs: PG1 is requested from a terminal in this example. No program data accompanies this program request. When PG1 receives control, it sets up and issues the chain request for SORT1. SORT1 is then loaded and begins executing. PG1 then sets up and issues the chain request for SORT02. When SORT02 is loaded, it issues an accept operation to receive the data passed from PG1, performs the sort function, and sets up and issues a chain request for PGM2. PGM2 is then loaded and executed.

Note: It is possible for PG1, SORT1, SORT02, and PGM2 to be executing at the same time, provided the programs do not have conflicting resource requirements. It is not necessary that one program end before another can begin executing.



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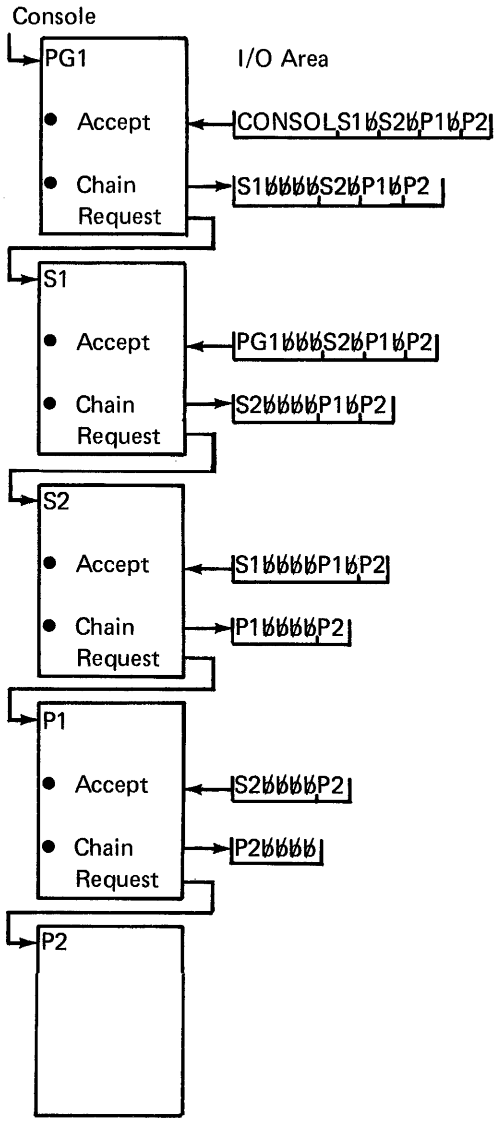
[1] Output length is zero.

[2] Output length is four.

Note: CCP/Sort issues a chain request if chaining was specified during the generation of the sort program.

Multiple Chain Requests Involving both Sort and Nonsort Programs: PG1 is loaded from the console by entering the program request: PG1ƀS1ƀS2ƀP1ƀP2. PG1 issues an accept operation to receive the program data, and sets up the chain request. Sort programs S1 and S2, and nonsort programs operate similarly to the preceding examples.



Note: PG1 and P1 must be set up by the programmer to build the chain requests from the input data and to move the program name into the name field. S1 and S2, the sort programs, are set up to use up to 6 characters of input or until the first blank (delimiter) is detected, as the name of the program for a chain request. The remaining characters are passed as data.

Considerations

- Symbolic file names that are valid for the requesting program are not valid for the requested program because the /FILE commands and SYMFILE statements do not resolve file name references.
- The MAXCHAIN parameter of the SYSTEM assignment statement must contain a value greater than zero for programs that use the Chain Task Request operation. If a Chain Task Request operation is made and MAXCHAIN-0 was specified in the assignment set, the program is terminated with a 3F termination code. The MAXCHAIN parameter has a default value of zero.
- Once a Chain Task Request is accepted by CCP and a return code returned to the requesting program, any further diagnostics and messages for that request are issued to the system operator's console.
- CCP allocation does not queue requests for unit record devices other than the line printer. If a Chain Task Request operation has been successfully executed, but the chained task requires a unit record device (other than the line printer) and is not available, the chained task is rejected and a message is issued to the system operator's console.
- If a program that issued a Chain Task Request operation abnormally terminates, the program requested by the task request is allowed to execute.
- When a series of task chained programs are active when SHUTDOWN is entered, the chained programs continue executing to normal end of job.

RELEASE TERMINAL

The Release Terminal operation enables an application program to give up control of a specific terminal in order to make the terminal available to the rest of the CCP system.

Operation Codes

Hex	Dec	RPG II	Meaning
000A	10	ƀƀƀK	Release terminal and the Communication line.
001A	26	ƀƀAK	Release terminal - keep line allocated to the program (switched lines only).

Additional Requirements

- Provide a symbolic terminal name (or blanks) in the record area.

Information Returned

- Count of Invite Inputs outstanding for this program, in the third field of the parameter list.

Function and Use of Release Terminal

When issued to a terminal on a nonswitched communication line, a Release Terminal operation causes the CCP to release the specified terminal from the program, making it available to other programs (if it was not the requesting terminal) or freeing it to enter commands (if it was the requesting terminal). When issued to a terminal on a switched line, Release Terminal can be issued so that it releases the terminal and either:

1. Keeps the line allocated to the program, or
2. Releases the line, making it available to other programs.

Keeping the line breaks the connection to the terminal, but allows the program to acquire any terminal on the line, since no other application program can gain access to the line.

After completion of the Release Terminal operation the third field of the parameter list contains a count of the outstanding Invite Input operations for the program, including any Invite Input operations issued by the CCP because of data accompanying a program request.

A typical use for the Release Terminal operation is to release a requesting terminal from a *multiple requesting terminal (MRT) program* (see index entry) after the program completes its work for the terminal. When an MRT program is handling its maximum number of requesting terminals, it must release a terminal before it can accept a request from a new terminal.

Your program should issue this operation when it no longer needs a specific terminal, so that the terminal can be available to other programs. Possibly the terminal has been yielding negative return codes because of a malfunction and the program can make no productive use of the terminal. The terminal cannot be placed in offline status by the system operator while it is allocated to a program. Thus, only after an application program releases the terminal can it be placed offline.

Specifying the Terminal

For this operation you may specify either a defined symbolic terminal name or blanks in the record area. A defined terminal name *must* be the name under which the referenced terminal was allocated to the program.

The use of a blank symbolic terminal name is valid for this operation only if the program is an SRT program.

The blank name references the terminal which requested the currently executing copy of the program.

None of the following may be specified as the symbolic terminal name:

- An undefined name (a name not assigned to a terminal)
- The defined name of a terminal not allocated to this program
- A defined name which references a terminal allocated to this program, but which is not the name under which that terminal was allocated to the program
- A sub-terminal name
- CONSOL – the console is automatically released by the CCP at the beginning of execution of a program requested from it.

Considerations

- This operation must not be issued as the initial data-transfer operation to a requesting terminal which entered data as part of the program request. The only valid operation which may be issued to such a terminal at that time is an Accept Input.
- This operation must not be issued to a terminal which has an Invite Input outstanding to it.
- In order to issue Release Terminal on a BSCA line, the line must be at EOT.
- *(Model 10 and Model 12 CCPs)* SRT programs using symbolic files must open the symbolic file before releasing the requesting terminal. In RPG II and FORTRAN, all files are opened before any I/O operations can be performed by the program; however, COBOL and Basic Assembler programs must explicitly open all symbolic files prior to issuing a Release Terminal operation to the requesting terminal.

SHUTDOWN INQUIRY

The Shutdown Inquiry operation is used to determine whether the system operator has requested CCP system shutdown.

Operation Code

Hex	Dec	RPG II	Meaning
0000	0	b̸b̸00	Shutdown Inquiry

Additional Requirements

None.

Information Returned

Return Codes:

0	Shutdown not requested
4	Shutdown requested

Function and Use of Shutdown Inquiry

The system operator can request shutdown of the CCP at any time. When he does, programs currently running should terminate their own execution in a controlled manner, rather than be cancelled by the system operator without warning. The Shutdown Inquiry operation determines whether or not shutdown has been requested and sets an appropriate return code in the parameter list.

If you want your program to perform a controlled termination when shutdown is requested, you may include a Shutdown Inquiry (or an Accept Input) and a test of the return code in your program. For example, perhaps you want your program to inform attached terminals that the CCP is about to shut down before your program terminates.

WAIT OPERATION (Model 15 only)

The Wait operation enables an application program to suspend operation for a specified time period (hours/minutes/seconds).

Note: To use the Wait operation, the timer option must be selected at system generation time.

Operation Code

Hex	Dec	RPG II	Meaning
0014	20	ƀƀAD	Wait Operation

Additional Requirements

- Set output length equal to 10. (If using RPG SUBR92, set output length to 24.)
- Specify the time limit in the user's record area.

Information Returned

Return Code 0 – Successful

Function and Use of Wait Operation

This operation enables the application program to issue a wait request for the amount of time specified (in decimal) in the data area. The data area is specified in the following format:

Terminal name	ƀ	hhmmss	ƀƀƀ
1-6	7	8-13	14-16

where:

1-6 – Symbolic terminal name
7 – Blank
8-13 – hh = number of hours in decimal
mm = number of minutes in decimal
ss = number of seconds in decimal
14-16 – Blanks

Wait Operation Format for RPG SUBR92

op code	output length	terminal name	ƀ	hhmmss	ƀƀƀ
1-4	5-8	9-14	15	16-21	22-24

where:

1-4 – ƀƀAD
5-8 – 0024
9-14 – Symbolic terminal name
15 – Blank
16-21 – hh = number of hours in decimal
mm = number of minutes in decimal
ss = number of seconds in decimal
22-24 – Blanks

Your program resumes execution after the wait operation is completed.

This chapter describes several aspects of communications programming that are important for you to understand before you write application programs that use the CCP communications interface facilities. (The interface facilities are described in Chapter 2 and are further defined in later chapters for each programming language.) The following topics are discussed:

- Terminal classes
- Program use of terminals
- Program types
- Program attributes
- Communications program logic
- Symbolic files
- Switched lines

TERMINAL CLASSES

Under the CCP, terminals are divided into two classes, based on whether or not they are allowed to enter commands to the CCP:

- Command terminals
- Data terminals

Terminals are designated either command terminals or non-command (data) terminals during CCP assignment. (See BSCATERM and MLTATERM assignment statements in *CCP System Reference Manual*.)

Command Terminals

A command terminal can request the CCP to perform special services; the most significant service request is a request to load and initiate a program. Command terminals must be capable of both input and output, since they must be able to transmit commands to the CCP and receive messages from the CCP. Once a command terminal has requested a program, it is capable of sending and receiving data under direction of the program. The terminal remains under control of the program until one of the following occurs:

- The terminal is released by the program.
- The program terminates.
- The terminal operator enters a /RELEASE command, releasing the terminal from the program.

At that time, the terminal is again allowed to enter commands to the CCP. A command terminal that is not currently signed on to enter commands may also be used by a program to send and receive data.

When a switched line with one or more command terminals is not under control of a program, the CCP awaits calls from command terminals on that line.

Data Terminals

A data terminal cannot request CCP services, but can only transmit and receive data under control of programs that use the terminal. When a program releases the terminal, the terminal is not used until it is required by another program.

A switched line that is connected only to data terminals is allocated by the CCP to a single application program at a time. Connections are established (answers or calls) when the program performs I/O operations referencing the symbolic name of a terminal on the line (see index entry *switched lines*).

A data terminal might have only input capability, only output capability, or both input and output capability.

PROGRAM USE OF TERMINALS

Your communications program differentiates between terminals with which it communicates based on whether the terminal requested the program.

Requesting Terminal

A requesting terminal is a command terminal that entered into communication with your program by entering a request for your program while in *command mode* (see *CCP System Operator's Guide* for a description of command mode and program requesting). Once a requesting terminal is in communication with your program, it is in *data mode* and is directed by your program to transmit data, receive data, or both.

From a programming point of view, there are few differences between handling requesting terminals and program-selected terminals. However, the following considerations apply to requesting terminals, but not program-selected terminals:

- A requesting terminal can include data with a program request (if the program is written to handle data with the program request, see PROGRAM assignment statement in *CCP System Reference*), therefore, the program can issue an Accept Input operation as the first operation to the terminal (the CCP in effect issues the first Invite Input operation to the terminal in this case).
- A program that handles only a single requesting terminal (see Program Types) can use a blank terminal name as a reference to the requesting terminal.
- The program does not know which terminal will be the requesting terminal and, therefore, must determine which terminal is requesting by examining the terminal name returned with an initial operation.

Program-Selected Terminal

A program-selected terminal is a terminal that has not requested your program, but is needed by your program to transmit data, receive data, or both.

A program-selected terminal can be attached to your program in two ways: it can be either specified at assignment time as required for your program or acquired by your program during its execution by means of an Acquire Terminal operation. A program-selected terminal can be one of the following:

- A data terminal in standby mode.
- A command terminal in initial mode.
- (5704-SC2 only) A command terminal in command mode and not formatted by a PRUF display.

There are hardware characteristics of certain of the MLTA terminals that need to be considered in designing and writing programs that use program-selected terminals:

A request for a program that uses a program-selected terminal is rejected by the CCP if the terminal is on a switched line that is already connected.

Data Terminals: No special consideration.

Command Terminals: Command terminals operating under 5704-SC1 must be in initial mode in order to be program selected. Command terminals operating under 5704-SC2 must be in either initial mode or in command mode and not formatted by a PRUF display in order to be program selected. However, while in initial mode, command terminals are invited for input by CCP. Thus, one of the steps in the allocation of a command terminal in initial mode is a Stop Invite Input request from CCP. If the Stop Invite Input fails (that is, the read to the terminal cannot be cancelled), the program selection of the terminal is considered to have failed. Thus, the capability of cancelling a read operation is crucial to the program selection of command terminals.

There are certain terminal types for which reads cannot be cancelled once they have been issued. Once a read has been issued to the terminal, no other operation can be started to the terminal until the input operation completes. The terminals whose hardware characteristics fall into this category are:

1. 2741
2. 2741 Dial

3. 2740 Dial with transmit control

4. 2740 Dial with transmit control and checking

5. 3767 simulating a 2741

6. 5100 simulating a 2741

Therefore, if these terminals are assigned as command terminals, it will be extremely difficult for them to be program selected. Application programs using these terminals should be written so as to handle them as requesting terminals. This may require writing a program as a multiple requesting terminal (MRT) program.

PROGRAM TYPES

Two general types of communications programs can be written to run under the CCP:

- Single Requesting Terminal (SRT) Program
- Multiple Requesting Terminal (MRT) Program

Programs are designated as either MRT programs or non-MRT (SRT) programs by the PROGRAM statement during CCP assignment (see *CCP System Reference Manual*). If the MRTMAX keyword is used on the PROGRAM statement, the program is considered an MRT program. (MRTMAX specifies the maximum number of requesters the program can handle concurrently.) SRT and MRT programs have different characteristics and place significantly different requirements on the application programmer (see *Examples of Application Program Logic,* later in this chapter).

Single Requesting Terminal (SRT) Program

An SRT program can service the needs of only one requesting terminal on each execution (that is, from the time the program is initiated by the CCP until it terminates). A typical example of an SRT program is an inquiry program that processes one or more messages from its requester and then terminates, using system resources only briefly. The program may access or update several different files in order to complete its processing. An SRT program might also transmit batched data to a host system, such as a System/370, where the host is the requester of the program.

An SRT program can be written to acquire (or require, by means of the TERMS parameter of the // PROGRAM assignment statement) one or more program-selected terminals while servicing the requesting terminal. For example, perhaps the requester wants information from several terminal locations or wants to send information to other locations. An example of such a program might be an inquiry program that serves a credit office application. The requesting terminal asks for information about a customer from terminals in other offices by issuing a message to program-selected terminals in those offices specifying the customer identification. The attached offices reply with the latest credit information.

If sufficient resources are available, the CCP can load and initiate separate, duplicate copies of an SRT program, each copy servicing a different requesting terminal. If resources are not available, second and subsequent requests for the program may be placed on a queue by the CCP (see /Q command in *CCP Terminal Operator's Guide*). Multiple copies of an SRT never-ending program are not permitted under the CCP.

Multiple Requesting Terminal (MRT) Program

An MRT program can service requests from one or more terminals each time it is executed. An MRT program may be written to handle multiple requesting terminals concurrently. The maximum number is specified by the MRTMAX keyword of the PROGRAM statement at assignment time. Requests for the program that are received while the program is already handling its maximum number of terminals are queued by the CCP (if the requester has indicated queuing) to be honored when the program has released a terminal; therefore, you need not check this in your program. Only a single copy of any one MRT program can be in main storage at a time.

New requesting terminals are attached to an MRT program by means of *Accept Input operations* (see index entry). A program is notified that a new terminal is attached by receiving a new terminal name from an Accept Input.

MRT programs must maintain status information regarding several requesting terminals in order to remember which terminals are attached and the status of each terminal relative to the program.

You must explicitly release a requesting terminal once your program has completed the processing required by the terminal (see index entry *Release Terminal operation*). If not released, the terminal remains allocated to the program until the program terminates. An MRT program should be written to terminate when it has no more requests to service, unless the program is defined as a *never-ending program* (see *Program Attributes*).

Many application programs, both order entry and inquiry, could be written in either single requester or multiple requester form. If a program is likely to be often requested from more than one terminal concurrently, it is more efficient to code the program as an MRT program, since the MRT version is not as likely to cause resource conflicts as are numerous requests of an SRT program. Also, an MRT program should take less main storage space than separate copies of an SRT program.

An MRT program can be defined as MRTMAX-1 on the PROGRAM assignment statement. In this case, only one request is processed at a time, as in an SRT program, but subsequent requests for the program can be queued to the same copy of the program if the requesting terminal has elected to queue requests (/Q command). An MRT program defined in this way does not have to keep track of multiple attached terminals; however, the program cannot process multiple requests concurrently and only one copy of the program can be in main storage at a time.

If an MRT program is specified as NEVEREND-NO and MRTMAX-1 (capable of handling only a single requesting terminal), the program is reloaded each time it is requested, even if it is in storage at the time of the request.

SPECIAL PROGRAM ATTRIBUTES

The two general communications program types—SRT and MRT—may have additional special attributes:

- Never-ending
- Serially reusable (Models 10 and 12)
- Dedicated (Models 10 and 12)
- Program request under format
- Sort

The PROGRAM assignment statement specifies whether a program has any of these attributes.

Never-Ending Program

If a program is to be requested frequently throughout the CCP run and if sufficient main storage is available, it can be defined as a never-ending program (NEP). An NEP, once it has been loaded and initiated by the CCP, does not terminate (except in an unusual situation) until the CCP is shut down. Under Model 10 and Model 12 CCP, once an NEP is loaded, the main storage it occupies is permanently unavailable for other programs, even if it terminates in an unusual situation. Under Model 15 CCP, the main storage occupied by an NEP is released for use by other programs if the NEP terminates in an unusual situation.

An NEP with no work to do (no outstanding Invite Inputs) issues an Accept Input operation and waits until it is requested again. See *Disk File Considerations* in *Chapter 9: Program Preparation* for a Model 15 CCP consideration in this situation.

When using NEPs, you should be aware of facts concerning system resource allocation:

- While a particular system resource is allocated to a NEP, requests for programs that also require the resource will be rejected, regardless of the queuing status (/Q or /NOQ) of the requesting terminal.
- When an NEP requires a system resource that is already allocated to another program, the request for the NEP will be rejected without regard to the queuing status of the requesting terminal. Under Model 15 CCP, a request for a NEP can be queued if CCP is handling the maximum number of tasks or if user program area is not immediately available.

An NEP should either check for the shutdown return code or issue the Shutdown Inquiry operation so that CCP shut down can be successfully completed.

When writing an SRT program as a never-ending program, be aware that second and subsequent requests for the program are rejected by the CCP.

To ensure that the required main storage is available for the never-ending program, it is recommended that all never-ending programs (only one of which can be an SRT program) be loaded into main storage prior to requesting any other programs. Main storage fragmentation could result if never-ending programs are not started as the initial programs in the system.

Note to Model 10 and 12 Users: It is especially important to load NEPs first if they use the 3270 Display Format Facility, because the Display Format Facility is loaded into the user program area for execution.

Note to Model 15 Users: CCP always loads NEPs at the opposite boundary of the user program area from non-NEPs to avoid fragmentation of this area, which could otherwise severely impair CCP performance.

Serially Reusable Program (Models 10 and 12)

A serially reusable program terminates normally after executing and can be re-executed without requiring a fresh copy of the program to be loaded in main storage. A serially reusable program must restore data areas and modified instructions to their initial condition prior to reusing those data areas and instructions when the program is reinitiated. Only COBOL and Basic Assembler programs can be written to be serially reusable. Never-ending programs cannot be specified as serially reusable.

Use of serially reusable programs can increase CCP efficiency, especially if the programs are requested frequently, since the need for repeated loading of the program can be avoided in some cases. If other programs are being requested and loaded, however, timing of the requests may be such that, when a subsequent request for the serially reusable program is entered, the main storage space previously occupied by the serially reusable program is already occupied by another program. In this case, the serially reusable program must be reloaded.

Dedicated Program (Models 10 and 12)

When a program defined as a *dedicated program* is running, it must be the only program running in the CCP program level, even though multiprogramming is allowed by the CCP. It may not be initiated while other programs are running and other programs may not be initiated while it is running. This program attribute applies only in CCP systems that allow more than one program to be executing concurrently.

You might want to designate a program as dedicated if it requires exclusive use of disk files that are otherwise shareable, for example, a program that performs summary operations at a particular cut-off time, such as day-end or month-end, when concurrent operations on the files are not desired. A dedicated program might also be used in applications where fast response time is important and the program relies on exclusive access to all communication lines, disk files, and other system resources.

Program Request Under Format

With a non-PRUF request, the maximum amount of data that can be passed to a user program, as a program request, is 78 characters. This is not an efficient use of the 3270 terminal buffer. An efficient method of using the 3270 terminal is to write a short SRT program which will put a display at a terminal, and then go to end of job. The terminal operator can then fill in the display with data, cause attention (PF key or ENTER key) and have the display at the terminal essentially request another program. The whole display will be used as program request data. This concept of requesting programs and passing up to a full screen of data to the requested program is called Program Request Under Format (PRUF).

The use of PRUF will provide the following capabilities:

- More than one field of data may be passed as program request data.
- More than 78 characters of data may be accepted as program request data.
- The AID character is passed as program request data to PRUF programs, but not to non-PRUF programs.
- The data passed to the user program with the program request may or may not be processed by DFF under format control if the program being requested is a PRUF program. However, DFF does not process non-PRUF program request data.
- Main storage can be used efficiently, as a program need not be in main storage during a lengthy terminal operator keying operation.

A program is defined as a PRUF program if the PRUFLNG parameter is specified in the assignment PROGRAM statement. The PRUFLNG parameter specifies the maximum length of program request data to be sent by the terminal. If the PRUF program is also a DFF program, the PRUF$Z parameter is specified in the PROGRAM statement. This gives the name of the format which will be used by DFF to format the program request data. (See the *IBM System/3 Models 10 and 12 Communications Control Program System Reference Manual,* GC21-7588, or the *IBM System/3 Model 15 Communications Control Program System Reference Manual,* GC21-7620, for a complete description of these keywords.)

To inform CCP that the next program request from a 3270 terminal will be a PRUF program request, user program A (which may be a PRUF or a non-PRUF program) executes a PRUF-Put operation to the 3270 terminal as its last output operation prior to releasing that terminal or going to end-of-job. If the terminal receiving the PRUF-Put operation was a requestor of the program issuing the PRUF-Put, that program must have ENDMSG-NO specified on its PROGRAM statement.

Before returning the terminal to command mode status, CCP will reserve an area from the TP buffer, equal in length to the maximum PRUFLNG, as a temporary hold area for the program request data from that terminal. It should be noted that CCP will only reserve a TP buffer area equal in length to the PGMREQL, as specified in the SYSTEM statement, if the last user output operation to that terminal is not a PRUF-Put operation.

The first field received from the 3270 must be the program name of the PRUF program to be requested and must begin in row 1, column 2 or later on the screen. The program name must be either entered in the first field on the screen (that field defined as an input field) or sent to the screen (by a PRUF-Put operation) in the first field defined as an output/input field. The terminal operator then keys in data to all needed input fields on the screen.

When all the needed fields have been keyed in, press the ENTER key, a PF key, or insert a card into the card reader (this action is device dependent). Now the program request for program B enters the system. If program B is a non-DFF program, the following data will be passed as program request data to program B:

cu	dev	aid	c@	sba	@@	pgmnamb̸ pgmdata . . .
1	2	3	4-5	6	7-8	9 . . .

Note: If the program is written in RPG II, these fields start in column 15 of the input specifications,

where:

cu = Control unit address of the 3270 terminal
dev = Device address of the 3270 terminal
aid = AID character
c@ = Cursor address
sba = Set buffer address (X'11')
@@ = Address of start of pgmnam field
pgmnam = Name of program B
b̸ = EBCDIC character for a blank (X'40')
pgmdata = Remainder of 3270 text stream or the number of characters specified by PRUFLNG parameter, whichever is smaller.

A PRUF program request will return *8* plus *PGMNAM length* plus *1 additional* character of data more than a program request for a non-PRUF program. If a program B is a DFF PRUF program, DFF will attach the PRUF$Z format to the program using that format for control and move data into program B's input record area at program request time. (See Chapter 8 for a description DFF handling of accept input data.)

The following considerations apply when running CCP assignment sets with PRUF programs:

- PRUF-Put operations to the system console are invalid.
- If the 3270 terminal has been formatted by a PRUF-Put operation, and the program being requested is a non-PRUF program, CCP will reject the program request.
- If PRUF is not active on the 3270 terminal, and the program being requested is a PRUF program, CCP will issue a 02 return code following the Accept Input operation. The program request data returned in this case will begin with the first character of data following the program name and a blank. This will not have been processed by DFF.
- If PRUF is active on the terminal, all system messages to that terminal will be output in positions 82 through 160. Therefore, these positions should be used with caution at program request time to PRUF programs.
- A terminal which had a PRUF-Put format sent to it has this condition (PRUF-type terminal) terminated by the next non-PRUF Put operation sent to the terminal, or if the terminal CLEAR key is pressed.

Sort Programs (5704-SC2 Only)

Sort programs must be generated offline from CCP but can be executed as user programs under CCP. Multiple sort programs can be active under CCP at one time providing each program has a unique name, and unique work and output files. A minimum of three files must be defined on the FILES parameter of the PROGRAM assignment statement for a sort program:

- An input file with CG access. Input files can be opened with CO, IO, and IOU access methods but the opening program must terminate successfully before the file can be shared. Up to eight input files can be defined.
- A work file with CA access and specified as nonshareable.
- An output file with CO access and specified as nonshareable. After a sort program has completed successfully, the output file can be opened using CA, CG, CO, CU, DG, or DU access methods.

Note: The sort input file cannot be specified as the sort output file. The use of SYMFILE statements and /FILE commands to resolve sort file name assignments is supported, but do not attempt to overlay the input file with the output file using the SYMFILE and /FILE facilities.

After a sort program has terminated successfully, the input, work, and output files are available to other sort and nonsort programs.

When a sort program is requested from a terminal, additional modules with the prefix $DG are loaded by the sort program. These additional modules (initially supplied on the system pack) must be on the same pack from which the sort program was loaded. For example, if a sort program has been placed on the program pack (PACK-PROGRAM specified on the PROGRAM assignment statement), the $DG modules must be copied to the program pack from the system pack. This can be accomplished using the following OCL:

```
// COPY FROM-nn, TO-nn, LIBRARY-O,RETAIN-P,
          NAME-$DG.ALL
```

Because of space considerations, it may be more convenient to put the sort program on the system pack.

Once a sort program has started, the requesting terminal is released and is free to perform other operations. All sort messages indicating the status of the sort program are issued to the system operator's console after the requesting terminal is released.

Note: If another program is allowed to update the sort input file at the same time that a sort program is processing the file, improper results can occur. For this reason, either specify NOSHR for the sort input file in the assignment set, or allow input only programs to access the file while the sort program is executing. See *CCP System Reference* manual for your system and the *IBM System/3 Disk Sort Reference Manual,* SC21-7522, for additional information about sorts.

If shutdown is requested, an active sort program is allowed to complete execution to normal termination.

Sorts and Task Chaining

When a sort program is to issue a chain request, the name of the requested program and the data (if required) must be passed to the sort program with the program request. The sort program interprets the first six characters (or up to the first blank if the name is less than six characters) as the name of the program to be requested. The remaining data is passed as data along with the chain request.

If more than 80 characters of data are passed to a sort program, the sort program issues a CCP DATA TRUNCATED message to the console, and issues the chain request, even though the data has been truncated.

If CCP is handling the maximum number of chain requests when a sort program issues a chain request, CCP issues a TASK CHAIN UNSUCCESSFUL message to the console. In this case, the sort program is allowed to complete execution, but the chain request is neither issued nor executed.

For an example of a sort program issuing a chain request, see index entry: *chain task request.*

EXAMPLES OF APPLICATION PROGRAM LOGIC

Programs that do not communicate with online terminals are most often designed to run in *batch processing* mode; that is, one program completely finishes its processing before the next program begins to run. Often, the program processes a large number of data records which contain similar data in similar format. Such a program probably uses only a few data files; perhaps it builds a temporary file and updates a permanent file. (Communication terminals can also be used to advantage in batch processing mode.)

Most communications programs, on the other hand are designed for a very different environment, characterized by *online processing;* that is, data enters the computer directly from the point of origin and is transmitted directly to where it is used. The communications environment often includes several terminals, each making requests in a random manner, each request requiring the execution of a different program. Each program might process only a single transaction at a time for the terminal, affecting several different files. The majority of communications programs utilize this type of processing, which requires program logic different from that required for batch processing.

The following examples illustrate the typical logic required to deal with:

- A single requesting terminal
- A single requesting terminal and program-selected terminals
- Multiple requesting terminals
- Multiple requesting terminals and program-selected terminals

Single Requesting Terminal

Figure 3-1 shows the program logic that might be used in a program that deals with only a single requesting terminal on each execution. The numbered notes further explain aspects of the logic.

❶ If data is expected with the program request, no Invite Input is required, since the first Accept Input will return the requester's name and data in the record area. If data is expected with the program request, an Accept Input *must* be issued.

❷ A Put operation with a blank terminal name causes the name of the requesting terminal to be returned in the record area. Invite Input can then be issued to that terminal. If no data is expected with the program request, a Get operation with a blank terminal name can be used after the Put operation instead of the Invite Input and Accept Input operations.

❸ If data is expected with the program request, the first input operation is an Accept Input. Subsequent input operations can either be Accept Input or Get operations. If Accept Input is used, Invite Input must be issued prior to the Accept Input except for the first Accept Input operation when data is expected with the program request.

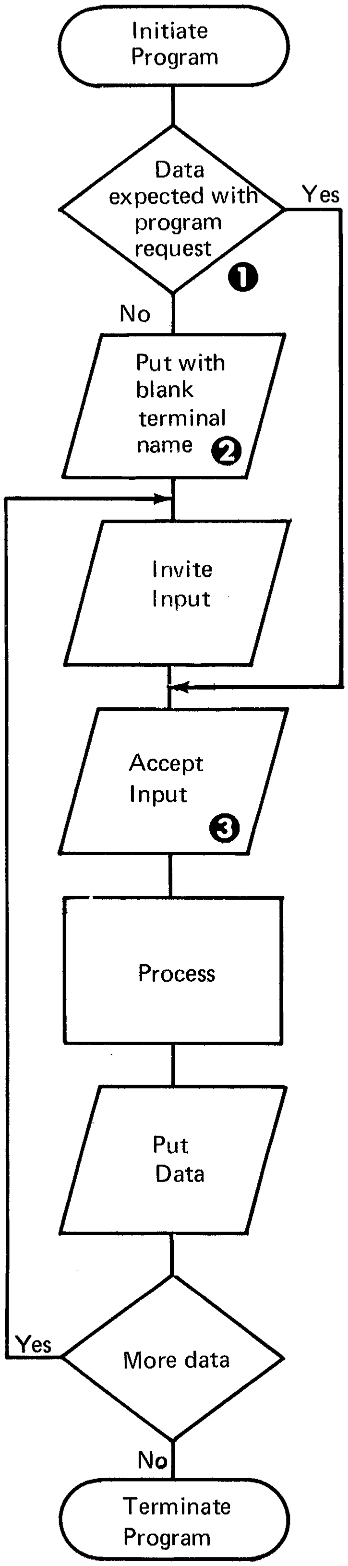


Figure 3-1. Program that Communicates with a Single Requesting Terminal

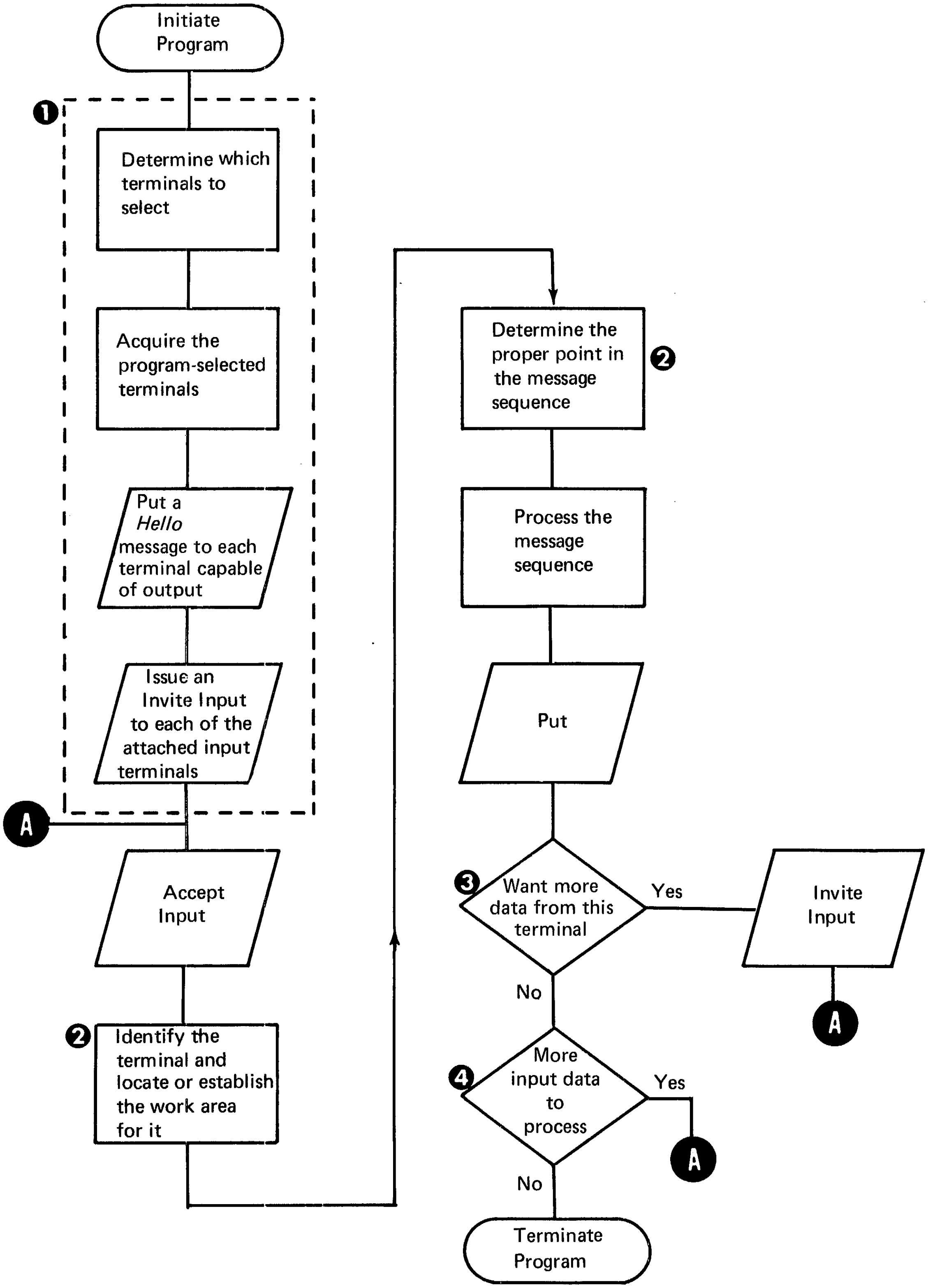


Figure 3-2. Program that Communicates with a Single Requesting Terminal and Program-Selected Terminals

Single Requesting Terminal and Program-Selected Terminals

Figure 3-2 illustrates the logic that could be used by a communications program to deal with a single requesting terminal and one or more program-selected terminals. The numbered notes further explain characteristic aspects of this type of logic.

❶ These steps (enclosed by the broken line) are performed only the first time through the program. A program can determine which terminals to select in various ways:

- The terminals required by the program are specified at assignment time and the terminals have been allocated to the program before it gains control.
- The program knows which terminals it needs, but must acquire them itself.
- The program does not know which terminals to select. The program might have to obtain this information from the system operator, a terminal, or from the data he is processing.

When the program knows which terminals to select, it can acquire them (if not already allocated by assignment), Put a "Hello" message, and Invite Input, as required.

❷ When a program is capable of handling more than one terminal, it may need to set aside a separate work area for each. The program would use the work area to retain enough information to remember what it has previously received from each terminal. When, for example, input data consists of more than one part, a separate routine often processes each different part. A complete input message might consist of a customer name or number, an order number, item numbers, quantities, prices, and other information, entered as separate lines of input data and, in fact, as separate transmissions from the terminal. The program must be able to determine which portion of the data it is processing, where to store that data in the work area, and which routine processes that portion of the data.

❸ When a program-selected terminal has completed a message sequence, the program must determine whether it wants additional input from the terminal. For example, if the program has received an end-of-input signal or if the system operator has issued the SHUTDOWN command (and the program recognizes the shutdown return code), the program should not issue an Invite Input to the terminal.

❹ If any other program-selected terminals have input messages to transmit (have outstanding Invite Input operations issued to them), the program finishes processing them. When all input from the program-selected terminals and the requesting terminal has been processed, the program terminates.

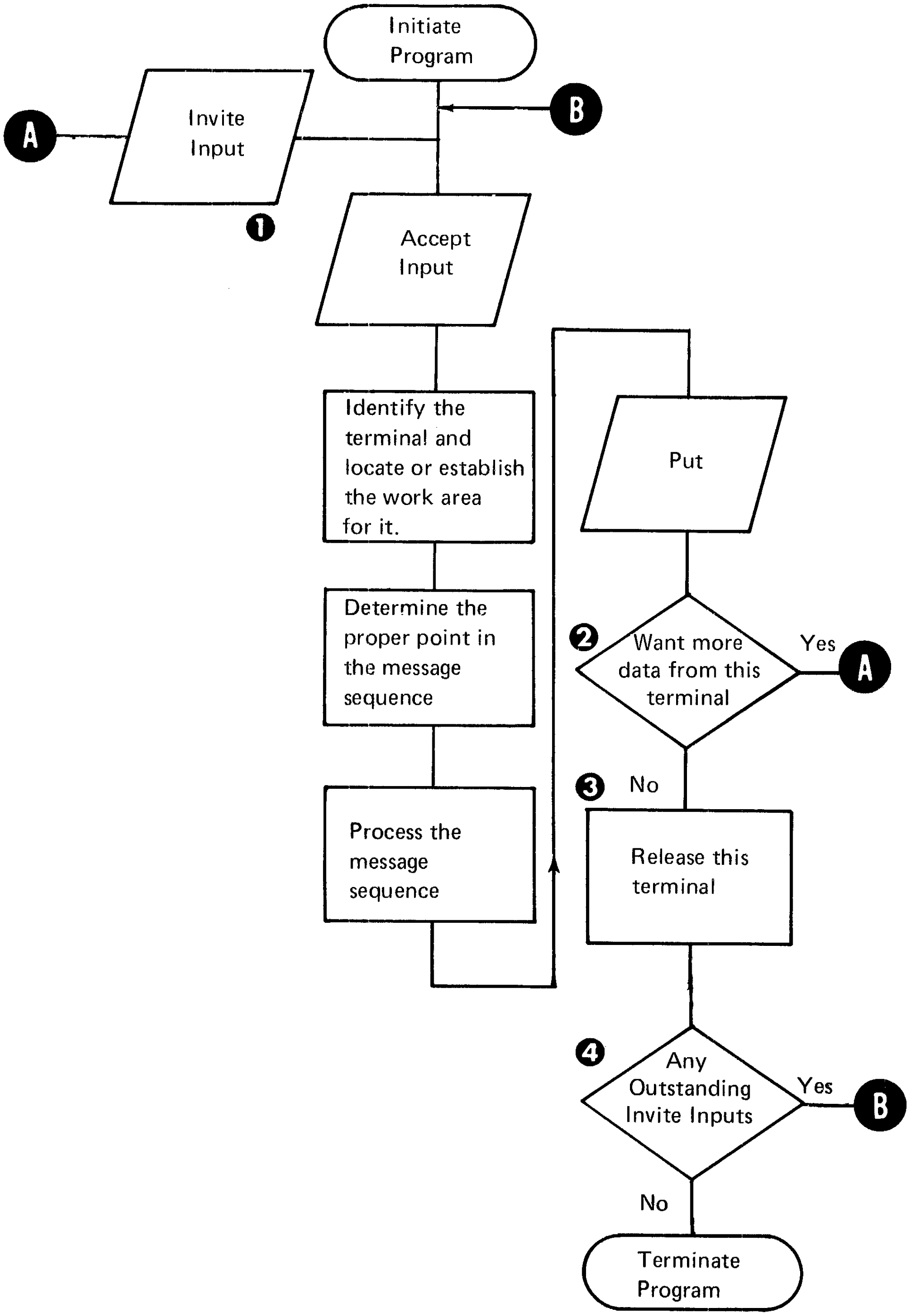


Figure 3-3. Program that Communicates with Multiple Requesting Terminals and No Program-Selected Terminals

Multiple Requesting Terminals

Figure 3-3 shows the program logic that might be used in a program that deals with multiple requesting terminals. The numbered notes further describe key steps in the logic.

❶ The Invite Input is bypassed the first time through since it is not known which terminal requested the program until after the Accept Input operation.

❷ When the program has received the final portion of a message sequence from a particular terminal, it must determine whether it wants additional input from the terminal. If, for example, the terminal has indicated that this is the last message it will send or if the system operator has issued the SHUTDOWN command to shutdown the CCP (and the program recognizes the shutdown return code), the program should not issue an Invite Input to the terminal.

❸ If no Invite Input is to be issued to this terminal, the terminal is released from the program.

❹ If requests from other terminals are in process or awaiting processing, they must be completed before the program terminates. The number of remaining requests can be determined from the count of outstanding Invite Inputs, returned in the third field of the parameter list by the previous Release Terminal operation.

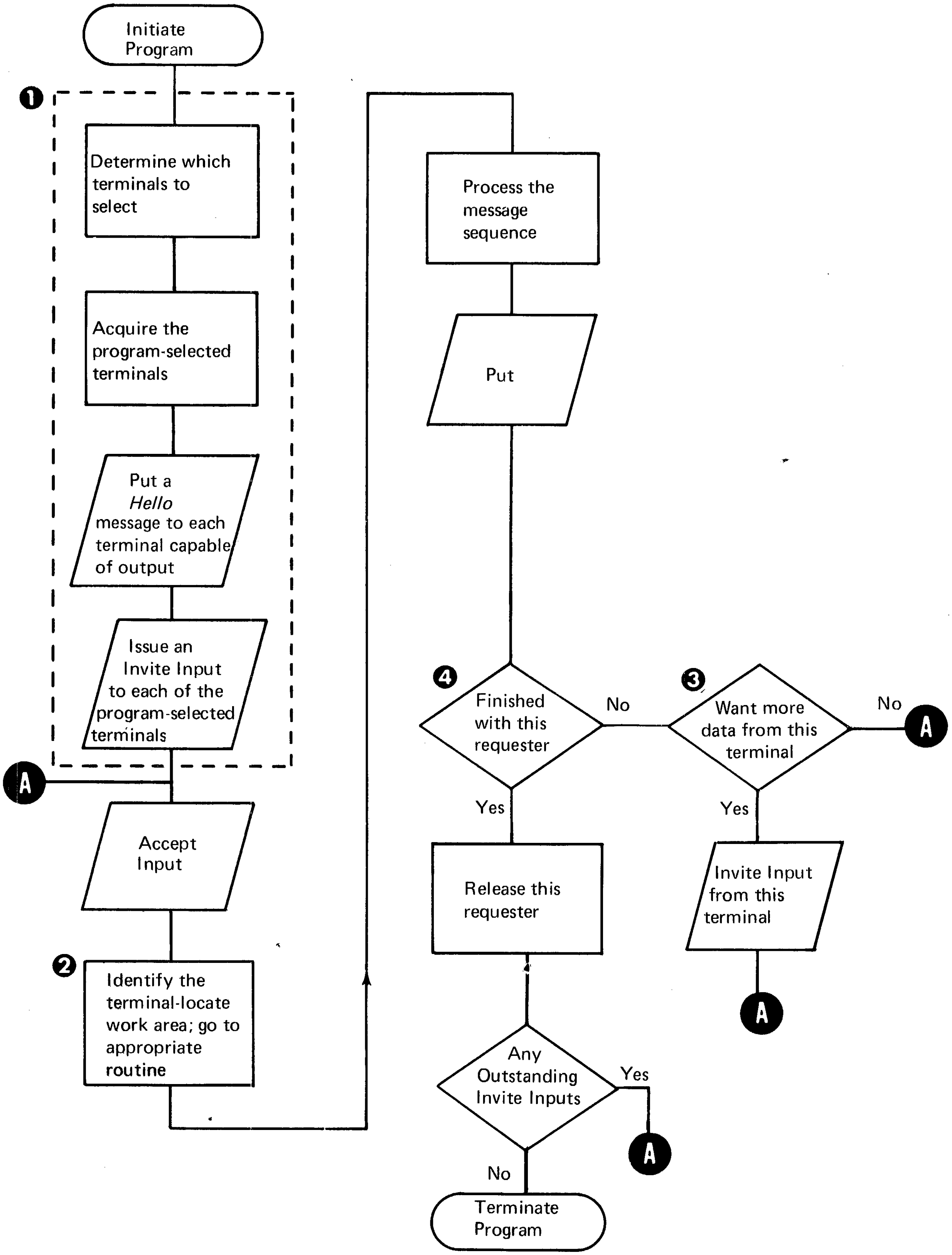


Figure 3-4. Program that Communicates with Multiple Requesting Terminals and Program-Selected Terminals

Multiple Requesting Terminals and Program-Selected Terminals

Figure 3-4 shows an example of the general logic of a communications program that accepts requests concurrently from several requesting terminals and, in satisfying the requests, contacts one or more program-selected terminals. As each requester is satisfied, the program releases it, enabling the requester to enter other commands to the CCP. The program-selected terminals in this example are not released from the program until the last requester has been served and the program is terminated. The numbered notes further explain key steps in the logic.

❶ The first-time processing required when program-selected terminals are used is described in Figure 3-2.

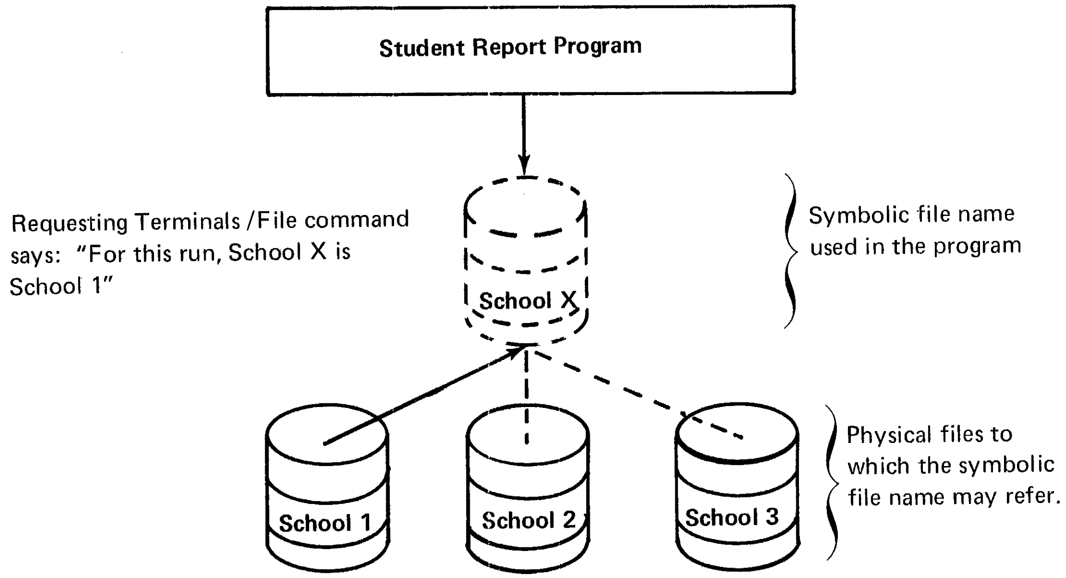
❷ When a program is capable of handling more than one terminal, it may need to set aside a separate work area for each. The program may have to retain enough information to remember what it has previously received from each terminal. When, for example, input data consists of more than one part, a separate routine often processes each different part. A complete input message might consist of a customer name or number, an order number, item numbers, quantities, prices, and other information, entered as separate lines of input data and, in fact, as separate transmissions from the terminal. The program must be able to determine which portion of the data it is processing, where to store that data in the work area, and which routine processes that portion of the data.

❸ When a program-selected terminal has completed a message sequence, the program must determine whether it wants to invite additional input from the terminal. For example, if the program has received an end-of-input signal or if the system operator has issued the SHUTDOWN command, the program should not issue an Invite Input to the terminal.

❹ If requests from other terminals are in process or awaiting processing, they must be completed before the program terminates.

SYMBOLIC FILES

Under the CCP, you can write a program using a file name (symbolic file) which might refer to a different physical disk file each time the program is executed. The physical (actual) files must be similar in format (that is, the same file organization, access method, record length, key length, and key position), although different in content. For example, you could write a student report program that generates a report for a different school on each execution, depending on which school's student file is associated with the symbolic file for a particular run (Figure 3-5).



Requesting Terminals /File command says: "For this run, School X is School 1"

Symbolic file name used in the program

Physical files to which the symbolic file name may refer.

The assignment statements for this example might look like this (see *CCP System Reference Manual* for explanations of the assignment statements):

```
// DISKFILE NAME-SCHOOL1, ORG-I, RECL-100, KEYPOS-94, KEYL-7
// DISKFILE NAME-SCHOOL2, ORG-I, RECL-100, KEYPOS-94, KEYL-7
// DISKFILE NAME-SCHOOL3, ORG-I, RECL-100, KEYPOS-94, KEYL-7
// SYMFILE NAME-SCHOOLX, DISKFILE-'SCHOOL1, SCHOOL2, SCHOOL3'
// PROGRAM NAME-STURPT, PGMDATA-NO, FILES-'SCHOOLX/DG'
```

Figure 3-5. A Symbolic File

The specific physical file to be used on a particular run of the program is determined by the operator of the requesting terminal by means of a /FILE command prior to the program request (see *CCP Terminal Operator's Guide* or *CCP System Operator's Guide* for a description of this command.) The names of one or more valid physical files are associated with the symbolic file name by means of the DISKFILE and SYMFILE assignment statements (see *CCP System Reference Manual*). // FILE OCL statements for the physical files are entered by the system operator during CCP startup.

Considerations and Restrictions in Using Symbolic Files

- An MRT program cannot use symbolic files.
- On the Model 10 Disk System or the Model 12, if your program releases the requesting terminal prior to the initial opening of any symbolic file, the CCP will cancel your program. You must be especially careful in programs that can be requested from the console, since the console is automatically released from your program by the CCP.

  To use symbolic files in Model 10 and Model 12 CCP application programs that can be requested from the console, you must specify at assignment time (// PROGRAM statement) that data is allowed with the program request, even if no data will actually be entered. The CCP releases the console when the first Accept Input in the program has resulted in the name CONSOL and program data being passed to the user program. Therefore, the symbolic file must be opened before the Accept Input. In RPG II all files are opened before any I/O operations can be performed.
- On the Model 10 Disk System or a Model 12, a serially reusable program (COBOL or Basic Assembler) will access the same physical file when it is reused (executed without being reloaded) as it was used on its initial execution.

SWITCHED LINES

A switched line is a communication line on which the connection between the system and the terminal is established by dialing a data set (telephone) number either automatically or manually. After the connection is completed, data can be transmitted. A terminal on a switched line is disconnected under control of an application program by means of the Release Terminal operation (see *Operations,* in Chapter 2). This operation can specify whether to keep the line allocated to the program or to "return" it to the CCP.

If command mode terminals are attached to a switched line, the CCP awaits calls from the terminals, rather than polling the terminals for commands.

Under the CCP, a data set (telephone) number can be established at assignment time (TERMNAME statement) for each terminal name assigned to a terminal that might be called by an application program running under the CCP. Also, the attribute set associated with a terminal on a switched line can assign the attributes auto/manual call and auto/manual answer.

Auto Call

If a terminal is defined as *auto call* by the TERMATTR assignment statement, an I/O operation from a user program to the terminal on a switched line that is not connected causes the CCP to place a call to the terminal automatically. Auto call cannot be used with MLTA terminals. In order to use auto call on BSCA terminals, the Auto Call feature must be installed on the BSCA hardware.

Manual Call

If a terminal is defined as *manual call* by the TERMATTR assignment statement, an I/O operation from a user program to the terminal on a switched line that is not connected causes the CCP to inform the system operator that he must dial a data set number on a certain line.

Auto Answer

If a terminal is defined as auto answer, the CCP awaits a call from the terminal, and automatically answers the call (if the auto answer feature is activated on the data set). An I/O operation from a user program to a switched line that is not connected causes the CCP to inform the system operator that the program is awaiting a call on the switched line.

Manual Answer

In manual answer, the system operator answers a call from a terminal. The system operator and terminal operator then place their data sets in data mode; the CCP waits for input from the terminal. An I/O operation from a user program to a switched line that is not connected causes the CCP to inform the system operator that the program is awaiting a call on the switched line.

BSCA Switched Line

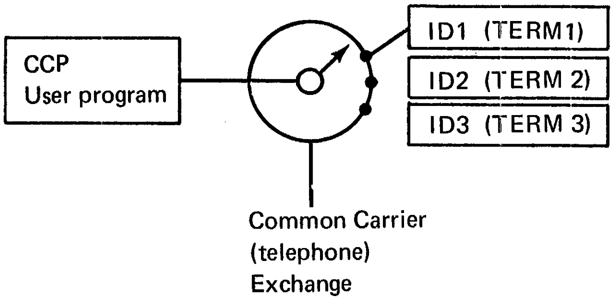
On a BSCA switched line, the CCP allocates the line to the user program when the first terminal on the line is allocated. In order to communicate with a terminal on the line, the program must either already have the line allocated or the line must be free for allocation (not currently allocated to another program).

Invite Input operations can be outstanding to multiple terminals on the same line after a connection has been made. The CCP determines which symbolic name to return with an Accept Input operation from the exchange identification characters, which are associated with a specific terminal name by the BSCATERM assignment statement (see *CCP System Reference Manual*).

Note: If a communications operation is issued to a terminal for which VERIFYID—NO is specified in the TERMATTR assignment statement and the operation is an answer operation, then any terminal that calls satisfies the operation.

BSCA Requesting Terminals

The following examples illustrate the use of BSCA switched lines with requesting terminals. Assume you have the following switched point-to-point network:



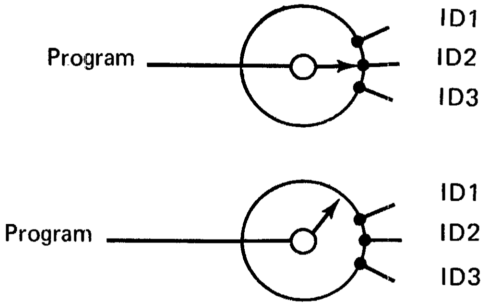
ID1
ID2
ID3

} Exchange ID's

TERM1
TERM2
TERM3

} Symbolic terminal names

Example 1:



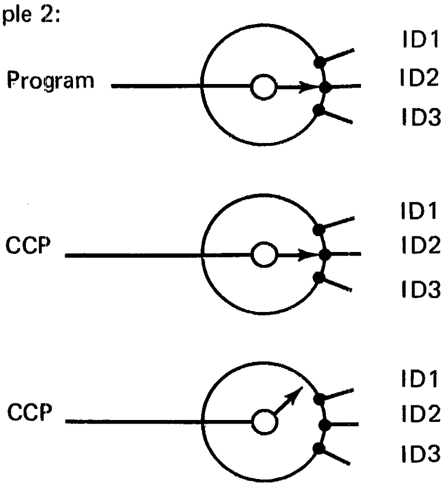
1. ID2 (TERM2) calls, makes connection, signs on, makes a program request, and communicates with program under the name TERM2.

2. Program issues Release Terminal operation, keeping the line. ID2 is signed off automatically.

3. Program now has control of the line, can call or accept calls from ID1, ID2, or ID3 in data mode.

   Note: No terminals are allowed to call in and sign on while the line is in control of the application program.

Example 2:



1. ID2 (TERM2) calls, makes connection, signs on, makes a program request, and communicates with program under the name TERM2.

2. Program reaches end of job without issuing a Release Terminal operation.

3. TERM2 is still connected and can enter other commands and program requests.

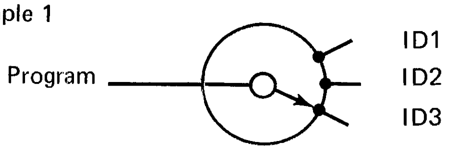
4. TERM2 signs off specifying DROP. The connection to TERM2 is broken.

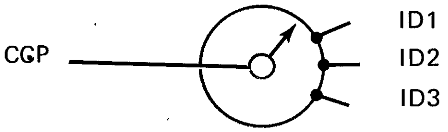
5. ID1, ID2, and ID3 can call and sign on.

Program-Selected Terminals

The following examples illustrate the use of BSCA switched lines with program-selected terminals. Assume, again, a switched point-to-point network.

Example 1





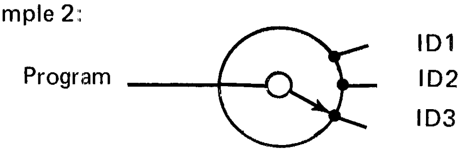
1. Program issues Invite Input operations to ID1, ID2, and ID3.

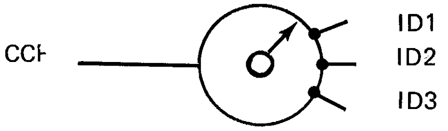
2 ID3 calls and communicates with program as TERM3 (Accept Input operation code).

3. Program issues Release Terminal to TERM3 with or without keeping the line and issues another Accept Input (the line is disconnected).

4. ID1 and ID2 can call and communicate with the program; ID3 cannot, since it no longer has an Invite Input.

Example 2:





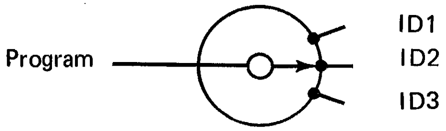
1. Program issues Invite Input operations to ID1, ID2, and ID3.

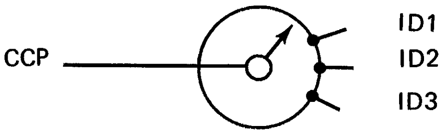
2. ID3 calls and communicates with program as TERM3 (Accept Input operation code).

3. Program goes to end of job without releasing terminals (programs should issue Stop Invite Inputs to terminals with outstanding Invite Inputs before going to end of job).

4. All Invite Inputs are cancelled; terminals are available to other programs.

Example 3:





1. Program calls ID2 and communicates with ID2 as TERM2.

2. Program issues Release Terminal to TERM2 with or without keeping the line (the line is disconnected).

3. Program can call ID1, ID2, or ID3 and issue Invite Inputs. CCP either automatically calls the correct data set number (auto call) or provides the correct data set and line number to the system operator (manual call).

MLTA Switched Line

On MLTA switched lines, there is only one terminal per line. Both the line and the terminal are allocated to the program by the CCP. The examples of using a switched line with command terminals and data terminals given under *BSCA Switched Line* apply also to MLTA switched lines, except that:

- All terminals that call on an MLTA switched line have the same symbolic terminal name; they cannot be uniquely distinguished from each other.
- MLTA terminals on switched lines do not have exchange identification characters associated with them.

Switched Line Disconnect Considerations

The CCP disconnects a terminal on a switched line in any of the following circumstances:

- User program issues a Release Terminal operation specifying the keep-line modifier.
- User program issues a Release Terminal operation without the keep-line modifier to a *data terminal* (see index entry).
- User program issues a Release Terminal operation to a command terminal that is not the requesting terminal.
- The user program terminates while the line is being used with a program-selected terminal.
- The system operator issues a VARY OFFLINE command to a terminal connected to the switched line.
- A requesting terminal on the line signs off (/OFF) and the DROP option is in effect.

The only Release Terminal operation for which the terminal is not disconnected is a Release Terminal operation to the requesting terminal without the keep-line modifier. In this case, the requesting terminal is still in command mode and can continue to enter commands to the CCP.

When a command terminal is connected on a switched line, the CCP attempts to maintain the terminal connection as long as possible. After a program has terminated and the CCP has sent the "ended" or "released" message (which can optionally be suppressed by specifying ENDMSG-NO on the // PROGRAM assignment statement), the CCP attempts to receive from the terminal for an amount of time that is based on the error retry count specified by the NRETRY parameter on the // BSCALINE assignment statement.

Chapter 4: COBOL

To request CCP communication services, you must write your COBOL programs using the standard application program interface described in Chapter 2. This standard interface is composed of the following elements:

- Communications Service Subroutine
- Parameter List
- Record Area

Note: This chapter assumes that you are familiar with the COBOL language. For more information on writing and executing COBOL programs, see the publications *IBM System/3 Subset American National Standard COBOL*, GC28-6452, and *IBM System/3 Subset American National Standard COBOL Compiler and Library Programmer's Guide*, GC28-6459.

COBOL USE OF THE STANDARD INTERFACE

To use the standard application program interface to the CCP, the COBOL application program must:

1. Define the record area and the parameter list (see *Defining the Record Area and Parameter List*).
2. Set the contents of the parameter list and the record area (see *Setting the Contents of the Parameter List and Record Area*).
3. Call the communications service subroutine, identifying the program's parameter list and record area, to initiate the operation (see *Calling the Communications Service Subroutine*).
4. Examine information returned by the CCP in the parameter list and record area and, for input operations, process the input data (see *Examining Returned Information*).

DEFINING THE RECORD AREA AND PARAMETER LIST

Before your COBOL program can perform communications operations, you must define one or more record areas and parameter lists.

Record Area

The number of record areas you must define depends upon the logic of your program. You need not always define separate record areas for input data and output data, or for operations with different terminals.

Each record area defined must be large enough to contain either the program name (if a chained task), or the terminal name, and the maximum length of data to be either received as input in the record area or to be transmitted as output from the record area. Define the record areas in the WORKING-STORAGE SECTION of the DATA DIVISION of your COBOL program.

The name field portion of the record area must be specified as an alphameric character field. In the following example, TERM-NAME is the name of a symbolic terminal name field that has been initialized to blanks:

```
05 TERM-NAME PIC X(6) VALUE SPACES.
```

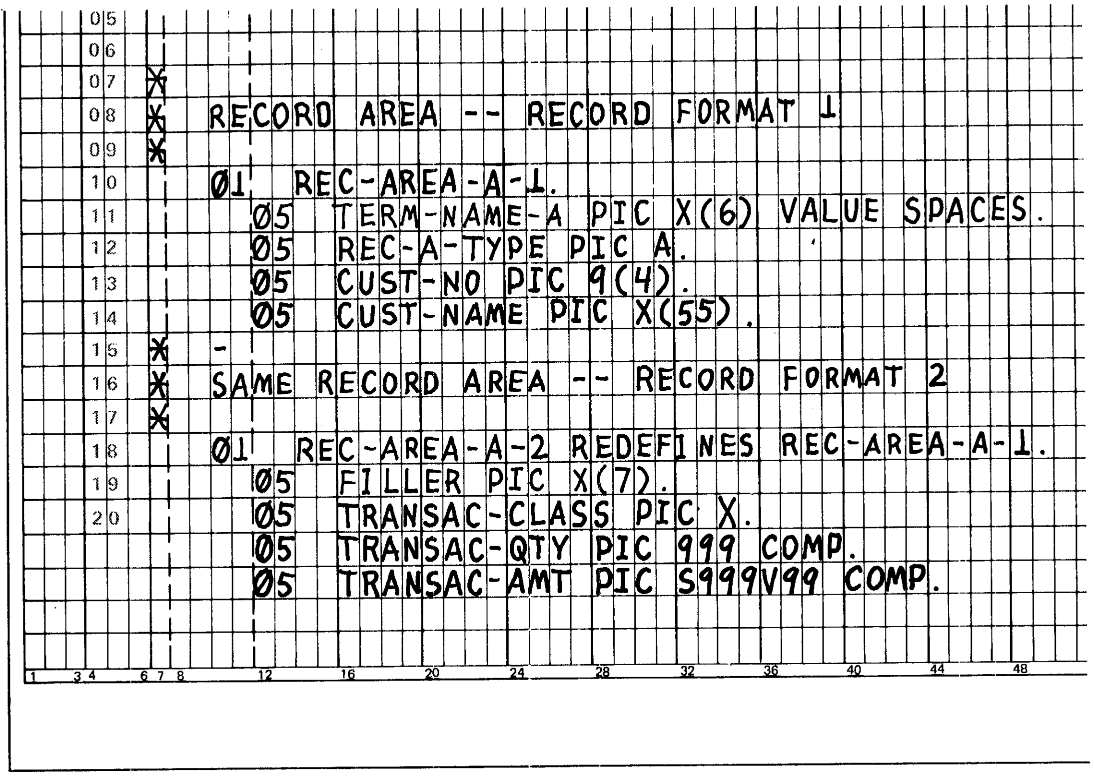
Define the data portion of the record area as required by your formats. Unless you are using a BSCA line with the Text Transparency feature (see index entry *Terminal Attribute*), you should define all elementary data items as one of the following types:

- Alphanumeric
- Alphabetic (PIC A).
- Numeric DISPLAY (PIC 9 . . . or S9. . . with USAGE as DISPLAY or omitted).
- Numeric zoned-decimal (PIC 9 or S9 with USAGE specified as COMP or COMPUTATIONAL).

Do not define numeric data fields of the record area with a USAGE specified as COMPUTATIONAL-3, COMP-3, COMPUTATIONAL-4, or COMP-4 unless data is being transferred over a BSCA line using Text Transparency.

Many COBOL application programs require that the same record areas be used for records with different formats. By defining each record area at the 01 level, you can redefine the record area with complete flexibility, using REDEFINES clause. (If you define record areas at another level, you must ensure that lengths are identical on any redefinition.) Because you must define the record area in the WORKING-STORAGE SECTION of the DATA DIVISION, rather than the FILE SECTION, you can assign a value to fields in the record area when you initially define the record area (though only in the original definition, when using the REDEFINES clause).

Example: Figure 4-1 shows how to define a record area whose record may be in either of two formats; REC-AREA-A-2 redefines REC-AREA-A-1. The symbolic terminal name field is initialized to blanks.



```
    05
    06
    07*
    08* RECORD AREA -- RECORD FORMAT 1
    09*
    10  01  REC-AREA-A-1.
    11     05  TERM-NAME-A PIC X(6) VALUE SPACES.
    12     05  REC-A-TYPE PIC A.
    13     05  CUST-NO PIC 9(4).
    14     05  CUST-NAME PIC X(55).
    15* -
    16* SAME RECORD AREA -- RECORD FORMAT 2
    17*
    18  01  REC-AREA-A-2 REDEFINES REC-AREA-A-1.
    19     05  FILLER PIC X(7).
    20     05  TRANSAC-CLASS PIC X.
           05  TRANSAC-QTY PIC 999 COMP.
           05  TRANSAC-AMT PIC S999V99 COMP.
```

Figure 4-1. Defining a Record Area

Parameter List

You must also define one or more parameter lists in the WORKING-STORAGE SECTION of your program's DATA DIVISION (see index entry *parameter list*). The first four fields of the parameter list should be defined as two-byte binary (PIC S9(4), USAGE specified as COMPUTATIONAL-4 or COMP-4) fields. Because the parameter list is defined in the WORKING-STORAGE SECTION of DATA DIVISION rather than the FILE SECTION, you can also specify initial values for these fields. The fields are, in the sequence they must be defined in the parameter list:

1. Return code field.
2. Operation code and modifier field.
3. Field used jointly for output data length, actual input data length, count of outstanding Invite Inputs, and attributes identifier.
4. Maximum input data length field.

These fields are the only fields you reference in your application program. The remaining four fields of the parameter list are not referenced directly by your COBOL program. However, they must be defined because space must be reserved for them. You can define them simply by specifying FILLER with a PICTURE of X(8). Your program should never initialize or set these fields.

Example: Figure 4-2 shows how to define a parameter list in a COBOL program. The operation field is initialized to 2 for a PUT operation. The output data length field is initialized to 48. This value might be the length of the first output message. The maximum input data length is initialized to 60. This value might be the total length of the data portion of a record area used with this parameter list.

Return Code Values

The CCP ignores the contents of the return code field of the parameter list at the beginning of a communications operation. At the completion of each operation, the CCP places a binary value in this field indicating the status of the operation. This value indicates:

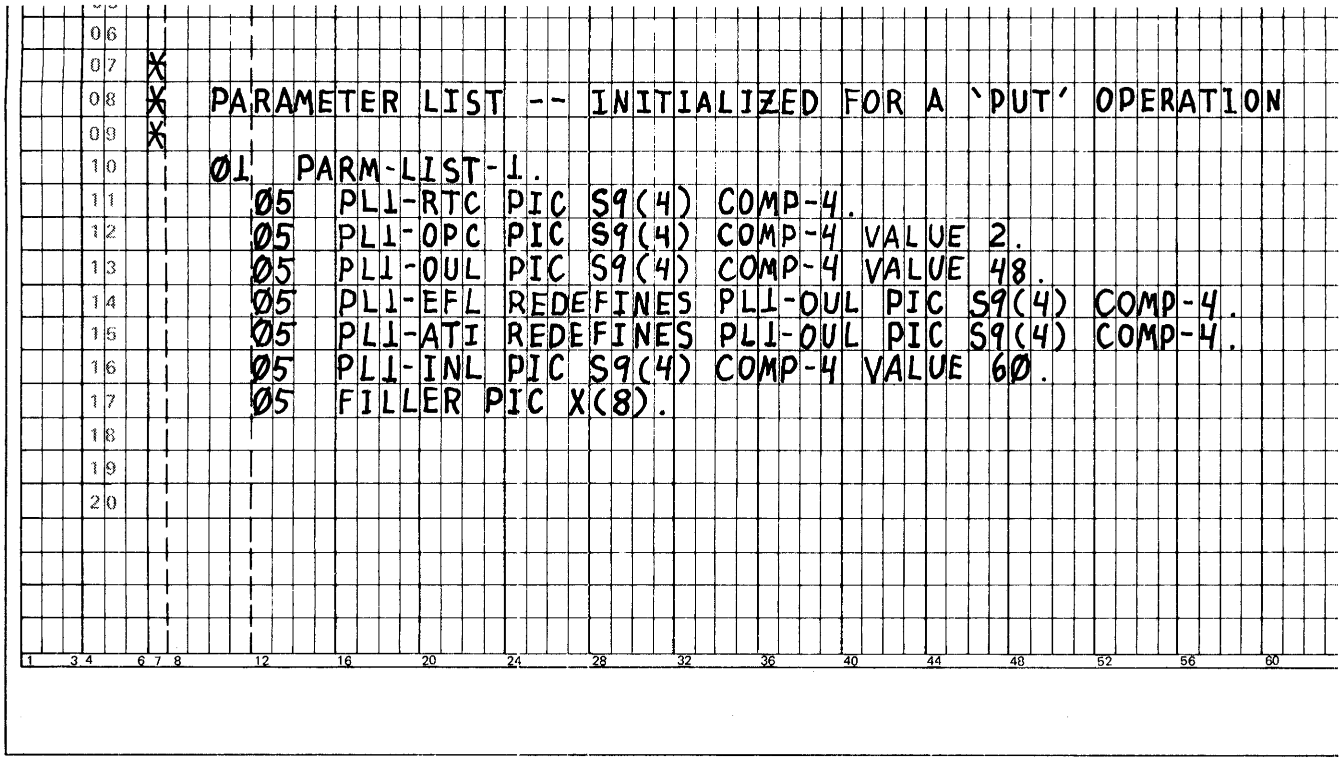
- The operation completed normally (value of zero) for nonchained operations; value of 14 for task chained operations)
- The operation resulted in an I/O error (negative value)
- The operation resulted in an exceptional condition (positive value)

The CCP places this value in the return code field of the parameter list before returning to the COBOL program. The COBOL program must check the return code value upon the completion of each operation. Specific return code values and their meanings are given in Appendix E. *Return Codes.*

Operation Code Values

For each communications operation, you must set the operation code field of a parameter list to a value which indicates the specific operation being requested. You must set this value within your COBOL program. This field can be set by initializing the field in the definition of the parameter list or by moving an appropriate value into the operation code field during execution (see *Setting Fields in the Parameter List* later in this chapter).

The CCP does not change this field during the communications operation; the contents of the field are the same after completion of the operation as they were at the beginning of the operation. See Chapter 2: *Standard Application Program Interface to the CCP* for descriptions of the valid operation. Appendix D: *Operation Codes* summarizes the operation code values.



```
      *
      * PARAMETER LIST -- INITIALIZED FOR A `PUT' OPERATION
      *
       01  PARM-LIST-1.
           05  PL1-RTC PIC S9(4) COMP-4.
           05  PL1-OPC PIC S9(4) COMP-4 VALUE 2.
           05  PL1-OUL PIC S9(4) COMP-4 VALUE 48.
           05  PL1-EFL REDEFINES PL1-OUL PIC S9(4) COMP-4.
           05  PL1-ATI REDEFINES PL1-OUL PIC S9(4) COMP-4.
           05  PL1-INL PIC S9(4) COMP-4 VALUE 60.
           05  FILLER PIC X(8).
```

Figure 4-2. Defining a Parameter List

SETTING THE CONTENTS OF THE PARAMETER LIST AND RECORD AREA

You must set the contents of the following areas before performing a communications operation in COBOL:

1. Parameter list fields, if different from the last operation.
2. Symbolic terminal name in the first six positions of the record area. (This can be omitted if a terminal name is not required for the operation or if the name is the same as in the previous operation.)
3. Output data in the data portion of the record area if the operation is an output operation.

Setting Fields in the Parameter List

You reference four parameter fields within your COBOL program:

- Return Code field.
- Operation Code field.
- Field used jointly for output length, effective input length, count of outstanding Invite Inputs, and attributes identifier.
- Maximum input length field.

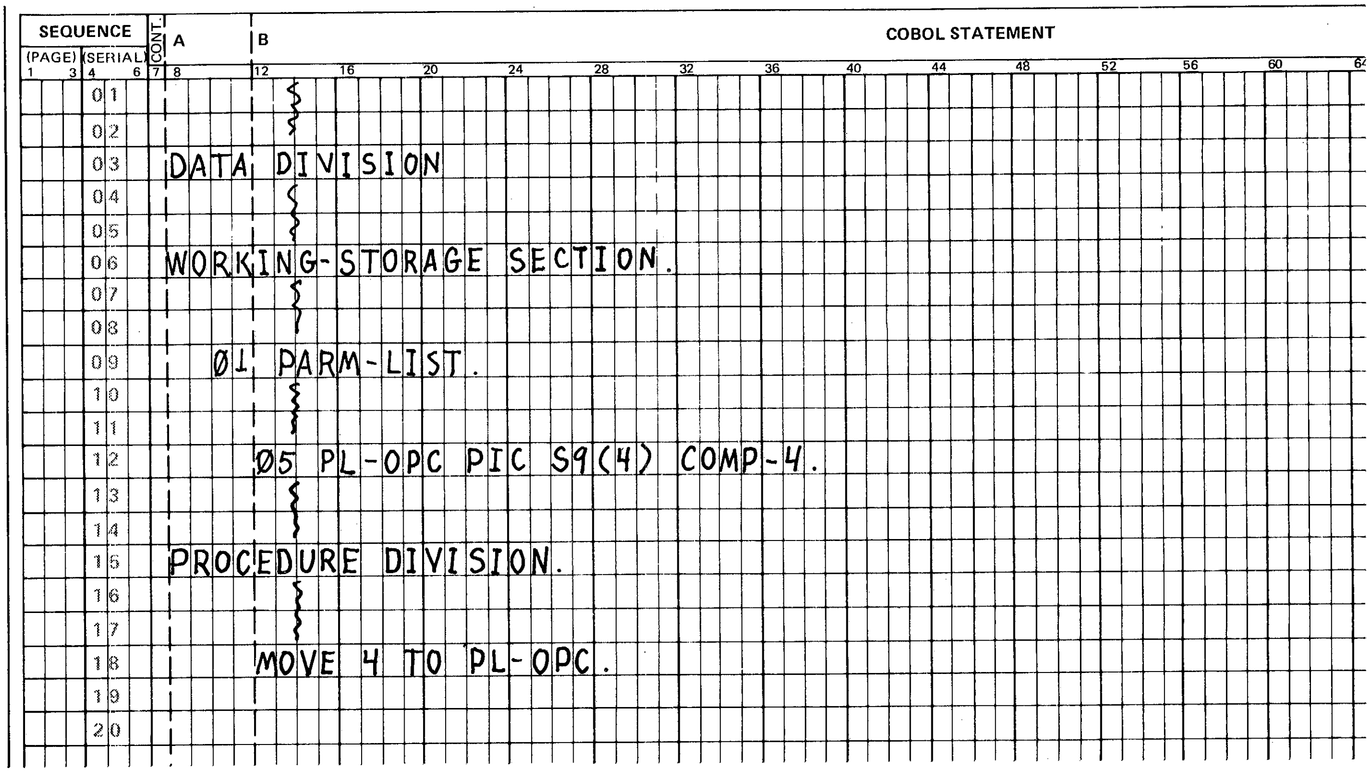
You need set only the operation code and the Maximum Input Length field for input operations. For output operations, you must set the operation code and the Output Length field. For an Acquire Terminal operation, you must set the operation code and, if this Acquire Terminal also sets the terminal attributes, the Attributes Identifier field. You need never set the return code field; it is used only by the CCP to return information about the operation to your COBOL program.

Operation Code

Whenever a communications operation is issued, this field must contain a value indicating the operation to be performed. You can set this field when you define it in the WORKING-STORAGE SECTION of the DATA DIVISION by specifying a VALUE clause:

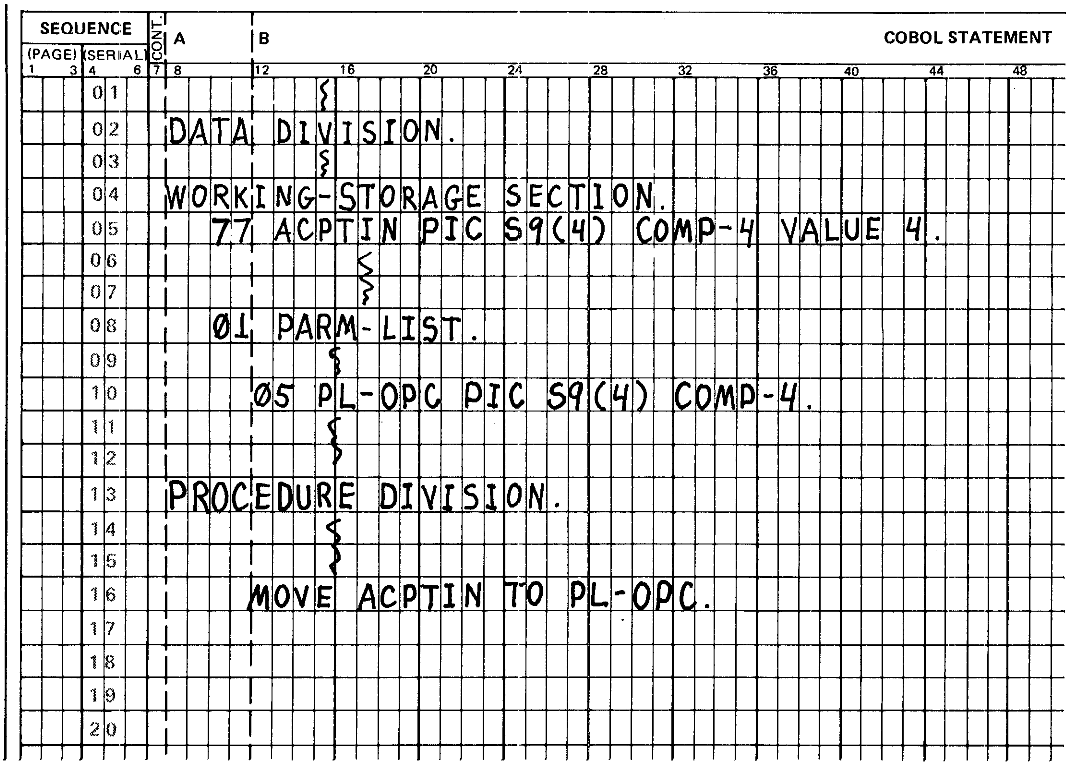
```
05 PL-OPC PIC S9(4) COMP-4 VALUE 4.
```

You can also set this field with a MOVE statement in the PROCEDURE DIVISION of your COBOL program. You can move either a numeric literal or a named numeric value into the operation code field of a parameter list you defined. In the following example, the numeric literal 4 (Accept Input operation) is moved into the operation code field PL-OPC:



```
    01
    02
    03 DATA DIVISION
    04
    05
    06 WORKING-STORAGE SECTION.
    07
    08
    09   01 PARM-LIST.
    10
    11
    12     05 PL-OPC PIC S9(4) COMP-4.
    13
    14
    15 PROCEDURE DIVISION.
    16
    17
    18     MOVE 4 TO PL-OPC.
    19
    20
```

The following example sets the Operation Code field by moving the named numeric field, ACPTIN, into it. ACPTIN is defined with the value 4.



```
01
02  DATA DIVISION.
03
04  WORKING-STORAGE SECTION.
05     77 ACPTIN PIC S9(4) COMP-4 VALUE 4.
06
07
08     01 PARM-LIST.
09
10      05 PL-OPC PIC S9(4) COMP-4.
11
12
13  PROCEDURE DIVISION.
14
15
16      MOVE ACPTIN TO PL-OPC.
17
18
19
20
```

The CCP never modifies the value in the Operation Code field. You do not need to reset the field if the operation to be performed is the same as the last operation using this parameter list.

For more information on the valid operations, see the chapter Standard *Application Interface to the CCP.* Appendix D: *Operation Codes* summarizes the operations and operation code values.

Output Length/Attributes Identifier/Count of Outstanding Invite Inputs/Effective Input Length

The third field of the parameter list can contain one of four different values depending on the type of operation:

- Output Length
- Attributes Identifier
- Count of Outstanding Invite Inputs
- Effective Input Length

The first two values you must set; the third and fourth are returned values set by the CCP for certain operations.

You can set this field when you define it in the WORKING-STORAGE SECTION of the DATA DIVISION by means of a VALUE clause, or in the PROCEDURE DIVISION by specifying a MOVE statement, just as you set the operation code field. You can move either a numeric literal or a named numeric value into the field.

Output Length: For task chaining and output operations, you must place into this field the length of the data you wish to write from the record area in your program. This length does not include the six positions for the program name or the symbolic terminal name. The output operations you must set a data length for are:

- Put
- Put-No-Wait
- Put-Then-Get
- Chain Task Request

You must reset this value if the output data length differs from the last operation using this parameter list or if the field was modified by the CCP. This field is modified by the CCP for the following operations:

- Get
- Put-Then-Get
- Accept Input
- Get Terminal Attributes
- Acquire Terminal
- Release Terminal

Attributes Identifier: If your operation code specifies an Acquire Terminal operation which sets the attributes of the terminal to be acquired, you must place into this field the identifier of the attributes set. This numeric value must correspond to the number you assigned to the desired set of attributes in an Assignment run.

Effective Input Length: You do not need to set this value. For each input operation, the CCP places the actual length of the input data passed to your COBOL program in this field before it returns control to your program. This is the length of the data only, it does not include the length of the terminal name.

Count of Outstanding Invite Inputs: On a Release Terminal operation and on any input operation that results in a 08 return code (terminal entered data mode escape and issued a /RELEASE command), this field is set by the CCP to the number of Invite Input operations still outstanding. If this is a multiple requesting terminal (MRT) program, this number includes not only the Invite Inputs you have issued that have not yet been satisfied by an Accept Input operation, but also the number of additional terminals that have requested your program but are not yet being served by your program.

Maximum Input Data Length

For each operation involving input data, you must enter a numeric value into the fourth field of the parameter list, indicating the maximum amount of input data you expect to receive. This value must be greater than zero and no larger than the size of the data portion of the record area with which this parameter list is used. The value does not include the six positions at the beginning of the record area for the name field. The input operations for which you must place a value in this field are:

- Get
- Invite Input
- Accept Input
- Put-Then-Get
- Get Terminal Attributes
- Stop Invite Input (in case input cannot be stopped)

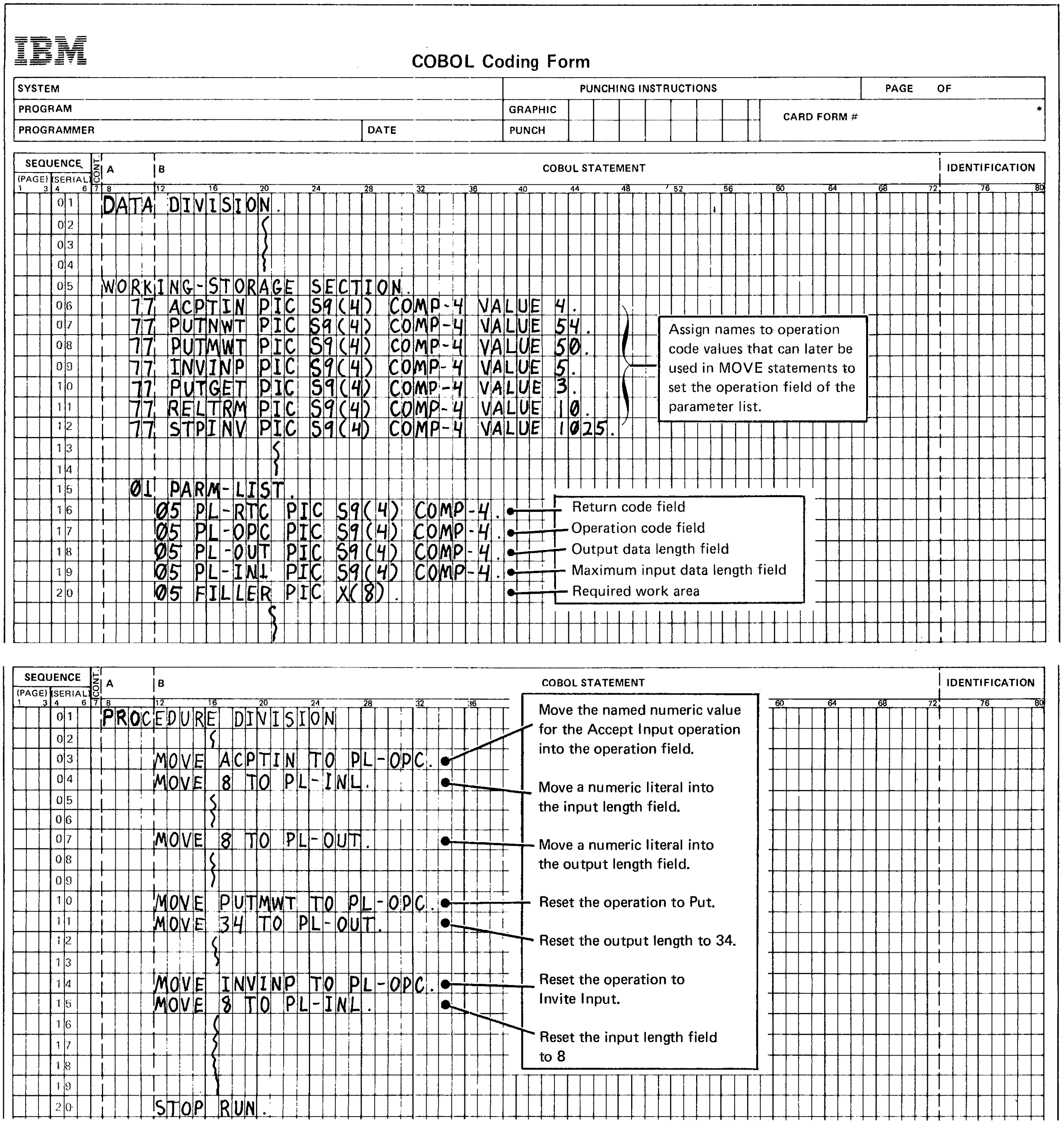
You can set the value of this field either when you define it in the WORKING-STORAGE SECTION of the DATA DIVISION or by means of a MOVE statement in the PROCEDURE DIVISION. The CCP never modifies the value in this field. Therefore, you do not need to reset it unless the maximum input length for this operation is different from the value set in this field the last time this parameter list was used. However, if this parameter list is used with more than one record area, you may need to alter this value during execution of your COBOL program.

Example of Setting Fields in the Parameter List

Figure 4-3 shows how you can set the operation, output data length, and maximum input data length fields of a parameter list. Each operation code value is assigned a name. These names are then used on a MOVE statement that moves the named numeric values into the operation field of the parameter list. The output data length and maximum input data length fields are set by moving literals into them.

Setting the Record Area

The record area consists of a six-position name field and a data area. For an operation with a terminal, except for Accept Input and Shutdown Inquiry operations, you must place the symbolic name of the terminal to be involved with the operation in the name field. For a Chain Task Request, you must place the name of the requested program in the name field. You must also provide the data to be transmitted in the data portion of the record area when an output operation is to be performed.



```
01  DATA DIVISION.
05  WORKING-STORAGE SECTION.
06      77 ACPTIN PIC S9(4) COMP-4 VALUE 4.
07      77 PUTNWT PIC S9(4) COMP-4 VALUE 54.
08      77 PUTMWT PIC S9(4) COMP-4 VALUE 50.
09      77 INVINP PIC S9(4) COMP-4 VALUE 5.
10      77 PUTGET PIC S9(4) COMP-4 VALUE 3.
11      77 RELTRM PIC S9(4) COMP-4 VALUE 10.
12      77 STPINV PIC S9(4) COMP-4 VALUE 1025.
15    01 PARM-LIST.
16        05 PL-RTC PIC S9(4) COMP-4.
17        05 PL-OPC PIC S9(4) COMP-4.
18        05 PL-OUT PIC S9(4) COMP-4.
19        05 PL-INL PIC S9(4) COMP-4.
20        05 FILLER PIC X(8).
```

Assign names to operation code values that can later be used in MOVE statements to set the operation field of the parameter list.

- Return code field
- Operation code field
- Output data length field
- Maximum input data length field
- Required work area

```
01  PROCEDURE DIVISION
03        MOVE ACPTIN TO PL-OPC.
04        MOVE 8 TO PL-INL.
07        MOVE 8 TO PL-OUT.
10        MOVE PUTMWT TO PL-OPC.
11        MOVE 34 TO PL-OUT.
14        MOVE INVINP TO PL-OPC.
15        MOVE 8 TO PL-INL.
20        STOP RUN.
```

- Move the named numeric value for the Accept Input operation into the operation field.
- Move a numeric literal into the input length field.
- Move a numeric literal into the output length field.
- Reset the operation to Put.
- Reset the output length to 34.
- Reset the operation to Invite Input.
- Reset the input length field to 8

Figure 4-3. Setting Fields in the Parameter List

Name Field

For an operation involving a terminal, the terminal name you place in a record area must have been assigned to your program. You may also identify the requesting terminal by using six blanks as the terminal name if your program is *not a multiple requesting terminal (MRT) program* (see index entry). See *Chapter 2: Standard Application Program Interface to the CCP* for more information on the valid terminal names.

For a Chain Task Request operation, you must provide the name of the program to be loaded in the name field.

You may set the name when you define the record area in the WORKING-STORAGE SECTION of the DATA DIVISION, or by means of a MOVE statement in the PROCEDURE DIVISION. You do not need to reset the terminal name if the terminal to be used is the same that was named the last time the record area was used, unless the name was modified by CCP. CCP modifies the name field of the record area in the following situations:

- Upon completion of an Accept Input operation, CCP sets the name field to the name of the program or terminal whose data is placed in the record area.

- Upon completion of any operation using the name field that was set to blanks, CCP sets the name field to the name of the requesting program or terminal.

Output Data Area

If the operation to be performed is an output operation, you must provide the data to be transmitted in the data portion of the record area. You do not need to provide data in the record area for operations other than output operations because either the data area is not used or data is provided to your program by CCP. Data provided to your program by CCP overlays the information previously in the data portion of the data area. For example, the input data transmitted to your program by the Get part of the Put-Then-Get operation overlays the output data transmitted from your program by the Put part of the operation. See the *Chapter 2: Standard Application Program Interface to the CCP* for more information on transferring data.

Note: If the message to be sent is shorter than the total length of the data area, you need not clear the excess area to blanks.

Example of Setting the Record Area

Figure 4-4 shows how you can define and set the record area when it is used for both input and output operations. Assume the CCP has set the terminal name and data area as the result of an Accept Input operation. The COBOL program then resets the data area for an output operation by moving the message "TRY AGAIN INV DATA" to the data portion of the record area. This message overlays the input data transmitted to the record area by the Accept Input operation. Later in the program, the terminal name is reset to a named alphanumeric value.

CALLING THE COMMUNICATIONS SERVICE SUBROUTINE

Since COBOL does not include special statement types for terminal I/O operations and other communications services, the CCP provides a communications service subroutine, 'CCPCIO,' that converts the COBOL program's communications requests into a standard request to the CCP communication facilities. The functions performed by CCPCIO for the COBOL program are:

- Loads index register 2 with the address of the program's parameter list.

- Places the address of the record area into the program's parameter list.

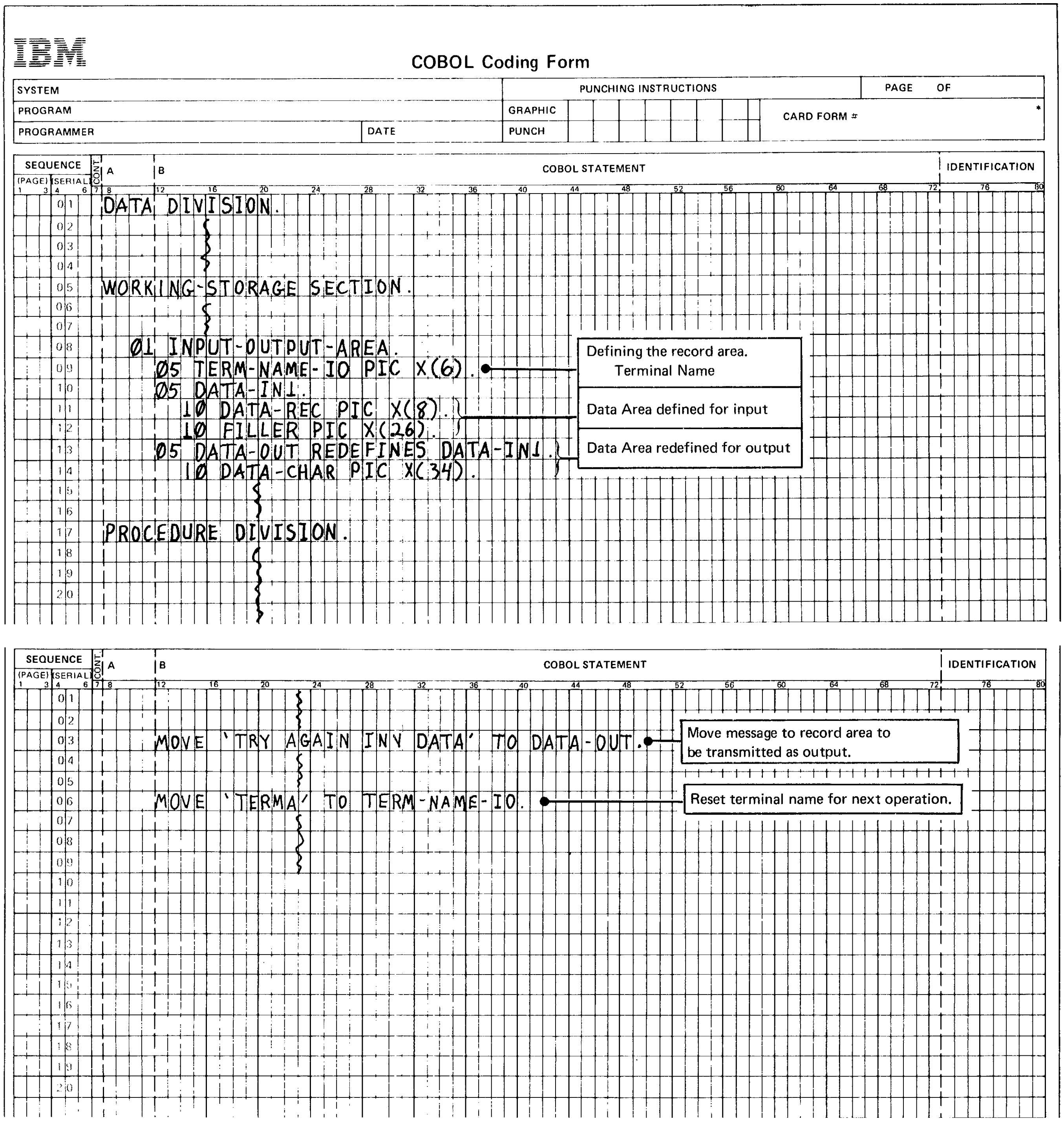
- Branches to the CCP.

The CCPCIO subroutine must be linkage edited with the COBOL application program. See *Chapter 9. Program Preparation.*

After you have set the required parameter list fields and the terminal name in the record area, and have prepared any output data, you are ready to request the CCP to perform the operation specified in the parameter list. You make this request by issuing a CALL statement specifying 'CCPCIO'. The names of your parameter list and record area must be passed as arguments to the subroutine.

The format of the CALL statement is as follows:

```
CALL 'CCPCIO' USING parameter-list-name, record-area-name.
```



```
DATA DIVISION.

WORKING-STORAGE SECTION.

   01 INPUT-OUTPUT-AREA.
       05 TERM-NAME-IO PIC X(6).
       05 DATA-IN1.
           10 DATA-REC PIC X(8).
           10 FILLER PIC X(26).
       05 DATA-OUT REDEFINES DATA-IN1.
           10 DATA-CHAR PIC X(34).

PROCEDURE DIVISION.
```

Defining the record area. Terminal Name

Data Area defined for input

Data Area redefined for output

```
    MOVE 'TRY AGAIN INV DATA' TO DATA-OUT.

    MOVE 'TERMA' TO TERM-NAME-IO.
```

Move message to record area to be transmitted as output.

Reset terminal name for next operation.

Figure 4-4. Setting the Record Area

The CALL statement appears in the PROCEDURE DIVISION of your COBOL program.

In the following example, the name of the parameter list is PARM-LIST. The name of the record area is INPUT-OUTPUT-AREA.

```
CALL 'CCPCIO' USING PARM-LIST, INPUT-OUTPUT-AREA.
```

Control returns to your COBOL program at the statement immediately following the CALL statement. When the return occurs, the following actions have already taken place:

- For output operations, any output data has been accepted by the CCP and, depending upon the output operation specified, has been received by the terminal. In any case, the record area is now free for you to use again.
- For input operations, any input data which was to be received in the record area is now in the record area, unless an error condition or one of several exception conditions occurred.
- For Accept Input operations, the name of the program or the symbolic terminal name of the terminal that provided the data in the record area has been set in the first six positions of the record area.
- For successful task chain operations, the requested program is placed on the program request input queue when control is returned to the requesting program.
- For operations that validly specified a blank terminal name, the symbolic terminal name of the requesting terminal has been set in the first six positions of the record area.
- For all operations, the return code field in your parameter list has been set indicating the result of the operation.
- For input operations, the actual input data length has been set in your parameter list.
- For Release Terminal operations or for input operations where the terminal has released itself from the program, the count of outstanding Invite Input operations has been set in your parameter list.

EXAMINING RETURNED INFORMATION

After control has returned to your COBOL program from the communications service subroutine, you should examine returned information supplied by the CCP, including one or more of the following:

- The return code
- The symbolic terminal name (if it was set by the CCP) or the name of the program that issued the Chain Task Request operation
- The count of outstanding Invite Inputs, if a Release Terminal operation was performed, or if the return code from an input operation indicates the terminal was released
- The actual input data length, if an input operation was successfully performed
- The input data, if an input operation was performed

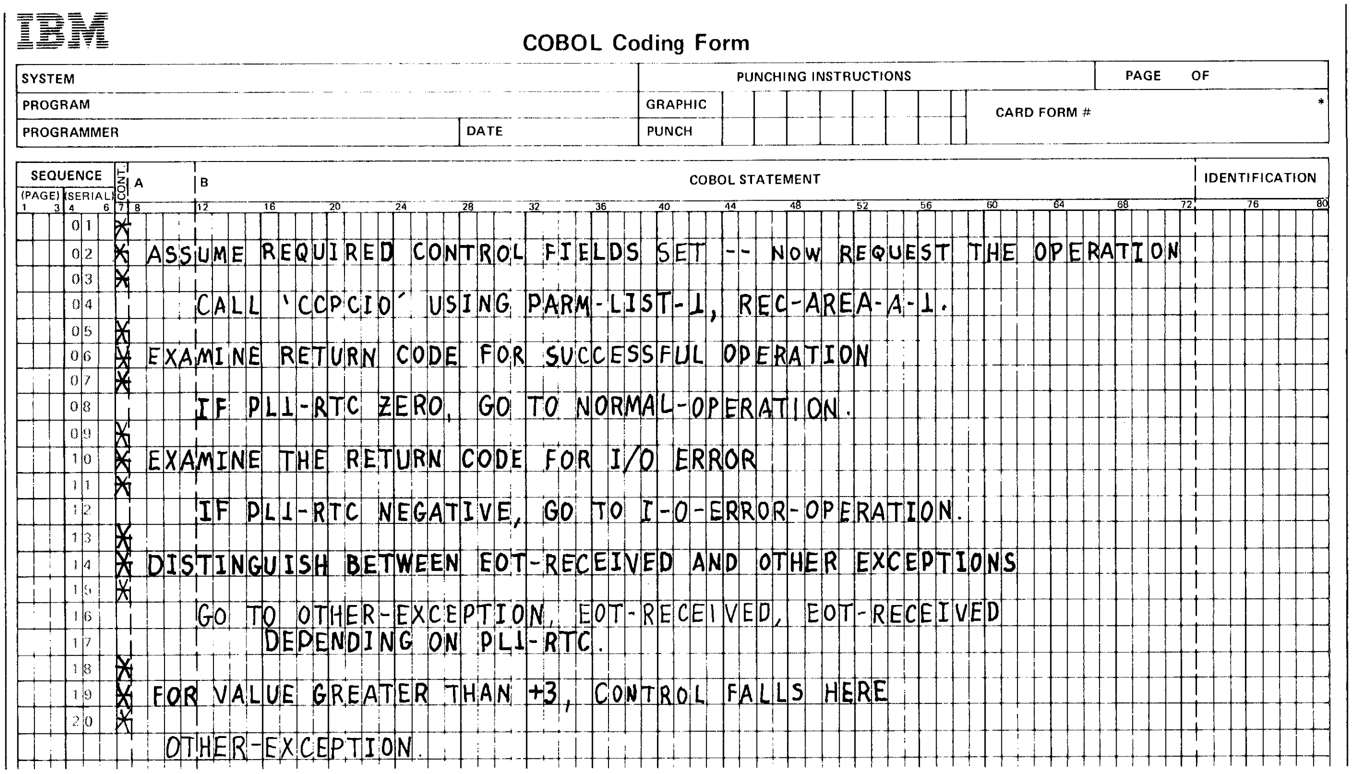
Return Code

The CCP always provides a return code after an operation. You should never assume that an operation is successful; you should always check the return code. In certain cases, you will find that no data transfer has occurred. See Appendix E for the meanings of specific return codes and see *Programming Examples*, later in this chapter, for examples of checking return codes.

You may wish to perform certain operations in your COBOL program depending upon the return code value set by the CCP. The example in Figure 4-5 assumes that you want to branch to one of several procedure names depending upon the value of the return code. The program examines the return code value for the following conditions:

- The operation was successful and no exceptions occurred
- An EOT was received on a successful operation, or on an operation in which data was truncated.
- Some other exception condition occurred.
- An I/O error occurred.

Assume that all data names have been defined earlier in this program. Note the use of comments in the example.



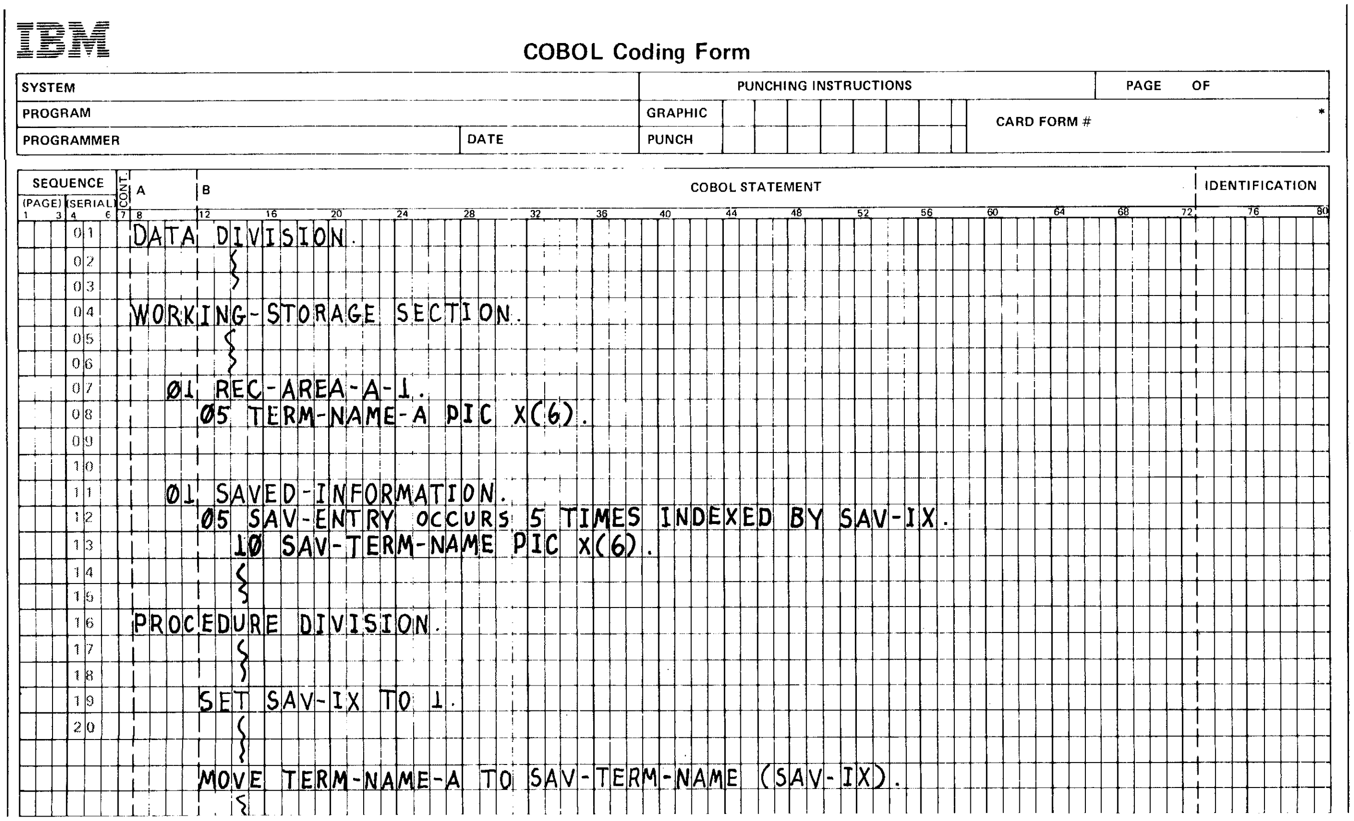
IBM COBOL Coding Form

SYSTEM | PUNCHING INSTRUCTIONS | PAGE OF
PROGRAM | GRAPHIC | CARD FORM #
PROGRAMMER | DATE | PUNCH

SEQUENCE (PAGE) (SERIAL) | CONT. | A | B | COBOL STATEMENT | IDENTIFICATION

```
      *
      * ASSUME REQUIRED CONTROL FIELDS SET -- NOW REQUEST THE OPERATION
      *
           CALL 'CCPCIO' USING PARM-LIST-1, REC-AREA-A-1.
      *
      * EXAMINE RETURN CODE FOR SUCCESSFUL OPERATION
      *
           IF PL1-RTC ZERO, GO TO NORMAL-OPERATION.
      *
      * EXAMINE THE RETURN CODE FOR I/O ERROR
      *
           IF PL1-RTC NEGATIVE, GO TO I-O-ERROR-OPERATION.
      *
      * DISTINGUISH BETWEEN EOT-RECEIVED AND OTHER EXCEPTIONS
      *
           GO TO OTHER-EXCEPTION, EOT-RECEIVED, EOT-RECEIVED
               DEPENDING ON PL1-RTC.
      *
      * FOR VALUE GREATER THAN +3, CONTROL FALLS HERE
      *
        OTHER-EXCEPTION.
```

Figure 4-5. Examining Return Code Values



IBM COBOL Coding Form

SYSTEM | PUNCHING INSTRUCTIONS | PAGE OF
PROGRAM | GRAPHIC | CARD FORM #
PROGRAMMER | DATE | PUNCH

SEQUENCE (PAGE) (SERIAL) | CONT. | A | B | COBOL STATEMENT | IDENTIFICATION

```
       DATA DIVISION.
             }

       WORKING-STORAGE SECTION.
             }

         01 REC-AREA-A-1.
           05 TERM-NAME-A PIC X(6).


         01 SAVED-INFORMATION.
           05 SAV-ENTRY OCCURS 5 TIMES INDEXED BY SAV-IX.
             10 SAV-TERM-NAME PIC X(6).
             }

       PROCEDURE DIVISION.
             }

           SET SAV-IX TO 1.
             }

           MOVE TERM-NAME-A TO SAV-TERM-NAME (SAV-IX).
             }
```

Figure 4-6. Saving the Symbolic Terminal Name

Examining a Returned Name

On certain operations, the CCP returns the symbolic terminal name to your program's record area. You may need to examine this name.

For example, you may need to examine the name of the terminal that provided the input data. You can then compare the terminal name in the record area with a saved terminal name to associate new data with data previously received from this terminal. You can save a terminal name for later comparison by specifying the terminal name field of the record area in a MOVE statement. The field to which the terminal name is moved must be defined with a PICTURE of X(6).

The example in Figure 4-6 saves the terminal name the CCP sets in the name field of the record area, TERM-NAME-A, by moving it to the field SAV-TERM-NAME. SAV-TERM-NAME is the name field in a table of saved values.

If a program can be requested from both a terminal and another program using the Chain Task Request operation, you may want to determine how the program was requested. This can be accomplished by checking for a 14 return code, indicating a Chain Task Request operation. This information is useful if a program communicates with the requestor since your program cannot communicate with a chain task requesting program.

Referencing Saved Information

In some of your COBOL programs, you may need to save the information entered on the terminals and reference it later in your program. For example, if your program receives data from several different terminals, you may need to associate new data entered on a terminal with data previously entered on the same terminal. To do this, you must save the significant data received from every terminal you are using and identify that saved data with the name of the terminal from which it was received. You can then associate new data with the saved data by comparing the terminal name set by the CCP in the record area with the saved terminal names.

One way you can save information received from each terminal is to define a table of group items. Specify the number of terminals from which information must be saved as the integer in the group item's OCCURS clause. For example, if information must be saved from five terminals, specify that the group item OCCURS 5 TIMES. Each group item consists of a set of elementary items, one of which is the terminal name. Upon completion of an Accept Input operation, you can then search the table of saved information until you find the saved terminal name that corresponds to the name of the terminal which just transmitted data to your program. Once you have found the table entry you are searching for, you can address any field of the save information by indexing that field name with the index name.

Figure 4-7 shows how to set up a table for saved information and reference the saved information in your COBOL program. By searching the table for the saved terminal names that corresponds to the terminal name in the record area, you can associate the new data with the data that was saved.

Effective Input Data Length

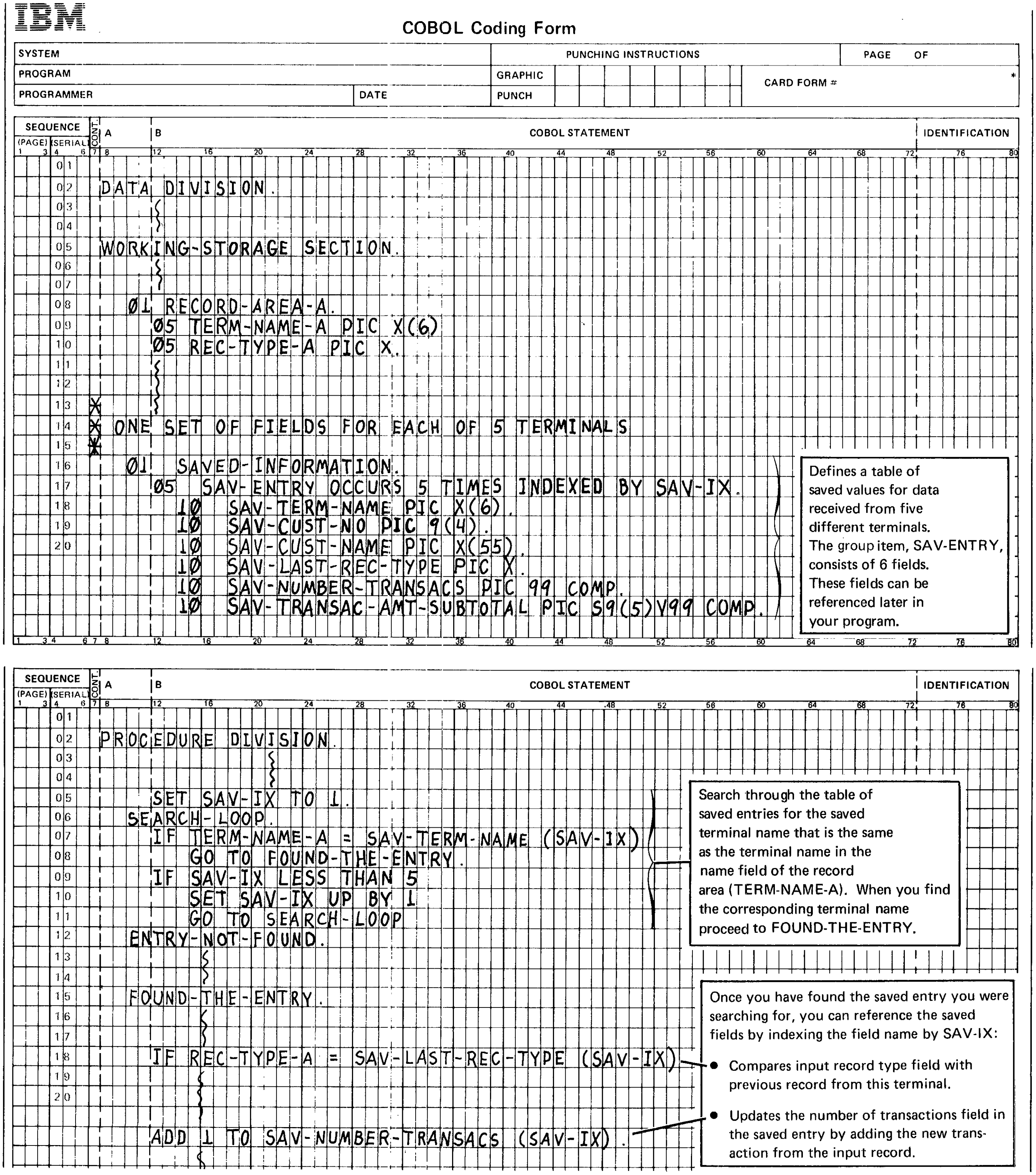
If the communications service subroutine requested an operation which transferred data to your program (Get, Accept Input, Get Attributes, Put-Then-Get, or Stop Invite Input), the CCP also places the effective length of the input data into the parameter list. Because this is the length of the data that was actually received by your program, you may wish to use this length to control subscripted or indexed operations in your program. For example, you may need to scan the input data for a specific character or string of characters. To do this you must know the length of the input data you must scan.

Count of Outstanding Invite Inputs

On a Release Terminal operation or on an input operation where the return code indicates that the terminal released itself from your program, the count of outstanding Invite Input operations is returned to your program. You may use this number to determine whether your program has any further terminals to serve or whether it can go to end of job.

Input Data

If the operation requested by your program is an input operation that transfers data, the CCP places the input data received by your program in the seventh and succeeding positions of your record area before it returns control to your COBOL program. Any excess positions, beyond the end of the actual data received, are filled with blanks by the CCP, up to the maximum input length you specified for the operation. The data is then available for you to use in your program.



```
       DATA DIVISION.
           ⋮
       WORKING-STORAGE SECTION.
           ⋮
         01  RECORD-AREA-A.
           05  TERM-NAME-A PIC X(6)
           05  REC-TYPE-A PIC X.
           ⋮
      *
      * ONE SET OF FIELDS FOR EACH OF 5 TERMINALS
      *
         01   SAVED-INFORMATION.
           05   SAV-ENTRY OCCURS 5 TIMES INDEXED BY SAV-IX.
             10   SAV-TERM-NAME PIC X(6).
             10   SAV-CUST-NO PIC 9(4).
             10   SAV-CUST-NAME PIC X(55).
             10   SAV-LAST-REC-TYPE PIC X.
             10   SAV-NUMBER-TRANSACS PIC 99 COMP.
             10   SAV-TRANSAC-AMT-SUBTOTAL PIC S9(5)V99 COMP.
```

Defines a table of saved values for data received from five different terminals. The group item, SAV-ENTRY, consists of 6 fields. These fields can be referenced later in your program.

```
       PROCEDURE DIVISION.
                   ⋮
           SET SAV-IX TO 1.
         SEARCH-LOOP.
           IF TERM-NAME-A = SAV-TERM-NAME (SAV-IX)
              GO TO FOUND-THE-ENTRY.
           IF SAV-IX LESS THAN 5
              SET SAV-IX UP BY 1
              GO TO SEARCH-LOOP.
         ENTRY-NOT-FOUND.
              ⋮
         FOUND-THE-ENTRY.
              ⋮
           IF REC-TYPE-A = SAV-LAST-REC-TYPE (SAV-IX)
              ⋮
           ADD 1 TO SAV-NUMBER-TRANSACS (SAV-IX).
              ⋮
```

Search through the table of saved entries for the saved terminal name that is the same as the terminal name in the name field of the record area (TERM-NAME-A). When you find the corresponding terminal name proceed to FOUND-THE-ENTRY.

Once you have found the saved entry you were searching for, you can reference the saved fields by indexing the field name by SAV-IX:

- Compares input record type field with previous record from this terminal.
- Updates the number of transactions field in the saved entry by adding the new transaction from the input record.

Figure 4-7. Referencing Saved Information

USING THE SYSTEM OPERATOR CONSOLE

If you wish to communicate with the system operator through either the 5471 Printer/Keyboard (Models 10 and 12) or CRT/Keyboard (Model 15), you must specify operations as though the device is a remote terminal. You cannot address the system operator's console by either the DISPLAY .... UPON console-name or the ACCEPT....FROM console-name statement. Instead of using these statements, you must specify either a Put or Put-Then-Get operation to a terminal named CONSOL. CONSOL is the only name that can be assigned to the system operator console.

Your program can communicate with the system operator's console at any time. To receive data from the console, you must issue a Put-Then-Get operation, which:

1. Transmits a message to the system operator; and
2. Accepts a reply from the system operator.

Control is not returned to your program until the system operator has transmitted input data to your program.

The operations that can be issued to the console are:

- Put
- Put-Then-Get
- Get Attributes

The console is available at all times to communicate with any program or to enter system operator commands. However, if the console requests a program, it cannot request another program until the first program is initiated by the CCP. It is not necessary, nor is it valid, to issue an Acquire Terminal operation to the console in order to communicate with it.

Example: The example in Figure 4-8 uses the system operator console as the terminal for a Put-Then-Get operation to notify the system operator of an I/O error.

COBOL PROGRAMMING CONSIDERATIONS

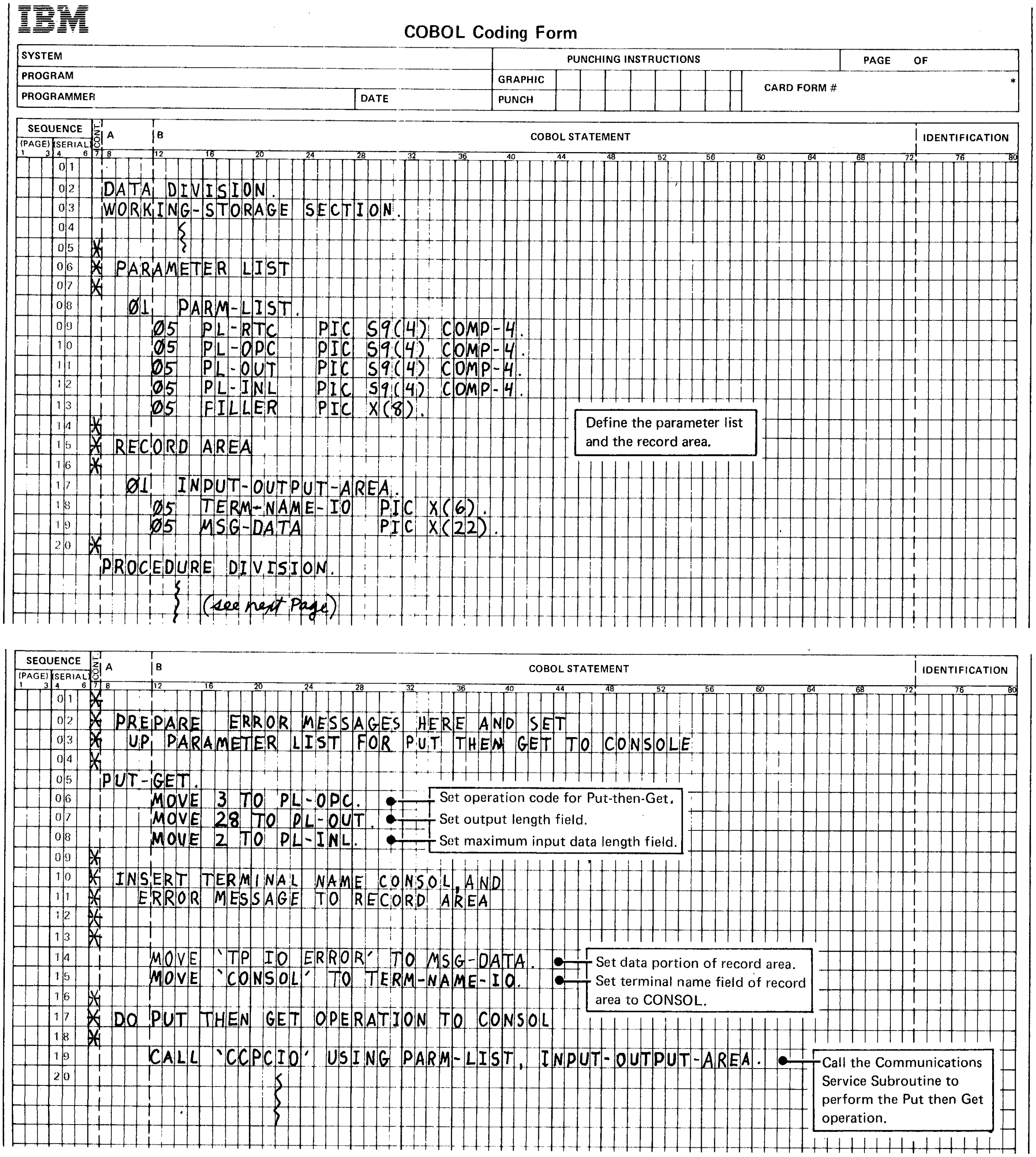
When writing your COBOL program, remember:

- (Model 10 and Model 12) You cannot use either the ACCEPT or the DISPLAY statements when addressing the CONSOL.
- You cannot use the Checkpoint/Restart facility of Disk Data Management. Therefore, your COBOL program cannot specify the RERUN statement.
- (Model 10 and Model 12 CCP) You must not issue a *STOP literal* statement. Programs running under the CCP are not permitted to issue halts.
- You should not use the APPLY CORE-INDEX clause in your COBOL program to create an in-storage index (master index) for randomly processed indexed files. The index is built as a result of the MSTRINDX keyword of the DISKFILE assignment statement (see *CCP System Reference);* therefore, if you use an APPLY CORE-INDEX clause, you will only add unnecessary storage size to your program.
- (Model 15) You cannot use the COBOL TRACE option under CCP.
- The DISPLAY statement cannot be used for a printer.

3270 DISPLAY FORMAT FACILITY

You can use the 3270 Display Format Facility (DFF) of the CCP to aid you in formatting and using the 3270 display. *Chapter 8: 3270 Display Format Facility* describes the programming requirements that are unique to using 3270 DFF, including the unique 3270 DFF operations, additional information that must be placed in the record area for certain operations, field types that are unique to the 3270, and other information.

See *Chapter 8: 3270 Display Format Facility* for an example of a COBOL program that uses the DFF to support a single requesting 3270 terminal.



IBM

COBOL Coding Form

SYSTEM

PROGRAM

PROGRAMMER

DATE

PUNCHING INSTRUCTIONS

GRAPHIC

PUNCH

PAGE OF

CARD FORM #

```
   01
   02  DATA DIVISION.
   03  WORKING-STORAGE SECTION.
   04
   05 *
   06 * PARAMETER LIST
   07 *
   08    01  PARM-LIST.
   09      05  PL-RTC   PIC S9(4)  COMP-4.
   10      05  PL-OPC   PIC S9(4)  COMP-4.
   11      05  PL-OUT   PIC S9(4)  COMP-4.
   12      05  PL-INL   PIC S9(4)  COMP-4.
   13      05  FILLER   PIC X(8).
   14 *
   15 * RECORD AREA
   16 *
   17    01  INPUT-OUTPUT-AREA.
   18      05  TERM-NAME-IO  PIC X(6).
   19      05  MSG-DATA      PIC X(22).
   20 *
       PROCEDURE DIVISION.
                (see next Page)
```

Define the parameter list and the record area.

```
   01 *
   02 * PREPARE    ERROR MESSAGES HERE AND SET
   03 *  UP PARAMETER LIST FOR PUT THEN GET TO CONSOLE
   04 *
   05  PUT-GET.
   06      MOVE 3 TO PL-OPC.
   07      MOVE 28 TO PL-OUT.
   08      MOVE 2 TO PL-INL.
   09 *
   10 * INSERT TERMINAL NAME CONSOL,AND
   11 *   ERROR MESSAGE TO RECORD AREA
   12 *
   13 *
   14      MOVE 'TP IO ERROR' TO MSG-DATA.
   15      MOVE 'CONSOL' TO TERM-NAME-IO.
   16 *
   17 * DO PUT THEN GET OPERATION TO CONSOL
   18 *
   19      CALL 'CCPCIO' USING PARM-LIST, INPUT-OUTPUT-AREA.
   20
```

Set operation code for Put-then-Get.

Set output length field.

Set maximum input data length field.

Set data portion of record area.

Set terminal name field of record area to CONSOL.

Call the Communications Service Subroutine to perform the Put then Get operation.

Figure 4-8. Using the Console

PROGRAMMING EXAMPLES

Two programming examples are explained in this section:

Example 1 – A COBOL program that supports a single requesting 3270 without using the Display Format Facility.

Example 2 – A COBOL program that supports multiple requesting terminals.

See Chapter 8 for an example of a COBOL program that uses the 3270 Display Format Facility to support a single requesting 3270 terminal.

Example 1

Figures 4-9, 4-10, and 4-11 show the flowcharts, messages, and listing for a sample single requesting terminal (SRT) COBOL program. This program transmits two messages to a 3270 Model 1 Display System (480 character screen). The first message from the program requests the terminal operator to enter a room number. The program uses the room number as the relative record number to access a disk file whose records contain guest and rate information about the room. This information is then formatted and displayed as the second message transmitted to the 3270 terminal. Figure 4-9 also shows how these messages appear on the 3270 terminal.

Because this program is a *single requesting terminal* (SRT) program (see index entry) without any program-selected terminals, it can receive data from and transmit data to only one 3270 terminal. However, multiple copies of this program could be in main storage at the same time, each communicating with a different 3270 Display System. (If multiple copies are in core at the same time, the disk file must be specified as sharable during the Assignment stage – see index entry *disk file sharing*.)

Formatting the Messages for the 3270 Display

Because this sample program does not use the Display Format Facility, this sample program must set all formatting control characters for the 3270 display screen into the data portion of the record area and transmit them as part of the messages to be displayed. Figure 4-10 shows the messages and the 3270 control characters as they are transmitted to the 3270 terminal. You can find the meanings of each of the 3270 screen format characters shown in Figure 4-10 in the publication *IBM 3270 Information Display System Component Description*, GA27-3004.

The printable control characters are set by defining them as part of the message in the VALUE clauses of the record area definition. Blanks are left in the VALUE clauses where the unprintable format characters will be set by MOVE statements later in the program.

The unprintable format characters (hexadecimal values that have no corresponding printable character in 96-column card code) are set by first coding the hexadecimal format characters as decimal values and initializing fields to these values (PSEUDO and PSEUDO2). The fields assigned these decimal values are then redefined so that the COBOL program can access these values, which are stored in hexadecimal internally, as the format characters. These redefined fields (INSERT-CURSOR, START-FIELD, SET-BUFFER-ADDR, and ESCAPE) are then moved into the appropriate position in the message. The notes to the right of the listing in Figure 4-11 explain the statements used by this program to format the 3270 display screen. You will also find the comments in the listing helpful.

Notes Concerning this Sample Program

- Message Mode was defined during the Assignment Stage for the 3270 terminal used by this program. (See TERMATTR statement in *CCP System Reference Manual*.) This eliminates the need to do repetitive input operations until EOT is received.
- To run this program using a terminal other than the 3270, you must remove all coding dependent on the 3270. This includes all screen formatting specifications and 3270 screen control characters within the data.
- This program will not accept data with the program request.
- Two different lengths are used for the output length field of the parameter list because the two messages transmitted by this sample program have different length.
- This program specifies a PUT operation and a GET operation using six blanks as the terminal name. The CCP places the name of the 3270 terminal being used in the terminal name field of the record area after the first PUT operation is performed.

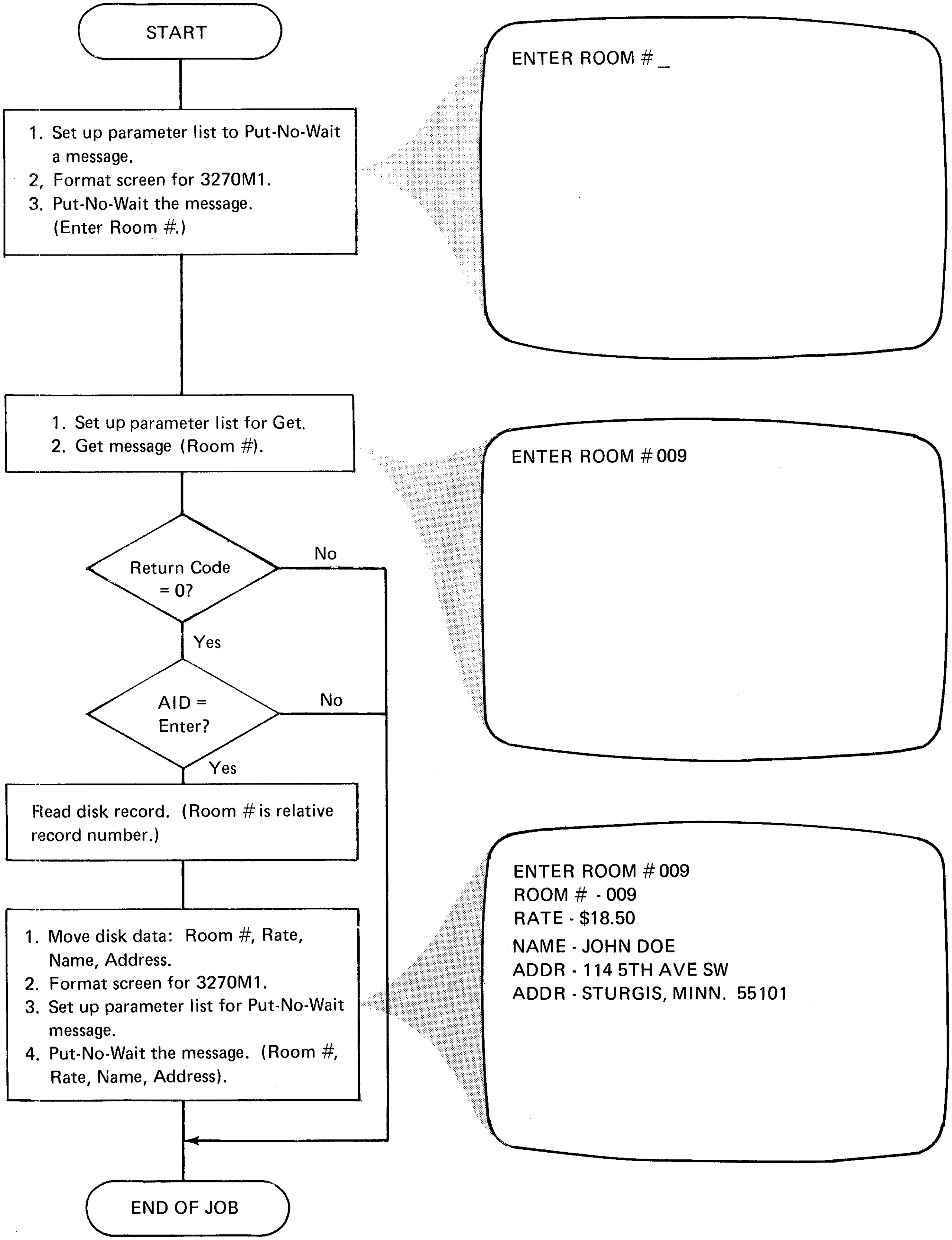
- To keep this sample program simple, return code checking is kept to a minimum. You may want to do more return code checking in your application programs. For example, when you issue Accept Input you should check for the Shutdown Requested return code (04). Also, if data mode escape is allowed in the CCP system, programs should check for return code 08 (terminal has released itself from the program). It is recommended that each installation design its own return code checking and console communication routines so that a standard is established that is satisfactory to the installation and can be used by all application programs.

- This program does not check the length of the input data because the terminal operator is requested to enter a three-digit room number. If less than three digits are entered, the program branches to the EXIT-DONE procedure and the program is canceled. However, you may want to check the input data length in your application programs.

- Since there are only two different screen formats used by this program, they are both contained within the program. For more complete applications, you might store the screen formats on disk and read them when they are needed by your program.

- You could also use the Get Attributes operation in this program. If you do not know whether the 3270 Model 1 or the 3270 Model 2 will request the program, you can issue a Get Attributes operation to find out which type of terminal requested the program.

- If this program were coded and specified as a multiple requesting terminal (MRT) program with a MRTMAX=1 keyword on the PROGRAM assignment statement (see *CCP System Reference Manual*), multiple copies of the program would not be allowed in main storage at the same time. As the program is written, multiple copies could be in main storage at the same time and the disk file must be specified as sharable (FILES keyword of PROGRAM assignment statement).



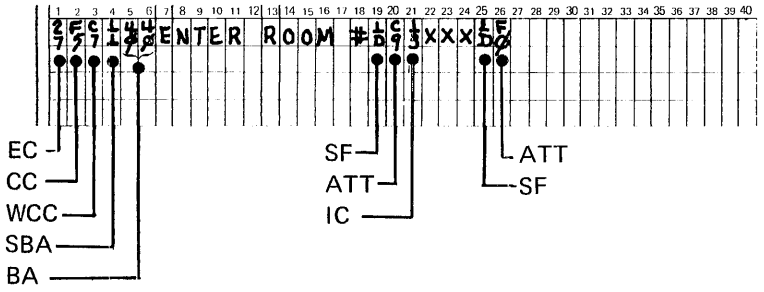
```
ENTER ROOM #_
```

```
ENTER ROOM #009
```

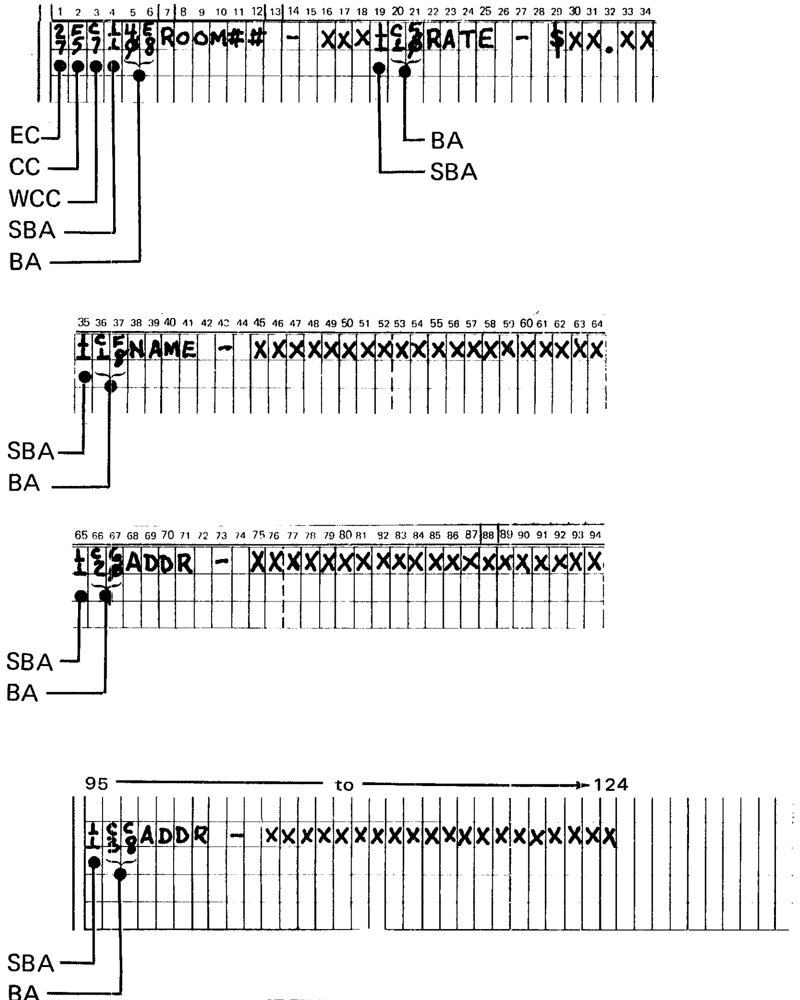
```
ENTER ROOM #009
ROOM # - 009
RATE - $18.50
NAME - JOHN DOE
ADDR - 114 5TH AVE SW
ADDR - STURGIS, MINN. 55101
```

Figure 4-9. Program Logic of Example 1 (COBOL SRT Program)

First Message



Second Message



SF	– Start Field	CC	– Command Code
ATT	– Attribute Character	WCC	– Write Control Character
IC	– Insert Cursor	SBA	– Set Buffer Address
x	– Data Character	BA	– Buffer Address of first character position in the field
EC	–Escape Character		

Figure 4-10. Message Formats for Example 1 (COBOL SRT Program)

```
                     IBM SYSTEM/3 AMERICAN NATIONAL STANDARD COBOL

STNO -A...B... C O B O L   S O U R C E   S T A T E M E N T S ..........IDENTFCN SEQ/NO S

      PROCESS MAP,LIST,GODECK
   1  IDENTIFICATION DIVISION.
   2  PROGRAM-ID. SRCOB1.
   3  REMARKS.  THIS IS A SAMPLE SINGLE REQUESTING TERMINAL PROGRAM
                DESIGNED TO RUN UNDER CCP.  A 3 DIGIT ROOM NUMBER
                WHOSE VALUE IS BETWEEN 1 AND 10 IS ENTERED FROM A 3270
                TERMINAL. THE ROOM NUMBER IS RECEIVED BY THIS PROGRAM,
                AND IS USED TO ACCESS A FILE WHOSE RECORDS CONTAIN
                GUEST AND RATE INFORMATION ABOUT THE ROOM. THE PROGRAM
                RECEIVES THIS INFORMATION FROM THE DISK AND FORMATS IT
                AND THEN SENDS IT BACK TO THE 3270 TO BE DISPLAYED.
   4  ENVIRONMENT DIVISION.
   5  CONFIGURATION SECTION.
   6  SOURCE-COMPUTER. IBM-S3.
   7  OBJECT-COMPUTER. IBM-S3.
   8  INPUT-OUTPUT SECTION.
   9  FILE-CONTROL.
  10      SELECT GUEST-FILE ASSIGN TO DA-5444-R-GSTFILE
              ACCESS MODE IS RANDOM
              ACTUAL KEY IS GUEST-KEY.
  11  DATA DIVISION.
  12  FILE SECTION.
      *****************************************************************
      *   THIS IS THE RECORD THAT CONTAINS THE GUEST AND RATE         *
      *      INFORMATION FROM THE DISK FILE.                          *
      *****************************************************************
  13  FD  GUEST-FILE LABEL RECORDS ARE STANDARD
                DATA RECORD IS GUEST-REC.
  14    01 GUEST-REC.
  15      02 RPG-DATA     PIC X.
  16      02 ROOM-NMBR    PIC X(3).
  17      02 ROOM-RATE    PIC 99V99.
  18      02 GUEST-NAME   PIC X(20).
  19      02 ADDR-HOME    PIC X(20).
  20      02 ADDR-WORK    PIC X(20).
  21      02 FILLER       PIC X(2).
  22  WORKING-STORAGE SECTION.
      *****************************************************************
      *   INDEPENDENT FIELDS AND CONSTANTS AND KEYS                   *
      *****************************************************************
  23    77 GUEST-KEY   PIC S9(7) COMP.
      *****************************************************************
      *   THESE ARE SPECIAL HEX-DECIMAL CHARACTERS USED FOR FORMATTING *
      *      THE 3270 SCREEN                                          *
      *****************************************************************
  24    01 PSEUDO          PIC 9999 COMP-4 VALUE 4893. ❶
  25    01 IC-SF REDEFINES PSEUDO. )
  26      05 INSERT-CURSOR  PIC X. }❷
  27      05 START-FIELD    PIC X. )
  28    01 PSEUDO2         PIC 9999 COMP-4 VALUE 4391. ❸
  29    01 SBA-ESC REDEFINES PSEUDO2. )
  30      05 SET-BUFFER-ADDR PIC X.   }❹
  31      05 ESCAPE          PIC X.   )
```

❶ Initialize PSEUDO using decimal values corresponding to the hexadecimal values for Insert Cursor and Start Field. These values will be internally represented in binary:

Insert Cursor = X'13'
Start Field = X'1D'
X'131D' = decimal 4893 (see *Note*)

❷ Redefine PSEUDO to make the resulting two hexadecimal values available to be manipulated individually in the program.

❸ Initialize PSEUDO2 using decimal values corresponding to the hexadecimal values for Set Buffer Address and Escape Character. These values will be internally represented in binary:

Set Buffer Address = X'11'
Escape Character = X'27'
X'1127' = decimal 4391 (see *Note*)

❹ Redefine PSEUDO2 to make the resulting two hexadecimal values available to be manipulated individually in the program.

Note: The hexadecimal value to be converted to decimal must never exceed X'270F', or the resulting decimal value will exceed four digits and will require a three-byte field. If this occurs, rearrange the order of the hexadecimal fields to see if it results in a lower decimal value. If it does not, use a three-byte field and place a X'00' filler in the first byte.

Figure 4-11 (Part 1 of 3). Example 1 – COBOL SRT Program

```
/*****************************************************************
 *   INPUT-OUTPUT PARAMETER LIST                                 *
 *****************************************************************
     01 PARM-LIST.
        05 PL-RTC       PIC S9(4) COMP-4.
        05 PL-OPC       PIC S9(4) COMP-4 VALUE 54.
        05 PL-OUTL      PIC S9(4) COMP-4 VALUE 26.
        05 PL-INL       PIC S9(4) COMP-4 VALUE 11.
        05 FILLER       PIC X(8).
```

Return Code Field
Operation Code Field
Output Length Field
Maximum Input Length Field
Required CCP Work Area

```
 *****************************************************************
 *   THIS IS THE INPUT/OUTPUT AREA                               *
 *****************************************************************
     01 INPUT-OUTPUT-AREA.
        05 I-O-TERM PIC X(6) VALUE SPACES.
```

Terminal Name Field

```
        05 I-O-AREA.
           10 MSG1      PIC X(21) VALUE ' 5G   ENTER ROOM # I'.
           10 ROOM-NUM PIC X(3) VALUE SPACES.
           10 CHRS1     PIC X(5)  VALUE ' O- $'.
           10 CHRS2     PIC 99.99.
           10 NAME      PIC X(10) VALUE ' A8NAME - '.
           10 NAM-CHR PIC X(20) VALUE SPACES.
           10 ADDR1     PIC X(10) VALUE ' B-ADDR - '.
           10 AD1-CHR PIC X(20) VALUE SPACES.
           10 ADDR2     PIC X(10) VALUE ' CHADDR - '.
           10 AD2-CHR PIC X(20) VALUE SPACES.
```

Data area for Messages: Initialize the contents of message fields to be displayed and of any printable 3270 formatting characters. Leave blanks for any unprintable 3270 control characters (characters that cannot be represented by a character in the COBOL character set). The blank fields are set by MOVE statements later in the program. The first half of this definition is used for the first message; the second half is used only for the second message. The first part of the second message will be added later by overlaying the first message.

```
        05 I-O-CHARS REDEFINES I-O-AREA.
           10 I-O-CHAR PIC X OCCURS 124 INDEXED BY INDX.
```

Redefine the data area with an index so each position in the area can be referenced separately.

```
        05 I-O-AREA2 REDEFINES I-O-AREA.
           10 ROOM      PIC X(15).
           10 ROOM-NM PIC X(3).
           10 RATE      PIC X(8).
           10 FILLER    PIC X(98).
```

Redefine the data area to set up the first part of the second message.

```
        05 INPUT-AREA REDEFINES I-O-AREA.
           10 DEVICE    PIC X.
           10 CNTRL-U PIC X.
           10 AID       PIC X.
           10 CRS-ADD PIC X(2).
           10 SBA       PIC X.
           10 SBA-ADD PIC X(2).
           10 RM-NUM    PIC X(3).
           10 FILLER    PIC X(113).
```

Redefine data area for Get operation.

```
/*****************************************************************
 *   NOW BEGIN EXECUTION BY OPENING THE DIRECT ACCESS FILE       *
 *****************************************************************
  PROCEDURE DIVISION.
  OPEN-THE-FILE.
        OPEN INPUT GUEST-FILE.
 *****************************************************************
 *   INSERT THE HEXADECIMAL CONTROL CHARACTERS INTO DATA STREAM  *
 *****************************************************************
  FIRST-CHARS.
        MOVE ESCAPE TO I-O-CHAR(1).
        MOVE SET-BUFFER-ADDR TO I-O-CHAR(4).
  NEXT-CHARS.
        MOVE START-FIELD TO I-O-CHAR(19).
        MOVE INSERT-CURSOR TO I-O-CHAR(21).
```

Move the hexadecimal values for the remaining 3270 formatting control characters to appropriate positions in the data area. These characters are unprintable.

```
 *****************************************************************
 *   THIS FIELD IS DEFINED TO PREVENT DATA FROM BEING ENTERED    *
 *      BEYOND THIS POSITION ON THE SCREEN.                      *
 *****************************************************************
        MOVE START-FIELD TO I-O-CHAR(25).
 *****************************************************************
 *   DO PUT MESSAGE NO WAIT OPERATION TO 3270 TERMINAL           *
 *      REQUESTING THE ROOM NUMBER BE ENTERED                    *
 *****************************************************************
```

Figure 4-11 (Part 2 of 3). Example 1 — COBOL SRT Program

```
77        CALL 'CCPCIO' USING PARM-LIST, INPUT-OUTPUT-AREA.
     *****************************************************************
     *   DO GET OPERATION FROM 3270 TERMINAL AND OBTAIN ROOM NUMBER   *
     *****************************************************************
78        MOVE 1 TO PL-OPC.
79        CALL 'CCPCIO' USING PARM-LIST, INPUT-OUTPUT-AREA.
     *****************************************************************
     *   IF THE RETURN CODE IS NOT ZERO GO TO END OF JOB              *
     *****************************************************************
80        IF PL-RTC NOT = 0 GO TO EXIT-DONE.
     *****************************************************************
     *   CHECK TO SEE IF THE ENTER KEY WAS PRESSED, IF IT WAS NOT GO  *
     *      TO END OF JOB.                                            *
     *****************************************************************
82        IF I-O-CHAR(3) NOT = QUOTE GO TO EXIT-DONE.
     *****************************************************************
     *   VALIDITY CHECK THE ROOM NUMBER IF ROOM NUMBER BAD GO TO END  *
     *      OF JOB                                                    *
     *****************************************************************
84        MOVE RM-NUM TO GUEST-KEY.
85        IF GUEST-KEY LESS THAN 1 GO TO EXIT-DONE.
87        IF GUEST-KEY GREATER THAN 10 GO TO EXIT-DONE.
89        MOVE RM-NUM TO ROOM-NM.
     *****************************************************************
     *   READ RECORD FROM DIRECT ACCESS FILE.  THE ROOM NUMBER        *
     *      REPRESENTS THE RELATIVE POSITION OF THE RECORD IN THE FILE*
     *****************************************************************
90        READ GUEST-FILE INVALID KEY GO TO EXIT-DONE.
     /****************************************************************
     *   MOVE THE ROOM NUMBER, RATE PER DAY, THE NAME AND ADDRESS OF  *
     *      THE GUEST INTO THE OUTPUT AREA                            *
     *****************************************************************
92        MOVE ' 1G  YROOM # - ' TO ROOM.
93        MOVE ' A&RATE ' TO RATE.
94        MOVE GUEST-NAME TO NAM-CHR.
95        MOVE ROOM-RATE TO CHRS2.
96        MOVE ADDR-HOME TO AD1-CHR.
97        MOVE ADDR-WORK TO AD2-CHR.
     *****************************************************************
     *   INSERT THE HEXADECIMAL CONTROL CHARACTERS INTO DATA STREAM   *
     *****************************************************************
98        PERFORM FIRST-CHARS.
99        MOVE SET-BUFFER-ADDR TO I-O-CHAR(19).
100       MOVE SET-BUFFER-ADDR TO I-O-CHAR(35).
101       MOVE SET-BUFFER-ADDR TO I-O-CHAR(65).
102       MOVE SET-BUFFER-ADDR TO I-O-CHAR(95).
     *****************************************************************
     *   SET UP PARAMETER LIST FOR A PUT MESSAGE NO WAIT              *
     *****************************************************************
103       MOVE 54 TO PL-OPC.
104       MOVE 124 TO PL-OUTL.
     *****************************************************************
     *   DO PUT MESSAGE NO WAIT OPERATION TO THE 3270 TERMINAL        *
     *****************************************************************
105       CALL 'CCPCIO' USING PARM-LIST, INPUT-OUTPUT-AREA.
106   EXIT-DONE.
107       CLOSE GUEST-FILE.
108       STOP RUN.
```

Move the message, data, and printable 3270 control characters for the first part of the second message into the data area of the record area, overlaying the first message.

Move the hexadecimal values for the 3270 formatting control characters that are not already set in the data area into the appropriate positions of the data area. These are the unprintable control characters.

Figure 4-11 (Part 3 of 3). Example 1 – COBOL SRT Program

Example 2

Figures 4-12, 4-13, and 4-14 show the flowchart, input/output messages, and listing for a sample COBOL multiple requesting terminal (MRT) program designed to run under the CCP. This program handles up to four MLTA requesting terminals. The terminal operator enters a seven-digit number preceded by a +, -, or N. The CCP transmits this signed number to the COBOL program. The COBOL program:

- Adds the number to the value in the accumulator field associated with the terminal that transmitted the data if the first position is +
- Subtracts the number from the accumulator if the first position is -
- Releases the terminal if the first position is N

If a value was either added or subtracted, the new value accumulated for the terminal is inserted into the message *CURRENT VAL = sxxxxxxxxxxx ENTER DATA* and the message is sent to the terminal.

This sample program also checks for several error conditions and transmits the appropriate error message to the terminal.

This sample program is not designed to show the most effective way of performing operations. Instead, it shows a variety of ways to do things. It uses a variety of operation codes that show how data can be associated with a terminal by defining a save area for the terminal names and accumulated data. It frequently checks return codes; but you can do even more return code checking if you wish. Data entered by the terminal operator must be fixed length. To allow variable length input fields, you could include a subroutine in your program to check the effective input length returned in the parameter list and align the data correctly. This program communicates with the console in addition to the requesting terminals.

The notes to the right of the listing in Figure 4-14 and the comments in the listing explain each section of the sample program.

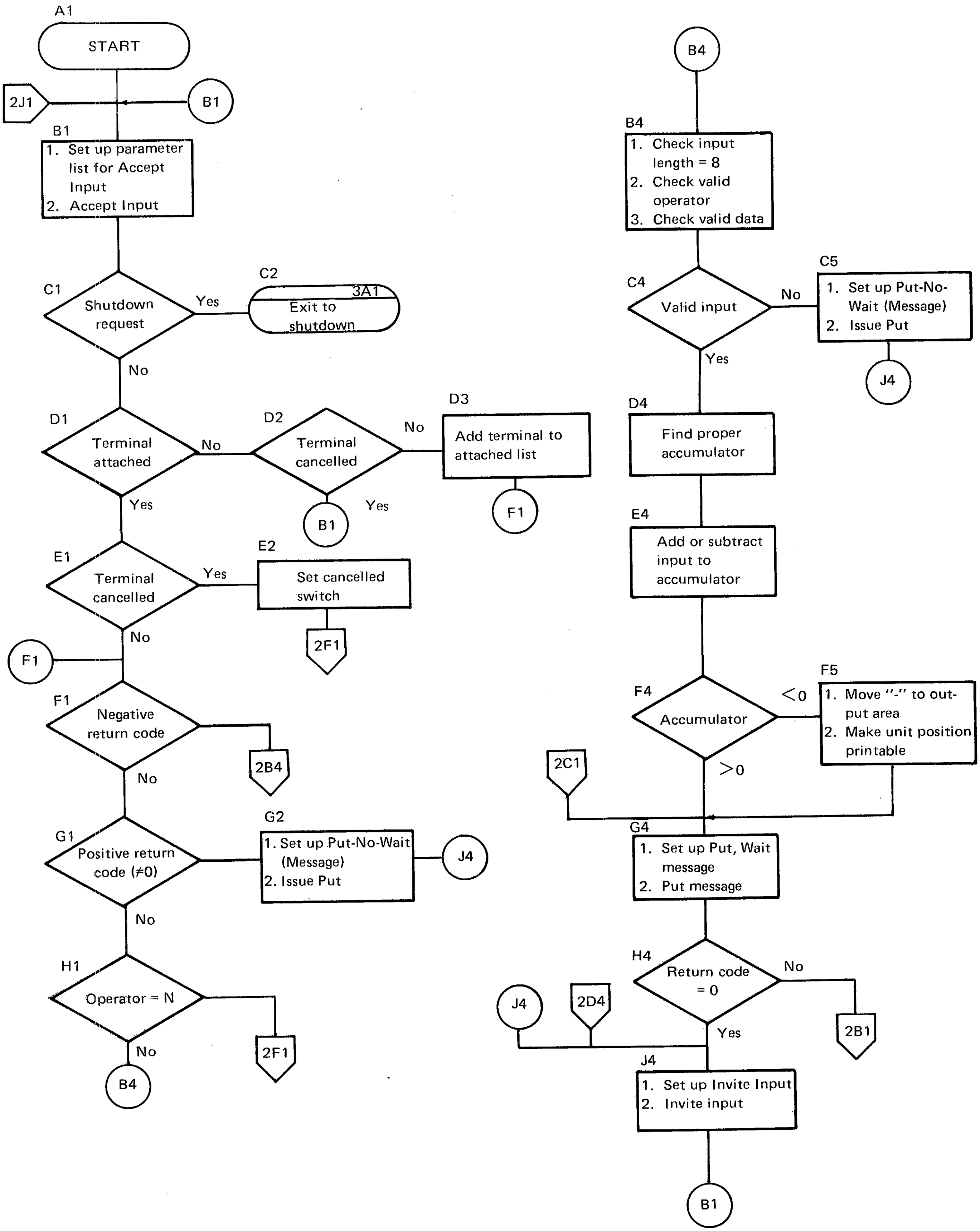


Figure 4-12 (Part 1 of 3). Program Logic of Example 2 (COBOL MRT Program)

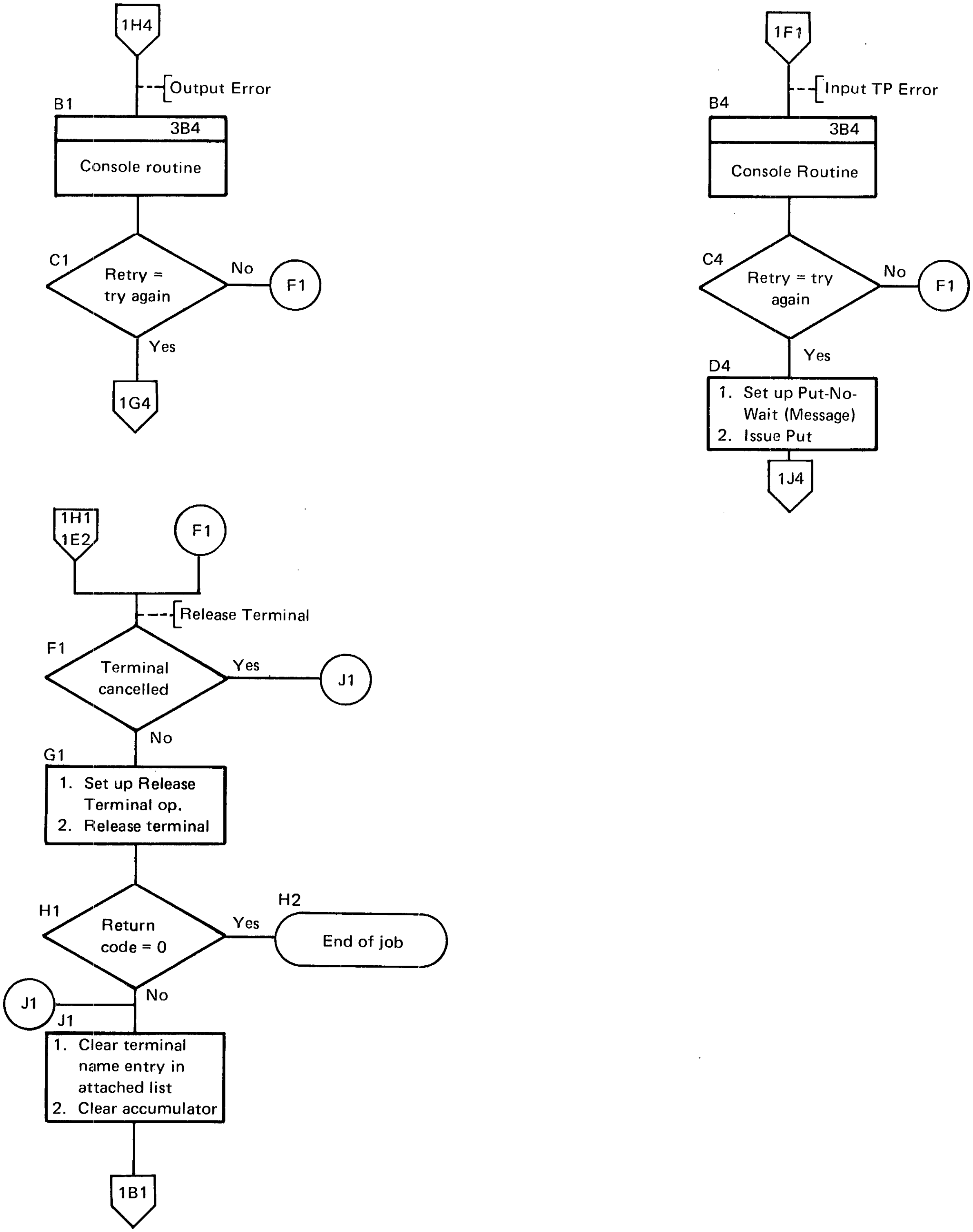


Figure 4-12 (Part 2 of 3). Program Logic of Example 2 (COBOL MRT Program)

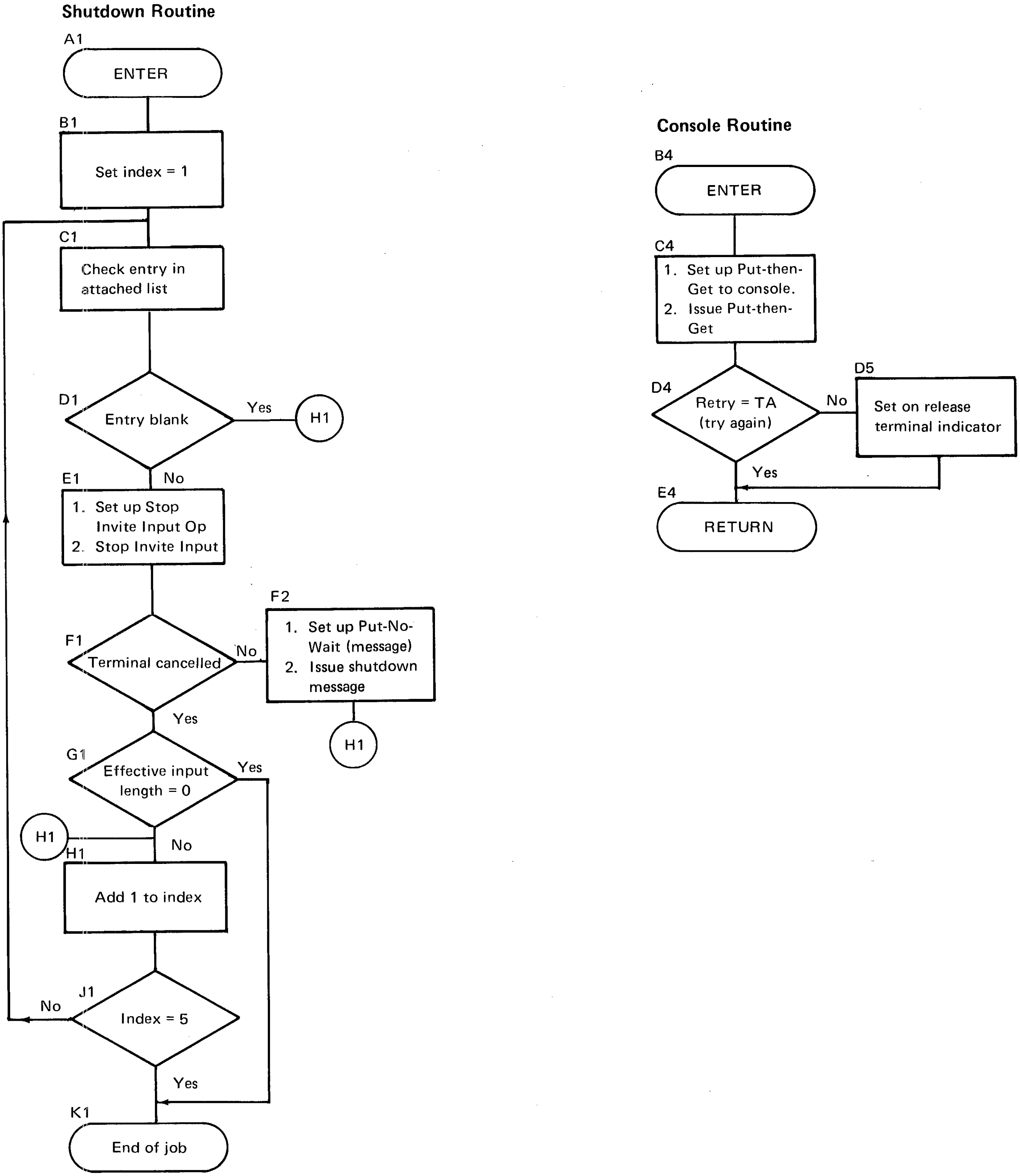


Figure 4-12 (Part 3 of 3). Program Logic of Example 2 (COBOL MRT Program)

Input Data Entered by Terminal Operator

```
SXXXXXXX
```

A fixed length numeric field where S is a +, –, or N and X is a numeric digit. All eight postions must be entered, except when N is entered in the first position.

Data Entered by System Operator on 5471 Printer/Keyboard (Models 10 and 12) or CRT/Keyboard (Model 15)

```
TA
CC
```

In response to the messages INPUT TP ERROR TNAME-cccccc and OUTPUT TP ERROR TNAME-cccccc to the console, the system operator replies TA if he wants to try again. Any other reply (cc) causes the terminal to be released.

Output to the Console

```
INPUT  TP ERROR TNAME-CCCCCC

OUTPUT TP ERROR TNAME-CCCCCC
```

These messages are transmitted to the console (cccccc = terminal name).

Output to Terminal

```
CURRENT VAL=SXXXXXXXXXX ENTER DATA

TRY AGAIN INV DATA

TRY AGAIN TP ERROR

CCP SHTDWN LAST REC-  TP ERROR

CCP SHTDWN LAST REC-  BAD DATA

CCP SHTDWN LAST REC-  SXXXXXXX

CCP SHTDWN LAST REC-  NO DATA
```

Transmitted with value in accumulator associated with the terminal.

Issued if data is invalid.

Issued if system operator replies TA (negative return code on Accept Input).

Issued for negative return code on Stop Invite Input.

Issued for positive return code other than 10 on Stop Invite Input.

Issued for return code of 0 on Stop Invite Input.

Issued for return code of 10 on Stop Invite Input

Figure 4-13. Input and Output Message Formats for Example 2 (COBOL MRT Program)

```
                    IBM SYSTEM/3 AMERICAN NATIONAL STANDARD COBOL

STNO -A...B... C O B O L   S O U R C E   S T A T E M E N T S ..........IDENTFCN SEQ/NO S

      PROCESS MAP,LIST
   1  IDENTIFICATION DIVISION.
   2  PROGRAM-ID. MRCOB1.
   3  REMARKS.  THIS IS A SAMPLE MULTIPLE REQUESTING TERMINAL PROGRAM
                DESIGNED TO RUN UNDER CCP.  A NUMBER CONSISTING
                OF UP TO 7 NUMERIC CHARACTERS AND A + OR - OPERATOR IS
                TRANSMITTED TO THIS PROGRAM BY ANY ONE OF UP TO 4
                TERMINALS. THE + OR - OPERATION IS PERFORMED AND THE
                RESULTS PLACED IN THE ACCUMULATOR ASSOCIATED WITH THE
                TERMINAL THAT REQUESTED THE OPERATION. THE VALUE IN THE
                ACCUMULATOR IS THEN SENT BACK TO THE TERMINAL FOR
                DISPLAY. IF AN N IS ENTERED AS THE OPERATOR THE
                TERMINAL WILL BE RELEASED. IF THIS IS THE ONLY TERMINAL
                LINKED WITH THE PROGRAM, THE PROGRAM WILL END
                EXECUTION.
   4  ENVIRONMENT DIVISION.
   5  CONFIGURATION SECTION.
   6  SOURCE-COMPUTER.  IBM-S3.
   7  OBJECT-COMPUTER.  IBM-S3.
   8  DATA DIVISION.
   9  WORKING-STORAGE SECTION.
     ******************************************************************
     *   INDEPENDENT FIELDS AND CONSTANTS                             *
     ******************************************************************
  10     77  SWITCH PIC 9 COMP-4.
     ******************************************************************
     *   OPERATION CODES
     ******************************************************************
  11     77 ACPTIN  PIC S9(4)  COMP-4 VALUE 4.
  12     77 PUTNWT  PIC S9(4)  COMP-4 VALUE 54.
  13     77 PUTMWT  PIC S9(4)  COMP-4 VALUE 50.
  14     77 INVINP  PIC S9(4)  COMP-4 VALUE 5.
  15     77 PUTGET  PIC S9(4)  COMP-4 VALUE 3.
  16     77 RELTRM  PIC S9(4)  COMP-4 VALUE 10.
  17     77 STPINV  PIC S9(4)  COMP-4 VALUE 1025.
     ******************************************************************
     *   TERMINAL DATA STORAGE ARRAY                                  *
     ******************************************************************
  18     01  TERMINAL-STORAGE-ARRAY.
  19       05  TERMINAL-ENTRY OCCURS 4 INDEXED BY TERM-X.
  20         10  TERM-NAME    PIC X(6).
  21         10  ACCUMULATOR PIC S9(11) COMP.
     /*****************************************************************
     *   COMMUNICATIONS AREA                                          *
     *   CCP-COBOL INTERFACE PARAMETER LIST
     ******************************************************************
  22     01  PARM-LIST.
  23       05  PL-RTC    PIC S9(4) COMP-4.
  24       05  PL-OPC    PIC S9(4) COMP-4.
  25       05  PL-OUT    PIC S9(4) COMP-4.
  26       05  PL-EFL REDEFINES PL-OUT PIC S9(4) COMP-4.
  27       05  PL-INL    PIC S9(4) COMP-4.
  28       05  FILLER    PIC X(8).
     ******************************************************************
     *   THIS IS THE INPUT OUTPUT AREA                                *
     ******************************************************************
  29     01  INPUT-OUTPUT-AREA.
  30       05  TERM-NAME-IO         PIC X(6).
  31       05  DATA-IN.
  32         10  OPERATOR           PIC X.
  33         10  DIGITS             PIC 9(7) COMP.
  34         10 FILLER              PIC X(26).
  35       05  DATA-IN1  REDEFINES DATA-IN.
  36         10  DATA-REC           PIC X(8).
  37         10  FILLER             PIC X(26).
  38       05  DATA-OUT  REDEFINES DATA-IN.
  39         10 DATA-CHAR           PIC X(34).
  40       05  ACCUM-OUT  REDEFINES DATA-IN.
  41         10  FILLER             PIC X(12).
  42         10 ACCUM-VALUE         PIC ++++++++++9.
  43         10  FILLER             PIC X(11).
  44       05  MSG-DATA  REDEFINES DATA-IN.
  45         10  MSG-DATA1          PIC X(22).
  46         10  MSG-DATA2          PIC X(8).
  47         10  FILLER             PIC X(4).
  48       05  MS-DATA REDEFINES DATA-IN.
  49         10  MS-DATA1           PIC X(6).
  50         10  MS-DATA2           PIC X(17).
  51         10  MS-DATA3           PIC X(6).
  52         10  FILLER             PIC X(5).
  53       05  TRY-AGAIN  REDEFINES DATA-IN.
  54         10  TA                 PIC X(2).
  55         10  FILLER             PIC X(32).
```

Define a symbolic name for each operation used in this program. These names are used in the procedure division instead of the numeric operation code values.

Set up a save area for the four terminals used by this program and their accumulators.

Return Code Field
Operation Code Field
Output Length Field
Input Length Field
Required Work Area

Terminal Name Field

The data portion of the record area is first defined for an eight-position field whose first position is for the operator (+, –, or N). It is then redefined for output and various messages.

Figure 4-14 (Part 1 of 5). Example 2 – COBOL MRT Program

```
     /*****************************************************************
     *   INITIALLY SET UP THE TERMINAL ARRAY IN ORDER THAT THIS      *
     *      PROGRAM BE RE-ENTRANT                                    *
     *****************************************************************
 56  PROCEDURE DIVISION.
 57  INIT.
 58      SET TERM-X TO 1.
 59  LOOP.
 60      MOVE ZEROES TO ACCUMULATOR(TERM-X).
 61      MOVE SPACES TO TERM-NAME(TERM-X).
 62      SET TERM-X UP BY 1.
 63      IF TERM-X LESS THAN 5 GO TO LOOP.
```

Initialize the accumulators to zeros and the terminal name save areas to blanks.

```
     *****************************************************************
     *   SET UP PARAMETER LIST FOR ACCEPT INPUT OPERATION            *
     *****************************************************************
 65  ACCEPT-INPUT.
 66      MOVE 0 TO SWITCH.
 67      MOVE ACPTIN TO PL-OPC.
 68      MOVE 8 TO PL-INL.
```

Set the value for the accept input operation in the operation code field of the parameter list.

Set the input field length to 8, the length of the expected input.

```
     *****************************************************************
     *   DO ACCEPT INPUT OPERATION                                   *
     *****************************************************************
 69      CALL 'CCPCIO' USING PARM-LIST, INPUT-OUTPUT-AREA.
     *****************************************************************
     *   CHECK TO SEE IF SHUTDOWN HAS BEEN REQUESTED                 *
     *****************************************************************
 70      IF PL-RTC = 4 GO TO SHUTDOWN.
     *****************************************************************
     *   DETERMINE IF TERMINAL HAS ALREADY BEEN ATTACHED, IF IT HAS  *
     *      GO CHECK THE RETURN CODE                                 *
     *****************************************************************
 72      SET TERM-X TO 1.
 73  TERM-SEARCH.
 74      IF TERM-NAME-IO = TERM-NAME(TERM-X) GO TO TERM-FOUND.
 76      SET TERM-X UP BY 1.
 77      IF TERM-X LESS THAN 5 GO TO TERM-SEARCH.
```

Determine if the terminal name for the terminal that transmitted the input data is in the terminal name save area. If it is, the data is added to the value in the accumulator associated with that terminal. If it is not in the save area and the terminal is not cancelled, the terminal name is added to the save area.

```
     *****************************************************************
     *   CHECK TO SEE IF THE TERMINAL HAS BEEN CANCELED, IF IT HAS   *
     *      RETURN TO ACCEPT INPUT IF NO INVITE INPUTS ARE OUTSTAND- *
     *      ING.  IF INVITES OUTSTANDING GO TO ACCEPT INPUT.         *
     *****************************************************************
 79      IF PL-RTC NOT = 8 GO TO ADD-TERM.
 81      IF PL-EFL = 0 GO TO DONE-EXIT.
 83      GO TO ACCEPT-INPUT.
 84  ADD-TERM.
     *****************************************************************
     *   ADD TERMINAL NAME TO ATTACHED LIST IF NOT ALREADY PRESENT   *
     *      LOCATE A BLANK 6 CHARACTER TERMINAL NAME SPACE IN THE    *
     *      TERMINAL DATA STORAGE ARRAY                              *
     *****************************************************************
 85      SET TERM-X TO 1.
 86  BLANK-SEARCH.
 87      IF TERM-NAME(TERM-X) NOT = SPACES
 88          SET TERM-X UP BY 1
 89          GO TO BLANK-SEARCH.
```

If the terminal name is not already in the terminal name save area, it is moved to the first blank terminal name field in the save area.

```
     *****************************************************************
     *   NOTE:  NO MORE THAN 4 TERMINALS WILL BE ALLOWED TO          *
     *       COMMUNICATE WITH THIS PROGRAM IF ASSIGNMENT SPECIFIES   *
     *       4 TERMINALS                                             *
     *****************************************************************
 90      MOVE TERM-NAME-IO TO TERM-NAME(TERM-X).
 91      GO TO VALIDITY-CHK.
     /*****************************************************************
     *   CHECK TO SEE IF TERMINAL HAS BEEN CANCELLED. IF IT HAS AND  *
     *      THERE ARE NO INVITES OUTSTANDING GO TO EXIT. IF THERE ARE *
     *      INVITES OUTSTANDING GO REMOVE FROM ACTIVE TERMINAL ARRAY. *
     *****************************************************************
 92  TERM-FOUND.
 93      IF PL-RTC = 8 GO TO CANCEL-CHK.
     *****************************************************************
     * CHECK FOR INPUT ERROR INDICATIONS, ISSUE ERROR MESSAGE IF     *
     *      RETURN CODE NOT = 0, OR IF LENGTH NOT WITHIN RANGE       *
     *   CHECK FOR VALID OPERATOR, IF OPERATOR EQUAL TO N GO RELEASE *
     *      TERMINAL                                                 *
     *****************************************************************
 95  VALIDITY-CHK.
 96      IF PL-RTC LESS THAN 0 GO TO PUT-GET.
 98      IF PL-RTC GREATER THAN 0 GO TO INVALID-DATA.
100      IF OPERATOR = 'N' GO TO CANCEL-CHK.
102      IF PL-OUT NOT = 8 THAN GO TO INVALID-DATA.
104      IF OPERATOR = '+' GO TO ADD-ACCUM.
106      IF OPERATOR = '-' GO TO SUB-ACCUM.
```

If the return code is not equal to 0, indicating a successful operation, or if the input length field is not equal to 8, an error message is transmitted to the terminal.

If the first position of the input field is +, the data is added to the accumulator associated with the terminal that transmitted the data. If the first position is -, the data is subtracted from the terminal. If the first position is N, the terminal is checked to see if it is cancelled.

```
     *****************************************************************
     *   ASSUME BAD OPERATOR, ISSUE INVALID DATA MESSAGE             *
     *****************************************************************
108  INVALID-DATA.
109      MOVE 'TRY AGAIN INV DATA' TO DATA-OUT.
110      MOVE 18 TO PL-OUT.
111      GO TO PUT-NO-WAIT.
```

If the first position of the input data is not +, -, or N, a message is transmitted to the terminal.

Figure 4-14 (Part 2 of 5). Example 2 – COBOL MRT Program

```
     /*****************************************************************
     *   NOW ADD THE VALUE RECIEVED AS INPUT TO THE VALUE IN THE      *
     *      ACCUMULATOR                                               *
     ******************************************************************
112   ADD-ACCUM.
113       ADD DIGITS TO ACCUMULATOR(TERM-X).
114       GO TO DISPLAY-ACCUM.
     ******************************************************************
     *   SUBTRACT THE VALUE RECEIVED AS INPUT FROM THE VALUE IN THE   *
     *      ACCUMULATOR                                               *
     ******************************************************************
115   SUB-ACCUM.
116       SUBTRACT DIGITS FROM ACCUMULATOR(TERM-X).
     ******************************************************************
     *   SET UP TO DISPLAY THE RESULTS RESIDING IN THE ACCUMULATOR    *
     *      TO THE TERMINAL THAT REQUESTED THE OPERATION              *
     ******************************************************************
117   DISPLAY-ACCUM.
118       MOVE 'CURRENT VAL=+           ENTER DATA' TO DATA-OUT.
119       MOVE ACCUMULATOR(TERM-X) TO ACCUM-VALUE.
     ******************************************************************
     *   SET UP PARM-LIST FOR PUT MESSAGE WAIT                        *
     ******************************************************************
120       MOVE PUTMWT TO PL-OPC.
121       MOVE 34 TO PL-OUT.
     ******************************************************************
     *   DO PUT MESSAGE WAIT OPERATION                                *
     ******************************************************************
122       CALL 'CCPCIO' USING PARM-LIST, INPUT-OUTPUT-AREA.
     ******************************************************************
     *   CHECK RETURN CODE TO SEE IF OPERATION WAS SUCCESSFUL, IF     *
     *      RETURN CODE NOT EQUAL TO 0 GO ISSUE ERROR MESSAGE         *
     ******************************************************************
123       IF PL-RTC NOT = 0 MOVE 6 TO SWITCH
125           GO TO PUT-GET.
     ******************************************************************
     *   SET UP PARAMETER LIST FOR INVITE INPUT                       *
     ******************************************************************
126   INVITE-INPUT.
127       MOVE INVINP TO PL-OPC.
128       MOVE 8 TO PL-INL.
     ******************************************************************
     *   DO INVITE INPUT OPERATION                                    *
     ******************************************************************
129       CALL 'CCPCIO' USING PARM-LIST, INPUT-OUTPUT-AREA.
130       GO TO ACCEPT-INPUT.
```

Insert accumulated value associated with the terminal in the output message and display on the terminal.

Figure 4-14 (Part 3 of 5). Example 2 – COBOL MRT Program

```
    /*****************************************************************
    *   HANDLE SHUTDOWN REQUEST BY ISSUING STOP INVITES TO ALL       *
    *      OUTSTANDING INVITE INPUTS PREVIOUSLY ISSUED               *
    ******************************************************************
131  SHUTDOWN.
132      SET TERM-X TO 1.
133  STOP-SEARCH.
134      IF TERM-NAME(TERM-X) = SPACES GO TO INCR-INDEX.
136      MOVE TERM-NAME(TERM-X) TO TERM-NAME-IO.
    ******************************************************************
    *   SET UP PARAMETER LIST FOR STOP INVITE INPUT                  *
    ******************************************************************
137      MOVE STPINV TO PL-OPC.
138      MOVE 8 TO PL-INL.
    ******************************************************************
    *   DO STOP INVITE INPUT OPERATION                               *
    ******************************************************************
139      CALL 'CCPCIO' USING PARM-LIST, INPUT-OUTPUT-AREA.
    ******************************************************************
    *   IF TERMINAL NOT CANCELLED, THEN ISSUE SHUTDOWN MESSAGE       *
    *       IF CANCELLED THEN IF NO INVITES OUTSTANDING GO TO EXIT,  *
    *       OTHERWTSE GO SET UP FOR NEXT STOP INVITE OPERATION.      *
    ******************************************************************
140      IF PL-RTC NOT = 8 GO TO SET-UP.
142      IF PL-EFL = 0 GO TO DONE-EXIT.
144      GO TO INCR-INDEX.
145  SET-UP.
    ******************************************************************
    *   SET UP PARAMETER LIST FOR PUT NO WAIT                        *
    ******************************************************************
146      MOVE PUTNWT TO PL-OPC.
147      MOVE 30 TO PL-OUT.
    ******************************************************************
    *   INSERT PROPER SHUTDOWN MESSAGE TO TERMINAL REFERENCED IN     *
    *      TERMINAL DATA ARRAY.  THE MESSAGE IS SET ACCORDING TO     *
    *      THE RETURN CODE                                           *
    ******************************************************************
148      IF PL-RTC LESS THAN 0 MOVE 'TP ERROR' TO MSG-DATA2
150                                GO TO DISPLAY-OUT.
151      IF PL-RTC = 10 MOVE ' NO DATA' TO MSG-DATA2
153                                GO TO DISPLAY-OUT.
154      IF PL-RTC = 0 MOVE DATA-REC TO MSG-DATA2
156                                GO TO DISPLAY-OUT.
157      MOVE 'BAD DATA' TO MSG-DATA2.
158  DISPLAY-OUT.
159      MOVE 'CCP SHTDWN LAST REC - ' TO MSG-DATA1.
    ******************************************************************
    *   DO PUT NO WAIT OPERATION                                     *
    ******************************************************************
160      CALL 'CCPCIO' USING PARM-LIST, INPUT-OUTPUT-AREA.
161  INCR-INDEX.
162      SET TERM-X UP BY 1.
163      IF TERM-X = 5 GO TO DONE-EXIT.
165      GO TO STOP-SEARCH.
```

Find every terminal name in the save area and issue Stop Invite Input to it. If the terminal has not been cancelled, a shutdown message is issued to it.

Note: When the last terminal attached to an MRT program is processed, issue a Release Terminal operation to that terminal in order to check the count of outstanding Invite Inputs. If the count is greater than zero, the program can issue an Accept Input operation. For example, suppose an MRT program is servicing the maximum number of requestors and one or more additional requests are queued to the program. If the program receives a shutdown-requested return code (04) and goes to end of job without checking the count of outstanding Invite Inputs, the program terminates with a 2C termination code (going to end of job with outstanding Invite Inputs), and each of the queued terminals receives an S06 message (program cancelled – shutdown).

Figure 4-14 (Part 4 of 5). Example 2 – COBOL MRT Program

```
      /*****************************************************************
      *   PREPARE INPUT OR OUTPUT ERROR MESSAGES HERE AND SET UP       *
      *       PARAMETER LIST FOR PUT THEN GET TO CONSOL                *
      ******************************************************************
166    PUT-GET.
167        MOVE PUTGET TO PL-OPC.
168        MOVE 29 TO PL-OUT.
169        MOVE 2 TO PL-INL.
      ******************************************************************
      *   INSERT TERMINAL NAME = CONSOL, TERMINAL NAME WHERE ERROR     *
      *     OCCURRED, AND INPUT OR OUTPUT ERROR MESSAGE                *
      ******************************************************************
170        MOVE ' INPUT TP ERROR TNAME =' TO MS-DATA.
171        IF SWITCH = 6 MOVE 'OUTPUT' TO MS-DATA1.
173        MOVE TERM-NAME-IO TO MS-DATA3.
174        MOVE 'CONSOL' TO TERM-NAME-IO.
```

If an input error occurred, the message 'INPUT TP ERROR TNAME xxxxxx' is issued to the console (xxxxxx = terminal on which the error occurred). If switch equals 6, a similar output error message is built and issued.

```
      ******************************************************************
      *   DO PUT GET OPERATION TO CONSOL                               *
      ******************************************************************
175        CALL 'CCPCIO' USING PARM-LIST, INPUT-OUTPUT-AREA.
      ******************************************************************
      *   MOVE TERMINAL NAME BACK TO TERMINAL NAME AREA IN TERMINAL    *
      *      DATA STORAGE ARRAY.  CHECK FOR REPLY REQUESTING TO TRY    *
      *      AGAIN-- TA, IF TA NOT PRESENT THEN GO DISCONNECT          *
      ******************************************************************
176        MOVE TERM-NAME(TERM-X) TO TERM-NAME-IO.
177        IF TA NOT = 'TA' GO TO CANCEL-CHK.
179        IF SWITCH = 6 GO TO DISPLAY-ACCUM.
```

If the system operator keys in *TA*, the terminal name of the terminal on which the error occurred is placed in the terminal name field of the record area and the operation is retried. If the operator keys in any other characters, the terminal name for which the error occurred is placed in the record area and, if the terminal has not been cancelled, a release terminal operation is issued to it.

```
      ******************************************************************
      *   IF OUTPUT ERROR MESSAGE THEN GO TRY TO OUTPUT AGAIN          *
      *   IF INPUT ERROR MESSAGE THEN GO TRY TO INPUT AGAIN            *
      ******************************************************************
181        MOVE 'TRY AGAIN TP ERROR' TO DATA-OUT.
182        MOVE 18 TO PL-OUT.
      /*****************************************************************
      *   SET UP PUT NO WAIT PARAMETER LIST                            *
      ******************************************************************
183    PUT-NO-WAIT.
184        MOVE PUTNWT TO PL-OPC.
      ******************************************************************
      *   DO PUT NO WAIT OPERATION                                     *
      ******************************************************************
185        CALL 'CCPCIO' USING PARM-LIST, INPUT-OUTPUT-AREA.
186        GO TO INVITE-INPUT.
      ******************************************************************
      *   CHECK TO SEE IF THIS TERMINAL HAS BEEN CANCELLED. IF IT HAS  *
      *       AND THERE ARE NO INVITES OUTSTANDING GO TO EXIT,         *
      *       OTHERWISE GO CLEAR FROM ACTIVE LIST.  IF IT HAS NOT BEEN *
      *       CANCELLED DO A RELEASE TERMINAL OPERATION.               *
      ******************************************************************
187    CANCEL-CHK.
188        IF PL-RTC NOT = 8 GO TO RELEASE-TERM.
190        IF PL-EFL = 0 GO TO DONE-EXIT.
192        GO TO CLEAR-ENTRY.
      ******************************************************************
      *   SET UP PARAMETER LIST FOR RELEASE TERMINAL OPERATION         *
      ******************************************************************
193    RELEASE-TERM.
194        MOVE RELTRM TO PL-OPC.
      ******************************************************************
      *   DO RELEASE TERMINAL OPERATION                                *
      ******************************************************************
195        CALL 'CCPCIO' USING PARM-LIST, INPUT-OUTPUT-AREA.
196        IF PL-EFL = 0 GO TO DONE-EXIT.
      ******************************************************************
      *   INITIALIZE THE TERMINAL DATA STORAGE ARRAY ENTRY FOR THE     *
      *      RELEASED TERMINAL TO BLANKS AND ZERO THE ACCUMULATOR AND  *
      *      RETURN TO ACCEPT INPUT                                    *
      ******************************************************************
198    CLEAR-ENTRY.
199        MOVE SPACES TO TERM-NAME(TERM-X).
200        MOVE ZEROES TO ACCUMULATOR(TERM-X).
201        GO TO ACCEPT-INPUT.
202    DONE-EXIT.
203        STOP RUN.
```

When a terminal is released, reinitialize the accumulator to zeros and the terminal name save area to blanks.

Figure 4-14 (Part 5 of 5). Example 2 – COBOL MRT Program

Chapter 5: FORTRAN IV

To request CCP communication services, you must write your FORTRAN programs using the standard application program interface, described in Chapter 2.

This standard interface is composed of the following elements:

- Communications Service Subroutine
- Parameter List
- Record Area

Note: This chapter assumes that you are familiar with the FORTRAN language. For more information on writing and executing FORTRAN programs, see the publication *IBM System/3 FORTRAN IV Reference Manual,* SC28-6874.

FORTRAN USE OF THE STANDARD INTERFACE

To use the standard application program interface to the CCP, your FORTRAN application program must:

1. Define the record area and the parameter list (see *Defining the Record Area and Parameter List*).
2. Set the contents of the parameter list and the record area (see *Setting the Contents of the Parameter List and Record Area*).
3. Call the communications service subroutine, identifying the program's parameter list and record area, to initiate the operation (see *Calling the Communications Service Subroutine).*
4. Examine information returned by the CCP in the parameter list and record area and, for input operations, process the input data (see *Examining Returned Information*).

DEFINING THE RECORD AREA AND PARAMETER LIST

Before your FORTRAN program can perform communications operations, you must define one or more record areas and parameter lists.

Record Area

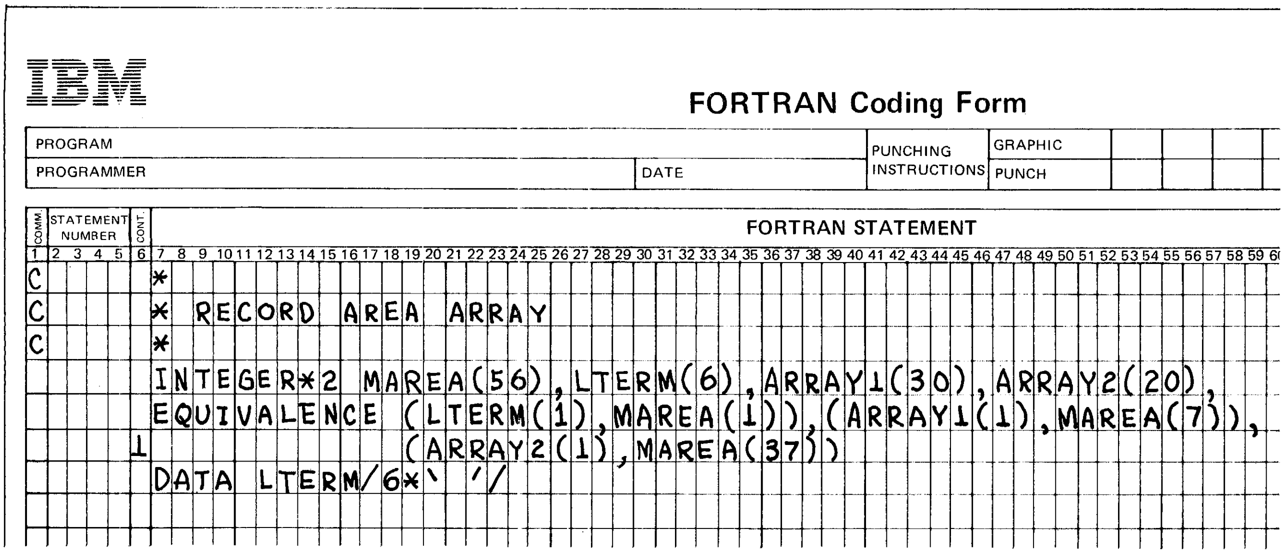
The number of record areas you must define depends upon the logic of your program. You need not always define separate record areas for input data and output data, or for operations with different terminals.

Each record area defined must be large enough to contain the name field and the maximum length of data to be received as input in the record area or to be transmitted as output from the record area. Define each record area you require as an array using an explicit specification statement. Define the array as type INTEGER*2. You may specify an initial value for the elements of your record area array by using the DATA statement.

Define the data portion of the record area as required by your record formats. You should define all data items as literal or unpacked data unless data is to be transferred over a BSCA line using Text Transparency (see index entry *terminal attributes*), when you can define data fields of the record area as binary, packed, or hexadecimal.

Many FORTRAN application programs require that the same record areas be used for records with different formats. By defining each record area array needed by the program and using EQUIVALENCE statements, you can redefine the record area array in a different format. The EQUIVALENCE statement specifies that the redefined record area format shares the same storage locations as the original record area array definition.

Example: Figure 5-1 shows how to define a record area whose record may be in either of two formats. The EQUIVALENCE statement assigns the array LTERM to the same storage locations used by the first six elements of MAREA, ARRAY1 to the same locations used by the next 30 elements of MAREA, and ARRAY2 to the same locations used by the last 20 elements of MAREA. The DATA statement initializes the six elements of the terminal name array, LTERM, to blanks.



IBM FORTRAN Coding Form

PROGRAM
PROGRAMMER
DATE
PUNCHING INSTRUCTIONS
GRAPHIC
PUNCH

```
C     *
C     * RECORD AREA ARRAY
C     *
      INTEGER*2 MAREA(56),LTERM(6),ARRAY1(30),ARRAY2(20),
      EQUIVALENCE (LTERM(1),MAREA(1)),(ARRAY1(1),MAREA(7)),
     1            (ARRAY2(1),MAREA(37))
      DATA LTERM/6*' '/
```

Figure 5-1. Defining a Record Area Array

Parameter List

You must also define one or more parameter lists in your program (see index entry *parameter list*). Define each parameter list you require as an eight element array using an explicit specification statement. Define the array as type INTEGER*2. The first four fields of the parameter list should be defined as two-byte numeric elements. You can initialize these fields by specifying them in a DATA statement. These fields are, in the sequence they must be defined in the parameter list:

1. Return code field.
2. Operation code and modifiers field.
3. Field used jointly for output data length, actual input data length, count of outstanding Invite Inputs, and attributes identifier.
4. Maximum input/output data length field.

These fields are the only fields you reference in your application program. The remaining four fields of the parameter list are not referenced directly by your FORTRAN program. However, they must be defined because space must be reserved for them. Your program should never initialize or set these fields.

Unless required by your program, you do not need to define separate parameter lists for each operation type nor permanently associate a parameter list with a particular record area array. The number of parameter list arrays you define in your program need not be the same as the number of record area arrays.

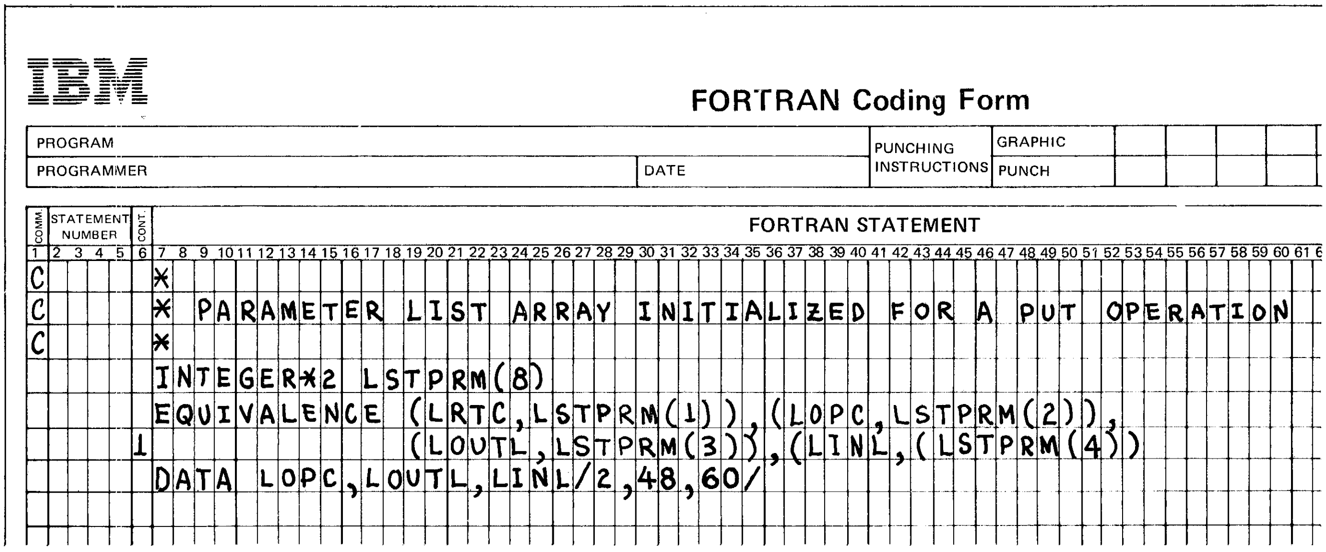
Example: Figure 5-2 shows how to define a parameter list array in a FORTRAN program. The EQUIVALENCE statement assigns LRTC to the same storage locations as the first element of the parameter list array, LOPC to the same locations as the second element. LOUTL to the same location as the third element, and LINL to the same location as the fourth element. The remaining four elements of LSTPRM are the required work area and are not set by the FORTRAN program. The operation field, LOPC, is initialized to 2 for a PUT operation. The output data length field, LOUTL, is initialized to 48. This value might be the length of the first output message. The maximum input/output data length field, LINL, is initialized to 60. This value might be the total length of the data portion of a record area used with this parameter list.

Return Code Values

The CCP ignores the contents of the return code field of the parameter list at the beginning of a communications operation. At the completion of each operation, the CCP places a binary value in this field indicating the status of the operation.

This value indicates:

- The operation completed normally (value of zero for nonchained operations, 14 for chained operations)
- The operation resulted in an I/O error (negative value)
- The operation resulted in an exceptional condition (positive value)



```
C     *
C     * PARAMETER LIST ARRAY INITIALIZED FOR A PUT OPERATION
C     *
      INTEGER*2 LSTPRM(8)
      EQUIVALENCE (LRTC,LSTPRM(1)),(LOPC,LSTPRM(2)),
     1            (LOUTL,LSTPRM(3)),(LINL,(LSTPRM(4))
      DATA LOPC,LOUTL,LINL/2,48,60/
```

Figure 5-2. Defining a Parameter List Array

The CCP places this value in the return code field of the parameter list before returning to your FORTRAN program. The FORTRAN program must check the return code value upon the completion of each operation. Specific return code values and their meanings are given in *Appendix F: Return Codes.*

Operation Code Values

For each communications operation, you must set the operation code field of a parameter list to a value which indicates the specific operation being requested. You must set this value within your FORTRAN program. This field can be set by initializing the field in the definition of the parameter list array or by moving constants into the operation code array element during execution (see *Setting Fields in the Parameter List* later in this chapter).

The CCP does not change this field during the communications operation; the contents of the field are the same after completion of the operation as they were at the beginning of the operation. See *Chapter 2: Standard Application Interface to the CCP* for descriptions of the valid operations, *Appendix E: Operations Codes* summarizes the operations and operation code values.

SETTING THE CONTENTS OF THE PARAMETER LIST AND RECORD AREA

You must set the contents of the following areas before performing a communications operation in FORTRAN:

1. Parameter list array, if different from the last operation.
2. The program name or the symbolic terminal name in the first six elements of the record area array. (This step can be omitted if a terminal name is not required for the operation, or if the name is the same as in the previous operation.)
3. Output data in the data portion of the record area array if the operation is an output operation.

Setting Fields in the Parameter List

You reference four parameter fields within your FORTRAN program.

- Return Code field.
- Operation Code field.
- Field used jointly for output length, effective input length, count of outstanding Invite Inputs, and attributes identifier.
- Maximum input/output length field.

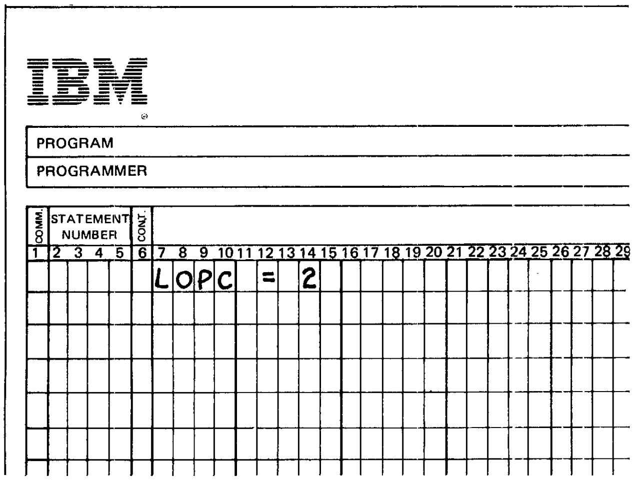
You need set only the operation code field and the maximum input/output length field for input operations. If you are doing an output or an Acquire Terminal operation, you must also set the field used as the output length or attributes identifer. You need never set the return code field; it is used only by the CCP to return information about the operation to your FORTRAN program.

Operation Code

Whenever a communications operation is issued, this field must contain a value indicating the operation to be performed. You can set this field when you define the parameter list array by specifying a DATA statement:

DATA OPC/2/

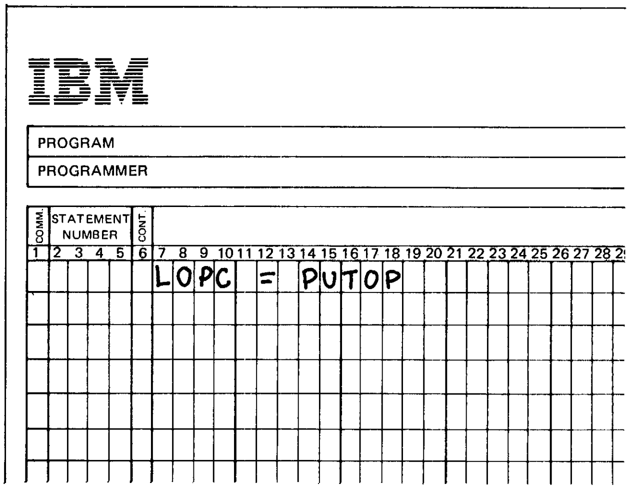
You can also set this field by specifying an assignment statement. You can assign it either a numeric value or a numeric variable. In the following example, the operation code element of the parameter list, LOPC, is assigned the value 2.



PROGRAM
PROGRAMMER

```
      LOPC = 2
```

The following example sets the operation code array element, LOPC, by moving the numeric variable, PUTOP, into it. PUTOP is defined with the value 2.



PROGRAM
PROGRAMMER

```
      LOPC = PUTOP
```

The CCP never modifies the value in the operation code field. You do not need to reset the field if the operation to be performed is the same as the last operation using this parameter list.

For more information on the valid operations, see the chapter *Standard Application Interface to the CCP.* Appendix D: *Operation Codes* summarizes the operations and operation code values.

Output Length/Attributes Identifier/Count of Outstanding Invite Inputs/Effective Input Length

The third field of the parameter list can contain one of four different values depending on the type of operation:

- Output Length
- Attributes Identifier
- Count of Outstanding Invite Inputs
- Effective Input Length

The first two values you must set; the third and fourth are returned values set by the CCP for certain operations.

You can set this field when you define the parameter list array by means of a DATA statement, or by means of an assignment statement, just as you set the operation code field. You can assign it either a numeric value or a numeric variable.

Output Length: For output operations, you must place into this field the length of the data you wish to write from the record area in your program. This length does not include the six elements at the beginning of the record area array for the name field. This length must be less than or equal to the output length specified for the fourth field of the parameter list. The output operations you must set a data length for are:

- Put
- Put-No-Wait
- Put-Then-Get
- Chain Task Request

You must reset this value if the output data length differs from the last operation using this parameter list or if the field was modified by the CCP. This field is modified by the CCP for the following operations:

- Get
- Put-Then-Get
- Accept Input
- Get Terminal Attributes
- Acquire Terminal
- Release Terminal

Attributes Identifier: If your operation code specifies an Acquire Terminal operation which sets the attributes of the terminal to be acquired, you must place into this field a value that identifies the attributes you want to assign to the terminal. This numeric value must correspond to the number you assigned to the desired set of attributes in an Assignment run.

Effective Input Length: You do not need to set this value. For each input operation, the CCP places the actual length of the data passed to your FORTRAN program in this field before it returns control to your program.

Count of Outstanding Invite Inputs: On a Release Terminal operation and on any input operation that results in a 08 return code (terminal entered data mode escape and issued a /RELEASE command), this field is set by the CCP to the number of Invite Input operations still outstanding. If this is a multiple requesting terminal (MRT) program, this number includes not only the Invite Inputs you have issued that have not yet been satisfied by an Accept Input operation, but also the number of additional terminals that have requested your program but are not yet being served by your program.

Maximum Input Length/Output Data Length

For each operation involving input data, you must enter a numeric value into the fourth field of the parameter list indicating the maximum amount of input data you expect to receive. For each operation involving output data, you must enter a numeric value indicating the maximum amount of output data you expect to transmit (in this respect, the FORTRAN communications interface differs from the standard interface defined in Chapter 2). This output length must be greater than or equal to the output length specified in the third field of the parameter list, but *no greater than the size of the data portion of the record area with which this parameter list is used*, or unpredictable results can occur. The value does not include the six elements at the beginning of the record area array for the terminal name. The input operations for which you must place a value in this field are:

- Get
- Invite Input
- Accept Input
- Put-Then-Get
- Get Terminal Attributes
- Stop Invite Input (in case input cannot be stopped)

The output operations for which you must place a value in this field are:

- Put
- Put-Then-Get
- Put-No-Wait

You can set the value of this field when you define the parameter list area by specifying a DATA statement or by specifying it in an assignment statement. The CCP never modifies the value in this field. Therefore, you do not need to reset it unless the maximum input/output length for this operation is different from the value set in this field the last time this parameter list was used. However, if this parameter list is used with more than one record area, you may need to alter this value during execution of your FORTRAN program.

Example of Setting Fields in the Parameter List

Figure 5-3 shows how you can set the operation, output data length, and maximum input/output data length fields of a parameter list. The maximum input/output data length element is set by initializing it to 125 in a DATA statement. It does not need to be reset unless you wish to receive (Get) or transmit (Put) data longer than 125. The operation code element and the output length element are set by assigning them numeric values.

Setting the Record Area

The record area consists of a six-position name field and a data area. For an operation with a terminal, except for Accept Input and Shutdown Inquiry operations, you must place the symbolic name of the terminal to be involved with the operation. For Chain Task Request, you must place the name of the requested program in the name field. You must also provide the data to be transmitted in the data elements of the record area array when an output operation is to be performed.

Name Field

For operations involving a terminal the name you place in a record area array must have been assigned to your program. You may also identify the requesting terminal by using six blank elements as the terminal name if your program is *not* a *multiple requesting terminal (MRT) program* (see index entry). See *Chapter 2: Standard Application Program Interface to the CCP* for more information on the valid terminal names.

For a Chain Task Request operation, you must provide the name of the program to be loaded in this field.

You may set the name field when you define the record area array by specifying a DATA statement or by specifying it in an assignment statement. You need not reset the terminal name array elements if the terminal to be used is the same that was named the last time the record area array was used, unless the name was modified by the CCP. The CCP modifies the terminal name field of the record area in the following situations:

- Upon completion of an Accept Input operation, CCP sets the name field to the name of the program or terminal whose data is placed in the record area array.
- Upon completion of any operation using the field name array element set to blanks, CCP sets the name element to the name of the requesting terminal.

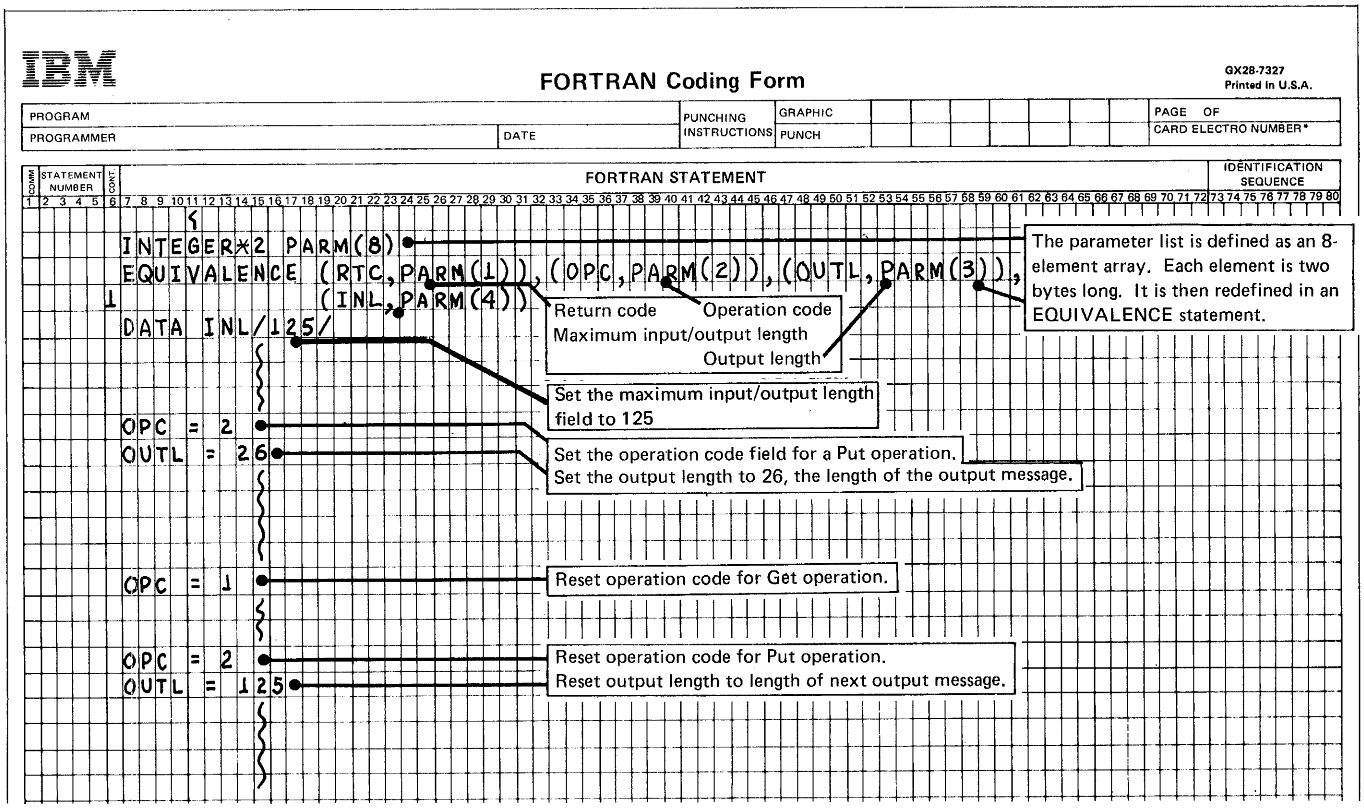
Output Data Area

If the operation to be performed is an output operation, you must provide the data to be transmitted in the data portion of the record area. You do not need to provide data in the record area for operations other than output operations because either the data area is not used or data is provided to your program by CCP in this area. Data provided to your program by the CCP overlays the information previously in the data portion of the data area. For example, the input data transmitted to your program by the Get part of the Put-Then-Get operation overlays the output data transmitted from your program by the Put part of the operation. See the *Chapter 2: Standard Application Program Interface to the CCP* for more information on transferring data.

Note: If the message to be sent is shorter than the total length of the data area, you need not clear the excess area to blanks.

Example of Setting the Record Area

Figure 5-4 shows how you can define and set the record area when it is used for both input and output operations. Assume the CCP has set the terminal name and data area as the result of an Accept Input operation. The FORTRAN program then resets the data area for an output operation by moving the message "TRY AGAIN INV DATA" to the data portion of the record area array. This message overlays the input data transmitted to the record area array by the Accept Input operation. Later in the program, the terminal name is reset.



```
      INTEGER*2 PARM(8)
      EQUIVALENCE (RTC,PARM(1)),(OPC,PARM(2)),(OUTL,PARM(3)),
     1            (INL,PARM(4))
      DATA INL/125/

      OPC = 2
      OUTL = 26

      OPC = 1

      OPC = 2
      OUTL = 125
```

The parameter list is defined as an 8-element array. Each element is two bytes long. It is then redefined in an EQUIVALENCE statement.

Return code
Operation code
Maximum input/output length
Output length

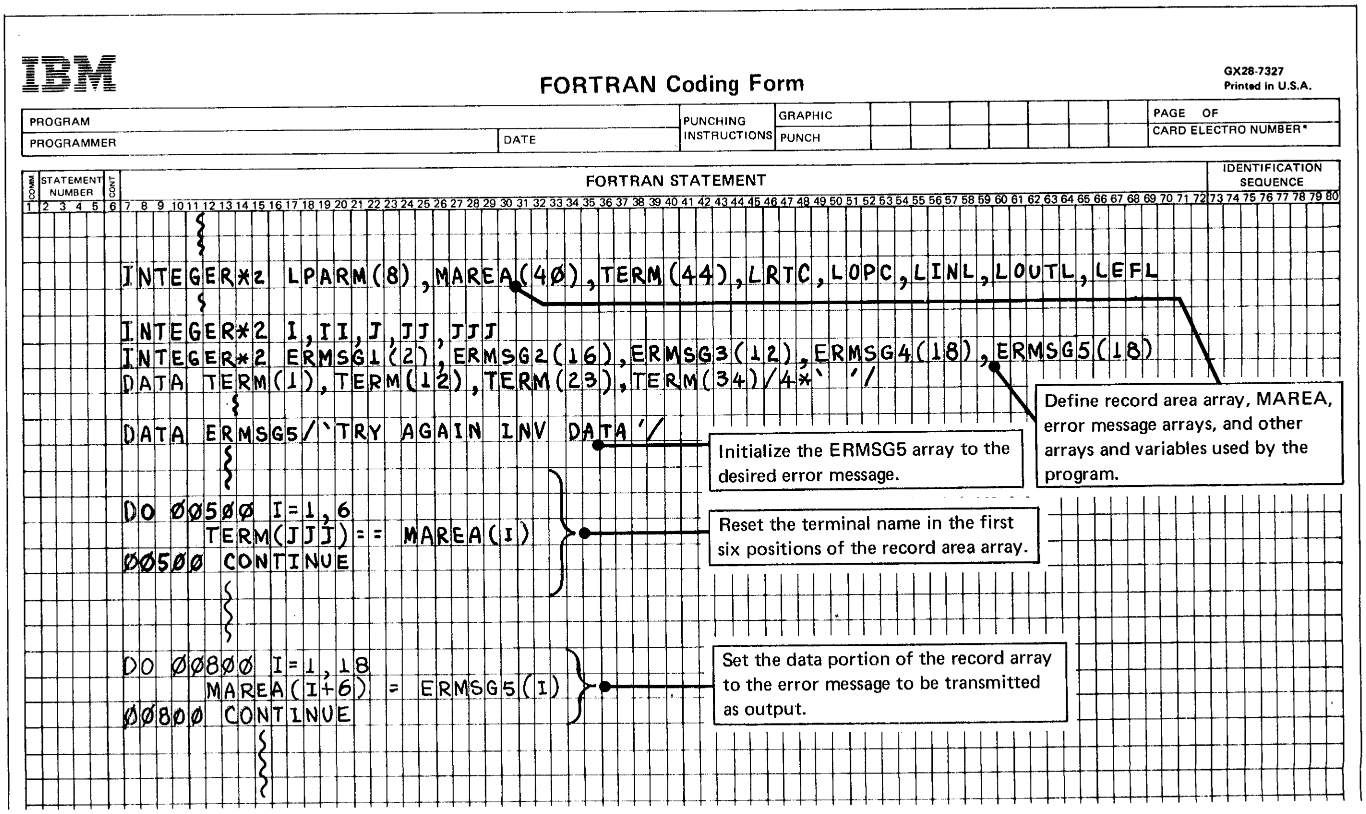
Set the maximum input/output length field to 125

Set the operation code field for a Put operation.
Set the output length to 26, the length of the output message.

Reset operation code for Get operation.

Reset operation code for Put operation.
Reset output length to length of next output message.

Figure 5-3. Setting Elements in the Parameter List Array



```
      INTEGER*2 LPARM(8),MAREA(40),TERM(44),LRTC,LOPC,LINL,LOUTL,LEFL

      INTEGER*2 I,II,J,JJ,JJJ
      INTEGER*2 ERMSG1(2),ERMSG2(16),ERMSG3(12),ERMSG4(18),ERMSG5(18)
      DATA TERM(1),TERM(12),TERM(23),TERM(34)/4*`  '/

      DATA ERMSG5/`TRY AGAIN INV DATA'/

      DO 00500 I=1,6
               TERM(JJJ)== MAREA(I)
00500 CONTINUE

      DO 00800 I=1,18
               MAREA(I+6) = ERMSG5(I)
00800 CONTINUE
```

Define record area array, MAREA, error message arrays, and other arrays and variables used by the program.

Initialize the ERMSG5 array to the desired error message.

Reset the terminal name in the first six positions of the record area array.

Set the data portion of the record array to the error message to be transmitted as output.

Figure 5-4. Setting the Record Area

CALLING THE COMMUNICATIONS SERVICE SUBROUTINE

Since FORTRAN does not include special statement types for terminal I/O operations and other communications services, the CCP provides a communications service subroutine, CCPFIO, that converts your FORTRAN program's communications requests into a standard request to the CCP communication facilities. The functions performed by CCPFIO for your FORTRAN program are:

- Loads index register 2 with the address of your program's parameter list.
- Places the address of the record area into your program's parameter list.
- Packs the data from A1 format to A2 before it is passed to CCP.
- Branches to the CCP.
- Unpacks the data from A2 format back to A1 before it is passed to the FORTRAN program.

The CCPFIO subroutine must be linkage edited with your FORTRAN application program. See *Chapter 9. Program Preparation.*

After you have set the required parameter list array element and the terminal name in the first six elements of the record area array, and have prepared any output data, you are ready to request the CCP to perform the operation specified in the parameter list array. You make this request by issuing a CALL statement, specifying CCPFIO. The names of your parameter list array and record area array must be passed as arguments to the subroutine.

The format of the CALL statement is as follows:

```
CALL CCPFIO (parameter-list-array-name, record-area-array-name)
```

In the following example, the name of the parameter list array is PARM-LIST; the name of the record area array is INPUT-OUTPUT-AREA:

```
CALL CCPFIO (PARM-LIST, INPUT-OUTPUT-AREA)
```

Control returns to your FORTRAN program at the statement immediately following the CALL statement. When the return occurs, the following actions have already taken place:

- For output operations, any output data has been accepted by the CCP and, depending upon the output operation specified, has been received by the terminal. In any case, the record area array is now free for you to use again.
- For input operations, any input data which was to be received in the record area array is now in the record area array.
- For Accept Input operations, the symbolic terminal name of the terminal which provided the data in the record area array has been set in the first six elements of the record area array.
- For all operations, the return code field in your parameter list array has been set indicating the result of the operation.
- For input operations, the actual input data length has been set in your parameter list array.
- For Release Terminal operations or for input operations where the terminal has released itself from the program, the count of outstanding Invite Input operations has been set in your parameter list.
- For successful Task Chain Request operations, the requested program is placed on the program request input queue when control is returned to the requesting program.

EXAMINING RETURNED INFORMATION

After control has returned to your FORTRAN program from the Communications Service Subroutine, you should examine returned information supplied by the CCP, including one or more of the following:

- The return code
- The symbolic terminal name (if it was set by the CCP) or the name of the program that issued the Chain Task Request operation.
- The count of outstanding Invite Inputs, if a Release Terminal operation was performed or if the return code value from an input operation indicates the terminal released itself.
- The actual input data length, if an input operation was successfully performed.
- The input data, if an input operation was performed

Return Code

The CCP always provides a return code after an operation. You should never assume that an operation is successful; you should always check the return code. In certain cases, you will find that no data transfer has occurred. See Appendix E for the meanings of specific return codes and see *Programming Examples*, later in this chapter, for examples of checking return codes.

You may wish to perform certain operations in your FORTRAN program depending upon the return code value set by the CCP. The example in Figure 5-5 assumes that you want to branch to one of several locations depending upon the value of the return code. The program examines the return code value for the following conditions:

- The operation was successful and no exceptions occurred.
- An EOT was received on a successful operation.
- Some other exception condition occurred.
- An I/O error occurred.

Assume that all array names have been defined earlier in this program. Note the use of comments in the example.

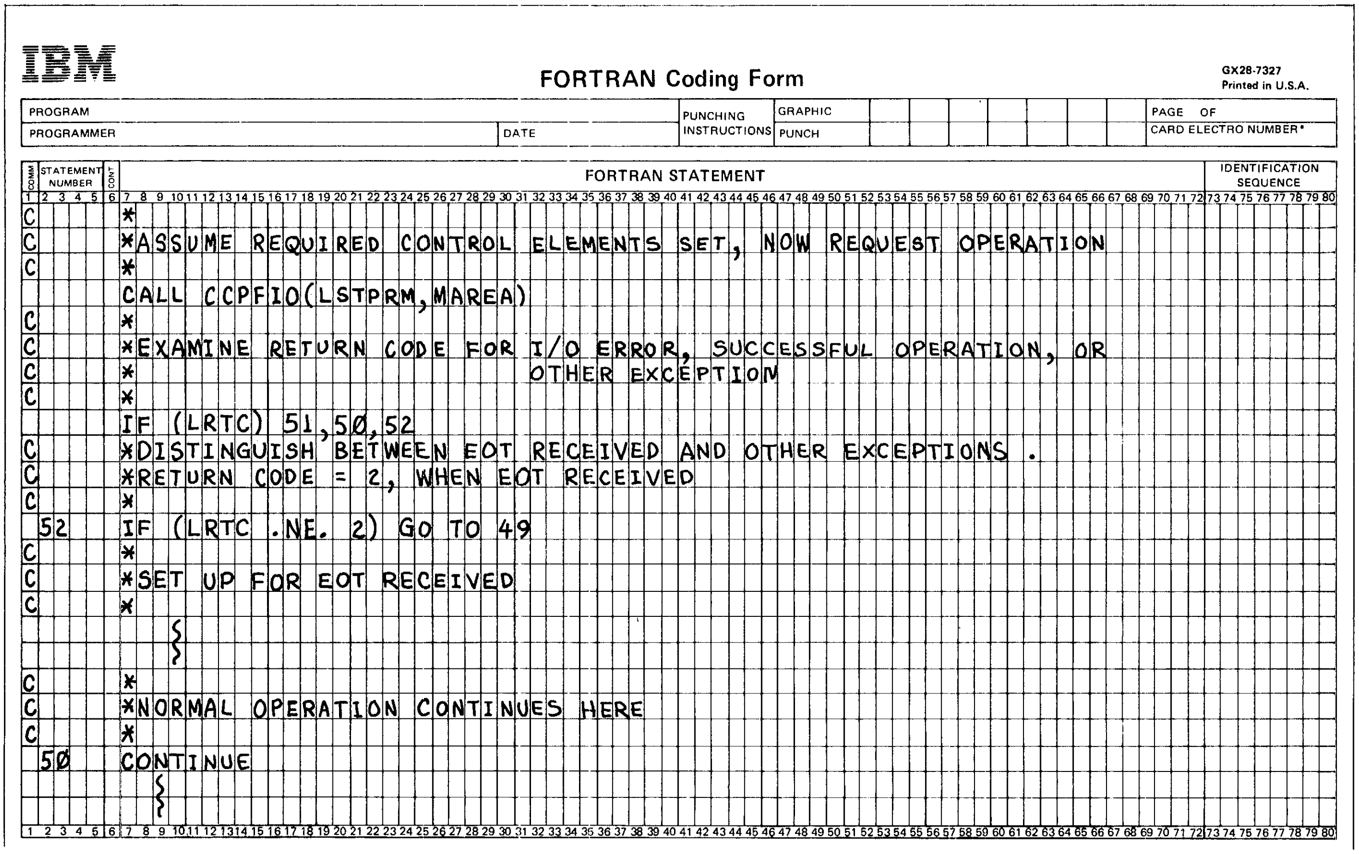
Examining a Returned Name

On certain operations, the CCP returns the symbolic terminal name to your program's record area array. You may need to examine this name.

For example, you may need to examine the name of the requesting terminal or the terminal that provided the input data to associate new data with data previously received by comparing the terminal name in the record area array with a saved terminal name. You can do this by specifying a DO loop that sets the elements of a six-element save area array equal to the terminal named elements of the record area array. The save area array must be defined as an area of type INTEGER*2.

If a program can be requested from both a terminal and another program using the Chain Task Request operation, you may want to determine how the program was requested. This can be accomplished by checking for a 14 return code, indicating a Chain Task Request operation. This information is useful if a program communicates with the requestor since your program cannot communicate with a chain task requesting program.

The example in Figure 5-6 saves the terminal name the CCP sets in the terminal name elements of the record area array, MAREA, by specifying a DO loop. The terminal name elements are saved in the array LFEFER.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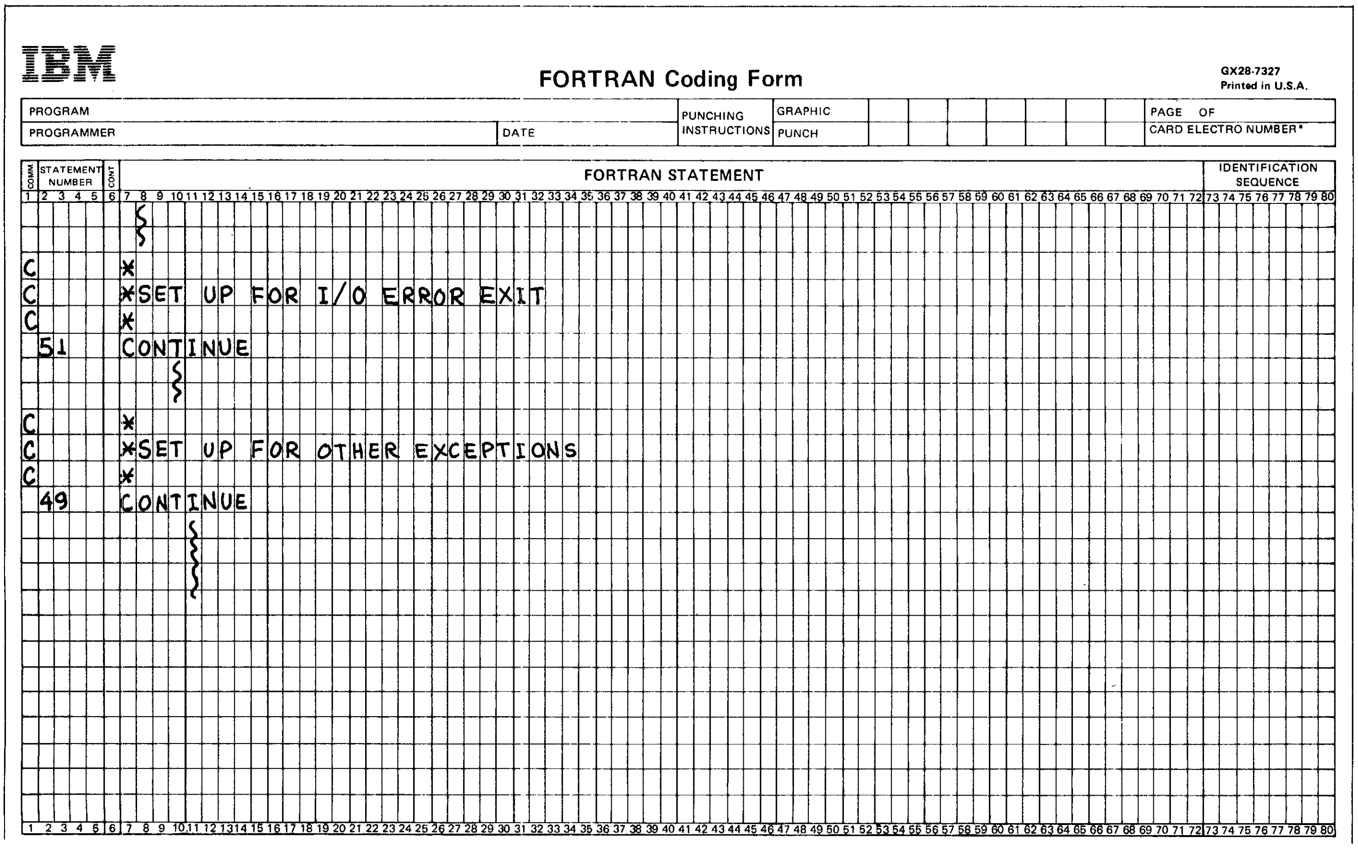
```
C     *
C     *ASSUME REQUIRED CONTROL ELEMENTS SET, NOW REQUEST OPERATION
C     *
      CALL CCPFIO(LSTPRM,MAREA)
C     *
C     *EXAMINE RETURN CODE FOR I/O ERROR, SUCCESSFUL OPERATION, OR
C     *                       OTHER EXCEPTION
C     *
      IF (LRTC) 51,50,52
C     *DISTINGUISH BETWEEN EOT RECEIVED AND OTHER EXCEPTIONS .
C     *RETURN CODE = 2, WHEN EOT RECEIVED
C     *
 52   IF (LRTC .NE. 2) GO TO 49
C     *
C     *SET UP FOR EOT RECEIVED
C     *
          ⌇
          ⌇
C     *
C     *NORMAL OPERATION CONTINUES HERE
C     *
 50   CONTINUE
         ⌇
         ⌇
```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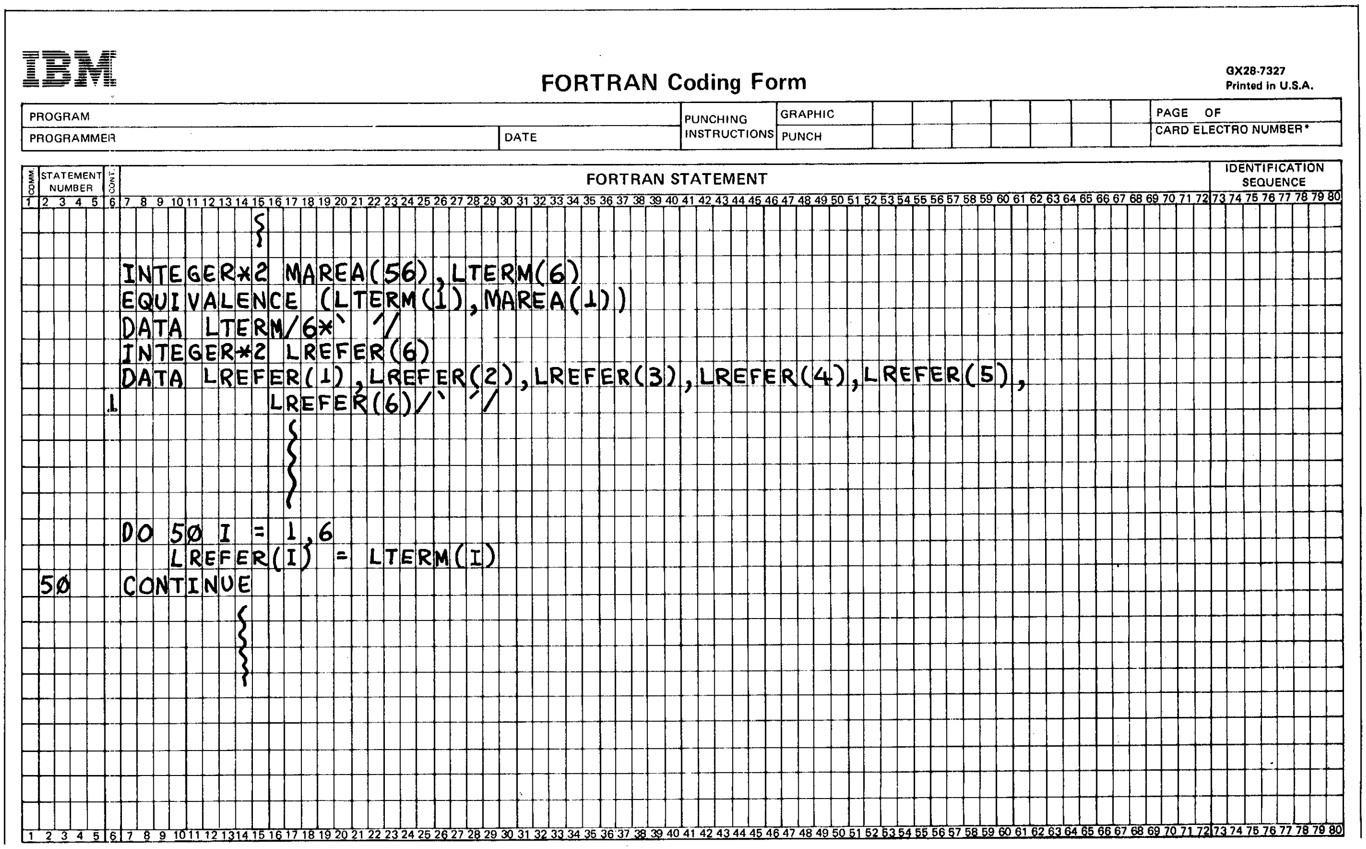
```
        ⌇
        ⌇
C     *
C     *SET UP FOR I/O ERROR EXIT
C     *
 51   CONTINUE
          ⌇
          ⌇
C     *
C     *SET UP FOR OTHER EXCEPTIONS
C     *
 49   CONTINUE
           ⌇
           ⌇
           ⌇
```

Figure 5-5. Examining Return Code Values



```
      INTEGER*2 MAREA(56),LTERM(6)
      EQUIVALENCE (LTERM(1),MAREA(1))
      DATA LTERM/6*' '/
      INTEGER*2 LREFER(6)
      DATA LREFER(1),LREFER(2),LREFER(3),LREFER(4),LREFER(5),
     1         LREFER(6)/' '/

      DO 50 I = 1,6
         LREFER(I) = LTERM(I)
 50   CONTINUE
```

Figure 5-6. Saving the Symbolic Terminal Name

Referencing Saved Information

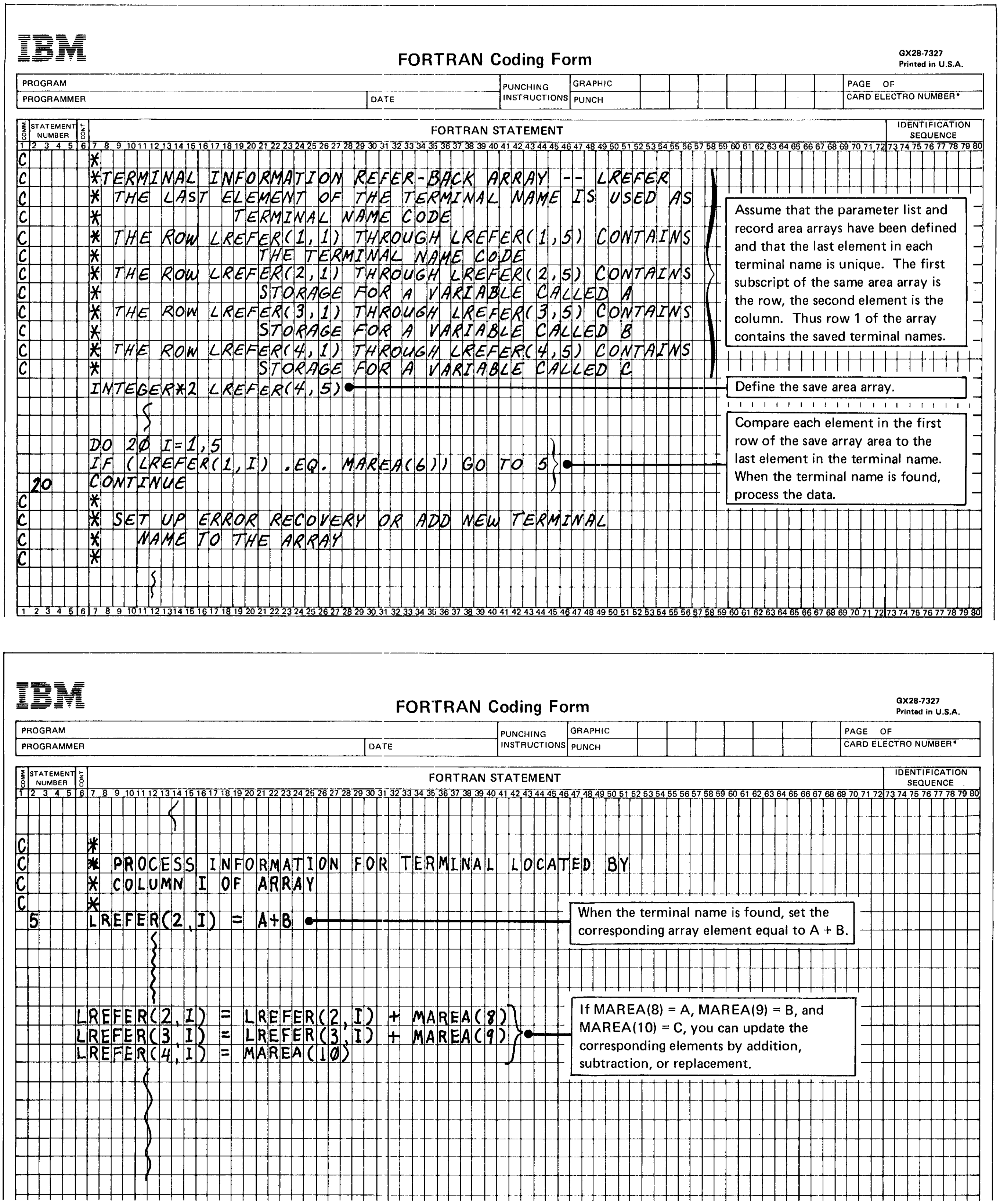
In some of your FORTRAN programs, you may need to save the information entered on the terminals and reference it later in your program. For example, if your program receives data from several different terminals, you may need to associate new data entered on a terminal with data previously entered on the same terminal. To do this, you must save the significant data received from every terminal you are using and identify that saved data with the name of the terminal from which it was received. You can then associate new data with the saved data by comparing the terminal name set by the CCP in the record area array with the saved terminal names.

You can save information for each terminal in a two-dimensional array. Each column of elements in the array could refer to a set of elements received previously from each terminal. The number of rows and columns specified by the array depends upon the number of data items and terminals. Upon completion of an Accept Input operation, you would then search the array to find the array entry for the terminal that just transmitted data to your program. You can then associate the new data with the saved data by specifying a DO loop.

Figure 5-7 shows how to set up a two-dimensional array for saved information and reference the saved information in your FORTRAN program. By searching the array for the saved terminal name elements that correspond to the terminal name elements in the record area array, you can associate the new data with the data that was saved.

Effective Input Data Length

If the Communications Service Subroutine requested an operation which transferred data to your program (Get, Accept Input, Get Attributes, Put-Then-Get, or Stop Invite Input), the CCP also places the effective length of the input data into the parameter list array. Because this is the length of the data that was actually received by your program, you may wish to use this length to control subscripted operations in your program. For example, you may need to scan the input data for a specific character or string of characters. To do this you must know the length of the input data you must scan.



```
C     *
C     *TERMINAL INFORMATION REFER-BACK ARRAY -- LREFER
C     * THE LAST ELEMENT OF THE TERMINAL NAME IS USED AS
C     *             TERMINAL NAME CODE
C     * THE ROW LREFER(1,1) THROUGH LREFER(1,5) CONTAINS
C     *                  THE TERMINAL NAME CODE
C     * THE ROW LREFER(2,1) THROUGH LREFER(2,5) CONTAINS
C     *                  STORAGE FOR A VARIABLE CALLED A
C     * THE ROW LREFER(3,1) THROUGH LREFER(3,5) CONTAINS
C     *                  STORAGE FOR A VARIABLE CALLED B
C     * THE ROW LREFER(4,1) THROUGH LREFER(4,5) CONTAINS
C     *                  STORAGE FOR A VARIABLE CALLED C
      INTEGER*2 LREFER(4,5)

      DO 20 I=1,5
      IF (LREFER(1,I) .EQ. MAREA(6)) GO TO 5
   20 CONTINUE
C     *
C     * SET UP ERROR RECOVERY OR ADD NEW TERMINAL
C     *     NAME TO THE ARRAY
C     *
```

Assume that the parameter list and record area arrays have been defined and that the last element in each terminal name is unique. The first subscript of the same area array is the row, the second element is the column. Thus row 1 of the array contains the saved terminal names.

Define the save area array.

Compare each element in the first row of the save array area to the last element in the terminal name. When the terminal name is found, process the data.

```
C     *
C     * PROCESS INFORMATION FOR TERMINAL LOCATED BY
C     * COLUMN I OF ARRAY
C     *
 5    LREFER(2,I) = A+B

     LREFER(2,I) = LREFER(2,I) + MAREA(8)
     LREFER(3,I) = LREFER(3,I) + MAREA(9)
     LREFER(4,I) = MAREA(10)
```

When the terminal name is found, set the corresponding array element equal to A + B.

If MAREA(8) = A, MAREA(9) = B, and MAREA(10) = C, you can update the corresponding elements by addition, subtraction, or replacement.

Figure 5-7. Referencing Saved Information

Count of Outstanding Invite Inputs

On a Release Terminal operation or on an input operation where the return code indicates that the terminal released itself from your program, the count of outstanding Invite Input operations is returned to your program. You may use this number to determine whether your program has any further terminals to serve or whether it can go to end of job.

Input Data

If the operation requested by your program is an input operation that transfers data, the CCP places the input data received by your program in the seventh and succeeding elements of your record area array before it returns control to your FORTRAN program. The data is then available for you to use in your program.

USING THE SYSTEM OPERATOR CONSOLE

If you wish to communicate with the system operator through either the 5471 Printer/Keyboard (Models 10 and 12) or the CRT/Keyboard (Model 15), you must specify operations as though the device is a remote terminal. You cannot address the system operator console by the TYPER subroutine or accept information from the system operator console via the KEYBD subroutine. You also cannot address the console or a terminal by using the READ or WRITE statements. Instead, you must specify a Put or Put-Then-Get operation to CONSOL. CONSOL is the only name that can be used for the system operator console.

Your program can communicate with the system operator console at any time. To receive data from the console, you must issue a Put-Then-Get operation, which:

1. Transmits a message to the system operator; and
2. Accepts a reply from the system operator.

Control is not returned to your program until the system operator has transmitted input data to your program.

Operations that can be issued to the console are:

- Put
- Put-Then-Get
- Get Attributes

The console is available at all times to communicate with any program or to enter system operator commands. However, if the console requests a program, it cannot request another program until the first program is initiated by the CCP. It is not necessary, nor is it valid, to issue an Acquire Terminal operation to the console in order to communicate with it.

Example: The example in Figure 5-8 uses the system operator console as the terminal for a Put-Then-Get operation. Assume that the parameter list array (LPARM), the record area array (MAREA), the console name array (CONSOL), and all other symbolic names have been previously defined.

FORTRAN PROGRAMMING CONSIDERATIONS

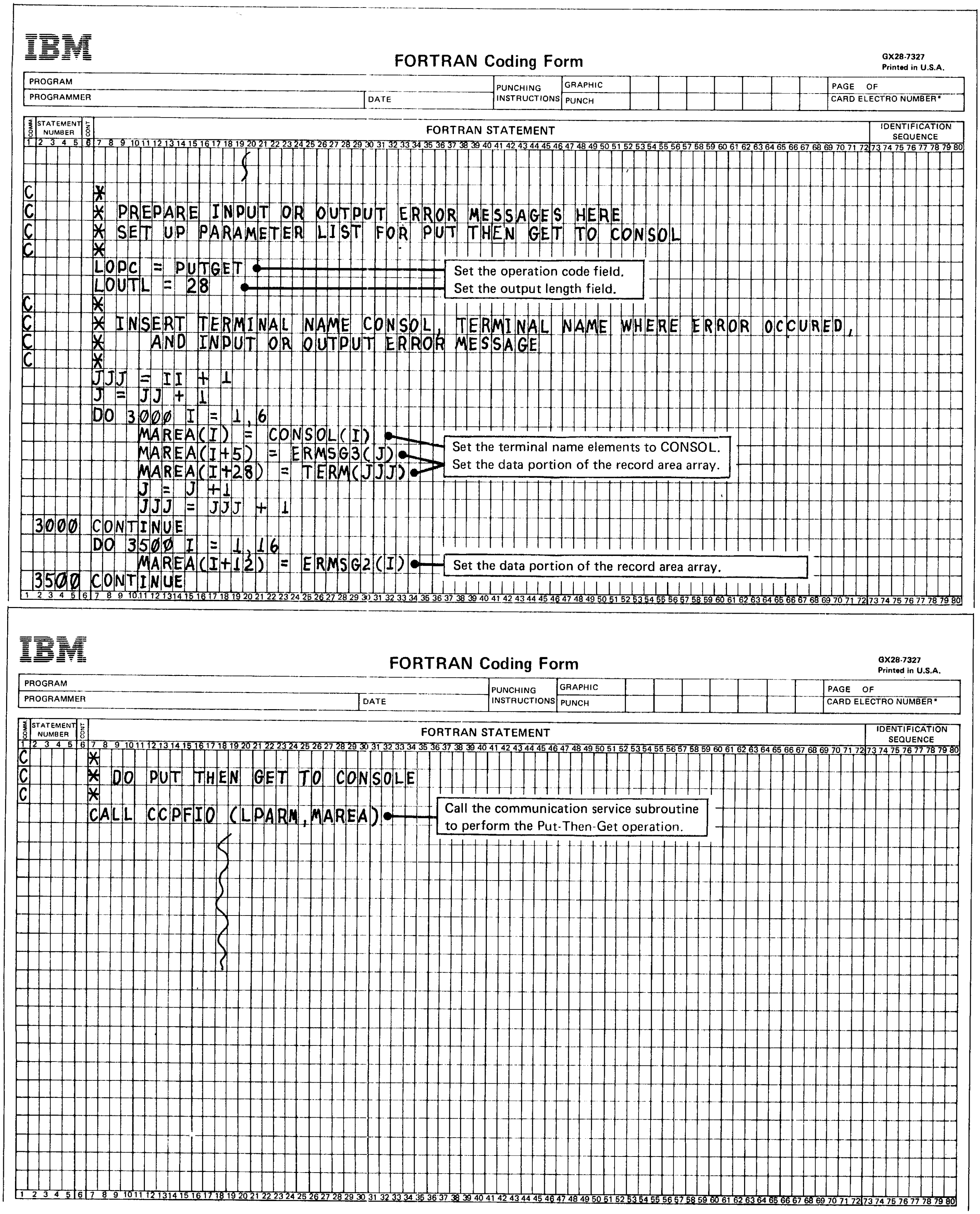
When writing your FORTRAN program, remember:

- You cannot use either the READ or WRITE statements when addressing either the console or teleprocessing terminals.
- You cannot use the TYPER and KEYBD subroutines to address the console.
- Use of the GLOBAL and INVOKE statements will lead to undefined results due to the storage managing characteristic of CCP.
- (Model 10 and Model 12 CCP) You must not use a PAUSE statement. Programs running under the CCP are not permitted to issue halts.

3270 DISPLAY FORMAT FACILITY

You can use the 3270 Display Format Facility (DFF) of the CCP to aid you in formatting and using the 3270 display. *Chapter 8. 3270 Display Format Facility* describes the programming requirements that are unique to using 3270 DFF, including the unique 3270 DFF operations, additional information that must be placed in the record area for certain operations, field types that are unique to the 3270, and other information.

See *Chapter 8: 3270 Display Format Facility* for an example of a FORTRAN IV program that uses the DFF to support a single requesting 3270 terminal.



IBM FORTRAN Coding Form GX28-7327 Printed in U.S.A.

PROGRAM | PUNCHING INSTRUCTIONS | GRAPHIC | PUNCH | PAGE OF
PROGRAMMER | DATE | CARD ELECTRO NUMBER*

STATEMENT NUMBER | CONT | FORTRAN STATEMENT | IDENTIFICATION SEQUENCE

```
C     *
C     * PREPARE INPUT OR OUTPUT ERROR MESSAGES HERE
C     * SET UP PARAMETER LIST FOR PUT THEN GET TO CONSOL
C     *
      LOPC = PUTGET
      LOUTL = 28
C     *
C     * INSERT TERMINAL NAME CONSOL, TERMINAL NAME WHERE ERROR OCCURED,
C     *     AND INPUT OR OUTPUT ERROR MESSAGE
C     *
      JJJ = II + 1
      J = JJ + 1
      DO 3000 I = 1,6
              MAREA(I) = CONSOL(I)
              MAREA(I+5) = ERMSG3(J)
              MAREA(I+28) = TERM(JJJ)
              J = J +1
              JJJ = JJJ + 1
 3000 CONTINUE
      DO 3500 I = 1,16
              MAREA(I+12) = ERMSG2(I)
 3500 CONTINUE
```

Set the operation code field.
Set the output length field.

Set the terminal name elements to CONSOL.
Set the data portion of the record area array.

Set the data portion of the record area array.

IBM FORTRAN Coding Form GX28-7327 Printed in U.S.A.

PROGRAM | PUNCHING INSTRUCTIONS | GRAPHIC | PUNCH | PAGE OF
PROGRAMMER | DATE | CARD ELECTRO NUMBER*

STATEMENT NUMBER | CONT | FORTRAN STATEMENT | IDENTIFICATION SEQUENCE

```
C     *
C     * DO PUT THEN GET TO CONSOLE
C     *
      CALL CCPFIO (LPARM,MAREA)
```

Call the communication service subroutine to perform the Put-Then-Get operation.

Figure 5-8. Using the Console

PROGRAMMING EXAMPLES

Two programming examples are explained in this section:

- *Example 1* – A FORTRAN program that supports a single requesting 3270 terminal without using the Display Format Facility.
- *Example 2* – A FORTRAN program that supports multiple requesting terminals.

See *Chapter 8: 3270 Display Format Facility* for an example of a FORTRAN IV program that uses the DFF to support a single requesting 3270 terminal.

Example 1

Figures 5-9, 5-10, and 5-11 show the flowcharts, messages, and listing for a sample hotel reservations inquiry program written in FORTRAN. This program transmits two messages to a 3270 Model 1 Display System (480 character screen). The first message from the program requests the terminal operator to enter a room number. The program uses the room number as the relative record number to access a disk file whose records contain guest and rate information about the room. This information is then formatted and displayed as the second message transmitted to the 3270 terminal. Figure 5-9 also shows how these messages appear on the 3270 terminal.

This program is a single requesting terminal (SRT) program (see index entry) with no program-selected terminals; it can receive data from and transmit data to only one 3270 terminal. However, multiple copies of this program could be in main storage at the same time (if your configuration of the CCP allows this), each communicating with a different 3270 Display System. (If multiple copies are in core at the same time, the disk file must be specified as sharable during the Assignment stage–see index entry *disk file sharing.*)

Formatting the Messages for the 3270 Display

Because this sample program does not use the Display Format Facility, this sample program must set all formatting control characters for the 3270 display screen into the data portion of the record area array and transmit them as part of the messages to be displayed (see Figure 5-10). You can find the meanings of each of the 3270 screen format characters shown in Figure 5-10 in the publication *IBM 3270 Information Display System Component Description,* GA27-3004.

The format characters are set by specifying the arrays LOC1, LOC2, LOC3, LOC4, LOC5, LOC6, LOC7, and LOC8 and initializing these arrays to the required 3270 format characters (Figure 5-11). The character Z is used to indicate hexadecimal characters since some of the format characters can only be specified in hexadecimal. The format characters are inserted in the data portion of the record area array by specifying an EQUIVALENCE statement that sets the format character array elements equal to the corresponding element in the data portion of the record area array.

The notes to the right of the listing in Figure 5-11 explain the statements used by this program to format the 3270 display screen. You will also find the comments in the listing helpful.

Notes Concerning this Sample Program

- Message mode was defined during the Assignment Stage for the 3270 terminal used by this program. (See TERMATTR statement in *CCP System Reference Manual.*) This eliminates the need to do repetitive input operations until EOT is received.
- To run this program using a terminal other than the 3270, you must remove all coding dependent on the 3270. This includes all screen formatting specifications and 3270 screen control characters within the data.
- This program will not accept data with the program request.
- Two different lengths are used for the output length field of the parameter list because the two messages transmitted by this sample program have different lengths.
- This program specifies a Put operation and a Get operation using six blanks as the terminal name. The CCP places the name of the 3270 terminal being used in the terminal name field of the record area after the first Put operation is performed.

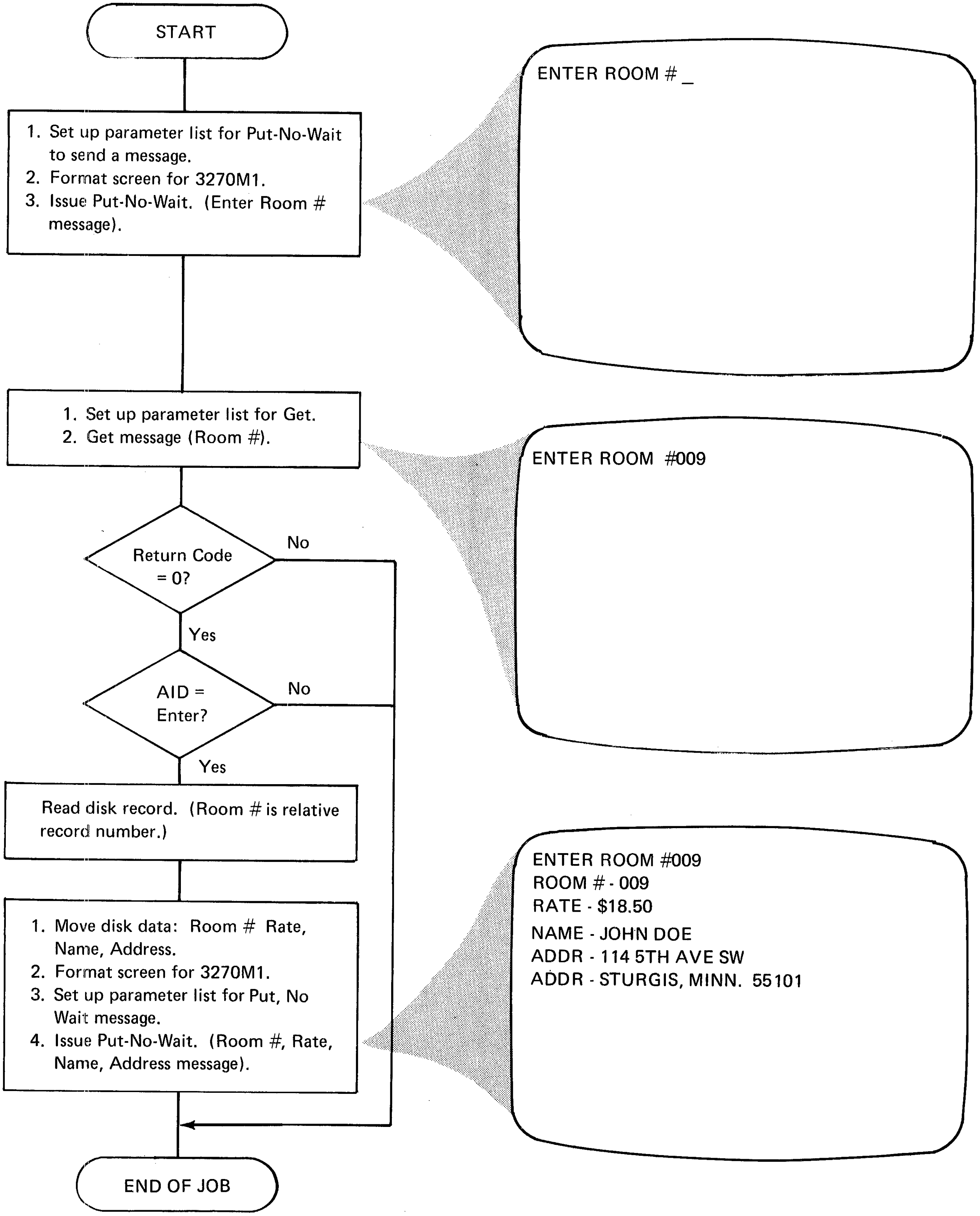
- To keep this sample program simple, return code checking is kept to a minimum. You may want to do more return code checking in your application programs. For example, when you issue Accept Input you should check for the Shutdown Requested return code (04). Also, if data mode escape is allowed in the CCP system, programs should check for return code 08 (terminal has released itself from the program). It is recommended that each installation design its own return code checking and console communication routines so that a standard is established that is satisfactory to the installation and can be used by all application programs.

- This program does not check the length of the input data because the terminal operator is requested to enter a three-digit room number. If less than three digits are entered, the program is canceled. However, you may want to check the input data length in your application programs.

- Since these are the only two different screen formats used by this program, they are both contained within the program. For more complete applications, you might store the screen formats on disk and read them when they are needed by your program.

- You could also use the Get Attributes operation in this program. If you do not know whether the 3270 Model 1 or the 3270 Model 2 will request the program, you can issue a Get Attributes operation to find out which type of terminal requested the program.

- If this program were coded and specified as a multiple requesting terminal (MRT) program with a MRTMAX-1 keyword on the PROGRAM assignment statement (see *CCP* System Reference), multiple copies of the program would not be allowed in main storage at the same time. As the program is written, multiple copies could be in main storage at the same time and the disk file must be specified as sharable (FILES keyword of PROGRAM assignment statement).

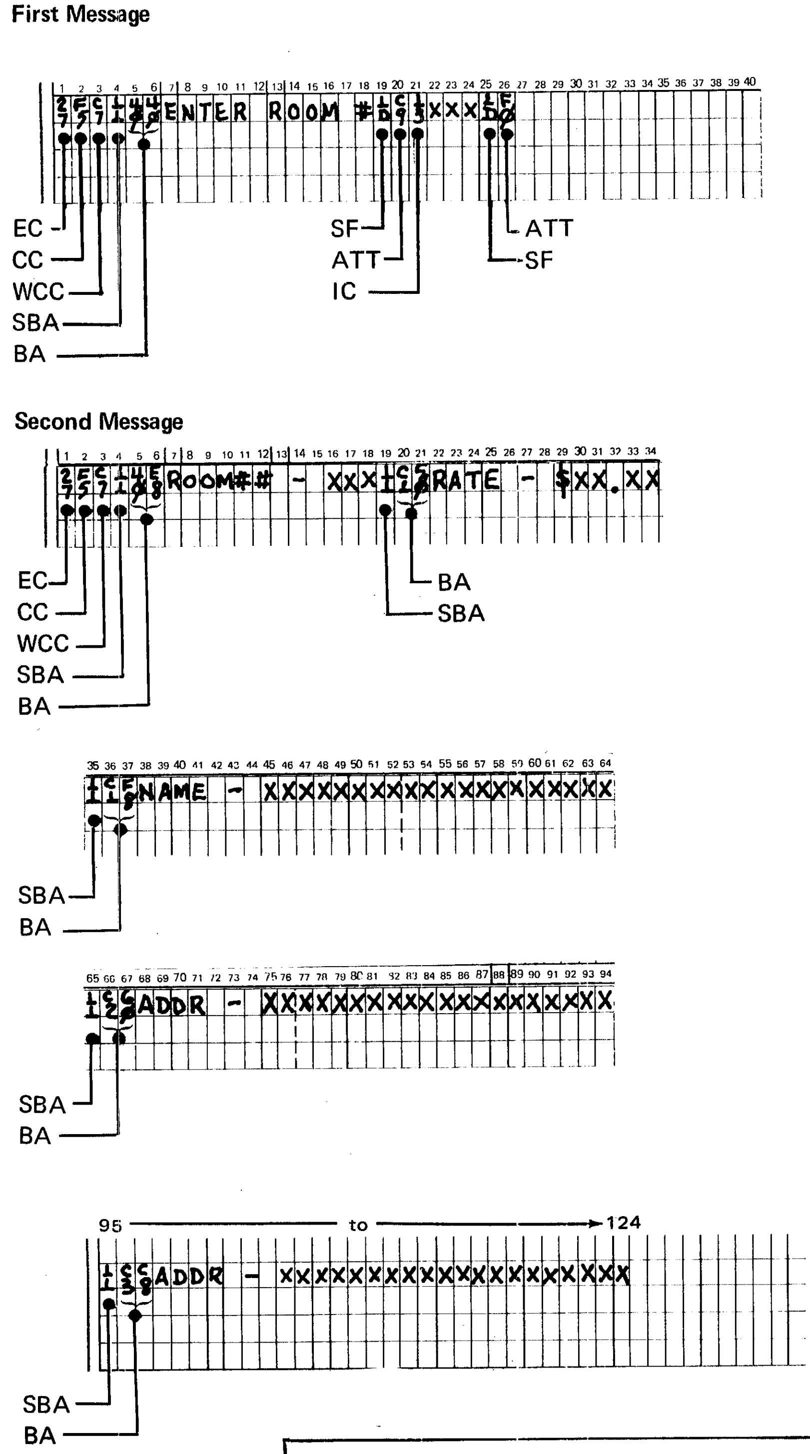


```
ENTER ROOM # _
```

```
ENTER ROOM  #009
```

```
ENTER ROOM #009
ROOM # - 009
RATE - $18.50
NAME - JOHN DOE
ADDR - 114 5TH AVE SW
ADDR - STURGIS, MINN.  55101
```

Figure 5-9. Communications Flow of Example 1 (FORTRAN SRT Program)



SF	– Start Field	CC	– Command Code
ATT	– Attribute Character	WCC	– Write Control Character
IC	– Insert Cursor	SBA	– Set Buffer Address
x	– Data Character	BA	– Buffer Address of first character position in the field
EC	–Escape Character		

Figure 5-10. Message Formats for Example 1 (FORTRAN SRT Program)

```
  FORTRAN IV

// DAD44 UNITNO-8
*PROCESS MAP,GODECK
   1          PROGRAM SRFOR1
        C
   2          DEFINE FILE 8(10,70,L,LAST)
        C
        C************************************************************************
        C       COMMUNICATION AREA                                              *
        C************************************************************************
        C
   3          INTEGER * 2 PARM(8),RTC,OPC,OUTL,INL
        C
   4          INTEGER * 2 IOAREA(130),TNAME(6),DATA1(124)
        C
   5          INTEGER * 2 IOUT1(124),LOC1(6),ROOMX(9),LOC2(3),RATEX(7),
             *                  LOC3(3),NAMEX(7),LOC4(3),ADDRX1(7),
             *                  LOC5(3),ADDRX2(7)
        C
   6          INTEGER * 2 IOUT2(26),LOC6(6),MESG(12),
             *                 LOC7(3),IBLANK(3),LOC8(2)
        C
   7          INTEGER * 2 ID,ROOM(3),RATE(4),NAME(20),ADDR1(20),ADDR2(20)
   8          INTEGER * 2 IDOLR,IPOINT,ENT
        C
   9          EQUIVALENCE (RTC,PARM(1)),(OPC,PARM(2)),(OUTL,PARM(3)),
             1            (INL,PARM(4))
        C
  10          EQUIVALENCE (TNAME(1),IOAREA(1)),(DATA1(1),IOAREA(7))
        C
  11          EQUIVALENCE (LOC1(1),IOUT1(1)),(ROOMX(1),IOUT1(7)),
             *            (LOC2(1),IOUT1(19)),(RATEX(1),IOUT1(22)),
             *            (IDOLR,IOUT1(29)),(IPOINT,IOUT1(32))
  12          EQUIVALENCE (LOC3(1),IOUT1(35)),(NAMEX(1),IOUT1(38)),
             *            (LOC4(1),IOUT1(65)),(ADDRX1(1),IOUT1(68)),
             *            (LOC5(1),IOUT1(95)),(ADDRX2(1),IOUT1(98))
        C
  13          EQUIVALENCE (LOC6(1),IOUT2(1)),(MESG(1),IOUT2(7)),
             *            (LOC7(1),IOUT2(19)),(IBLANK(1),IOUT2(22)),
             *            (LOC8(1),IOUT2(25))
        C
  14          DATA LOC1 /Z2740,ZF140,ZC740,Z1140,Z4040,ZE840/
  15          DATA ROOMX /'R O O M   #   -   '/
        C
  16          DATA LOC2 /Z1140,ZC140,Z5040/
  17          DATA RATEX /'R A T E   -   '/
        C
  18          DATA LOC3 /Z1140,ZC140,ZF840/
  19          DATA NAMEX /'N A M E   -   '/
        C
  20          DATA LOC4 /Z1140,ZC240,Z6040/
  21          DATA ADDRX1 /'A D D R   -   '/
        C
  22          DATA LOC5 /Z1140,ZC340,ZC840/
  23          DATA ADDRX2 /'A D D R   -   '/
        C
  24          DATA LOC6 /Z2740,ZF540,ZC740,Z1140,Z4040,Z4040/
  25          DATA MESG /'E N T E R   R O O M   # '/
```

Parameter list array

Record area array

Output area array

Message area array

Disk fields

Other variables used by the program

Redefine parameter list array

Redefine record area array

Redefine output area array

Redefine message area array

Initialize 3270 format characters and variables

Figure 5-11 (Part 1 of 2). Example 1 – FORTRAN SRT Program

```
C
      DATA LOC7 /Z1D40,ZC940,Z1340/
      DATA IBLANK /3*'   '/
C
      DATA LOC8 /Z1D40,ZF040/
C
      DATA TNAME /6*'   '/
C
      DATA IDOLR/'$'/,IPOINT/'.'/,ENT/''''/
C
C***********************************************************************
C          A PUT SENDING THE MESSAGE 'ENTER ROOM #' IS SENT TO THE 3270  *
C***********************************************************************
C
      OPC = 54
      OUTL = 26
      INL = 26
      CALL MOVE (IOUT2,1,26,DATA1,1)
      CALL CCPFIO (PARM,IOAREA)
C
C***********************************************************************
C          DO A GET FOR THE ROOM NUMBER AND CHECK THE RETURN CODE FOR    *
C          ZERO. IF IT IS NOT ZERO GO TO EOJ.                            *
C***********************************************************************
C
      OPC = 1
      OUTL = 11
      INL = 11
      CALL CCPFIO (PARM,IOAREA)
      IF (RTC.NE.0) GO TO 20
C
C***********************************************************************
C          CHECK IF ENTER AID KEY WAS ON AT GET, IF IT WAS NOT GO TO EOJ *
C          CONVERT THE ROOM NUMBER FROM A1 FORMAT TO INTEGER FORMAT      *
C          THEN CHECK TO INSURE IT IS IN THE RANGE OF FROM 001 TO 010.   *
C***********************************************************************
C
      IF (DATA1(3).NE.ENT) GO TO 20
      XROOM = GET (DATA1,9,11,1.0)
      INROOM = XROOM
      IF (INROOM.LT.1) GO TO 20
      IF (INROOM.GT.10) GO TO 20
C
C***********************************************************************
C          READ A RECORD FROM A DIRECT-ACCESS DISK FILE.  THE ROOM NUMBER*
C          REPRESENTS THE RELATIVE POSITION OF THE RECORD IN THE FILE    *
C***********************************************************************
C
      READ (8'INROOM,10000) ID,ROOM,RATE,NAME,ADDR1,ADDR2
C
C***********************************************************************
C          MOVE THE ROOM NUMBER, RATE PER DAY, THE NAME AND ADDRESS OF   *
C          THE GUEST INTO THE GUEST ARRAY, THEN DO A PUT OF IT TO THE    *
C          3270                                                          *
C***********************************************************************
C
      CALL MOVE (ROOM,1,3,IOUT1,16)
      CALL MOVE (RATE,1,2,IOUT1,30)
      CALL MOVE (RATE,3,4,IOUT1,33)
      CALL MOVE (NAME,1,20,IOUT1,45)
      CALL MOVE (ADDR1,1,20,IOUT1,75)
      CALL MOVE (ADDR2,1,20,IOUT1,105)
      CALL MOVE (IOUT1,1,124,DATA1,1)
      IRETRY = 0
      OPC = 54
      OUTL = 124
      INL = 124
   10 CALL CCPFIO (PARM,IOAREA)
C
C***********************************************************************
C          AFTER THE PUT CHECK THE RETURN CODE FOR ZERO, IF IT IS NOT    *
C          ZERO RETRY THE PUT ONE TIME.                                  *
C***********************************************************************
C
      IF (RTC.EQ.0) GO TO 20
      IF (IRETRY.EQ.1) GO TO 20
      IRETRY = IRETRY + 1
      GO TO 10
   20 STOP
10000 FORMAT (A1,3A1,4A1,20A1,20A1,20A1)
      END
```

Figure 5-11 (Part 2 of 2). Example 1 — FORTRAN SRT Program

Example 2

Figures 5-12, 5-13, and 5-14 show the flowchart, input/output messages, and listing for a sample FORTRAN multiple requesting terminal (MRT) program designed to run under the CCP. This program supports up to four MLTA requesting terminals. The terminal operator enters a seven-digit number preceded by a +, -, or N. The CCP transmits this signed number to the FORTRAN program.

The FORTRAN program:

- Adds the number to the value in the accumulator associated with the terminal that transmitted the data if the first position is +
- Subtracts the number from the accumulator if the first position is –
- Releases the terminal if the first position is N.

If a value was either added or subtracted, the new value accumulated for the terminal is inserted into the message *CURRENT VAL = sxxxxxxxxxx ENTER DATA* and the message is sent to the terminal.

This sample program also checks for several error conditions and transmits the appropriate error message to the terminal requesting the operation.

This sample program is not designed to show the most effective way of performing operations. Instead, it shows a variety of ways to do things. It uses a variety of operation codes that show how data can be associated with a terminal by defining a save area array for the terminal names and accumulated data. It frequently checks return codes, but you can do even more return code checking if you wish. Data entered by the terminal operator must be fixed length. To allow variable length input fields you could include a subroutine in your program to check the effective input length returned in the parameter list and align the data correctly. This program communicates with the console in addition to the requesting terminals.

The notes to the right of the listing in Figure 5-14 and the comments in the listing explain each section of the sample program.

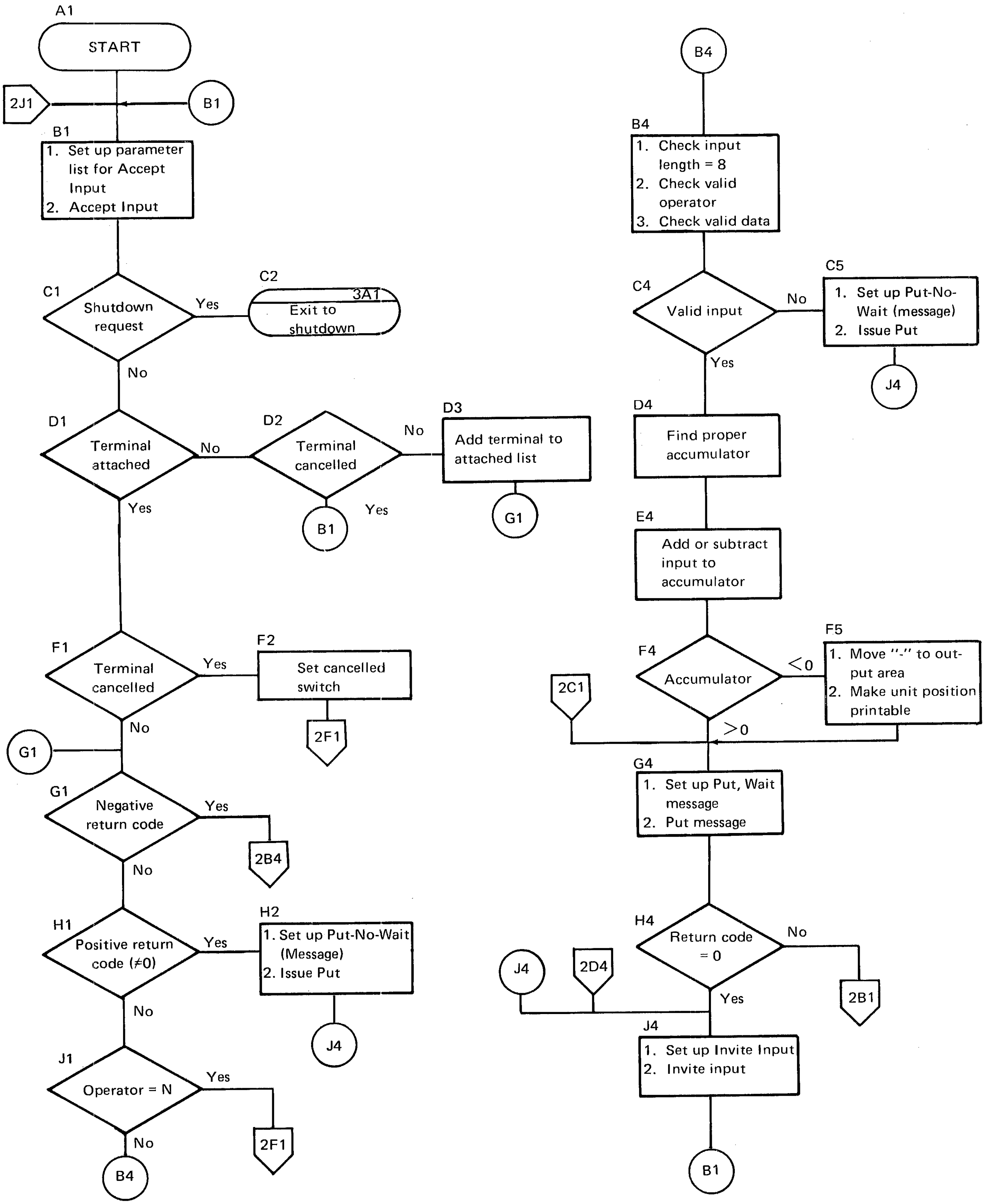


Figure 5-12 (Part 1 of 3). Program Logic of Example 2 (FORTRAN MRT Program)

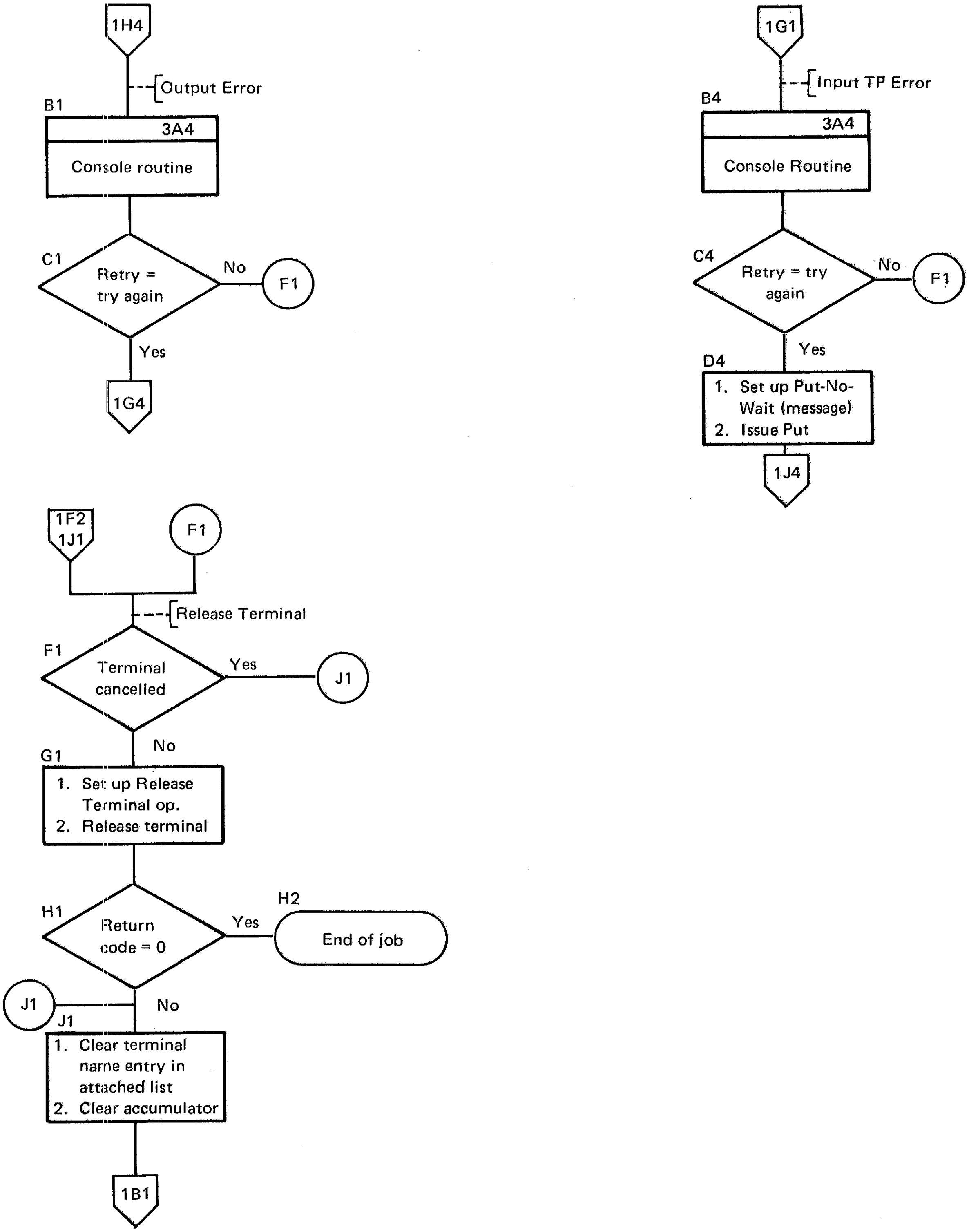
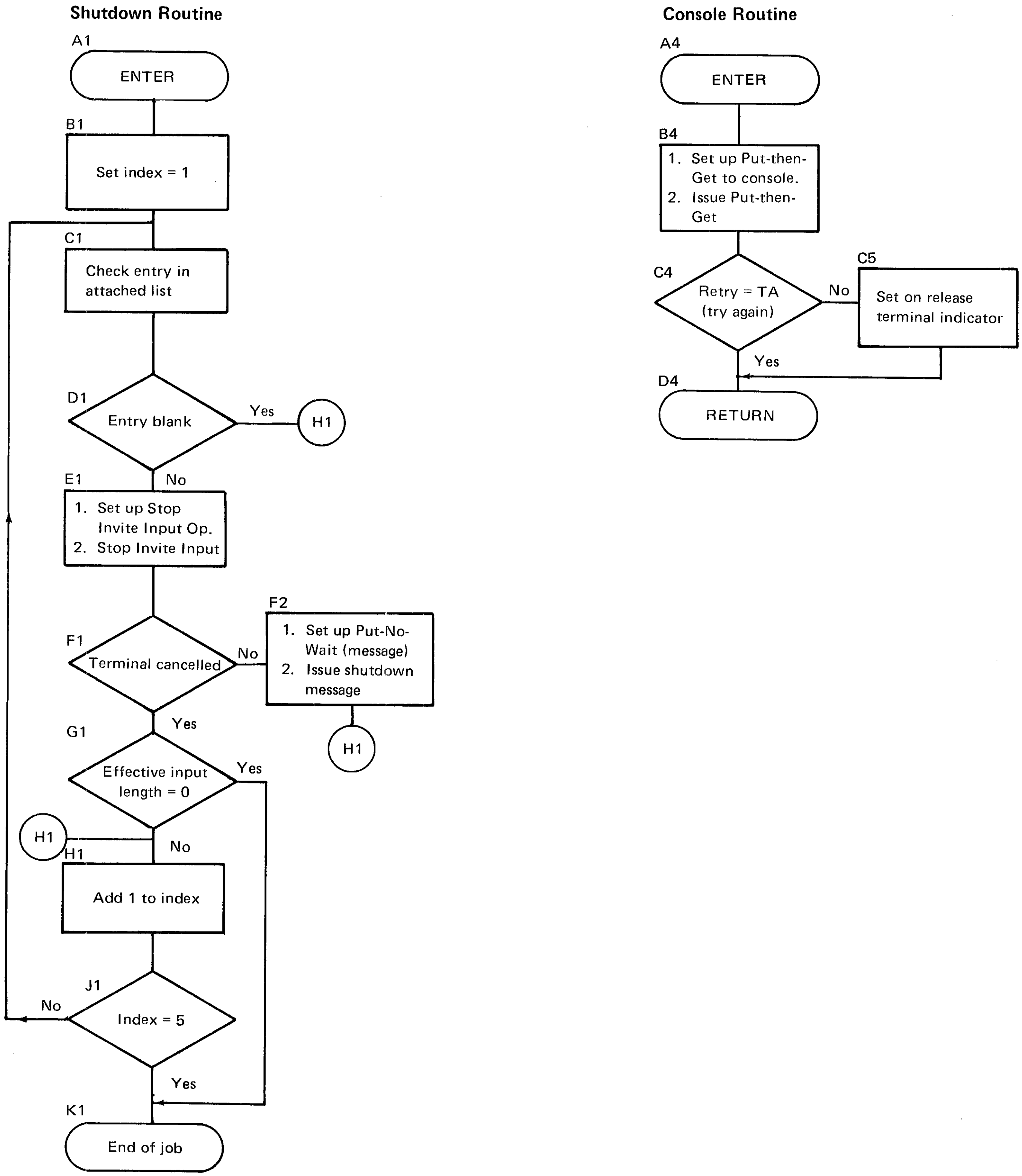


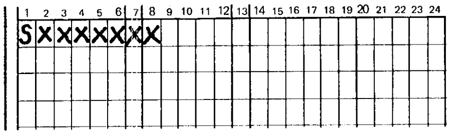
Figure 5-12 (Part 2 of 3). Program Logic of Example 2 (FORTRAN MRT Program)


Shutdown Routine

Console Routine

Figure 5-12 (Part 3 of 3). Program Logic of Example 2 (FORTRAN MRT Program)

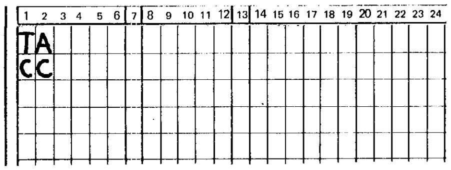
Input Data Entered by Terminal Operator



```
SXXXXXXX
```

A fixed length numeric field where S is a +, -, or N and X is a numeric digit. All eight positions must be entered, except when N is entered in the first position.

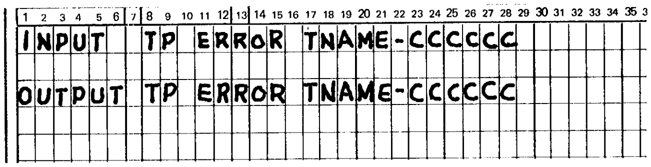
Data Entered by System Operator on 5471 Printer/Keyboard (Models 10 and 12) or CRT/Keyboard (Model 15)



```
TA
CC
```

In response to the messages INPUT TP ERROR TNAME-cccccc and OUTPUT TP ERROR TNAME-cccccc to the console, the system operator replies TA if he wants to Try Again. Any other reply (cc) causes the terminal to be released.

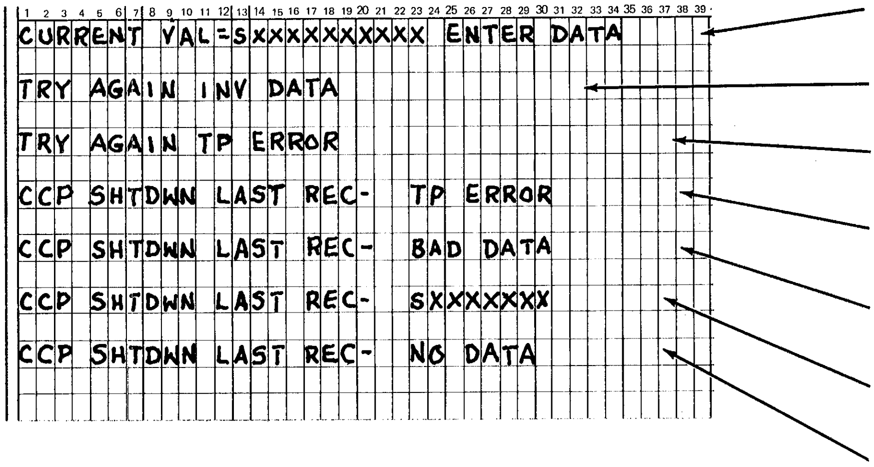
Output to the Console



```
INPUT  TP ERROR TNAME-CCCCCC
OUTPUT TP ERROR TNAME-CCCCCC
```

These messages are transmitted to the console (cccccc = terminal name).

Output to Terminal



```
CURRENT VAL=SXXXXXXXXXX ENTER DATA
TRY AGAIN INV DATA
TRY AGAIN TP ERROR
CCP SHTDWN LAST REC-  TP ERROR
CCP SHTDWN LAST REC-  BAD DATA
CCP SHTDWN LAST REC-  SXXXXXXX
CCP SHTDWN LAST REC-  NO DATA
```

Transmitted with value in accumulator associated with the terminal.

Issued if data is invalid

Issued if system operator replies TA (Negative return code on Accept Input)

Issued for negative return code on Stop Invite Input

Issued for positive return code other than 10 on Stop Invite Input

Issued for return code of 0 on Stop Invite Input

Issued for return code of 10 on Stop Invite Input

Figure 5-13. Input and Output Message Formats for Example 2 (FORTRAN MRT Program)

```
FORTRAN IV

*PROCESS MAP
   1          PROGRAM MRFOR1
   2          INTEGER*2 LPARM(8),MAREA(40),TERM(44),LRTC,LOPC,LINL,LOUTL,LEFL
   3          INTEGER*2 ACCEPT,PUTNWT,PUTMWT,INVINP,PUTGET,RELTRM,STPINV
   4          INTEGER*2 CRNTVL(34),CONSOL(6),LBLNK,LPLUS,LMINUS,LNNN,N
   5          INTEGER*2 I,II,J,JJ,JJJ,MSAV(2)
   6          INTEGER*2 ERMSG1(2),ERMSG2(16),ERMSG3(12),ERMSG4(18),ERMSG5(18)
   7          INTEGER*2 ERMSG6(22),ERMSG7(24)
   8          INTEGER*4 LZERO
   9          EQUIVALENCE (LRTC,LPARM(1)),(LOPC,LPARM(2)),(LOUTL,LPARM(3)),
             1            (LINL,LPARM(4)),(LEFL,LPARM(3))
  10          DATA ACCEPT,PUTNWT,PUTMWT,INVINP,PUTGET,RELTRM/4,54,50,5,3,10/
  11          DATA STPINV/1025/
  12          DATA LPLUS,LMINUS,LNNN,LBLNK/'+','-','N',' '/
  13          DATA LZERO/'  00'/
  14          DATA CRNTVL/'C U R R E N T   V A L = +                       E N T
             1 E R   D A T A '/
  15          DATA CONSOL/'C O N S O L '/
  16          DATA TERM(1),TERM(12),TERM(23),TERM(34)/4*'  '/
  17          DATA LINL/34/
  18          DATA ERMSG1/'T A '/
  19          DATA ERMSG2/'  T P   E R R O R   T N A M E = '/
  20          DATA ERMSG3/'I N P U T   O U T P U T '/
  21          DATA ERMSG4/'T R Y   A G A I N   T P   E R R O R '/
  22          DATA ERMSG5/'T R Y   A G A I N   I N V   D A T A '/
  23          DATA ERMSG6/'C C P   S H T D W N   L A S T   R E C   -   '/
  24          DATA ERMSG7/'T P   E R R O R B A D   D A T A   N O   D A T A '/
      C*********************************************************************
      C  II=INDEX FOR TERMINAL ARRAY, JJ=SWITCH, JJ=1 INPUT, JJ=7 OUTPUT.   *
      C  JJJ=ADDITIONAL INDEX FOR VARIOUS SHORT TERM PURPOSES.              *
      C                                                                    *
      C   SET UP PARAMETER LIST FOR ACCEPT INPUT                           *
      C*********************************************************************
  25  00100 JJ=1
  26          LOPC=ACCEPT
      C*********************************************************************
      C   DO ACCEPT INPUT OPERATION                                        *
      C*********************************************************************
  27          CALL CCPFIO(LPARM,MAREA)
      C*********************************************************************
      C   CHECK TO SEE IF A SHUTDOWN HAS BEEN REQUESTED                    *
      C*********************************************************************
  28          IF (LRTC-4) 00190,02500,00190
      C*********************************************************************
      C   DETERMINE IF TERMINAL IS ALREADY ATTACHED, NCOMP IS SET TO 0 IF  *
      C       FIRST 6 ELEMENTS IN MESSAGE AREA MATCH A 6 ELEMENT TERMINAL  *
      C       NAME IN THE TERMINAL DATA STORAGE ARRAY                      *
      C*********************************************************************
  29  00190 DO 00200 II=1,34,11
  30              IF (NCOMP(MAREA,1,6,TERM,II)) 00200,00600,00200
  31  00200 CONTINUE
      C*********************************************************************
      C   CHECK TO SEE IF TERMINAL HAS BEEN CANCELLED.IF IT HAS RETURN     *
      C       TO ACCEPT INPUT IF INVITES ARE OUTSTANDING, IF NO INVITES ARE *
      C       OUTSTANDING GO TO EXIT.                                      *
      C*********************************************************************
  32          IF (LRTC-8) 00250,00220,00250
  33  00220 IF (LEFL) 00100,09000,00100
      C*********************************************************************
      C   LOCATE A BLANK 6 ELEMENT TERMINAL NAME SPACE IN THE TERMINAL DATA *
      C       STORAGE ARRAY                                                *
      C   NOTE:  NO MORE THAN 4 TERMINALS WILL BE ALLOWED TO COMMUNICATE   *
      C          WITH THIS PROGRAM IF ASSIGNMENT SPECIFIES 4 TERMINALS     *
      C*********************************************************************
  34  00250 DO 00300 II=1,34,11
  35              IF (TERM(II).EQ.LBLNK) GO TO 00400
  36  00300 CONTINUE
      C*********************************************************************
      C   INSERT THE NEW TERMINAL NAME INTO THE SPACE JUST LOCATED AND ZERO *
      C       THE ACCUMULATOR ASSOCIATED WITH THIS LOCATION                *
      C*********************************************************************
  37  00400 CALL MOVE(MAREA,1,6,TERM,II)
  38          CALL FILL(TERM,II+6,II+10,LZERO)
  39          GO TO 00610
      C*********************************************************************
      C   CHECK TO SEE IF TERMINAL HAS BEEN CANCELLED. IF IT HAS GO MAKE   *
      C       TERMINAL NAME AREA AVAILABLE FOR NEW ENTRY                   *
      C*********************************************************************
```

Define parameter list array, record area array, save area array, console name array, output message array, error messages, and other variables used by program.

Set parameter list fields equal to elements in parameter list arrays.

Initialize operation code fields, output messages, save area array, error messages, and other variables used in program.

Set operation code field equal to numeric variable for Accept Input.

Determine if the terminal name for the terminal that transmitted the input data is in the save area array. If it is, the data is added to the accumulator associated with that terminal. If it is not in the save area array and the terminal is not cancelled, the terminal is added to the save area array.

Figure 5-14 (Part 1 of 4). Example 2 — FORTRAN MRT Program

```
00600 IF (LRTC-8) 00610,04900,00610
C***********************************************************************
C    CHECK FOR INPUT ERROR INDICATIONS, ISSUE ERROR MESSAGE IF RETURN   *
C        CODE NOT EQUAL TO 0, OR IF LENGTH NOT 8                        *
C    CHECK FOR VALID OPERATOR, IF OPERATOR EQUAL TO N GO RELEASE TERMINAL
C***********************************************************************
00610 IF (LRTC) 02800,00650,00700
00650 IF (MAREA(7).EQ.LNNN) GO TO 04800
      IF (LEFL-8) 00700,00660,00700
00660 IF (MAREA(7).EQ.LPLUS) GO TO 00900
      IF (MAREA(7).EQ.LMINUS) GO TO 00900
```

If the first position of the input field is +, the data is added to the accumulator element associated with the terminal that transmitted the data. If the first position is –, the data is subtracted from the terminal. If the first position is N, the terminal is checked to see if it is cancelled.

```
C***********************************************************************
C    ASSUME BAD OPERATOR, ISSUE INVALID DATA MESSAGE                    *
C***********************************************************************
00700 CALL MOVE(ERMSG5,1,18,MAREA,7)
      LOUTL=18
      GO TO 04300
```

If the first position of the input data is not +, –, or N, a message is issued to the terminal.

```
C***********************************************************************
C    CONVERT THE VALUE RECEIVED AS INPUT FROM CHARACTER (A1) TO ZONED   *
C        DECIMAL (D1) FORMAT                                            *
C        IF N NOT EQUAL TO 0 SET UP INVALID DATA MESSAGE                *
C***********************************************************************
00900 N=0
      CALL A1DEC(MAREA,8,14,N)
      IF (N) 00700,01000,00700
C***********************************************************************
C    NOW ADD THE VALUE RECEIVED AS INPUT  TO THE VALUE IN THE           *
C        ACCUMULATOR ASSIGNED WITH THE TERMINAL NAME                    *
C***********************************************************************
01000 JJJ=II+6
      N=0
      IF (MAREA(7).EQ.LMINUS) GO TO 01500
C***********************************************************************
C    ADD VALUE RECEIVED TO VALUE IN ACCUMULATOR                         *
C***********************************************************************
      CALL ADD(MAREA,11,14,TERM,JJJ,JJJ+4,N)
      GO TO 01600
01500 CALL SUB(MAREA,11,14,TERM,JJJ,JJJ+4,N)
C***********************************************************************
C    SET UP TO DISPLAY RESULTS IN ACCUMULATOR, TO TERMINAL              *
C    NOTE: IF OVERFLOW OCCURRED MAX VALUE WILL BE DISPLAYED,ALL 9'S     *
C***********************************************************************
01600 CALL MOVE(CRNTVL,1,34,MAREA,7)
      CALL MOVE(TERM,JJJ,JJJ+4,MAREA,25)
C***********************************************************************
C    SET INDICATOR N ACCORDING TO THE SIGN OF THE ACCUMULATOR VALUE THEN*
C        SET LAST DIGIT OF ACCUMULATOR VALUE POSITIVE                   *
C***********************************************************************
      CALL NSIGN(MAREA,29,1,N)
      IF (N) 01800,01900,01900
01800 MAREA(19)=LMINUS
C***********************************************************************
C    CONVERT THE ZONED RESULTS TO CHARACTERS IN A1 FORMAT FOR OUTPUT    *
C***********************************************************************
01900 N=0
      CALL DECA1(MAREA,20,29,N)
C***********************************************************************
C    SET UP PARM LIST FOR PUT MESSAGE WAIT                              *
C***********************************************************************
      LOPC=PUTMWT
      LOUTL=34
C***********************************************************************
C    DO PUT MESSAGE WAIT OPERATION                                      *
C***********************************************************************
      CALL CCPFIO(LPARM,MAREA)
```

Insert accumulated value associated with the terminal into the output message and display it on the terminal.

```
C***********************************************************************
C    CHECK RETURN CODE TO SEE IF OPERATION WAS SUCCESSFUL               *
C        IF RETURN CODE NOT EQUAL TO ZERO GO ISSUE ERROR MESSAGE        *
C***********************************************************************
      IF (LRTC) 02100,02200,02100
02100 JJ=7
      GO TO 02800
C***********************************************************************
C    SET UP PARAMETER LIST FOR INVITE INPUT                             *
C***********************************************************************
02200 LOPC=INVINP
C***********************************************************************
C    DO INVITE INPUT OPERATION                                          *
C***********************************************************************
      CALL CCPFIO(LPARM,MAREA)
      GO TO 00100
C***********************************************************************
C    HANDLE SHUTDOWN REQUEST BY ISSUING STOP INVITES TO ALL OUTSTANDING *
C        INVITE INPUTS PREVIOUSLY ISSUED                                *
C***********************************************************************
02500 DO 02600 II=1,34,11
            IF (TERM(II).EQ.LBLNK) GO TO 02600
C***********************************************************************
C    SET UP PARAMETER LIST FOR STOP INVITE INPUT                        *
C***********************************************************************
```

Note: When the last terminal attached to an MRT program is processed, issue a Release Terminal operation to that terminal in order to check the count of outstanding Invite Inputs. If the count is greater than zero, the program can issue an Accept Input operation. For example, suppose an MRT program is servicing the maximum number of requestors and one or more additional requests are queued to the program. If the program receives a shutdown-requested return code (04) and goes to end of job without checking the count of outstanding Invite Inputs, the program terminates with a 2C termination code (going to end of job with outstanding Invite Inputs), and each of the queued terminals receives an S06 message (program cancelled – shutdown).

Figure 5-14 (Part 2 of 4). Example 2 – FORTRAN MRT Program

```
76                 LOPC=STPINV
77            CALL MOVE(TERM,II,II+5,MAREA,1)
        C***********************************************************************
        C   DO STOP INVITE INPUT OPERATION                                     *
        C***********************************************************************
78                 CALL CCPFIO(LPARM,MAREA)
        C***********************************************************************
        C   IF TERMINAL NOT CANCELLED, THEN ISSUE SHUTDOWN MESSAGE. IF TERMINAL*
        C      CANCELLED THEN GO TO EXIT IF NO OUTSTANDING INVITES, ELSE GO    *
        C      SEARCH FOR NEXT ACTIVE TERMINAL.                                *
        C***********************************************************************
79            IF (LRTC-8) 02510,02508,02510
80      02508 IF (LEFL) 02600,09000,02600
        C***********************************************************************
        C   SET UP PARAMETER LIST FOR PUT NO WAIT                              *
        C***********************************************************************
81      02510      LOPC=PUTNWT
82                 LOUTL=30
        C***********************************************************************
        C   INSERT PROPER SHUTDOWN MESSAGE TO TERMINAL REFERENCED IN TERMINAL  *
        C      DATA ARRAY.  THE MESSAGE IS SET ACCORDING TO THE RETURN CODE    *
        C***********************************************************************
83                 IF (LRTC) 02520,02535,02525
84      02520      JJJ=1
85                 GO TO 02528
86      02525      IF (LRTC-10) 02526,02527,02526
87      02526      JJJ=9
88                 GO TO 02528
89      02527      JJJ=17
90      02528 CALL MOVE(ERMSG7,JJJ,JJJ+7,MAREA,29)
91                 GO TO 02558
92      02535 CALL MOVE(MAREA,7,14,MAREA,29)
93      02558 CALL MOVE(ERMSG6,1,22,MAREA,7)
        C***********************************************************************
        C   DO PUT NO WAIT OPERATION                                           *
        C***********************************************************************
94                 CALL CCPFIO(LPARM,MAREA)
95      02600 CONTINUE
96            GO TO 09000
        C***********************************************************************
        C   PREPARE INPUT OR OUTPUT ERROR MESSAGES HERE                        *
        C   SET UP PARAMETER LIST FOR PUT THEN GET TO CONSOL                   *
        C***********************************************************************
97      02800 LOPC=PUTGET
98            LOUTL=28
        C***********************************************************************
        C   INSERT TERMINAL NAME=CONSOL, TERMINAL NAME WHERE ERROR OCCURRED,   *
        C      AND INPUT OR OUTPUT ERROR MESSAGE                               *
        C***********************************************************************
99            CALL MOVE(CONSOL,1,6,MAREA,1)
100           CALL MOVE(ERMSG3,JJ,JJ+5,MAREA,7)
101           CALL MOVE(TERM,II,II+5,MAREA,29)
102           CALL MOVE(ERMSG2,1,16,MAREA,13)
        C***********************************************************************
        C   DO PUT GET OPERATION TO CONSOLE                                    *
        C***********************************************************************
```

If an input error occurred, the message 'INPUT TP ERROR TNAME xxxxxx' is issued to the console (xxxxxx = terminal on which the error occurred). If an output error occurred, a similar output error message is built and issued.

Figure 5-14 (Part 3 of 4). Example 2 – FORTRAN MRT Program

```
      CALL CCPFIO(LPARM,MAREA)
C***********************************************************************
C   MOVE TERMINAL NAME BACK TO TERMINAL NAME AREA IN TERMINAL DATA     *
C       ARRAY                                                          *
C   CHECK FOR REPLY REQUESTING TO TRY AGAIN--TA                        *
C       IF TA NOT PRESENT THEN GO DISCONNECT                           *
C***********************************************************************
      MSAV(1)=MAREA(7)
      MSAV(2)=MAREA(8)
      CALL MOVE(TERM,II,II+5,MAREA,1)
      IF (NCOMP(MSAV,1,2,ERMSG1,1)) 04800,03800,04800
C***********************************************************************
C   IF OUTPUT ERROR MESSAGE THEN GO  TRY TO OUTPUT AGAIN               *
C***********************************************************************
03800 IF(JJ-7) 03810,01600,03810
C***********************************************************************
C   IF INPUT ERROR MESSAGE THEN GO TRY TO INPUT AGAIN                  *
C***********************************************************************
03810 CALL MOVE(ERMSG4,1,18,MAREA,7)
      LOUTL=18
C***********************************************************************
C   SET UP PUT NO WAIT PARAMETER LIST                                  *
C***********************************************************************
04300 LOPC=PUTNWT
C***********************************************************************
C   DO PUT NO WAIT OPERATION                                           *
C***********************************************************************
      CALL CCPFIO(LPARM,MAREA)
      GO TO 02200
C***********************************************************************
C   CHECK TO SEE IF THIS TERMINAL HAS BEEN CANCELLED.IF IT HAS GO      *
C       REMOVE IT FROM THE ACTIVE LIST. IF NOT CANCELLED DO A RELEASE  *
C       TERMINAL OPERATION.                                            *
C***********************************************************************
04800 IF (LRTC-8) 04850,04900,04850
C***********************************************************************
C   SET UP PARAMETER LIST FOR RELEASE TERMINAL OPERATION               *
C***********************************************************************
04850 LOPC=RELTRM
C***********************************************************************
C   DO RELEASE TERMINAL OPERATION                                      *
C***********************************************************************
      CALL CCPFIO(LPARM,MAREA)
C***********************************************************************
C   SET THE FIRST ELEMENT OF THE TERMINAL NAME AREA OF THE ARRAY TO A  *
C       BLANK,SIGNIFYING THAT THIS ENTRY AND ITS ACCUMULATOR ARE       *
C       AVAILABLE. RETURN TO ACCEPT INPUT IF MORE INVITES ARE OUTSTAND- *
C       ING,OTHERWISE EXIT.                                            *
C***********************************************************************
04900 TERM(II)=LBLNK
      IF (LEFL) 00100,09000,00100
09000 STOP
      END
```

If the system operator keys in *TA*, the terminal name of the terminal on which the error occurred is placed in the terminal name field of the record area and the operation is retried. If he keys in any other characters, the terminal name for which the error occurred is placed in the record area and, if the terminal has not been cancelled, a Release Terminal operation is issued to it.

Figure 5-14 (Part 4 of 4). Example 2 – FORTRAN MRT Program

Programs written in RPG II can communicate with terminal devices via the CCP by means of either or both of the following two RPG II facilities:

- *SPECIAL files* - One or more SPECIAL files can be defined for communications devices; different file types can be assigned, depending on how the device is used.
- *EXIT/RLABL operations* - Terminal operations can be requested using EXIT and RLABL operations with subroutines provided by the CCP.

You can issue all of the communications operations described under *Operations* in Chapter 2 through either the SPECIAL or the EXIT/RLABL interface. In general, however, use of SPECIAL files is recommended for operations involving data transfer, such as Get, Put, Accept Input, Put-Then-Get, and Stop Invite Input (which may result in a Get). EXIT/RLABL is best suited for use in non-I/O operations, such as Acquire Terminal, Release Terminal, and Shutdown Inquiry. By following this general rule, you can eliminate the need for RPG II logic to move fields from a record area when no data has been received.

Programming for non-TP devices (console, card devices, printer, and disk) under the CCP is the same as in RPG II programs that are not written to run under the CCP, with a few exceptions:

- The system operator console is treated as a terminal device under the CCP. Therefore, you must communicate with the console through either SPECIAL or EXIT/RLABL; you cannot use the name CONSOLE (Model 10 Disk System and Model 12) or CRT77 (Model 15) on File Description Specifications.
- You should not specify a core index for disk files (columns 60-65 of the File Description Specification). The CCP builds a core index based on the MSTRINDX keyword of the DISKFILE assignment statement (see *CCP System Reference Manual*). If you also specify a core index in your program, you will cause unnecessary code to be generated for your program.
- You should be aware of how other programs running under the CCP are using disk files that you use in your program, especially if records are being added to the files. See index entry *disk file considerations* for detailed information.
- You cannot use magnetic tape files in programs written to run under the CCP.

Note: You are assumed to be familiar with the RPG II object program cycle and the RPG II language, including SPECIAL files, arrays, and EXIT/RLABL, READ, and EXCPT operations. If you are not familiar with these RPG II facilities and operations, you should consult the following publications:

- *IBM System/3 RPG II Reference Manual,* SC21-7504
- *IBM System/3 RPG II Additional Topics Programmer's Guide,* GC21-7567
- *IBM System/3 RPG II Disk File Processing Programmer's Guide,* GC21-7566

RPG II Use of the Standard CCP Interface

The interface used by RPG II application programs for CCP communications operations differs somewhat from the standard interface described in Chapter 2. However, you should read Chapter 2 before reading this chapter, since most of the information in that chapter also applies to RPG II. The differences in the RPG II interface are due mainly to the fixed nature of RPG II object program cycle, a characteristic that COBOL, FORTRAN, and Basic Assembler do not possess. The basic elements of the interface, although somewhat different in content and use, remain the same:

- Parameter list
- Record area
- Communications service subroutine

COMMUNICATIONS INTERFACE USING RPG II SPECIAL FILES

One method of performing operations with terminals under the CCP is to define one or more SPECIAL files for terminals in the File Description Specifications. SPECIAL files can be defined in a variety of ways, depending on the needs of the particular application. For example, a program that performs both input and output operations with a single terminal might define one SPECIAL file as a primary input file, to be used for input operations with the terminal, and a second SPECIAL file as a detail output file, for output operations to the terminal. Thus, two SPECIAL files would be defined for a single terminal.

Suppose, on the other hand, the program communicates with several terminals. The same two SPECIAL files defined for communication with a single terminal could be used for communication with several terminals - one for all terminal input and one for all terminal output.

It is also possible to define a single SPECIAL file for both input and output operations with one or more terminals. For example, a SPECIAL file could be defined as a Combined Demand Input and Exception Output file to be processed by READ and EXCPT operations in Calculations.

These are just a few examples of the variety of ways of defining SPECIAL files for use in terminal operations via the CCP. Any of the following file types can be defined as a SPECIAL file to be used for I/O operations with one or more terminals:

- Primary Input file
- Secondary Input file
- Demand Input file (used with the READ operation)
- Exception, Detail, or Total Output file
- Combined Demand Input and Exception Output file (used with READ and EXCPT)
- Combined Primary or Secondary Input file and Exception Output file
- Combined Primary or Secondary Input and Detail Output file

Parameter Array for SPECIAL

In the RPG II communications interface to the CCP, using SPECIAL, each parameter list must be contained in an RPG II array consisting of five elements – six positions each. The contents of the parameter array for SPECIAL are shown in Figure 6-1. Notice that the contents of the parameter array are similar to the contents of the standard parameter list defined in Chapter 2, except that no CCP work area is provided and, for SPECIAL input operations, the symbolic terminal name with which the operation is to be performed is placed in the parameter list.

Unlike the standard interface defined in Chapter 2, certain parameters for the SPECIAL interface are placed in the record area, instead of parameter array. See *Performing CCP Operations with SPECIAL,* later in this chapter, for details of using the parameter array and record area in various operations.

The parameters for an operation can be placed in the parameter array during RPG II compilation, at pre-execution time, or during execution of the program, depending on how the array is defined in Extension Specifications (see *Defining the Parameter Array,* later in this chapter).

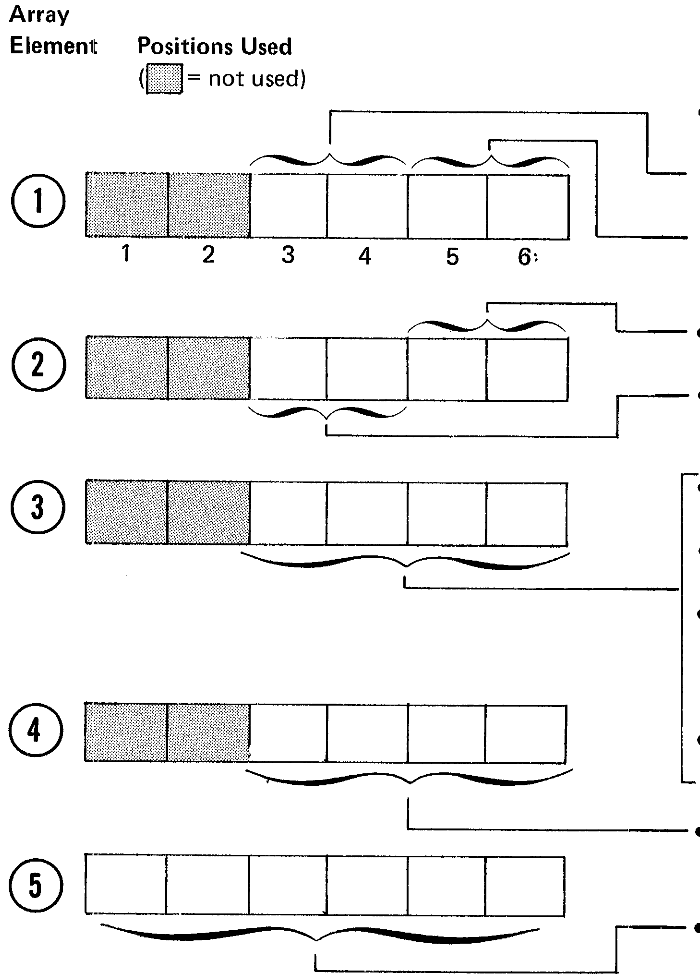
Record Area for SPECIAL

When using RPG II SPECIAL, input and output record areas for CCP operations are defined by coding Input Specifications and/or Output-Format Specifications. As shown in Figure 6-2, the formats of the input and output record areas for SPECIAL are different from the standard record area format defined in Chapter 2. An additional eight positions, besides the name field, must be set aside in both input and output record areas; therefore, data always begins in position 15. Figures 6-3 and 6-4 show example RPG II specifications for input and output record areas.

Input Record Area

On input operations, the CCP places the following information in the record area, as well as in the parameter array:

- Return code for the input operation and the last output operation
- Effective input length from the input operation
- The program name or the symbolic terminal name



Contents

- Return code – two decimal characters returned by the CCP.
  SPECIAL input operations: Return code is placed in positions 3-4.
  SPECIAL output operations: Return code is placed in positions 5-6.
- Operation code – two alphameric characters.
- Operation modifier – two alphameric characters, (optional).
- Output data length– up to four decimal characters (output operations).
- Effective input data length – up to four decimal characters (returned by CCP on input operations).
- Count of outstanding Invite Inputs – a four digit decimal number (returned by CCP on release terminal operations and when a 08 return code occurs on input operations).
- Terminal attributes identifier – up to three decimal characters (acquire terminal operation only).
- Maximum input data length – up to four decimal characters.
- Program name or symbolic terminal name – up to six alphameric characters.

Note: See *Summary – Performing CCP Operations Using RPG II SPECIAL Files,* later in this chapter, for a summary of the use of the parameter array.

Figure 6-1. RPG II Parameter Array for SPECIAL Files.

Because this information is available in the record area, you can check the contents of these areas without moving array elements into fields. You can also check the input return code and effective input length using field indicators. See *Performing CCP Operations with SPECIAL,* later in this chapter, for more information about examining the return code, effective input length, and terminal name.

Output Record Area

On heading, detail, total, or exception (H, D, T, or E) output operations, you must place the following information in the output record area:

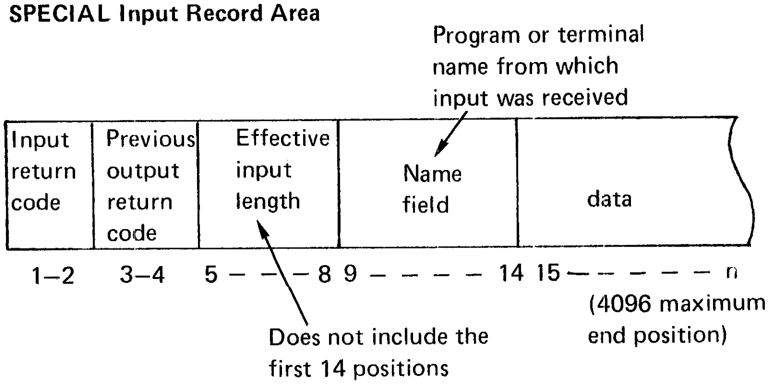
- Operation code (positions 1-4)
- Output length (positions 5-8)
- Symbolic terminal name, CONSOL, program name, or blanks (positions 9-14)

H, D, T, and E output specifications can be used to issued either output or non-I/O operations (such as Release Terminal and Invite Input -- for Invite Input, the maximum input length must be provided in the parameter array). See *Performing CCP Operations with SPECIAL,* later in this chapter, for additional information about setting parameters for various operations.

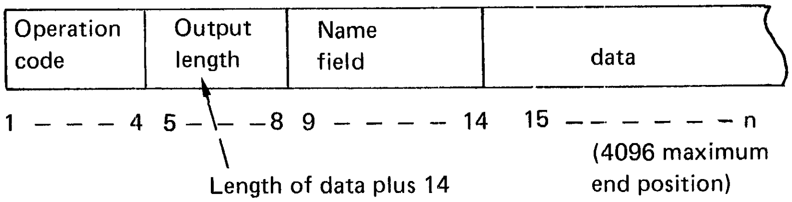
CCP Communications Service Subroutines for SPECIAL

Two SPECIAL file subroutines, SUBR92 and SUBR93, are provided by the CCP for terminal operations. SUBR92 is used for processing all requests for terminal operations. SUBR93 is used only with a "false" SPECIAL file (see *Defining SPECIAL Files*) in order to bypass the record selection part of the RPG II object program cycle so that input operations can be performed in calculations using the RPG II READ operation code. The first entry to SUBR93 returns to your program without data; all subsequent entries to SUBR93 cause the end of the file condition to be set on for the false SPECIAL file.

SPECIAL Input Record Area

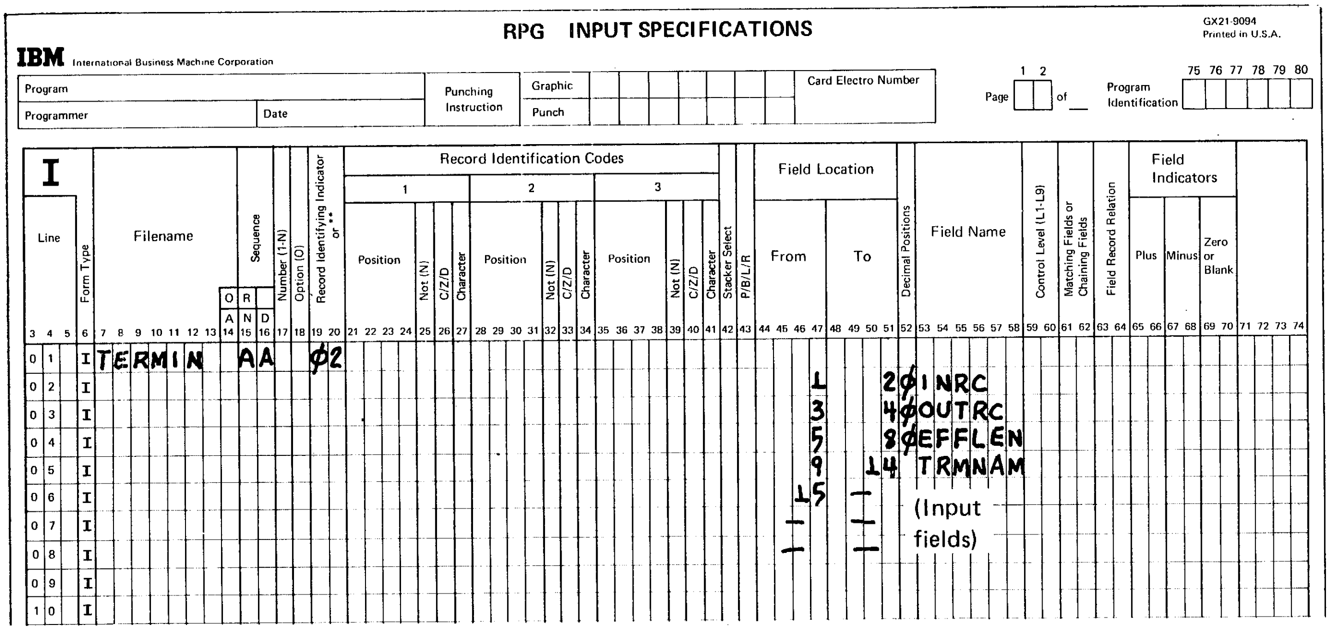


SPECIAL Output Record Area



Note: See *Summary – Performing CCP Operations Using RPG II SPECIAL Files,* later in this chapter, for a summary of the use of record areas.

Figure 6-2. RPG II Communications Record Area Formats for SPECIAL



IBM International Business Machine Corporation

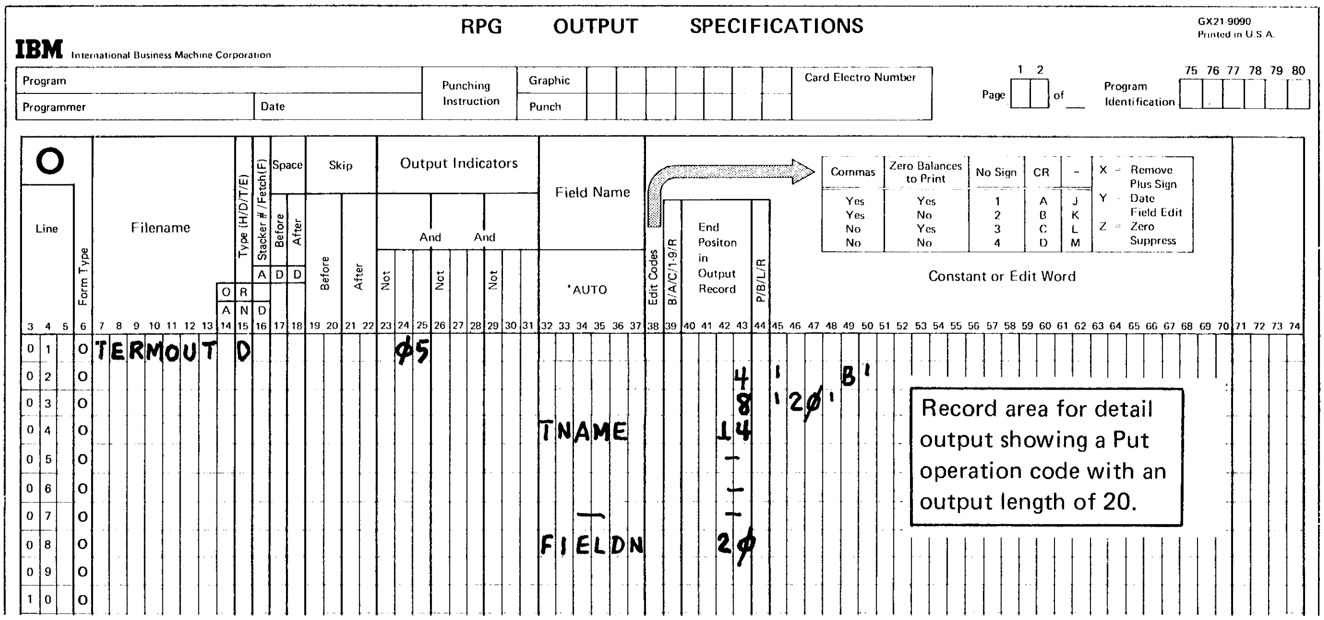
RPG INPUT SPECIFICATIONS

GX21-9094
Printed in U.S.A.

Program
Programmer
Date
Punching Instruction: Graphic / Punch
Card Electro Number
Page ☐☐ of __
Program Identification

Line	Form Type	Filename	Sequence	Record Identifying Indicator	Field Location From	Field Location To	Decimal Positions	Field Name
01	I	TERMIN	AA	02				
02	I				1	2	0	INRC
03	I				3	4	0	OUTRC
04	I				5	8	0	EFFLEN
05	I				9	14		TRMNAM
06	I				15	–		(Input
07	I				–	–		fields)
08	I				–	–		
09	I							
10	I							

Figure 6-3. Input Record Area for SPECIAL



IBM International Business Machine Corporation

RPG OUTPUT SPECIFICATIONS

GX21-9090 Printed in U.S.A.

```
01 OTERMOUT D        05
02 O                                    4 '   B'
03 O                                    8 '20'
04 O                         TNAME     14
05 O                                    -
06 O                                    -
07 O                          -         -
08 O                         FIELDN    20
09 O
10 O
```

Record area for detail output showing a Put operation code with an output length of 20.

Figure 6-4. Output Record Area for SPECIAL

Indicators Reserved for CCP Use

Indicators 91 and 92 are reserved for use in communications operations using the SPECIAL interface.

SUBR92 sets on indicator 91 when an operation results in a negative return code (error condition). SUBR92 sets on indicator 92 when an operation results in a positive (greater than zero) return code (exception conditions) other than a 14 return code (the 14 return code indicates a successful accept operation of the chain request data). You can use these indicators to condition operations in your RPG II program. For example, you could use indicators 91 and 92 to bypass input field moves, calculations, or to execute a subroutine that checks return codes when an error or exception condition occurs on the previous I/O operation, as shown in Figure 6-5.

If indicator 91 is on when SUBR92 receives control to perform an operation, the requested operation is ignored and control is immediately given back to your program.

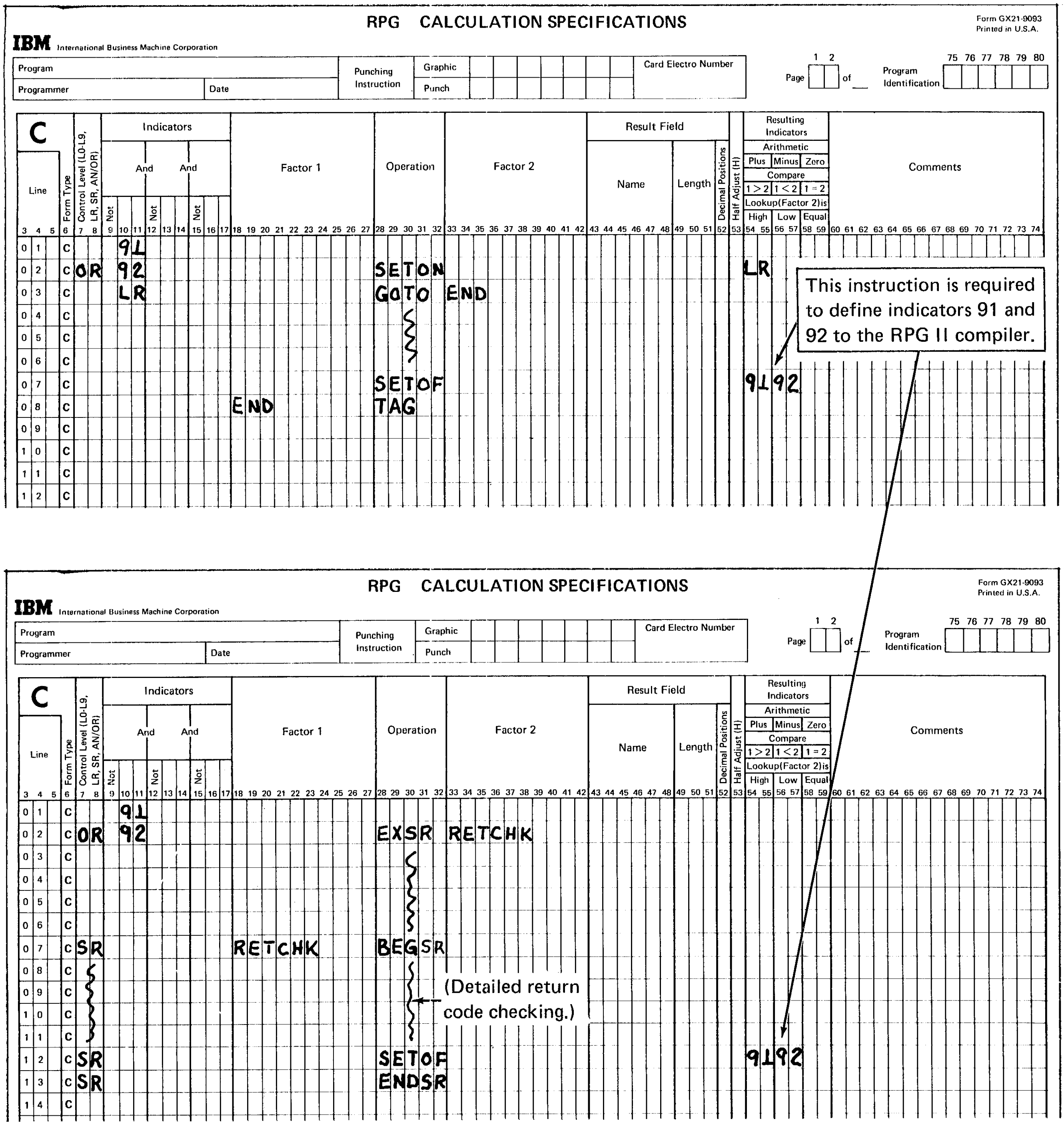
SUBR92 only sets these indicators on. If your program uses indicator 92 to determine whether an exception condition occurred, your program must set indicator 92 off after an exception; otherwise, indicator 92 would remain on until end of job. It is even more important to set off indicator 91, because, if it is already on at the time a communications operation is issued, the operation is *not* performed, and a return code of -91 is given even though the error condition may no longer exist.

DEFINING SPECIAL FILES FOR USE WITH CCP

One or more SPECIAL files can be defined in File Description Specifications for use with the CCP. If you are a beginning user of the CCP, it may be easier for you to define one input and one output file instead of a combined file, until you gain familiarity with the use of RPG II for CCP operations. Combined files, however, are sometimes more economical in their use of main storage and are the only file types allowed with the Put-Then-Get operation. Combined files are more economical of main storage if the size of the input and output are approximately the same. Separate files should be used (possibly sharing the same parameter array) if there is a significant difference (53 or more positions) between the sizes of the two record areas.

Two File Description Specifications are required to define each SPECIAL file to be used with the CCP, a main file statement and a continuation statement. Figure 6-6 shows the valid ways of defining a SPECIAL file. Columns that are unshaded in the figure have valid required or optional entries.

Note: As shown in Figure 6-6, a continuation specification is not required for a "false" SPECIAL file (using SUBR93), since a parameter array is not required.



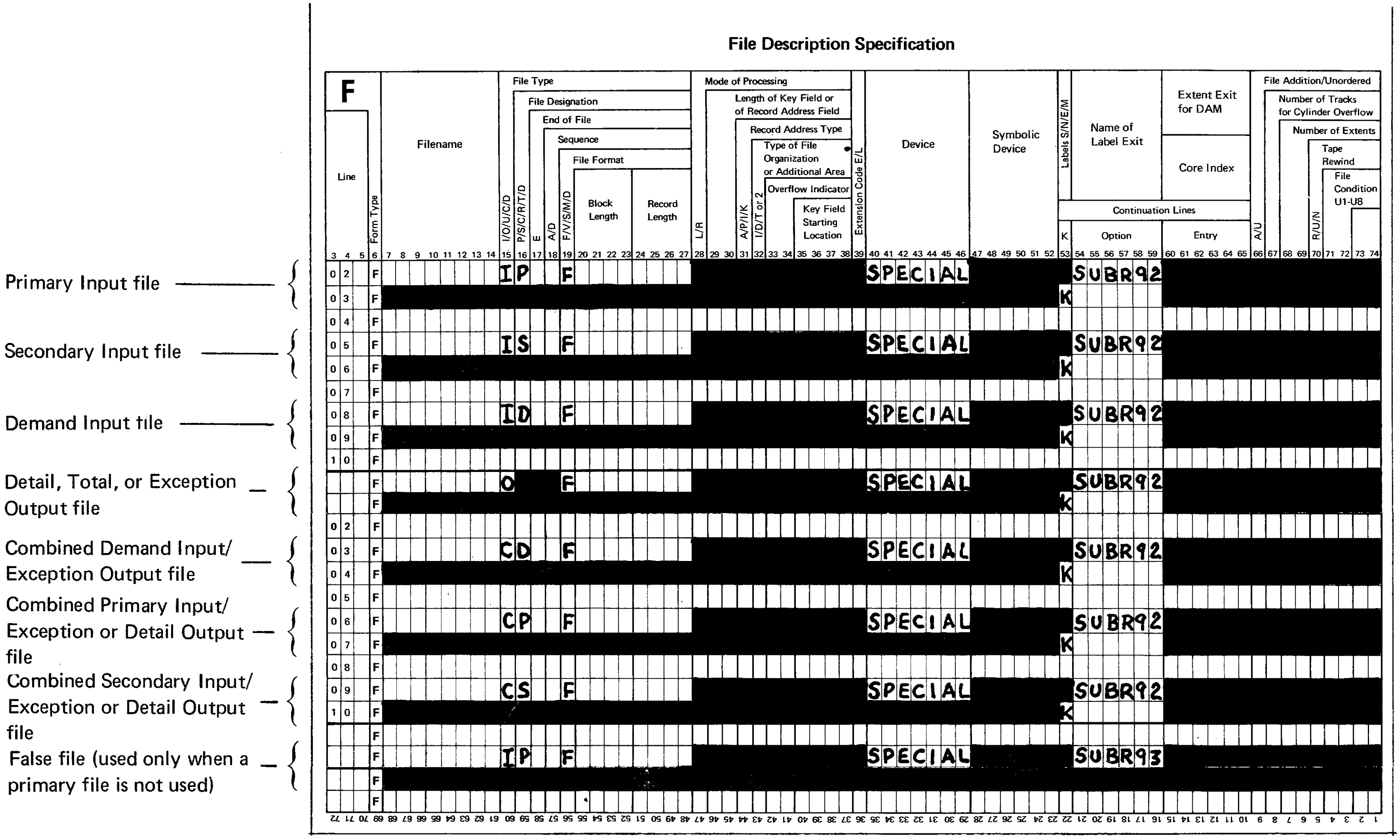
```
01 C   91
02 COR 92                SETON                     LR
03 C   LR                GOTO END
04 C
05 C
06 C
07 C                     SETOF                     9192
08 C           END       TAG
09 C
10 C
11 C
12 C
```

This instruction is required to define indicators 91 and 92 to the RPG II compiler.

```
01 C   91
02 COR 92                EXSR RETCHK
03 C
04 C
05 C
06 C
07 CSR         RETCHK    BEGSR
08 C
09 C
10 C
11 C
12 CSR                   SETOF                     9192
13 CSR                   ENDSR
14 C
```

(Detailed return code checking.)

Figure 6-5. Using Reserved Indicators 91 and 92 (SPECIAL Only)



File Description Specification

Line	Form Type	File Type	File Designation	File Format	Device	K	Name of Label Exit
02	F	I	P	F	SPECIAL		SUBR92
03	F					K	
04	F						
05	F	I	S	F	SPECIAL		SUBR92
06	F					K	
07	F						
08	F	I	D	F	SPECIAL		SUBR92
09	F					K	
10	F						
	F	O		F	SPECIAL		SUBR92
	F					K	
02	F						
03	F	C	D	F	SPECIAL		SUBR92
04	F					K	
05	F						
06	F	C	P	F	SPECIAL		SUBR92
07	F					K	
08	F						
09	F	C	S	F	SPECIAL		SUBR92
10	F					K	
	F						
	F	I	P	F	SPECIAL		SUBR93
	F						
	F						

Figure 6-6. Valid Methods of Defining a SPECIAL File for CCP Operations

Main File Description for SPECIAL

Page and Line (1-5): See *RPG II Reference Manual,* SC21-7504.

Form Type (6): The preprinted character F identifies this as a file description specification.

Filename (7-14): Enter a name for the CCP SPECIAL file. Use this name to refer to the SPECIAL file - *not* to a specific terminal - in subsequent Input, Calculation, and Output Specifications. Rules for forming filenames are given in the *RPG II Reference Manual,* SC21-7504.

File Type (15): I, O, and C are valid entries in this column. See combinations on Figure 6-6 for valid File Type/File Designation entries.

File Designation (16): P, S, D, and *blank* are valid entries in this column. See Figure 6-6 for valid combinations of File Type/File Designation entries.

End of File (17): E is a valid entry with Input and Combined files which are designated as primary or secondary. Leave this column blank if you need not process terminal input data to End of File. When using a false SPECIAL file, set End of File to on during the second and subsequent entries to SUBR93. When using a SPECIAL file with SUBR92, you must set the End of File condition by issuing the Force End of File operation, even though you may have entered an E in this column (see *CCP Operation Codes,* later in this chapter, for an explanation of the Force End of File operation).

Sequence (18): See *RPG II Reference Manual.*

File Format (19): Enter an F or leave blank (RPG II assumes F). Files must be defined as having fixed-length records, even though variable length records can be handled via the CCP (see *Record Length* and index entry *variable length records*).

Block Length (20-23): Enter the same value specified in columns 24-27 (record length), or leave these columns blank. If you specify a block length greater than record length, you will add unnecessary space to your program. Blocking is allowed with BSCA terminals (see index entry *blocking*), but is specified during CCP assignment (see TERMATTR statement in *CCP System Reference Manual*).

Record Length (24-27): Enter a value equal to the maximum size record or message you expect to receive or send, plus 14. The extra positions are required for the input/output parameters and terminal name in the first 14 positions of the record area. (Additional information must be provided in the record area for certain *3270 Display Format Facility* operations – see index entry.) For SUBR93, a record length of *1* is suggested.

Columns 28-39: Leave these columns blank.

Device (40-46): Enter SPECIAL.

Columns 47-53: Leave these columns blank.

Name of Label Exit (54-59): Enter SUBR92 for all SPECIAL files to be used for communicating with terminals. Enter SUBR93 only if you are defining a *false* file in order to bypass RPG II record selection logic when using demand files (see Figure 6-6). See *Programming Examples* later in this chapter for an example of using SUBR93.

Columns 60-74: Leave these columns blank.

Continuation Specification for SPECIAL

A continuation specification must follow each SPECIAL file description, except for a *false* SPECIAL file. The purpose of the continuation line is to associate an array with the SPECIAL file, to be used as a parameter list for communicating with terminals via the SPECIAL file.

Form Type (6): The preprinted character F identifies this as a file description specification.

Columns 7-52: Leave these columns blank.

Column 53: Enter *K* (continuation).

Operation (54-59): Enter the name of the array that is to be used to pass parameters to the subroutine defined in the previous SPECIAL file description. This array must be defined in Extension Specifications.

DEFINING THE PARAMETER ARRAY

One Extension Specification must be provided for each array associated with a SPECIAL file (SUBR92) in File Description Specifications and for each array used with EXIT/RLABL (see *EXIT/RLABL Communications Interface*). You may use one array for both SPECIAL files and EXIT/RLABL processing; EXIT/RLABL subroutines SUBR91 disregards the fifth element.

You can use the same parameter array for more than one SPECIAL file. Whether you use the same array or separate arrays for different SPECIAL files can be determined by which is most convenient for your program.

You can load the parameter array at compilation time, pre-execution time, or during execution (Figure 6-7). Compilation time arrays are most efficient in terms of the amount of RPG II object code generated. You should load the array at compilation time or pre-execution time if it is to be used with a primary or secondary SPECIAL file, so that the proper operation code and maximum input length are in the array when the file is read on the first program cycle. See *RPG II Reference Manual*, SC21-7504, or *RPG II Additional Topics*, GC21-7567, for a complete description of loading and defining arrays.

Note: If the array is a pre-execution time array, the card input device or disk file used to load the array is allocated to the program until end of job. The card device or disk file must be defined on the // PROGRAM assignment statement.

Extension Specifications

Page and Line (1-5): See *RPG II Reference Manual*, SC21-7504.

Form Type (6): The preprinted character E identifies this as an extension specification.

Columns 7-10: Leave these columns blank.

From Filename (11-18): If the array is to be loaded at pre-execution time, enter the name of the file from which it is to be loaded.

Columns 19-26: Leave these columns blank.

Array Name (27-32): Enter the name of an array which is described on a File Description Continuation Specification with a SPECIAL file or which is used as an RLABL following an EXIT operation. Rules for forming array names are given in the *RPG II Reference Manual,* SC21-7504.

Number of Entries Per Record (33-35): Make an entry in these columns only for compilation time and pre-execution time arrays. Enter *005* for arrays used with SPECIAL files and SUBR92; enter *004* for arrays used only with EXIT/RLABL. When loading an array at compilation time or pre-execution time, the entire array must be loaded from a single record. An entry is required in these columns when using primary or secondary files with SUBR92, since you must use a compilation time or pre-execution time array to provide parameters for the first operation.

Number of Entries Per Array (36-39): Enter 0005 for arrays used with SPECIAL files and SUBR92; enter 0004 for arrays used only with EXIT/RLABL.

Length of Entry (40-42): Enter *006*, the length of array elements.

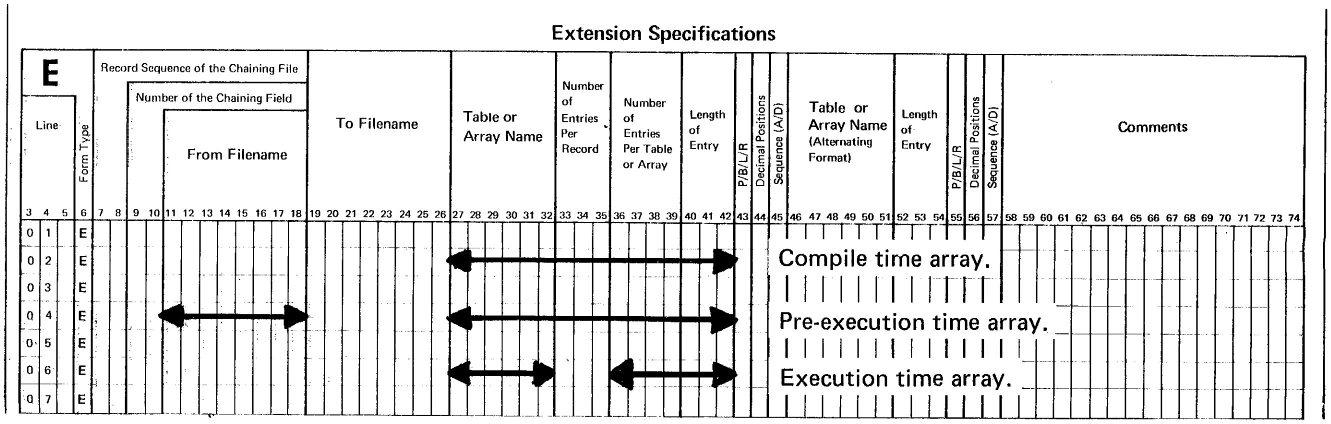


Figure 6-7. Entries Required to Define Parameter Arrays Used with CCP SPECIAL Files and EXIT/RLABL Operations

Columns 43-74: Leave these columns blank. Note that the array must be defined as alphameric.

CCP OPERATION CODES

The RPG II form of the CCP operation codes for SPECIAL and EXIT/RLABL communications operations is composed of two parts. The rightmost two characters of the operation code define the basic operation to be performed. The valid RPG II operation code/modifier combinations are summarized in Appendix D. See *Chapter 8: 3270 Display Format Facility* for additional operations and operation codes that are used only with the DFF.

The valid CCP operation codes for RPG II are:

Code	*Meaning*
00	Shutdown Inquiry
ƀA	Get (For Stop Invite Input see modifier Code D below)
AA	Get and Reverse Interrupt
GA	Force End of File
ƀB	Put
BB	Put Block
DB	Copy (DFF only)
EB	Erase All Unprotected (DFF only)
FB	Put Block – PRUF
CB	Put Message
GB	Put Message – PRUF
ƀC	Combined Put (Record)-Then-Get
CC	Put (Message)-Then-Get
ƀD	Accept Input
ƀE	Invite Input
ƀF	Put-No-Wait
BF	Put-No-Wait Block
CF	Put-No-Wait Message
GF	Put-No-Wait Message – PRUF
ƀH	Get Terminal Attributes
ƀI	Acquire Terminal (with present attributes)
AI	Acquire Terminal (with new attributes)
BI	Acquire a command-mode non-DFF terminal
ƀK	Release Terminal (and release line)
AK	Release Terminal (keep line)
BK	Chain Task Request
CS	Put (Message) with Invite Input
ƀW	Put-No-Wait (Message) with Invite Input

The valid operation modifiers for RPG II are:

Code	*Meaning*
ƀƀ	Perform carriage-returns at start of data and at end of data for MLTA typewriter terminals. (See index entries *new line* and *end line*)
ƀA	Perform a carriage-return at start of data, not at end of data.
ƀB	Perform a carriage-return at end of data, not at start of data.
ƀC	Do not perform carriage-return.
ƀD	Stop an Invite Input for this terminal. This modifier is only valid with the Get operation code, that is 'ƀDƀA'. (See index entry *stop invite input.*)
ƀH	Override (modify) format fields (DFF only -- used with operation codes CB, GB, CF, GF, CS, and ƀW).

Descriptions of the operations listed above are given under *Operations* in Chapter 2 and under *Display Format Facility Operations* in Chapter 8, except for the following three operations, which are used only with the RPG II SPECIAL interface: Force End of File, Put with Invite Input, and Put-No-Wait with Invite Input.

Force End of File (SPECIAL Only)

When using a primary or secondary SPECIAL file, for communications operations, you may need to inform the communications service subroutine (SUBR92) when to set on an end of file indication in order to cause another secondary file to be processed or to cause your RPG II program to perform LR logic. To issue a Force End of File operation, you need only set the operation code in the second array element (if issued as an input operation) or in the output record area (if issued as an output operation).

CCP does not return a return code for this operation. The information in the parameter list is not changed by this operation.

Force End of File cannot be issued using EXIT/RLABL and cannot be issued to the "False" SPECIAL file (SUBR93). The "False" SPECIAL file will be set at end of file after the second access of the file.

Put With Invite Input (SPECIAL Only)

Put with Invite Input is the equivalent of a Put Message operation (treated as Put Record for MLTA terminals) followed by Invite Input to the same terminal. This operation allows you to issue a Put and an Invite Input via H, D, T, or E output specifications in a single operation. To issue this operation, place the maximum input length for the Invite Input into the fourth element of the parameter array (if not there already) and place the following parameters in the output record area:

- Operation code 'ƀƀCS' ('ƀHCS', if DFF overrides are being put)
- Output length for the Put
- Symbolic terminal name

If Put with Invite Input is being issued at detail output time, the operation code for Accept Input ('ƀD') must be placed in the second element of the parameter array prior to issuing the Put. This allows the program to accept data at the next input time in the RPG II cycle.

The CCP places the return code for this operation in the parameter list and sets on indicator 91 or 92 if an error or exception condition results from the operation. The return code and indicators reflect only the result of the Put portion of the operation. If indicator 91 is on after the operation, the Invite Input (and Accept Input, if issued) will have been ignored and a -91 return code returned to your program.

When you want to Put a message to a terminal and Invite additional input from the terminal, you can save coding and possibly save an unnecessary pass through the RPG II logic cycle by using Put with Invite Input.

Put-No-Wait With Invite Input (SPECIAL Only)

The function and use of Put-No-Wait with Invite Input are the same as Put with Invite Input, except that after the CCP has accepted the operation, your program does not wait for, and does not receive a return code. The operation code is 'ƀƀƀW' ('ƀHƀW', if DFF overrides are being put).

If indicator 91 is on after the operation, the Invite Input (and Accept Input, if issued) will have been ignored and a -91 return code returned to your program.

PERFORMING CCP OPERATIONS WITH SPECIAL

Performing a CCP communications operation using SPECIAL involves one or more of the following steps. The specific steps required depend on which operation is being issued and whether the operation is issued as an input operation (primary, secondary, or demand input) or an output operation (H, D, T, or E output):

1. Set the parameters for the operation in the proper location in the parameter array (input) or record area (output).
2. Specify the name of the program for a chain task request or the symbolic terminal name for the operation, if required, in the parameter array (input) or record area (output).
3. Place any data to be transmitted in the record area (output operations).
4. Issue the operation during output or input time in the RPG II program cycle (via Output or Input specifications) or, if demand input or exception output are used, issue a READ or EXCPT operation in calculations to perform the operation.

5. Check the result of the operation by testing the return code and/or using indicators 91 and 92.

6. Examine and/or process other returned information, such as the effective input length (if a data truncated return code is received), symbolic terminal name, and input data.

Operations that involve transfer of either input or output data are restricted to being issued either as input or output operations, since either an input or output record area must be provided. The following operations must be issued as primary, secondary, or demand input operations via a SPECIAL input or combined file:

- Get
- Accept Input
- Stop Invite Input (may result in a Get)
- Get Attributes

The following operations must be issued as output operations, using H, D, T, or E Output Specifications via a SPECIAL output or combined file:

- Put
- Put-No-Wait
- Put with Invite Input
- Put-No-Wait with Invite Input
- Copy (DFF)
- Chain Task Request
- Erase All Unprotected (DFF)

The following operations can be issued as either input or output operations, since they do not result in transfer of data:

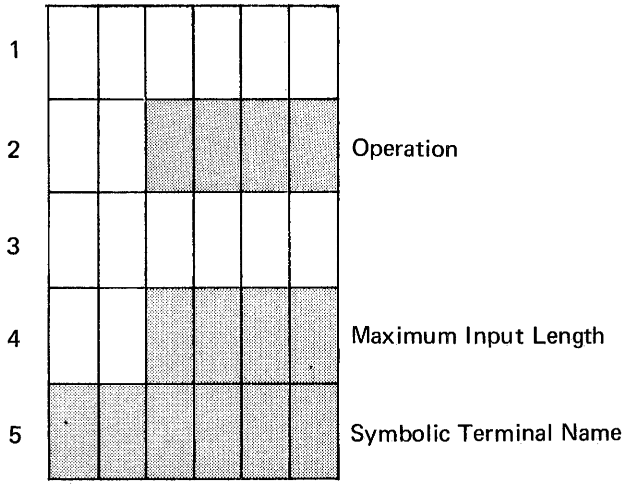
- Acquire Terminal
- Invite Input
- Shutdown Inquiry
- Force End of File
- Release Terminal

Of these operations, Acquire Terminal, Invite Input, and Shutdown Inquiry are most logically issued as output operations; Force End of File is most logically issued as an input operation. (See *Non-I/O Operations*, later in this section.)

The Put-Then-Get operation, which can be used only with combined SPECIAL files, is both an input and output operation and requires both an input and an output record area (see *Put-Then-Get Operation*, later in this section).

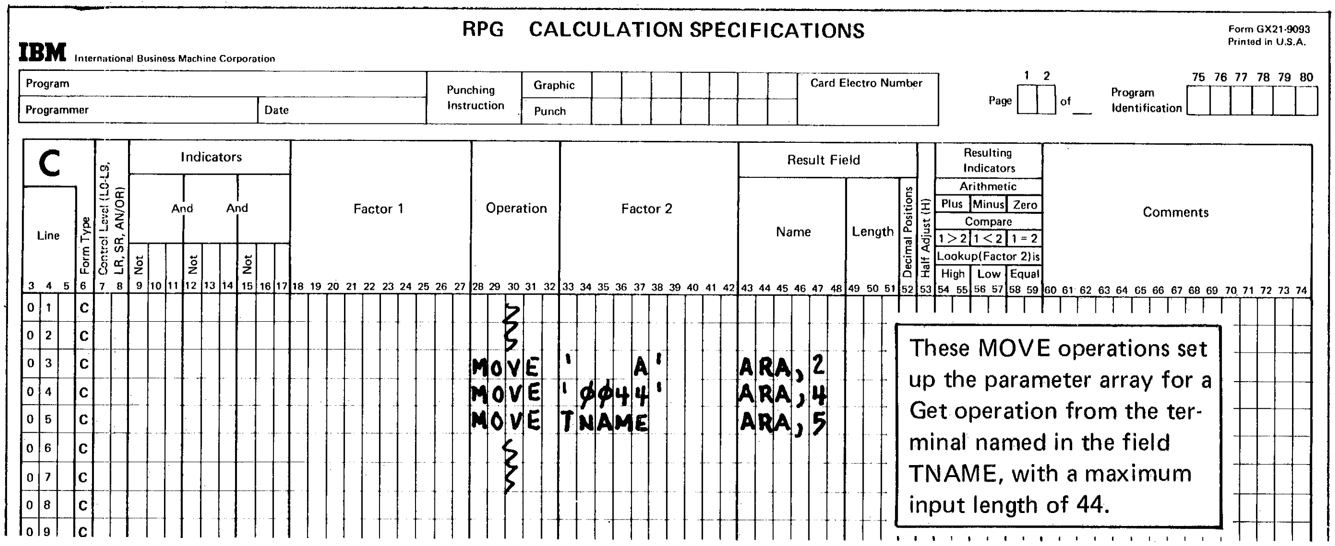
Performing CCP Operations Using Primary, Secondary, or Demand Input

To cause an operation to be performed during primary, secondary, or demand input time in the RPG II program cycle, provide an input record area in the appropriate format (Figure 6-2 and 6-3) and place the following information in the parameter array:



When using a primary or secondary SPECIAL file, this information must be placed in the array prior to the first read from the file. Therefore, you should load the array at either compilation time or pre-execution time with the appropriate information for the first operation. For subsequent operations from the file, if any of the array contents must be changed, they can be reset in calculations, as shown in Figure 6-8.

In some applications, it is not convenient to perform input operations at primary or secondary input time in the RPG II cycle. Using a demand file, you have more control over when the file is read, since you cause the file to be read whenever you issue the READ operation in calculations. Therefore, demand files are more flexible for communicating interactively with terminals.



```
0 3 C                     MOVE '   A'      ARA,2
0 4 C                     MOVE '0044'      ARA,4
0 5 C                     MOVE TNAME       ARA,5
```

These MOVE operations set up the parameter array for a Get operation from the terminal named in the field TNAME, with a maximum input length of 44.

Figure 6-8. Setting the Parameter Array Contents for a Primary, Secondary, or Demand Input Operation

If the file is used for a series of operations, you may not need to modify all parameter array elements for every operation.

Operation Code

In setting or modifying the operation code, you can avoid having an invalid operation code/modifier combination by always moving both parts of the operation code into the parameter array, as is done in Figure 6-8. (See *Put-Then-Get Operation,* later in this section, for special considerations.)

Maximum Input Data Length

For operations that can result in input data being received in the input record area (Get, Accept Input, Get Attributes, and Stop Invite Input), set the fourth element of the parameter array to indicate the maximum amount of data you expect from a terminal, including device control characters your program handles (see index entry *device control characters*) and including the 14 characters reserved in the record area for CCP use. The maximum number you can enter is 4096.

For the Get Attributes operation, set the value of the fourth array element to 35, the length of the attributes data (21) plus the required information in the first 14 positions of the record area.

This element of the parameter array is never modified by the CCP; therefore, as long as your maximum input length remains the same, you need not reset this element.

Symbolic Terminal Name

You must place the symbolic terminal name (or blanks) in the fifth array element when you issue one of the following operations at primary, secondary, or demand input time:

- Get
- Invite Input
- Stop Invite Input
- Get Attributes

You can use blanks in the fifth array element for these operations only in *single requesting terminal (SRT) programs* (see index entry). When you use a blank terminal name, the CCP returns the name of the terminal that requested the program in the input record area and in the parameter array after the operation.

You need not specify a name for the Accept Input operation; however, after the operation, the CCP places the name of the program or terminal from which the input data was received in the fifth element of the parameter array and in the record area.

See *Put-Then-Get Operation,* later in this section, for special considerations.

Testing the Return Code

After any CCP operation, you should test the return code to determine the result of the operation, since the result may require special actions in your program. If the operation resulted in an error condition (negative return code) or exception condition (positive return code), you might either take specific actions in your program or inform the system operator of the condition by issuing a message to the console.

The CCP places the return code for input operations issued at primary, secondary, or demand input time in the first two positions of the input record area as well as in the middle two positions of the first element of the parameter array (see Figures 6-1 and 6-2). The return code for the last output operation is available in positions 5-6 of the first array element and in positions 3-4 of the input record area. Also, the CCP sets on indicators 91 and 92 for error and exception conditions, respectively (see *Indicators Reserved for CCP Use*). Thus, you can test return codes in a variety of ways:

- Using Calculations to test the contents of the return code field in the input record area.
- Using indicators 91 and 92 to condition operations in Calculations and to condition output lines (Figure 6-5).
- Using record identification codes or field indicators on Input Specifications.

Figure 6-9 shows an example of testing the return code for plus, minus, or zero by means of a compare operation and resulting indicators. If you wish, you can test for the exact return code to determine which exception or error condition occurred and take appropriate action. Return codes and recommended program actions are summarized in Appendix E.

If indicator 91 is on when any input operation is requested, the operation is ignored by SUBR92 and a return code of -91 is returned (appears as 9J). This return code may be used to prevent blanking out of previous input fields (see Figure 6-10).

Figure 6-10 shows how indicators may be set on for input operations with SPECIAL files to indicate record type, normal completion, error or exception return code. In this example, the record *NAM* is read with indicator 01; the record ADR is read with indicator 02. If there is not a normal completion of the input operation, indicator 03 is on, the return code is moved into a two-character numeric field (RTNCOD) for more detailed testing in calculations.

Special considerations are involved when you use the input return code from positions 3 and 4 of the first element of the array. If the correct sequence of operations is not followed, the sign of the input return code can be lost. The procedure requires that the first element be moved into a four-position alphameric field via a MOVEL instruction, and that the same four-position field be moved into a two-position field via a MOVE instruction. The two-position field then contains the input return code with the correct sign.

Although it is possible to do preliminary return code checking using the method shown in Figure 6-10, that method is not recommended, since it is much easier to detect positive and negative return codes using indicators 91 and 92.

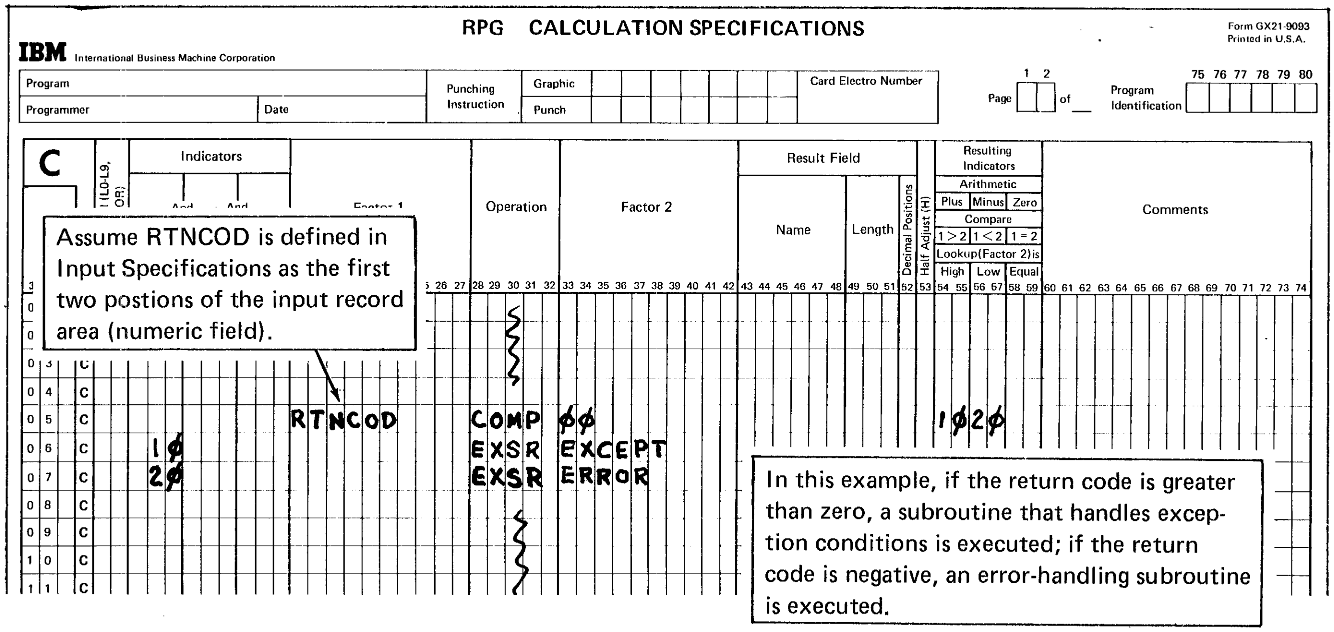
Examining the Effective Input Length

On SPECIAL input operations, the CCP returns the effective input length in positions 5-8 of the input record area (Figure 6-2). This value includes only the actual length of data available to your program and does not include the 14 characters preceding the data in the record area or the length of truncated data. The input data begins in position 15 of the record area.

After you have issued an input operation, you can examine the effective input length, for example, to verify that the terminal entered a required number of characters, in order to detect erroneous input. You might also use the value of the effective input length as the limiting value in a routine that scans the input data.

The effective input length may be equal to or less than the maximum input length you specified for the operation, depending on the actual amount of data transmitted to your program by a terminal. If the terminal transmits more data than the maximum you specified, the excess data is truncated and your program receives a "data truncated" return code. (See index entry *data truncated, special use in DFF,* for a special meaning of the data truncated return code.)

Contents of the effective input length field for each operation code and return code is summarized in Appendix E (Table E-7).



Assume RTNCOD is defined in Input Specifications as the first two postions of the input record area (numeric field).

Line	Form Type	Indicators	Factor 1	Operation	Factor 2	High	Low
05	C		RTNCOD	COMP	00	10	20
06	C	10		EXSR	EXCEPT		
07	C	20		EXSR	ERROR		

In this example, if the return code is greater than zero, a subroutine that handles exception conditions is executed; if the return code is negative, an error-handling subroutine is executed.

Figure 6-9. Using Calculations to Test the Return Code in the SPECIAL Input Record Area

Examining a Returned Name

For the Accept Input operation and for operations issued with a blank name field, CCP returns the program name or a symbolic terminal name to your program (see index entry *operations*). For all operations issued at primary, secondary, or demand input time, the CCP places this name in positions 9-14 of the input record area. You may need to examine this name to determine which program or terminal is communicating with your program.

For example, in a *multiple requesting terminal (MRT) program* (see index entry), you should examine the terminal name you receive from an Accept Input operation in order to determine if the terminal is a new requester or if it is already attached to your program. If the terminal is a new requester, you might move the terminal name to a save area. If the terminal has previously provided input to your program, you may need to associate new data with data previously received by comparing the terminal name with a saved terminal name. *Example 2* under *Programming Examples* shows an example of examining the terminal name after an Accept Input operation.

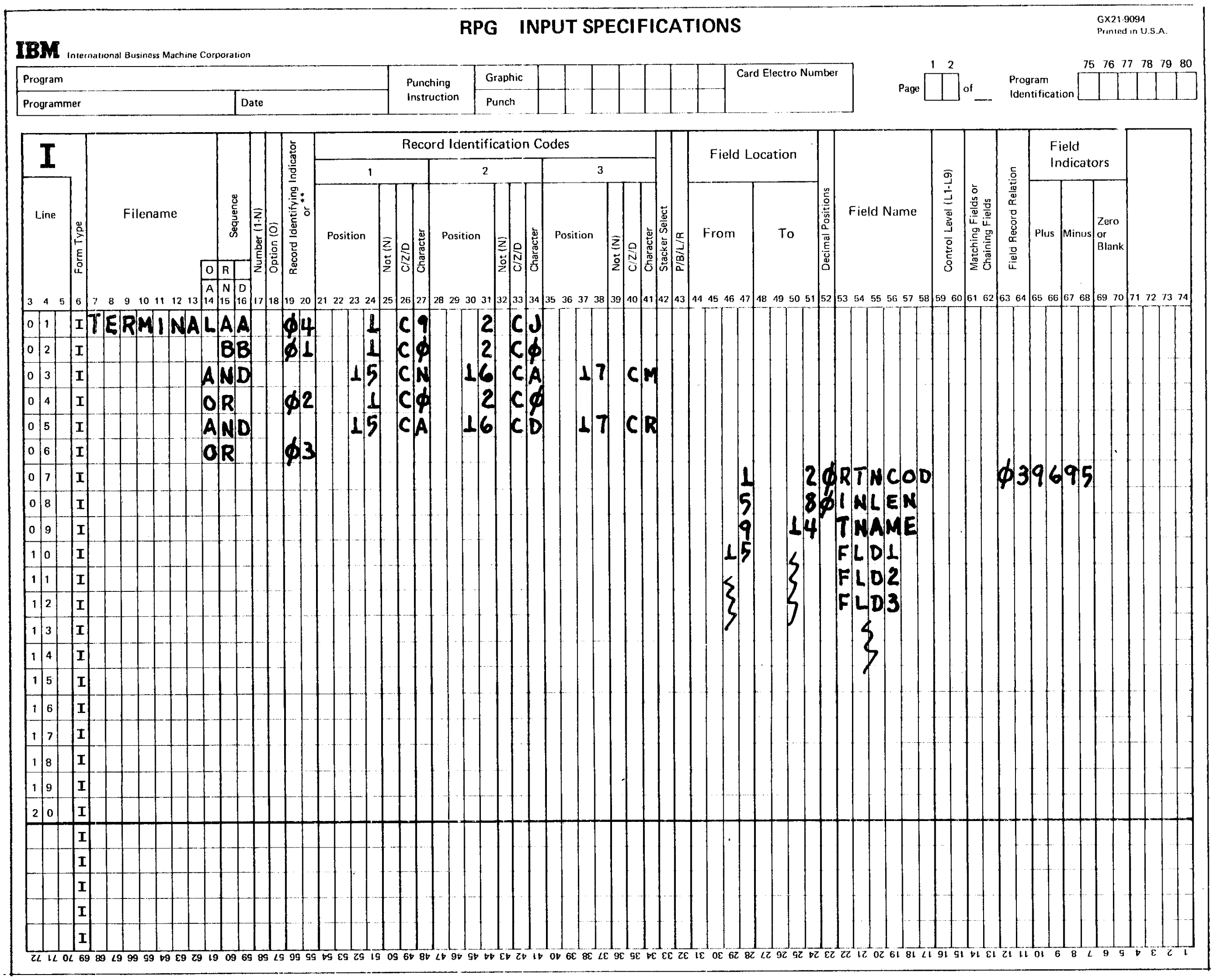
If a program can be requested from both a terminal and another program using the Chain Task Request operation, you may want to determine how the program was requested. This can be accomplished by checking for a 14 return code, indicating a Chain Task Request operation. This information is useful if a program communicates with the requestor since your program cannot communicate with a chain task requesting program.

Performing CCP Operations Using Heading, Detail, Total or Exception Output

When issuing CCP output operations at H, D, T, or E output time via a SPECIAL output or combined file, you must place the operation code, output length, and the program or terminal name in the output record area, as shown in Figures 6-2 and 6-4.

The output length for SPECIAL output operations includes the 14 positions required in the record area for the operation code, output length, and terminal name. This length also includes device control characters you are inserting yourself and the special information required for certain 3270 DFF operations. Thus, the value of the highest end position used on the Output Specifications should be used as the output length. The maximum length is 4096.

After an operation is performed at H, D, T, or E output time, the CCP places the return code in positions 5-6 of the first element of the parameter array (Figure 6-1). You can easily test the return code for a positive or negative value by using indicators 91 and 92 (see *Indicators Reserved for CCP Use,* earlier in this chapter). In order to test for a specific return code value, however, you must move the contents of the first array element to a two-position numeric field. Figure 6-11 shows how these methods can be used in combination to test the return code. See *Programming Examples,* later in this chapter, for additional examples of testing return codes.



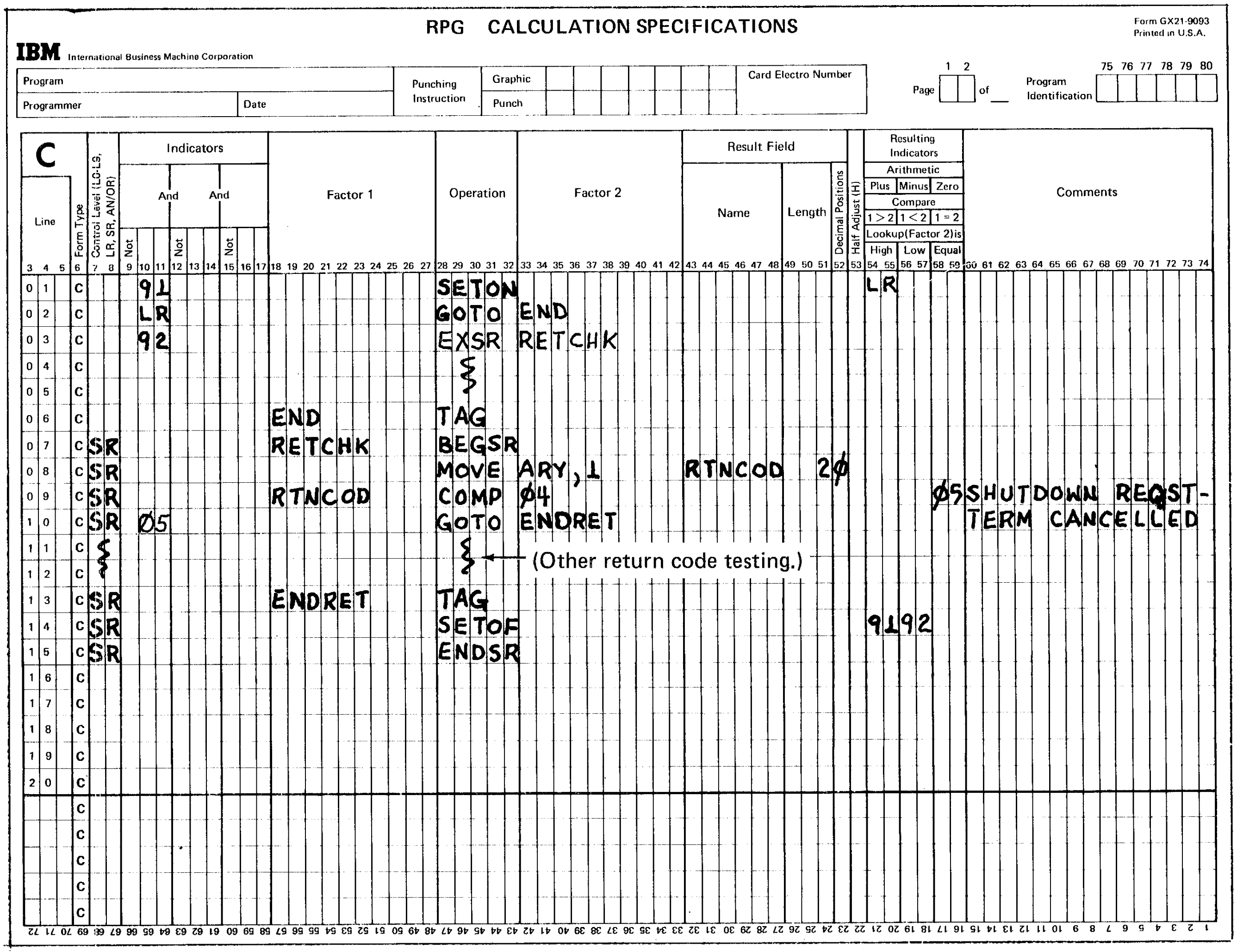
```
01 ITERMINALAA  04   1 C9   2 CJ
02 I        BB  01   1 C0   2 C0
03 I       AND      15 CN  16 CA  17 CM
04 I       OR   02   1 C0   2 C0
05 I       AND      15 CA  16 CD  17 CR
06 I       OR   03
07 I                                        1   20RTNCOD      039695
08 I                                        5   80INLEN
09 I                                        9  14 TNAME
10 I                                       15     FLD1
11 I                                              FLD2
12 I                                              FLD3
13 I
14 I
15 I
16 I
17 I
18 I
19 I
20 I
   I
   I
   I
   I
   I
```

Figure 6-10. Testing the Return Code on Input Specifications (SPECIAL Input Operation)

When performing operations via H, D, T, or E output, you need only use the parameter list in the following cases:

- To test the return code in positions 5-6 of the first element after the operation.
- To check the count of outstanding Invite Inputs in the third array element after issuing a Release Terminal operation at output time.
- To specify the maximum input length value in the fourth element when issuing an Invite Input operation at output time (see *Non-I/O Operations,* later in this section).
- On SPECIAL output operations issued with a blank terminal name (valid for SRT programs only), the CCP returns the name of the requesting terminal in the fifth element.

Note: If a valid terminal name is given in the output record area for a SPECIAL output operation, any name in the fifth element of the parameter array is not modified.



RPG CALCULATION SPECIFICATIONS

```
  010C   91                SETON                     LR
  020C   LR                GOTO END
  030C   92                EXSR RETCHK
  040C
  050C
  060C           END       TAG
  070CSR         RETCHK    BEGSR
  080CSR                   MOVE ARY,1     RTNCOD  20
  090CSR         RTNCOD    COMP 04                      05SHUTDOWN REQST-
  100CSR 05                GOTO ENDRET                    TERM CANCELLED
  110C
  120C
  130CSR         ENDRET    TAG
  140CSR                   SETOF                     9192
  150CSR                   ENDSR
```

(Other return code testing.)

Figure 6-11. Example of Return Code Testing After a SPECIAL Output Operation

Exception Output

To perform exception output to a specific terminal (via a SPECIAL output or combined file), place the appropriate operation code, output length, and program or terminal name in the output record area (Figure 6-2 and 6-4), and issue the EXCPT operation in calculations. If the program or terminal name is less than six characters long, it must be left-justified and padded with blanks in the name field of the output record area.

Exception output enables you to check the return code in calculations immediately after performing the EXCPT operation.

If you are sending multiple lines of output to one terminal, or single lines to more than one terminal during any one EXCPT operation, you can check the return code for only the last operation (last line of output). Therefore, it is suggested that one output record be sent to only one terminal by each EXCPT operation. This can be controlled through the use of indicators.

See *Programming Examples, Example 2,* later in this chapter, for examples of exception output.

Heading, Detail or Total Output

In general, using H, D, or T output to issue CCP operations is similar to using exception output, in that the operation code, output length, and terminal name are placed in the output record area rather than in the parameter array and several lines of data can be sent to the same or different terminals on each program cycle.

You must be aware that when you send several lines of output to the same SPECIAL output file using H, D, or T output, the return code in the parameter list applies only to the last output line. Therefore, you have no way of knowing when an exception condition occurred on output lines previous to the last output line. Also, when an error occurs, you have no way of knowing on which output line the error occurred.

See *Programming Examples, Example 1,* and the *MRT Programming Example Using the Display Format Facility* in Chapter 8 for examples of H, D, and T output lines.

Put-Then-Get Operation

The Put-Then-Get operation must be issued with a combined SPECIAL file. The operation is not actually performed via SUBR92 until the input part of the combined operation is performed.

Combined Demand Input/Exception Output File

Perform the Put-Then-Get operation as follows:

1. Place the maximum input length in the parameter array.
2. Place the following information in the output record area:
    - Put-Then-Get operation code (positions 1-4)
    - Output length (positions 5-8)
    - Symbolic terminal name (positions 9-14)
3. Issue an EXCPT operation.
4. Issue a READ operation.

After you issue the READ operation, the input data is available in the input record area. You need not provide a terminal name or operation code in the parameter array for the READ, since SUBR92 assumes that the first input operation for a combined file following the Put part of a Put-Then-Get to the file is the Get part of the operation from the same terminal.

When issuing a Put-Then-Get to a terminal using EXCPT and READ, you may do output to other terminals after doing the output part of the combined operation. If successive Put-Then-Get operations are performed to the same or different terminals using the same SPECIAL file before doing the input part of the combined operation, then only the last output will be sent to the terminal.

See *Programming Examples, Example 2,* for an example of using READ and EXCPT to issue a Put-Then-Get operation.

Combined Primary or Secondary Input/H, D, or T Output File

You can also issue a Put-Then-Get operation using H, D, or T output and primary or secondary input with a combined SPECIAL file. Place the maximum input length in the parameter array for the combined SPECIAL file. Place the following information in the output record area:

- Put-Then-Get operation code (positions 1-4)
- Output length (positions 5-8)
- Symbolic terminal name (positions 9-14)

The input data from the Put-Then-Get is available in the input record area after Primary or Secondary input in the RPG II cycle. You need not provide a terminal name or operation code parameter array for the input part of the combined operation, since SUBR92 assumes that the first input from the file is the input part of the operation for the same terminal.

Considerations for performing other output operations after the output part of the combined operation and for performing successive Put-Then-Get operations are the same as described for EXCPT and READ.

Testing the Return Code After a Put-Then-Get

The return code from a Put-Then-Get is placed in positions 3-4 of the first array element. Positions 5-6 of the first array element will be zero if the last output operation was the Put part of this combined operation. If an error condition resulted from the operation (this can be determined using indicator 91) you can determine whether the error occurred on the Put or on the Get by testing the value in the third array element. If this value is the same as the output length specified for the Put-Then-Get, then the error occurred on the Put portion of the operation (the Get was not performed). If the value of the third array element is different from the output length specified for the operation, then the error occurred on the Get.

Note Concerning the Use of Put-Then-Get

The typical use for Put-Then-Get is to issue a message to the system operator (CONSOL) and receive instructions. In an MRT program, the need to modify the parameter list can be minimized by initializing the array for the combined file with the 'ƀƀƀD' operation code (Accept Input), a blank terminal name, and the maximum input length used by the program. Thus, when the Put-Then-Get operation is issued, the array need not be modified in order to continue with normal operation, since the Put-Then-Get operation code was given in the output record area.

Non-I/O Operations

Non-I/O operations can be issued at either input time (primary, secondary, or demand) or at output time (H, D, T, or E), since they do not result in transfer of data to or from your program. The non-I/O operations are:

- Acquire Terminal
- Release Terminal
- Invite Input
- Shutdown Inquiry
- Force End of File

When issued via SPECIAL files, Acquire Terminal, Release Terminal, Invite Input, and Shutdown Inquiry are most logically issued as output operations; Force End of File is most logically issued as an input operation.

When you issue non-I/O operations at input time using SPECIAL files, you must provide a "dummy" input specification to avoid getting an UNIDENTIFIED RECORD halt, since RPG II assumes that valid data is contained in your input record area after the operation. See *Programming Examples, Example 2,* for an example of a "dummy" input specification.

While all of the non-I/O operations can be issued using SPECIAL files, it is also convenient to use EXIT/RLABL for these operations, since no input or output record area is required and there is no requirement for RPG II to move input or output fields. You must be aware, however, that using both SPECIAL and EXIT/RLABL for CCP operations increases the main storage requirement of your program. This can be an important consideration in some cases.

SUMMARY – PERFORMING CCP OPERATIONS USING RPG II SPECIAL FILES

(see notes on opposite page)

INPUT RECORD AREA

Input Return Code	Output Return Code	1. Effective Input Length 2. #Outstanding Invite Inputs	Program or Symbolic Terminal Name	Data
I_4	I_5	I_3	I_7	I_6
1 2	3 4	5 8	9 14	15

PARAMETER ARRAY

Return Code	Operation Code/ Modifier	1. Effective Input Length 2. Attributes ID 3. #Outstanding Invite Inputs	Maximum Expected Input Length	Program or Symbolic Terminal Name
I_4 I_5	I	I_3	I_1	I_2
O_4 O_3	O_4	O_5	O_4	O_6

OUTPUT RECORD AREA

Operation Modifier	Operation Code	1. Output Length 2. Attributes ID	Program or Symbolic Terminal Name	Data
O		O_1	O_2	O_7
1	4	5 8	9 14	15

Operations Issued at Input Time

Information Supplied by Programmer:

I Place the operation code here before issuing the operation. *Exception:* On a Put-Then-Get operation, this element is disregarded on the Get portion of the operation. Upon completion of the operation, this element remains unchanged.

I_1 Place the maximum expected input length here before issuing the operation (includes the first 14 positions in the record area). Upon completion of the operation, this element remains unchanged.

I_2 Place the symbolic terminal name here prior to issuing the operation. *Exception:*

1. Accept Input -- contents are ignored by the CCP
2. Blanks - CCP assumes the requesting terminal (SRT programs)
3. Shutdown Inquiry -- contents are ignored by the CCP

This element is changed after Accept Input or a blank terminal name is used. *Exception:* When a Put-Then-Get is issued with a blank terminal name, the name of the requesting terminal is returned only in positions 9-14 of the input record area.

Information Returned by CCP:

I_3
1. Contains the effective input length (not including the first 14 positions), after an input operation (Get, Accept Input, Put-Then-Get, Get Terminal Attributes, and Stop Invite Input that fails to stop input.)
2. Contains the count of outstanding Invite Inputs when:
   a. A Release Terminal operation is issued
   b. A 08 return code was received

I_4 Input operation return code.

I_5 Return code from the last output operation using this array.

I_6 If the 3270 Display Format Facility is used, position 15 contains the AID character, except when data is received with the program request on systems *without* Program Request Under Format (PRUF).

I_7 After an Accept Input operation, Put-Then-Get operation, or an operation issued with a blank terminal name, the CCP returns a symbolic terminal name or for an Accept Input in a program loaded by a Chain Task Request, the name of the program that issued the Chain Task Request operation in these positions.

Operations Issued at Output Time

Information Supplied by Programmer:

O Place the operation code here prior to issuing the operation.

O_1 Place the output length here for output operations (include the first 14 positions of the record area). Place the attributes identifier here for Acquire terminal with Set Terminal Attributes modifier. CCP ignores the contents of this field for Release Terminal, Invite Input, Shutdown Inquiry, and Acquire Terminal without Set Terminal Attributes modifier.

O_2 Place the requested program name, the symbolic terminal name, blanks, or CONSOL here. This entry is ignored for Shutdown Inquiry.

Information Returned by CCP:

O_3 Output operation return code.

O_4 These elements are unchanged after the output operation. Place the maximum input length in the fourth array element prior to issuing Invite Input, Put with Invite Input, Put-No-Wait with Invite Input, and Put-Then-Get.

O_5 After the Release Terminal operation, this element contains the count of outstanding Invite Inputs.

O_6 CCP returns the symbolic terminal name in this element after operations issued with a blank terminal name, except Put-Then-Get. On Put-Then-Get operations issued with a blank terminal name, CCP returns the symbolic terminal name in positions 9-14 of the input record area after the Get portion of the operation is performed.

O_7 If the Display Format Facility is used, positions 15-20 contain the format name for the Put Message operation; position 15 contains the Write Control Character for the Put Overrides operation.

EXIT/RLABL COMMUNICATIONS INTERFACE

All of the CCP operations described under *Operations* in Chapter 2 can be performed using EXIT/RLABL. CCP provides four subroutines for use with EXIT: SUBR91, which can be used for all communications operations including task chain request operations; SUBR90, which can be used to move fields to or from a record area; SUBR87, which is used to issue Chain Task Request operations only; and SUBR88, which is used to accept both program request and chain task data. SUBR87 and SUBR88 are best suited for programs that are primarily used for task chaining operations.

Note: You must not use SPECIAL subroutines SUBR92 and SUBR93 with EXIT/RLABL.

Parameter Array

As with the SPECIAL interface, you must place the parameters for an operation in a parameter array. The format of the parameter array for EXIT/RLABL (Figure 6-12) is the same as for SPECIAL, except as follows:

- CCP always places the return code from an operation in positions 5-6 of the first array element, not in the record area.
- The program name or the symbolic terminal name is always in the record area. Therefore, you may define an array of four elements if you are using the array only for EXIT/RLABL. You can use the same array for both SPECIAL and EXIT/RLABL if the array has five elements.

The Extension Specifications for defining parameter arrays are described in *Defining the Parameter Array,* previously in this chapter.

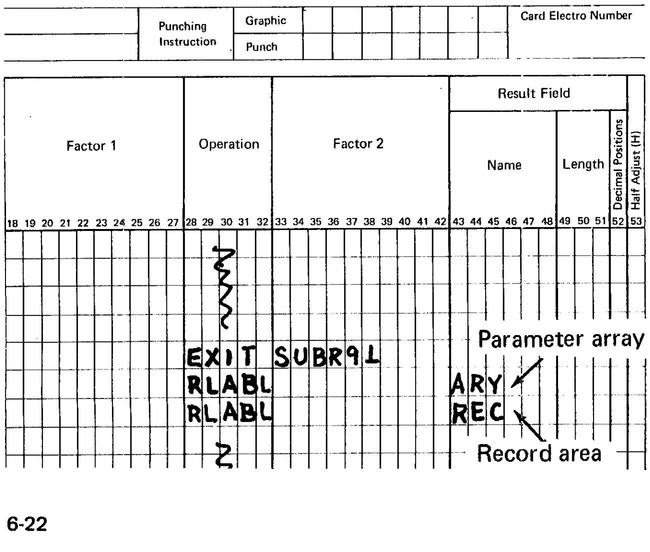
Record Area

The record area for communications operations using EXIT/RLABL must be defined by an RLABL in calculations (see *EXIT to SUBR91*). The record area (Figure 6-13) consists of the name field and a data area. Note that the format is different from the record area for SPECIAL.

EXIT to SUBR91

The linkage to SUBR91 to perform a CCP operation involves an EXIT operation followed by two RLABLs, as follows:

RPG CALCULATION SPECIFICATIONS

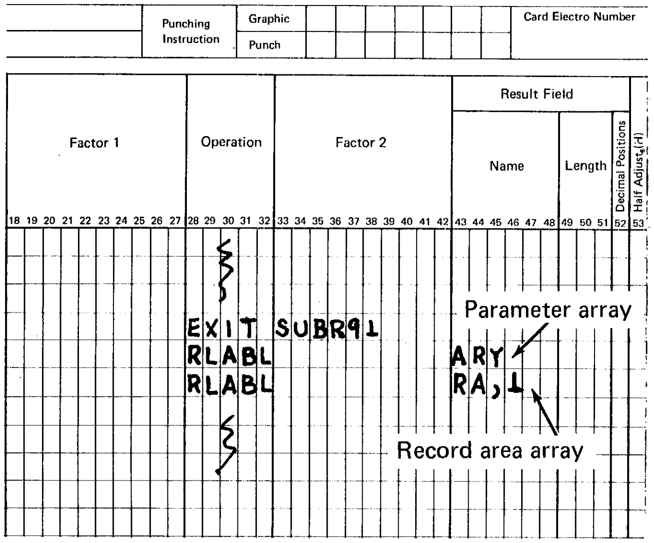


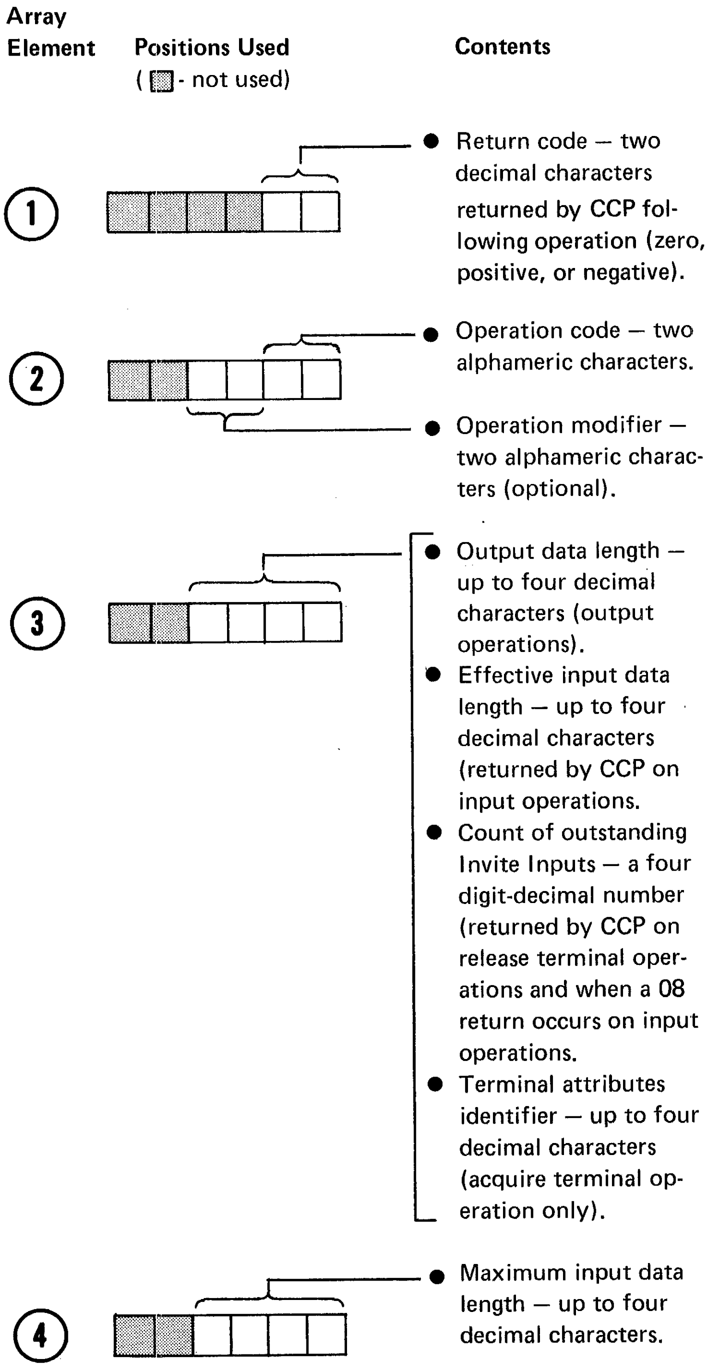
The first RLABL is the name of an array (ARY, for example) which is used as a parameter list by SUBR91. It may be the same array as used for a SPECIAL file, except that the fifth element is not used. See *Defining the Parameter Array*, earlier in this chapter.

The second RLABL is the record area. The first six positions of this area must contain the program name or the symbolic terminal name for which an operation is intended, followed immediately by the data to be sent or received to or from a terminal. Since this data may consist of many fields, the CCP provides another EXIT subroutine, SUBR90, to move fields to or from the record area (see *EXIT to SUBR90*).

The size of the record area should be large enough to contain the maximum amount of data to be sent or received plus the six characters for the name field. If the largest amount of data to be sent or received is greater than 256 (including the name field, then an array must be defined for this area, since the maximum size of an RPG II alpha field is 256. Thus, if 800 characters are needed (for example with a 3270 Display) plus the symbolic name (a total of 806), an array could be defined containing four elements of 202 characters each. This would create a contiguous area of core of 808 bytes, which is large enough. If an array is defined as the record area for EXIT/RLABL linkage, the second RLABL must be a reference to the first element of the array:

RPG CALCULATION SPECIFICATIONS





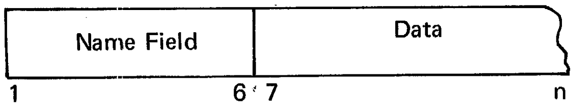
Array Element 1:
- Return code – two decimal characters returned by CCP following operation (zero, positive, or negative).

Array Element 2:
- Operation code – two alphameric characters.
- Operation modifier – two alphameric characters (optional).

Array Element 3:
- Output data length – up to four decimal characters (output operations).
- Effective input data length – up to four decimal characters (returned by CCP on input operations.
- Count of outstanding Invite Inputs – a four digit-decimal number (returned by CCP on release terminal operations and when a 08 return occurs on input operations.
- Terminal attributes identifier – up to four decimal characters (acquire terminal operation only).

Array Element 4:
- Maximum input data length – up to four decimal characters.

Figure 6-12. RPG II Parameter Array for EXIT/RLABL

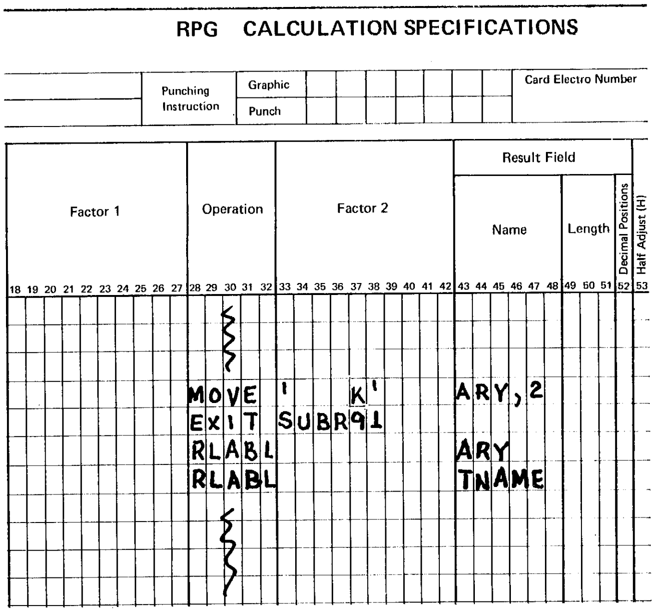


(4096 maximum, including the terminal name)

Figure 6-13. Record Area Format for EXIT/RLABL CCP Interface

Setting the Parameters for an Operation

Issuing a non-I/O operation (such as Release Terminal) involves simply setting the contents of the parameter array with MOVE instructions and placing the terminal name in the record area. Since only the terminal name is required in the record area for non-I/O operations, you can issue the operation as shown in the following example, specifying a field that contains the terminal name as the second RLABL.



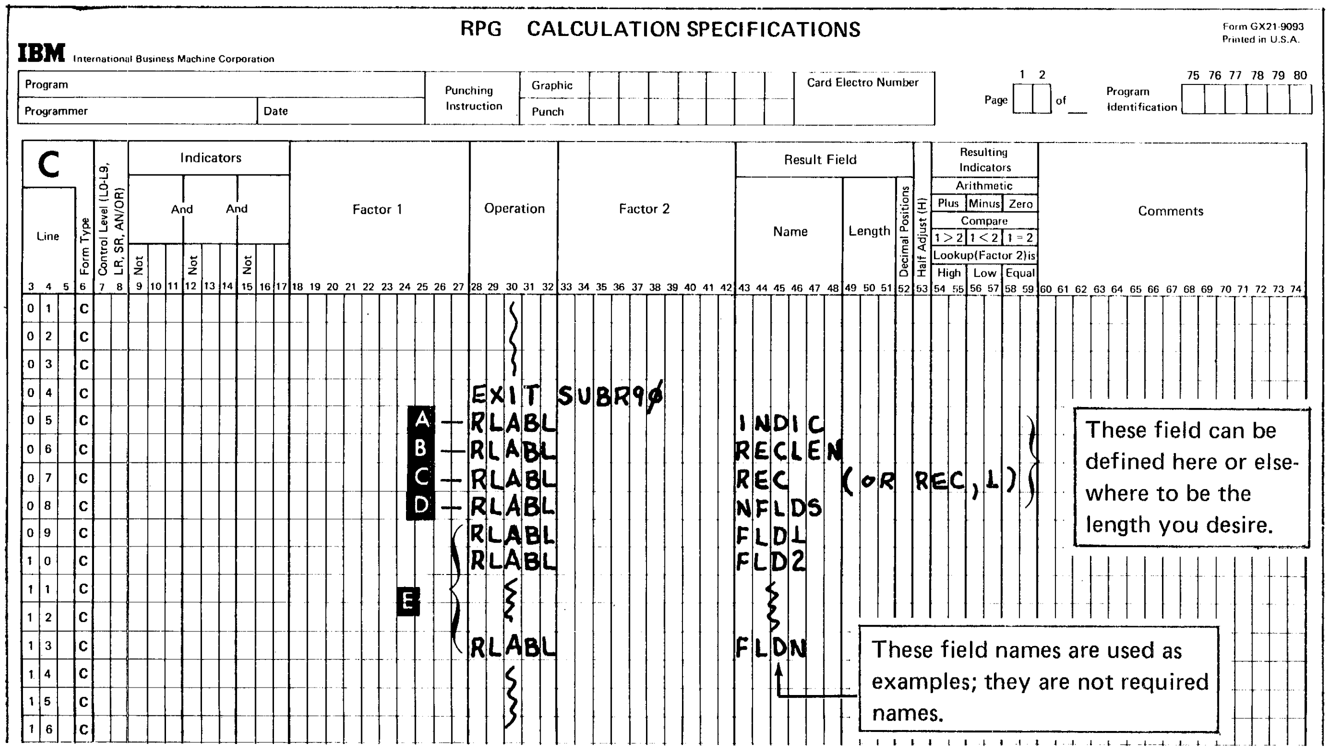
Factor 1 (18-27)	Operation (28-32)	Factor 2 (33-42)	Result Field Name (43-48)	Length (49-51)	Decimal Positions (52)	Half Adjust (H) (53)
	MOVE	'K'	ARY,2			
	EXIT	SUBR91				
	RLABL		ARY			
	RLABL		TNAME			

If, however, you are issuing an operation that involves a number of fields of input or output data, you will need to use SUBR90 to move fields to or from the record area, since there is no facility in RPG II Calculations to move fields to or from various section of another data field. (A series of MOVE or MOVEL operations could be used to move a small number of fields.)

Exit to SUBR90

You must prepare the record area before doing an output operation using SUBR91. Therefore, you must move fields into this area of storage before requesting the I/O operation. For input operations, you are presented with a mass of data from which you must extract specific fields. When you use SPECIAL file processing, the input and output specifications provide this capability. However, in RPG II Calculations there is no facility for selecting fields from various sections of another data field. Thus, SUBR90 is provided to serve this purpose.

Figure 6-14 illustrates the coding required to link to SUBR90.



```
0 1 C
0 2 C
0 3 C
0 4 C      EXIT SUBR90
0 5 C  A - RLABL          INDIC
0 6 C  B - RLABL          RECLEN
0 7 C  C - RLABL          REC     (OR REC,1)
0 8 C  D - RLABL          NFLDS
0 9 C      RLABL          FLD1
1 0 C      RLABL          FLD2
1 1 C  E
1 2 C
1 3 C      RLABL          FLDN
1 4 C
1 5 C
1 6 C
```

These field can be defined here or elsewhere to be the length you desire.

These field names are used as examples; they are not required names.

Figure 6-14. Coding Required to Use SUBR90

The first four RLABL's following an EXIT to SUBR90 provide information to SUBR90 about the fields to be moved.

A The first RLABL is an indicator. If you "set on" this indicator prior to exiting to SUBR90, the subroutine moves the data from the fields specified in subsequent RLABL's **E** to the record area. If the indicator is off when control is given to the routine, data is moved from the record area to the fields specified.

B The second RLABL is a field which must contain either the total length of data to be moved, if moving data to the output area, or the total length of the record area, if moving data from the input area to fields. The total length of all the fields which are to be moved from or to the record area must be less than or equal to the value contained in the field named by this RLABL.

C The third RLABL must name the data area used with SUBR91. If the data area is larger than 256, an alpha array may be defined which is at least as large as the data area needed. In this case, the third RLABL passed to SUBR90 should be the first element of the array (indexed by the integer 1).

D The fourth RLABL must name a field which contains the number of fields to be moved to or from the data area. It also defines the number of RLABL's which follow the fourth RLABL.

E The fifth and succeeding RLABL's name the fields which are to be moved to or from the data area. These names may refer to fields, or an array indexed by a constant. The RLABL's may not name an array without an index. Fields are moved into the data area in the order you specify them as RLABL's; therefore, the fifth RLABL must identify a six-position terminal name field as the first field in the record area. There must be a character-for-character correspondence between the "from" and "to" fields; if blanks are to occur in the data area, fields containing blanks must be provided in the list of RLABL's.

Alphameric and Numeric Fields

Alphameric and numeric fields are properly left-justified or right-justified by your RPG II program prior to being moved to the record area by SUBR90 (SUBR90 treats all fields as alphameric fields). On input operations, however, the terminal operator must know whether he should enter data into a field left-justified (alphameric) or right-justified(numeric). These instructions may have been given previously to the terminal operator by means of a published procedure, preprinted typewriter form, or a display format (3270). If not, your program should put out a format to the terminal before any data is requested from the terminal to indicate to the operator where the data should appear in the record and how fields should be justified. For batch terminals, such as other central processing units, this step is unnecessary, since the communicating programs will be written to expect data in a certain format.

Editing with SUBR90

The standard RPG II editing facilities available with the SPECIAL file interface to the CCP are not available with the EXIT/RLABL interface. Therefore, SPECIAL is recommended if edited fields are to be used.

If editing must be performed when using SUBR90, either you must provide coding in your program to insert and remove editing characters or edit characters must be shown on preprinted fields at the terminal. For 3270 terminals, edit characters may be placed on the display as part of a display format.

If the 3270 Display Format Facility is used, negative integer numeric fields (no decimal positions) are automatically converted so that the minus sign is printed to the right of the value in the field. Likewise, on input operation, the field is automatically converted by 3270 DFF to its internal negative form (D zone in the right-most position of the field -- see *negative numbers* in the *RPG II Reference Manual*).

Exit to SUBR87 and SUBR88

SUBR87, an entry in SUBR88, is used to issue Chain Task Request operations from RPG II programs. SUBR88 is used to accept both program-request and chain-task data by RPG II programs.

Unlike SUBR91, SUBR87 and SUBR88 do not require a parameter list; instead, you specify two RLABLs. The first RLABL specifies an output data length (for SUBR87) or an input data length (for SUBR88). The second RLABL specifies the record area that consists of a name field and a data area. The name field is six characters long. When using SUBR87, you must place the name of the program to be requested, left-justified and padded with blanks if not six characters long, in the name field. When using SUBR88 to accept task chaining data, SUBR88 places the name of the program that requested the task chain into the name field before returning control to the chained routine. The data field is used to pass data between programs.

SUBR87 and SUBR88 set on indicator 91 if the accept operation resulted in a negative return code, and indicator 92 if the operation resulted in a positive return code other than a 14 return code. The 14 return code indicates a successful accept operation of the chain request data.

Figure 6-15 shows an example program (PGM1) that uses SUBR87 to issue a chain request and an example program (PGM2) that uses SUBR88 to accept the task chain data. SUBR93 is used in both examples to bypass the record selection in the RPG II program cycle. Input and output occurs in calculations using SUBR87 and SUBR88.

If the Overlay Linkage Editor is entered directly from the RPG II Compiler, and the program being compiled contains exits to SUBR87 but does not contain at least one exit to SUBR88, a halt (E0 'P 25) will occur. This halt occurs because the linkage editor cannot resolve internal entry points of subroutines (see the *IBM System/3 Overlay Linkage Editor Reference Manual*, GC21-7561 for additional information on the linkage editor). One method to avoid this halt is to code a dummy exit to SUBR88 as shown in the following example:

```
          EXIT   SUBR87
          RLABL  LEN
          RLABL  DAREA
          GOTO   BYPASS
          EXIT   SUBR88
BYPASS    TAG
```

Another method to avoid this halt is to compile the program and place the non-link-edited program in a library (see *object output* in the *IBM System/3 RPG II Reference Manual*, SC21-7504, for additional information). Then call the linkage editor ($OLINK). The OCL for this procedure is shown in the following example:

```
// CALL       RPG,R1
// COMPILE    SOURCE-rpgchn,OBJECT-nn,UNIT-nn
// RUN
// CALL       OLINK,R1
// RUN
// INCLUDE    NAME-rpgchn,UNIT-nn
// INCLUDE    NAME-SUBR88,UNIT-nn
// INCLUDE    NAME-SUBR93,UNIT-nn
// END
```

Notes:

1. Rpgchn is the name of the program containing the task chain exit.
2. The FILE statements are handled by default in the example.
3. As with SUBR91, SUBR93 must be included as a dummy input file when using SUBR88.

Setting the Parameters for EXIT/RLABL Operations

All parameters for CCP operations are placed in the parameter array. The program name or the symbolic terminal name is always placed in the record area (see *EXIT to SUBR91*).

Operation Code

In setting the operation code, you can avoid having an invalid operation/modifier combination by always moving both parts of the operation code into the second array element. The valid operation and modifier codes are given in *CCP Operation Codes,* earlier in this chapter.

Output Length

For EXIT/RLABL output operations, place the length of the output data in the third array element. The output length includes device control characters which you are inserting into the data in your program (see index entry *Device Control Characters*). The output length should not include the six characters for the program name or the symbolic terminal name.

The maximum output length you can specify is 4090. See *RPG II Programming Considerations,* later in this chapter, for information about using the third array element with the Acquire Terminal operation.

Maximum Input Length

The maximum input length in the fourth array element for an EXIT/RLABL operation must not include the six characters for the program name or the symbolic terminal name, but must include the length of any device control characters you are handling in your program. You must enter a maximum input length for the following operations:

- Get
- Invite Input
- Put-Then-Get
- Get Attributes

If you also specify a maximum input length for the Accept Input operation, it will override the length given for the Invite Input operation. For the Get Attributes operation, set the value of the fourth array element to 21.

PGM1

File Description Specification

```
02 FDUMMY   IP  F   1   1            SPECIAL       SUBR93
```

```
04 C                     MOVE '0005'    OFIELD  4
05 C                     MOVEL'PGM2ƀƀ'  TNAM0  11
06 C                     MOVE 'DATA1'   TNAM0
07 C                     EXIT SUBR87
08 C                     RLABL          OFIELD
09 C                     RLABL          TNAM0
10 C    92               SETON                     LR
```

Set up chain request.

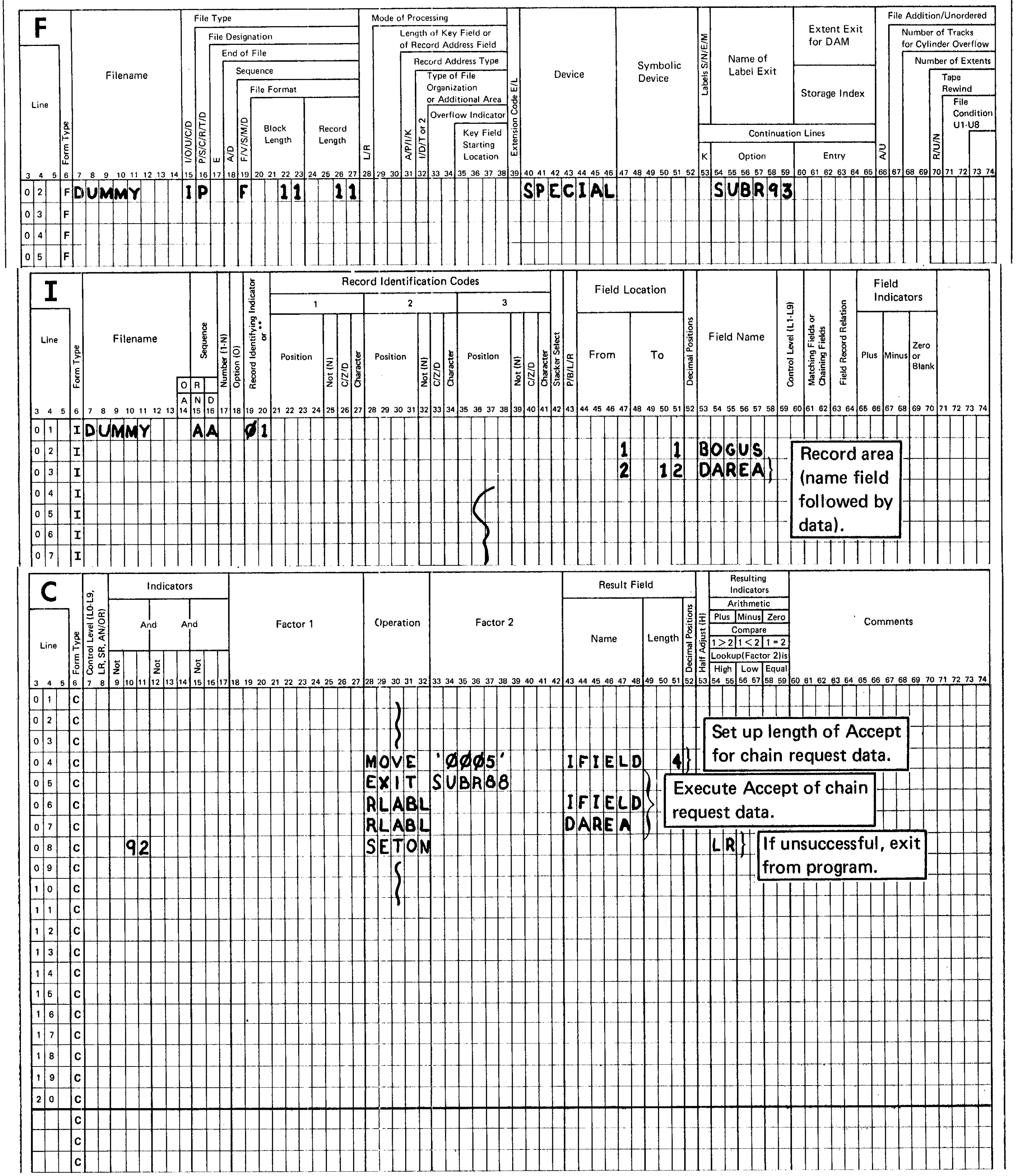
Execute chain request.

If unsuccessful, exit from program.

Figure 6-15 (Part 1 of 2). Coding for SUBR87 and SUBR88

PGM2

File Description Specification



```
  02 FDUMMY   IP  F  11  11            SPECIAL       SUBR93
```

```
  01 IDUMMY   AA  01
  02 I                                        1   1 BOGUS
  03 I                                        2  12 DAREA
```

Record area (name field followed by data).

```
  04 C                     MOVE '0005'    IFIELD  4
  05 C                     EXIT SUBR88
  06 C                     RLABL          IFIELD
  07 C                     RLABL          DAREA
  08 C   92                SETON                     LR
```

Set up length of Accept for chain request data.

Execute Accept of chain request data.

If unsuccessful, exit from program.

Figure 6-15 (Part 2 of 2). Coding for SUBR87 and SUBR88

Examining Returned Information

After you have issued a CCP operation using EXIT/RLABL, you should examine information returned to your program by the CCP:

- Return Code (*Note*: Indicators 91 and 92 are not reserved or used with SUBR91.)
- Effective input length (if an input operation was performed)
- The program name or the symbolic terminal name (if it was set by the CCP, such as for an Accept Input operation or a Put issued with a blank terminal name)

Testing the Return Code

After an EXIT/RLABL operation, the CCP places the return code in positions 5-6 of first parameter array element. Figure 6-16 shows an example of testing the return code for plus, minus, or zero by means of a compare operation and resulting indicators. In this example, a subroutine that checks for specific return codes is executed when a positive or negative return code is encountered after a Stop Invite Input operation. Before checking the return code after an EXIT/RLABL operation, you must move the return code from the first array element to a 2-position numeric field.

Note: Notice the use of a MOVEL instruction to move the terminal name from the field TNAME to the first six positions of the record area, INREC. This technique is useful when the record area consists of the symbolic terminal name and a single field (in this case assume the input record is a single 10-character field).

Examining the Effective Input Length

After operations that return input data to your program, you may need to know the actual length of input data returned to your program, that is, the effective input length. This value does not include the six characters for the program name or the symbolic terminal name and does not include the length of truncated data when a terminal sends more data than you specified in your maximum input length for the operation. Special considerations are involved when you use the 3270 Display Format Facility (DFF) input operations; see *3270 Display Operations.*

In order to use the effective input length, you must first move the contents of the third array element to a numeric field.

Symbolic Terminal Name

On EXIT/RLABL operations for which the CCP returns a terminal name (see index entry *Operations*), you may need to examine or otherwise use the terminal name (for example, to associate the input data with data previously received from the same terminal). The CCP places the returned symbolic terminal name in the first six positions of the record area.

See *Programming Examples, Example 2,* later in this chapter, for examples of saving and examining terminal names in an MRT program.

3270 DISPLAY FORMAT FACILITY

You can use the 3270 Display Format Facility (DFF) of the CCP to aid you in formatting and using the 3270 terminal. *Chapter 8. 3270 Display Format Facility* describes the programming requirements that are unique to using the DFF, including the unique DFF operations, additional information that must be placed in the record area for certain operations, field types that are unique to the 3270, and other information.

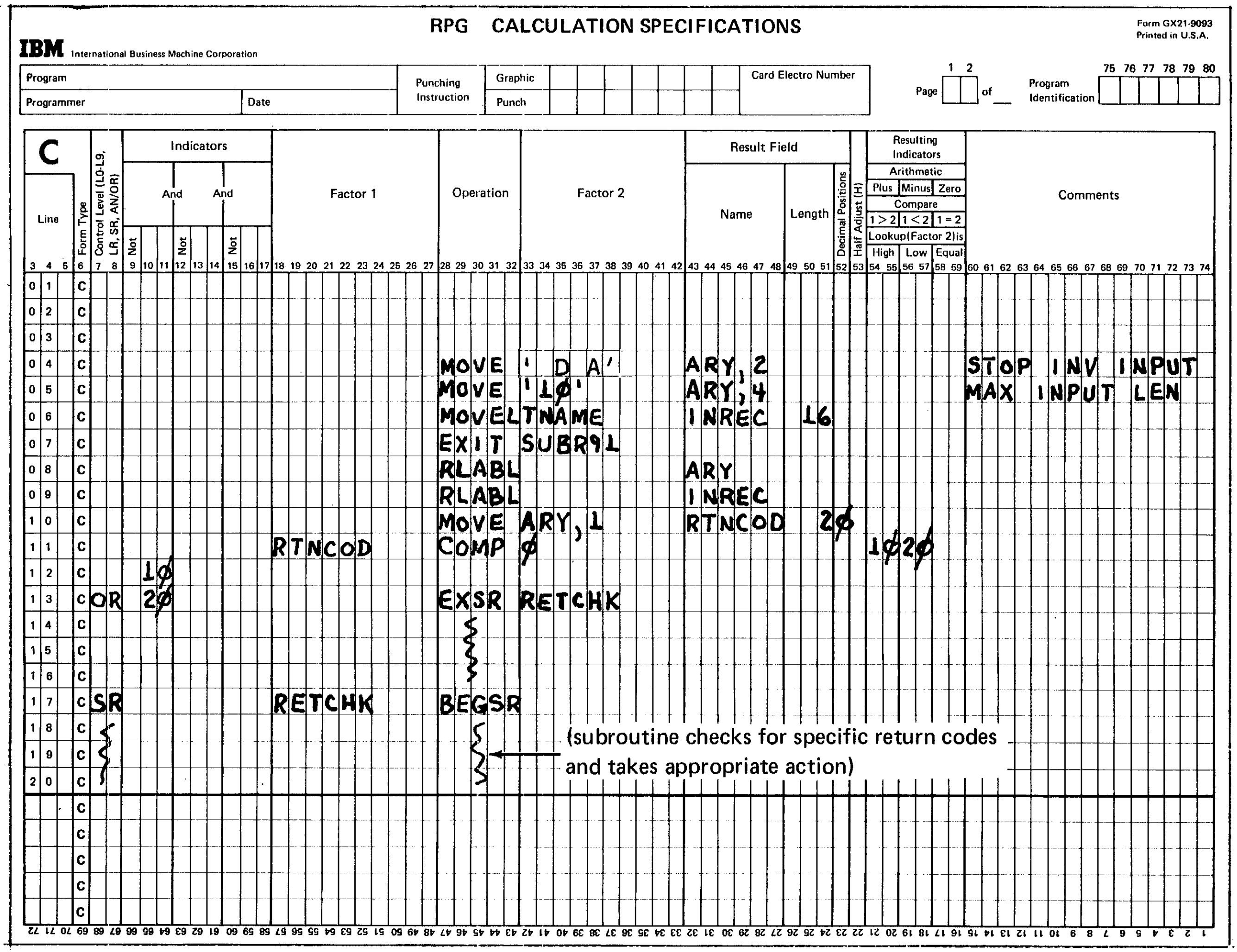
You can compare the programming necessary to use the 3270 without DFF to programming with the DFF by comparing *Example 1* under *Programming Examples,* later in this chapter, to the example in Chapter 8.

RPG II PROGRAMMING CONSIDERATIONS

This section contains some reminders, suggestions, and restrictions pertaining to writing RPG II programs to run under the CCP.

Data Mode Escape and Release Terminal Operation

If data mode escape is allowed in your CCP system (specified by the ESCAPE keyword in the $EFAC generation statement—see *CCP System Reference Manual*) you must include coding in your program to test for the 08 return code (terminal has entered data mode escape and released itself from your program). When the CCP returns a 08 return code after an input operation (Accept Input, Get, or Stop Invite Input), a count of outstanding Invite Input operations is returned in the third element of the parameter array (effective input length). In an MRT program, you should check this count to determine how many terminals are still attached to your program. If you do not check this count, you might do an Accept Input operation without having an outstanding Invite Input, causing the CCP to cancel your program (unless it is a *never-ending program*—see index entry).



IBM International Business Machine Corporation

RPG CALCULATION SPECIFICATIONS

Form GX21-9093
Printed in U.S.A.

Line	Form Type	Control Level (L0-L9, LR, SR, AN/OR)	Indicators	Factor 1	Operation	Factor 2	Result Field Name	Length	Decimal Positions	Resulting Indicators High	Low	Equal	Comments
01	C												
02	C												
03	C												
04	C				MOVE	' DA'	ARY,2						STOP INV INPUT
05	C				MOVE	'10'	ARY,4						MAX INPUT LEN
06	C				MOVEL	TNAME	INREC	16					
07	C				EXIT	SUBR91							
08	C				RLABL		ARY						
09	C				RLABL		INREC						
10	C				MOVE	ARY,1	RTNCOD	2	0				
11	C			RTNCOD	COMP	0				10	20		
12	C		10										
13	C	OR	20		EXSR	RETCHK							
14	C												
15	C												
16	C												
17	C	SR		RETCHK	BEGSR								
18	C												
19	C												
20	C												
	C												
	C												
	C												
	C												
	C												

(subroutine checks for specific return codes and takes appropriate action)

Figure 6-16. Checking the Return Code After an EXIT/RLABL Operation

Following a Release Terminal operation in an MRT program, the CCP also returns a count of outstanding Invite Input operations in the third array element. You should check this count to avoid doing an Accept Input operation without an outstanding Invite Input. (The Release Terminal operation always returns a 00 return code.)

Using Both SPECIAL and EXIT/RLABL

You should be aware that when you use both SPECIAL and EXIT/RLABL for CCP operations you are adding additional code to your program, since at least two subroutines must be included. Therefore, if you are concerned about the size of your program, you can reduce its size by using only one of these methods of performing CCP operations.

You must be sure to specify the correct communications service subroutines for SPECIAL and EXIT/RLABL. For example, if you mistakenly use SUBR91 with SPECIAL, the results are unpredictable.

Multiple Output Lines

When sending multiple H, D, or T output lines in a single program cycle or when sending multiple output lines with a single EXCPT operation, you should condition the output lines with indicator *N91* so that you can react to output errors when they occur. However, even if you use this technique, it is difficult to determine which output lines were or were not successfully sent in this case.

End of File with SUBR92

Remember, when using SPECIAL files with SUBR92 you will never get end of file on a SPECIAL file unless you issue the Force End of File operation to the file (see *CCP operation codes*, earlier in this chapter). Therefore, the end of file indicator in positions 58-59 of the Calculation specification for the READ operation is meaningless unless Force End of File is used.

Host/Subhost Communications

Considerations for communicating with host and subhost systems via BSCA are given in *Appendix A*.

Communicating With the Console

You can communicate with the system operator console only by means of Put and Put-Then-Get operations. The symbolic terminal name for the console is CONSOL.

You cannot issue an Acquire Terminal operation to the console (there is no need, since any program can communicate with the console at any time).

You cannot communicate with the system operator console by specifying CONSOLE (Model 10 Disk System and Model 12) or CRT77 (Model 15) as the device in columns 40-46 of File Description Specifications.

Master Index

CCP builds an in-storage index based on either the MSTRINDX or MIXSIZE keyword of the DISKFILE assignment statement (see *CCP System Reference Manual*). Specify a master index for disk files in the application program as follows:

- On a Model 10 or 12, specify at least one master index entry (key length plus 2) in the application program to make use of a master track index. This improves performance for large index files.
- On a Model 15, a master index entry is not required in the application program to make use of the master track index.

Disk File Usage

You should be aware of how other programs running under the CCP are using disk files that you also use in your program, especially if records are being added to the files. See index entry *disk file considerations* for detailed information.

Specific Restrictions

- Do not use multivolume files (columns 68-69 of the File Description Specifications *must be blank*).
- Do not use magnetic tape files.
- Do not use look-ahead fields.
- Do not describe a SPECIAL file for CCP operations as a table file.
- Do not use the RPG II inquiry feature.
- (Model 10 and Model 12 CCP) Do not use RPG II halt indicators. If programs running under the CCP issue halts, they will be cancelled.

PROGRAMMING EXAMPLES

The following programming examples are explained in this section.

Example 1—an RPG II program that supports a single requesting 3270 without using the Display Format Facility.

Example 2—an RPG II program that supports multiple requesting terminals.

See Chapter 8 for examples of RPG II programs that use the 3270 Display Format Facility.

Before attempting to use these examples, you should read and understand the description of the RPG II CCP interface in this chapter.

Example 1

Figures 6-17, 6-18, and 6-19 show the flowcharts, messages, and listing for a single requesting terminal (SRT) RPG II program (see index entry *SRT program*). This program transmits two messages to a 3270 Model 1 Display System (480 character screen). The first message from the program requests the terminal operator to enter a room number. The program uses the room number entered by the terminal operator as the relative record number to access a disk file whose records contain guest and rate information about the room. This information is then formatted and displayed as the second message transmitted to the 3270 terminal. The program then goes to end of job. Figure 6-17 also shows how these messages appear on the 3270 terminal.

Because this program is a *single requesting terminal* (SRT) program (see index entry), it can receive data from and transmit data to only one 3270 terminal. However, multiple copies of this program could be in main storage at the same time (if the system has sufficient main storage), each communicating with a different 3270 Display System. (If multiple copies are in core at the same time, the disk file must be specified as sharable during the Assignment stage—see index entry *disk file sharing.*)

Formatting the Messages for the 3270 Display

Because this sample program does not use the Display Format Facility, this sample program must provide formatting control characters for the display screen in the data portion of the record area and transmit them as part of the messages to be displayed. Figure 6-19 shows the messages and the 3270 control commands and orders as they are transmitted to the 3270. See *IBM 3270 Information Display System Component Description*, GA27-3004, for a description of 3270 system components, concepts, control commands, and orders.

The printable format characters are set by defining them as part of the message in the RPG II Output Specifications definition.

The unprintable format characters (hexadecimal values that have no corresponding printable character in 96-column card code) are in a pre-execution time array (ORDERS) that was loaded by a previous RPG II program (see comments in File Description Specifications). Elements of the ORDERS array are then used in appropriate positions in the output messages.

Notes Concerning this Sample Program

- Message Mode was defined during CCP assignment for the 3270 terminal used by this program. (See TERMATTR statement in *CCP System Reference Manual.*) This eliminates the need to do repetitive input operations until EOT is received.

- To run this program using a terminal other than the 3270, you must remove all coding dependent on the 3270. This includes all screen formatting specifications and 3270 screen control characters within the data.

- This program will not accept data with the program request.

- This program specifies a Put with Invite Input operation using a blank terminal name as the first operation (1P output time in the RPG II program cycle). In an SRT program such as this, the blank terminal name refers to the current requester of the program. The name of the requester is received in the TNAME field of the input record area after the Accept Input operation.

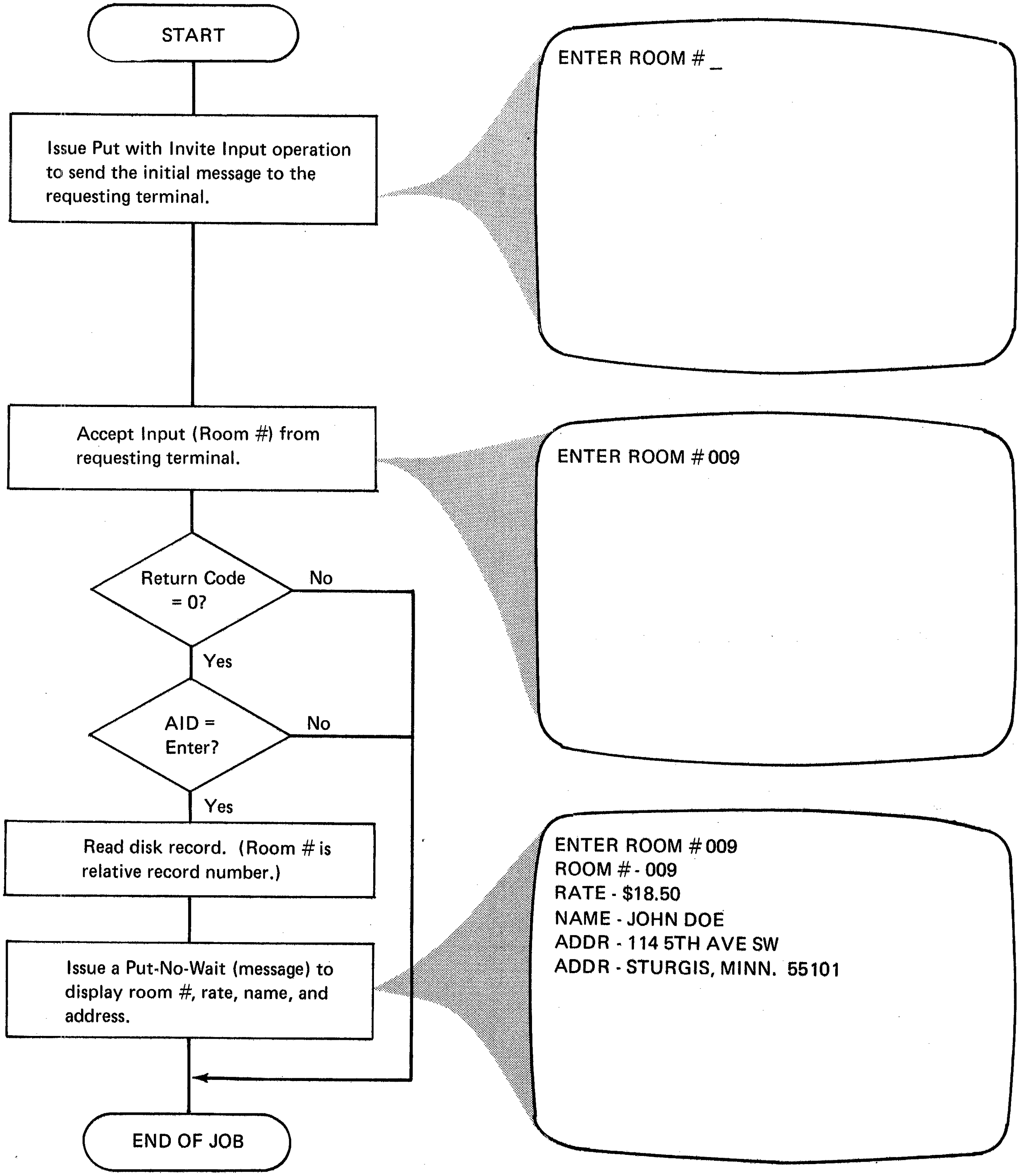
- To keep this sample program simple, return code checking is kept to a minimum. You should do more return code checking in your application programs. For example, when you issue Accept Input you should check for the Shutdown Requested return code (04). Also, if data mode escape is allowed in the CCP system, programs should check for return code 08. It is recommended that each installation design its own return code checking and/or console communication routines so that a satisfactory standard is established for the installation that can be used in all application programs.

- This program does not check the length of the input data because the terminal operator is requested to enter a three-digit room number. However, you may want to check the input data length in your application programs.

- Since there are only two different screen formats used by this program, they are both contained within the program.. For more complete applications, you might store the screen formats on disk and read them when they are needed by your program.

- You could also use the Get Attributes operation in this program. For example, if you do not know whether the 3270 Model 1 or the 3270 Model 2 will request the program, you can issue a Get Attributes operation to find out which type of terminal requested the program.

- If this program were coded and specified as a multiple requesting terminal (MRT) program with a MRTMAX=1 keyword on the PROGRAM assignment statement (see *CCP System Reference Manual*), multiple copies of the program would not be allowed in main storage at the same time. As the program is written, multiple copies could be in main storage at the same time and the disk file must be specified as sharable (FILES keyword of PROGRAM assignment statement).



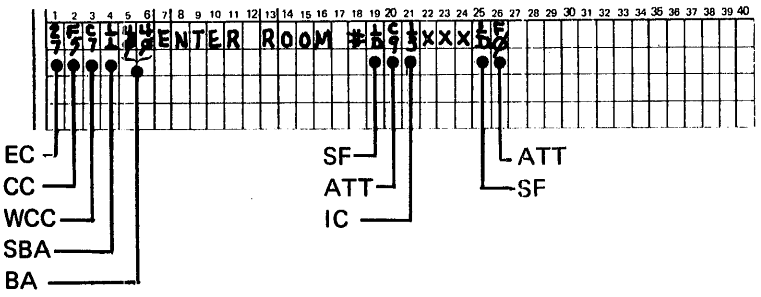
```
ENTER ROOM #_
```

```
ENTER ROOM #009
```

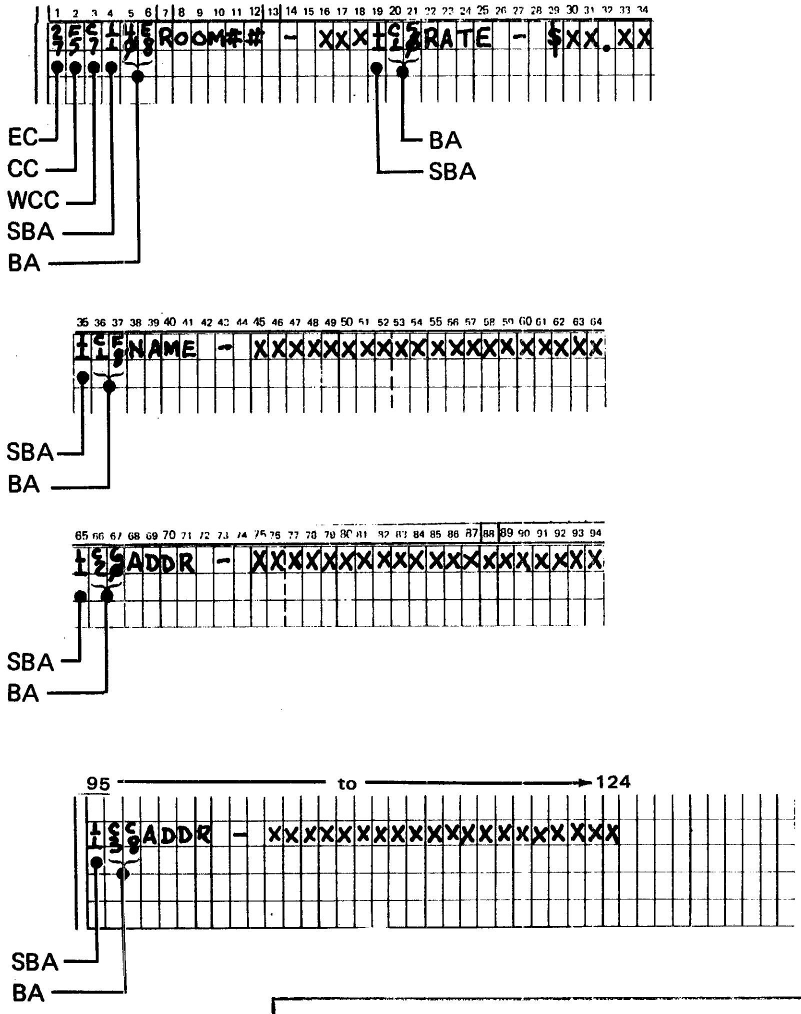
```
ENTER ROOM #009
ROOM #-009
RATE - $18.50
NAME - JOHN DOE
ADDR - 114 5TH AVE SW
ADDR - STURGIS, MINN.  55101
```

Figure 6-17. Program Logic of Example 1 (RPG II SRT Program)

First Message



Second Message



SF – Start Field	CC – Command Code
ATT – Attribute Character	WCC – Write Control Character
IC – Insert Cursor	SBA – Set Buffer Address
x – Data Character	BA – Buffer Address of first character position in the field
EC – Escape Character	

Figure 6-18. Message Formats for Example 1 (RPG II SRT Program)

```
      01010H    R  4
0001  0102 FTPIN    IP         25            SPECIAL       SUBR92
0002  0103 F                                              KIARR
0003  0104 FTPOUT   O     138 138            SPECIAL       SUBR92
0004  0104 F                                              KIARR
0005  0106 FGUEST   IC      70  70R           DISK
0006  0108 FORDERS  IT      4   4           EDISK
      0109 F* THIS FILE WAS LOADED BY A PREVIOUS RPG PROG SINCE IT CONTAINS HEX-
      0110 F*ADECIMAL DATA THAT MUST BE AVAILABLE AT 1P OUTPUT. THAT RPG
      0111 F*PROGRAM COULD HAVE CREATED THESE CHARS WITH THE SET BIT
      0112 F*INSTRUCTION OR FILE TRANSLATION.
0007  0201 E                    IARR  0050005 06               INOUT CCP ARRAY
0008  0203 E    ORDERS          ORDR    4   4 01               3270 ORDERS
      0204 E** THE FOLLOWING ORDERS   (1 CHARACTER EACH) ARE CONTAINED IN THE
      0205 E** ORDR ARRAY  ORDR,1 -ESCAPE CHAR
      0206 E**             ORDR,2 -SET BUFFER ADDRESS
      0207 E**             ORDR,3 -START FIELD
      0208 E**             ORDR,4 -INSERT CURSOR
0009  0301 ITPIN    AA  01  17 C'
0010  03010I                                        5   80EFL
0011  03020I                                        9  14 TNAME
0012  03021I                                       23  250ROOM
0013  03030I        AB  02
      03040I** CATCH ALL FOR UNIDENTIFIED RECORD
0014  0308 IGUEST   BA  03   1 CG
0015  0309 I                                        2   4 GROOM
0016  0310 I                                        5   82GRATE
0017  0311 I                                        9  28 GNAME
0018  0312 I                                       29  48 GADDR1
0019  0313 I                                       49  68 GADDR2
0020  0314 I        BB  05
      0315 I** CATCH ALL
     S0305 I*NOTE: POSITION 17 IS AN AID CHAR. A SINGLE QUOTE MEANS THE
      0306 I*ENTER KEY WAS KEYED.  ANY OTHER AID CHARACTER OR NON-ZERO
      0307 I*RETURN CODE ON INPUT CAUSES THIS PROGRAM TO GO TO END OF JOB.
0021  04010C         91
0022  04011COR       92
0023  04012COR       02          SETON                     LR    BAD AID,RTN COD
0024  0402 C         LR          GOTO END
0025  0403 C         01ROOM      COMP 1                      LR  ROOM # ENTERED
0026  0405 C         LR          GOTO END
0027  0406 C         01ROOM      COMP 10                   LR
0028  0408 C         LR          GOTO END
0029  0409 C         01ROOM      CHAINGUEST
0030  04100C         05          SETON                     LR
0031  0411 C         03          SETON                     LR04
0032  04111C         03          SETOF                     9291
0033  0412 C           END       TAG
      050100*FORMAT THE SCREEN FOR DATA ENTRY.
0034  050110TPOUT   H        1P
0035  0502 O                                   14 '      '
0036  0503 O                                    4 ' S'
0037  050310                                    8 '40'
0038  0504 O                         ORDR,1    15
      0505 O* HEX'27' - ESCAPE CHAR
0039  0506 O                                   16 '5'
      0507 O* HEX'F5' - ERASE/WRITE
0040  0508 O                                   17 'G'
      0509 O* HEX'C7' - WRITE CONTROL CHAR (SOUND ALARM,RESTORE KEYBOARD,
      0510 O* RESET MODIFIED DATA TAGS)
0041  0511 O                         ORDR,2    18
      0512 O* HEX'11' - SET BUFFER ADDRESS COMMAND
0042  0513 O                                   20 '  '
      0514 O* HEX'4040' ROW1  COL1 3270 MOD 1
0043  0515 O                                   32 'ENTER ROOM #'
0044  0601 O                         ORDR,3    33
      0602 O*HEX'1D'-START OF FIELD
0045  0603 O                                   34 'I'
      0604 O* HEX'C9'-UNPROTECTED ALPHAMERIC INTENSIFIED
0046  0605 O                         ORDR,4    35
      0606 O* HEX'13'-INSERT CURSOR
0047  0607 O                                   38 '   '
      0608 O* AREA FOR ROOM NUMBER
0048  0609 O                         ORDR,3    39
0049  0610 O                                   40 '0'
      0611 O* PROTECT REMAINDER OF SCREEN
0050  0701 O        T           LR 04
0051  0702 O                                    4 'CF'
0052  070210                                    8 '138'
0053  0703 O                         TNAME     14
0054  0706 O                         ORDR,1    15
0055  0707 O                                   16 '1'
      070710*WRITE ONLY
0056  0708 O                                   17 'G'
0057  0709 O                         ORDR,2    18
0058  0710 O                                   20 ' Y'
```

In this example, the same array is used for the input and output SPECIAL files since it is convenient and saves space in the program.

The parameter array is a compile time array in this example, so the array contents are set when 1P output is performed (see the first message).

At input time in the program cycle an Accept Input is issued. The Invite Input has been issued at 1P output time.

The program expects a room number between 1 and 10. If a different number is entered, the program does not attempt to access the GUEST file for rate, name, and address. Only the room number is printed on the T output line. If the operator enters an incorrect room number such as 1ƀƀ, the room number is displayed as 100.

A Put with Invite Input operation with a blank terminal name issued at 1P output time sends the initial message to the terminal and invites input from the terminal. The maximum input length (25) for the Invite Input is in the parameter array.

Figure 6-19 (Part 1 of 2). Example 1 — RPG II SRT Program

```
       0711 O* 3270 M1 ADDRESS ROW2 COL1
0059   0712 O                                29 'ROOM # - '
0060   0712 O                       GROOM    32
0061   0714 O                       ORDR,2   33
0062   0715 O                                35 'A&'
       0716 O* 3270 M1 ADDRESS ROW3 COL1
0063   0801 O                                42 'RATE - '
0064   0802 O                       GRATE 3  48 '$'
0065   0803 O                       ORDR,2   49
0066   0804 O                                51 'A8'
       0805 O* 3270 M1 ADDRESS ROW4 CCL1
0067   0806 O                                58 'NAME - '
0068   0807 O                       GNAME    78
0069   0808 O                       CRDR,2   79
0070   0809 O                                81 'B-'
       0810 O* 3270 M1 ADDRESS ROW5 COL1
0071   0811 O                                88 'ACCR - '
0072   0812 O                       GADDR1  108
0073   0813 O                       ORDR,2  109
0074   0814 O                               111 'CH'
       0815 O* 3270 M1 ADDRESS ROW6 COL1
0075   0901 O                               118 'ADDR - '
0076   0902 O                       GADDR2  138
       0903 O**   END OF PROG **


**
           D            25



  INDICATORS USED
        LR 1P 01 02 03 04 05 91 92

RG 314  UNREFERENCED TABLE/ARRAY NAMES
  STMT#         NAME
   0007        IARR

              EXECUTION TIME TABLES AND ARRAYS
  STMT#    TABLE/  DEC  ENTRY  NUMBER OF    DTT       T/A
  DEFINED   ARRAY  POS  LENGTH  ENTRIES     DISP      DISP
   0008    ORDR            001   00004      0100      0000

RG 314 UNREFERENCED FIELD NAMES
  STMT#  NAME
   0010 EFL

   FIELD NAMES USED
  STMT#  NAME   DEC  LGTH  DISP
   0011 TNAME        006   0009
   0012 ROOM     0   003   004B
   0015 GROOM        003   000C
   0016 GRATE    2   004   004F
   0017 GNAME        020   0020
   0018 GADDR1       020   0034
   0019 GADDR2       020   0048

   LABELS USED
  STMT#  NAME    TYPE
   0033 END      TAG

                COMPILE TIME TABLES AND ARRAYS
  STMT#     TABLE/  DEC  ENTRY  NUMBER OF    DTT       T/A
  DEFINED   ARRAY   POS  LENGTH  ENTRIES     DISP      DISP
   0007     IARR            006    0005      0000      000D


     IARR

           D            25                                                      001110
     END OF TABLE/ARRAY - LAST ENTRY WAS BLANK


   ERROR NUMBER  STATEMENT NUMBER
     RG 097            0014
     RG 097            0020
     RG 558            0029

   ERROR SEVERITY                                   TEXT
RG  097 W        NO FIELDS DESCRIBED FOR THIS OR PREVIOUS RECORD.
RG  314 W        FIELD, TABLE OR ARRAY NAME DEFINED BUT NEVER USED.
RG  392 W        LAST ENTRY IN ONE OR MORE COMPILE TIME TABLE/ARRAYS WAS BLANK.
RG  558 W        INVALID USE OF, OR MISSING, RESULTING INDICATORS WITH THIS OP CODE.  ASSUME
                  INVALID RESULTING INDICATORS BLANK.
```

Figure 6-19 (Part 2 of 2). Example 1 — RPG II SRT Program

Example 2

Figures 6-20, 6-21 and 6-22 show the flowchart, input/output messages, and listing for a sample RPG II multiple requesting terminal (MRT) program designed to run under the CCP (see index entry *MRT program*). This program handles up to four MLTA requesting terminals. The terminal operator enters a seven-digit number preceded by a +, –, or N. The CCP transmits this signed number to the RPG II program. The RPG II program:

- Adds the number to the value in the accumulator associated with the terminal that transmitted the data if the first position is +.
- Subtracts the number from the accumulator if the first position is –.
- Releases the terminal if the first position is N.

If a value was either added or subtracted, the new value accumulated for the terminal is inserted into the message *CURRENT VAL = sxxxxxxxxxxx ENTER DATA* and the message is sent to the terminal.

This sample program also checks for several error conditions and transmits the appropriate error message to the terminal requesting the operation.

This sample program is not designed to show the most effective way of performing operations. Instead, it shows a variety of ways to do things. It uses a variety of operation codes that show how data can be associated with a terminal by defining a save area for the terminal names and accumulated data. It frequently checks return codes; but you can do even more return code checking if you wish. Data entered by the terminal operator must be fixed length. To allow variable length input fields, you could include a subroutine in your program to check the effective input length returned in the parameter list and align the data correctly. This program communicates with the console in addition to the requesting terminals.

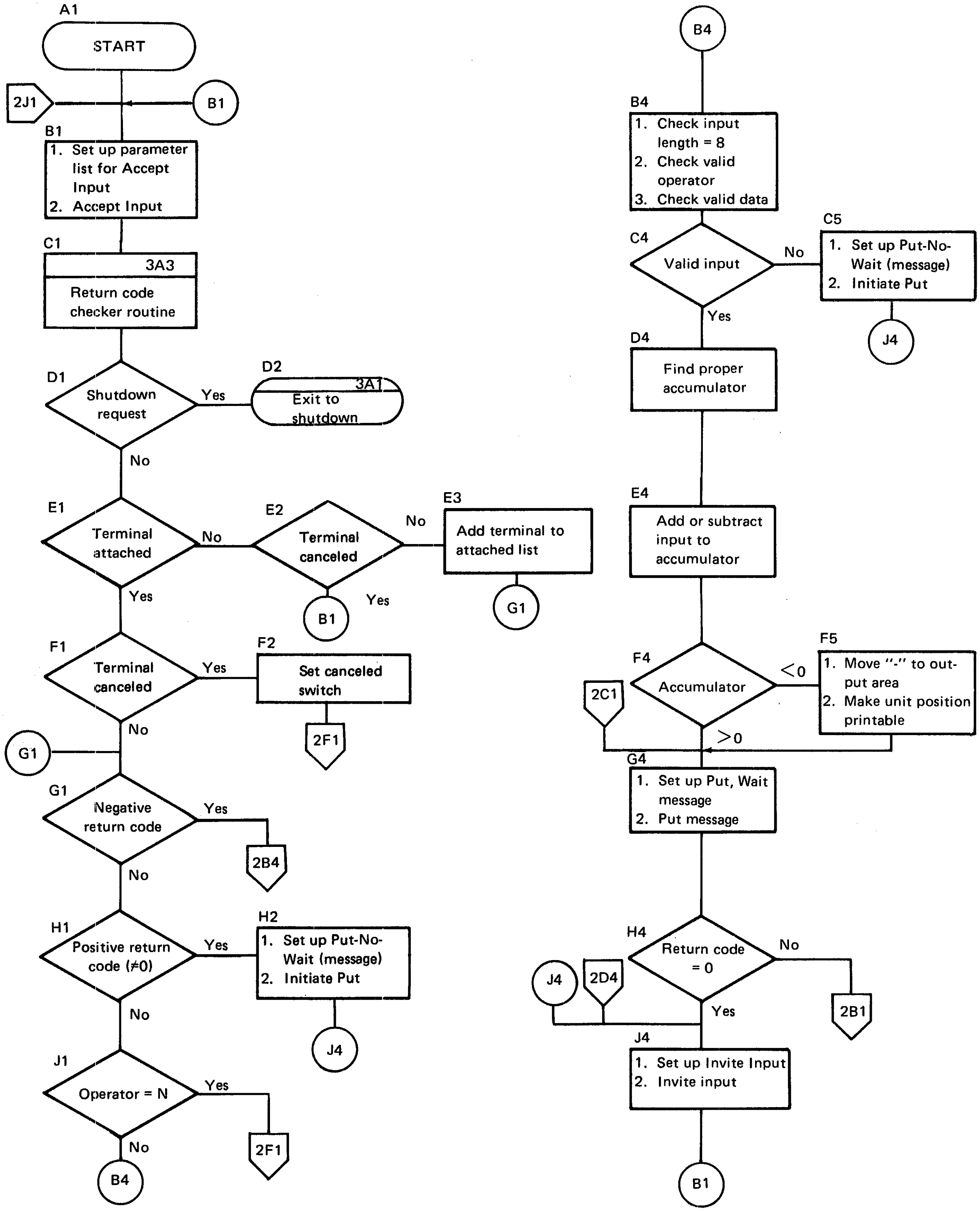


Figure 6-20 (Part 1 of 3). Program Logic of Example 2 (RPG II MRT Program)

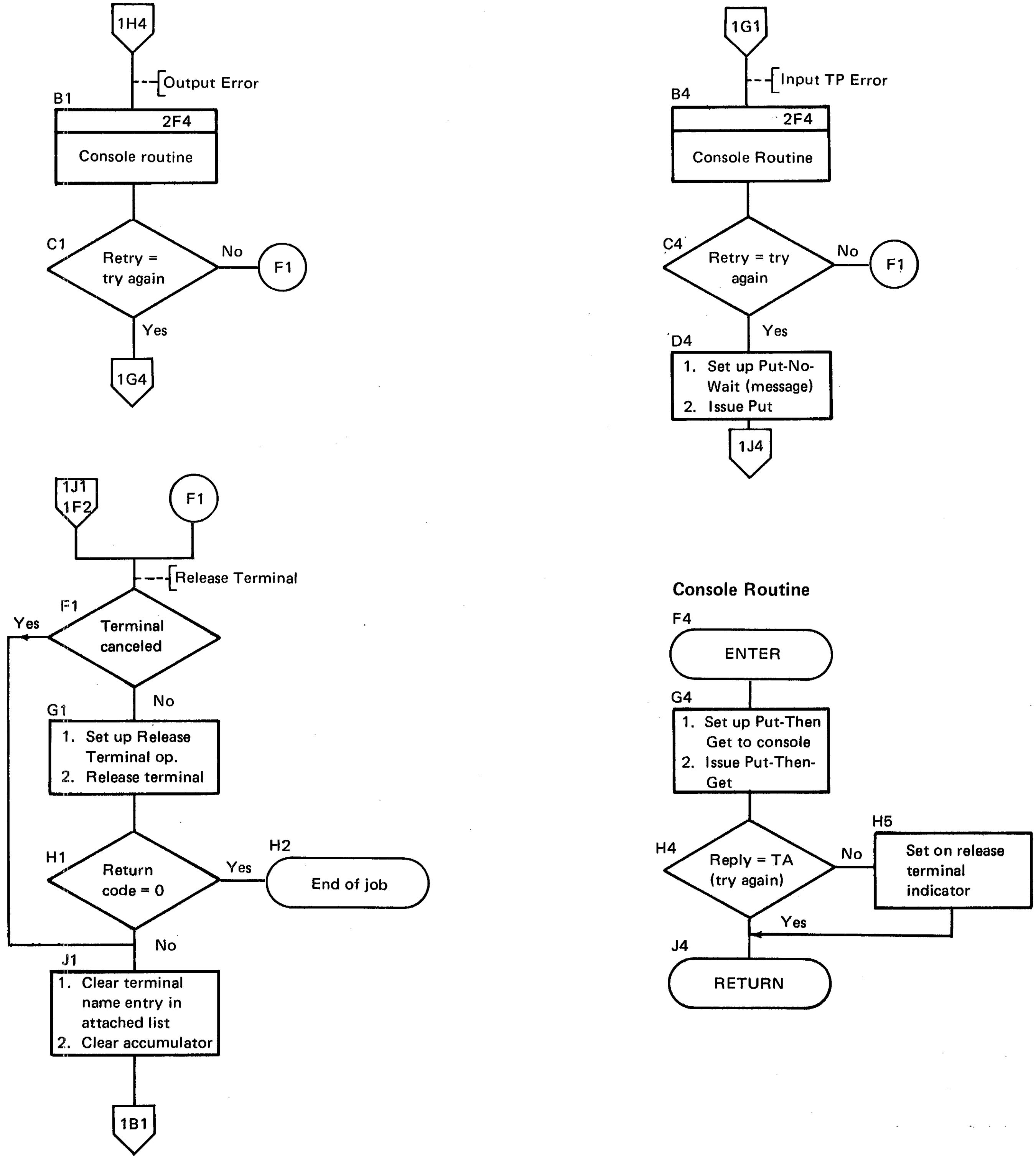
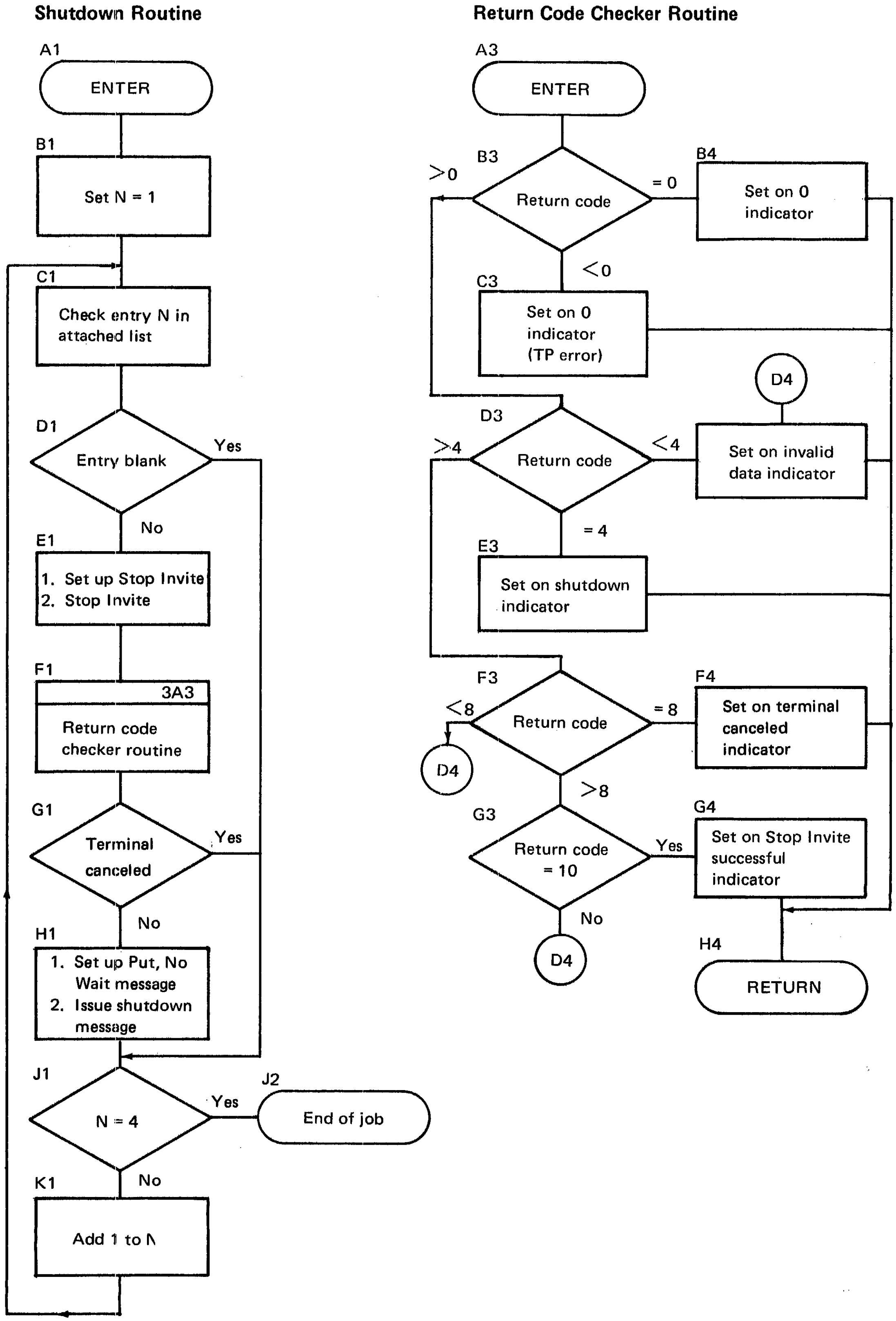


Figure 6-20 (Part 2 of 3). Program Logic of Example 2 (RPG II MRT Program)


Shutdown Routine

Return Code Checker Routine

Figure 6-20 (Part 3 of 3). Program Logic of Example 2 (RPG II MRT Program)

Input Data Entered by Terminal Operator

```
SXXXXXXX
```

A fixed length numeric field where S is at a +, -, or N and X is a numeric digit. All eight positions must be entered, except when N is entered in the first position.

Data Entered by System Operator on 5471 Printer/Keyboard (Models 10 and 12) or CRT/Keyboard (Model 15)

```
TA
CC
```

In response to the messages INPUT TP ERROR TNAME-cccccc and OUTPUT TP ERROR TNAME-cccccc to the console, the system operator replies TA if he wants to Try Again. Any other reply (cc) causes the terminal to be released.

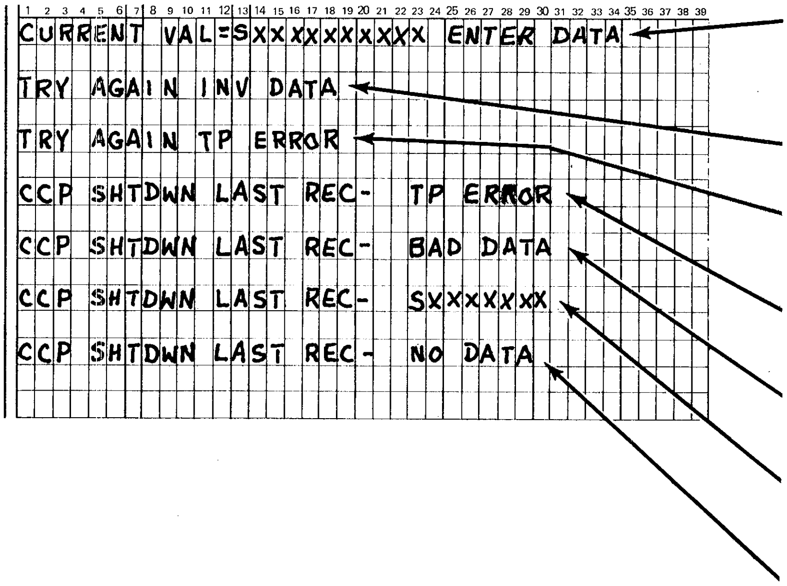
Output to the Console

```
INPUT  TP ERROR TNAME-CCCCCC

OUTPUT TP ERROR TNAME-CCCCCC
```

These messages are transmitted to the console (cccccc = terminal name).

Output to Terminal



```
CURRENT VAL=SXXXXXXXXXX ENTER DATA

TRY AGAIN INV DATA

TRY AGAIN TP ERROR

CCP SHTDWN LAST REC-  TP ERROR

CCP SHTDWN LAST REC-  BAD DATA

CCP SHTDWN LAST REC-  SXXXXXXX

CCP SHTDWN LAST REC-  NO DATA
```

Transmitted with value in accumulator associated with the terminal.

Issued if data is invalid

Issued if system operator replies TA (Negative return code on Accept Input)

Issued for negative return code on Stop Invite Input

Issued for positive return code other than 10 on Stop Invite Input

Issued for return code of 0 on Stop Invite Input

Issued for return code of 10 on Stop Invite Input

Figure 6-21. Input and Output Message Formats for Example 2 (RPG II MRT Program)

```
      01010H   R   4                                                            MRRPG1
0001  02010FDUMMY   IP      1   1            SPECIAL       SUBR93               MRRPG1
0002  02020FTPCONSIOCD     52  52            SPECIAL       SUBR92               MRRPG1
0003  02030F                                              KTPRY                 MRRPG1
0004  03010E                    TPRY        5  6               CCP PARM LIST    MRRPG1
0005  03020E                    ATRY        4  6               ATTACHD TERM LISTMRRPG1
0006  03030E                    ACMY        4 10 0             ACCUMULATOR LIST MRRPG1
0007  04010IDUMMY   AA  01                                                      MRRPG1
      04020I* DUMMY SPEC FOR PRIMARY FILE (RPG REQUIRES A PRIMARY FILE)         MRRPG1
0008  04030ITPCONSIOBB  02                                                      MRRPG1
0009  04040I                                        1   20RETCOD                MRRPG1
0010  04050I                                        5   80EFFL                  MRRPG1
0011  04060I                                        9  14 TNAME                 MRRPG1
0012  04070I                                       15  15 OPRATR                MRRPG1
0013  04080I                                       16  220TPIPT                 MRRPG1
0014  04090I                                       15  17 CONSIP                MRRPG1
      05010C*** CHECK THE 3RD ELEMENT OF THE PARAMETER ARRY TO DETERMINE IF     MRRPG1
      05020C** IF ANY MORE TERMINALS TO BE SERVICED. IF NOT GO TO EOJ.         MRRPG1
0015  05030C           ACPIPT    TAG                                            MRRPG1
0016  05040C         09                                                         MRRPG1
0017  05050COR       13TPRY,3    COMP '  0000'                 LR NO MOR IF 0   MRRPG1
0018  05060C         LR          GOTO END                              GO TO EJ MRRPG1
0019  05070C         01N         SUB  N         N       10       CLEAR INDEX    MRRPG1
0020  05080C         01          MOVE ' D'      TPRY,2           ACP  IPT OP CODMRRPG1
0021  05090C         01          MOVE '22'      TPRY,4           MAX XPECT LEN  MRRPG1
      05100C********************************************************************MRRPG1
      05110C*                                                                   MRRPG1
      05120C* ACCEPT INPUT                                                      MRRPG1
      05130C*                                                                   MRRPG1
      05140C********************************************************************MRRPG1
0022  05150C         01          READ TPCONSIO                   ACCEPT INPUT   MRRPG1
      05160C********************************************************************MRRPG1
      05170C*                                                                   MRRPG1
      05180C* GO TO RETURN CODE CHECKER ROUTINE                                 MRRPG1
      05190C*                                                                   MRRPG1
      05200C********************************************************************MRRPG1
0023  06010C         02          EXSR RETCHK                     CHECK RTN CODE MRRPG1
      06020C********************************************************************MRRPG1
      06030C*                                                                   MRRPG1
      06040C* IF SHUTDOWN REQUEST RETCOD = 04,IND ON IS 06                      MRRPG1
      06050C*                                                                   MRRPG1
      06060C********************************************************************MRRPG1
0024  06070C         06          GOTO SHTDWN                     SHUTDOWN CODE  MRRPG1
      06080C********************************************************************MRRPG1
      06090C*                                                                   MRRPG1
      06100C* ROUTINE TO DETERMINE IF TNAME IS AN ATTACHED TEMINAL              MRRPG1
      06110C* IF ATTACHED IND 12 IS ON,IF NOT IND 13 IS ON                      MRRPG1
      06120C*                                                                   MRRPG1
      06130C********************************************************************MRRPG1
0025  06140C           LUP1      TAG                                            MRRPG1
0026  06150C   01      N         ADD  1         N                ADD TO INDEX   MRRPG1
0027  06160C   01      ATRY,N    COMP TNAME                    12NAME FOUND     MRRPG1
0028  06170C   01 12             GOTO GO1                                       MRRPG1
0029  06180C   01      N         COMP 4                        13NAME NOT IN LSTMRRPG1
0030  06190C   01N13             GOTO LUP1                       KEEP LOOKING   MRRPG1
      06200C********************************************************************MRRPG1
      07010C*                                                                   MRRPG1
      07020C* TERMINAL NOT ATTACHED AND CANCELED                                MRRPG1
      07030C*                                                                   MRRPG1
      07040C********************************************************************MRRPG1
0031  07050C   09 13             GOTO ACPIPT                     TERM CANCELLED MRRPG1
      07060C********************************************************************MRRPG1
      07070C*                                                                   MRRPG1
      07080C* IF TERMINAL NOT ATTACHED AND NOT CANCELED                         MRRPG1
      07090C*    ADD TERMINAL TO ATTACHED LIST                                  MRRPG1
      07100C*                                                                   MRRPG1
      07110C********************************************************************MRRPG1
```

Figure 6-22 (Part 1 of 6). Example 2 -- RPG II MRT Program

```
0032  07120C   13      N         SUB  N         N                CLEAR INDEX    MRRPG1
0033  07130C           LUP2      TAG                                            MRRPG1
0034  07140C   13      N         ADD  1         N                ADD TO INDEX   MRRPG1
0035  07150C   13      ATRY,N    COMP '      '                 14THIS NTRY AVAILMRRPG1
0036  07160C   13N14             GOTO LUP2                       NO TRY AGAIN   MRRPG1
0037  07170C   13 14             MOVE TNAME     ATRY,N           YES ENTER NAME MRRPG1
0038  07180C   13                GOTO GO2                                       MRRPG1
      07190C********************************************************************MRRPG1
      07200C*                                                                   MRRPG1
      08010C* IF TERMINAL WAS IN THE ATTACHED LIST AND RETURN CODE              MRRPG1
      08020C*    IS CANCEL,GO TO RELEASE TERMINAL ROUTIN                        MRRPG1
      08030C*                                                                   MRRPG1
      08040C********************************************************************MRRPG1
0039  08050C           GO1       TAG                                            MRRPG1
0040  08060C   12 09             GOTO RELEAS                     CLEAR TERM     MRRPG1
      08070C********************************************************************MRRPG1
      08080C*                                                                   MRRPG1
      08090C* IF NEGATIVE RETURN CODE-IND ON IS 03,GO TO                        MRRPG1
      08100C*    INPUT TP ERROR ROUTINE                                         MRRPG1
      08110C*                                                                   MRRPG1
      08120C********************************************************************MRRPG1
0041  08130C           GO2       TAG                                            MRRPG1
0042  08140C   03                GOTO IPTER                      NEG RET CODE   MRRPG1
      08150C********************************************************************MRRPG1
      08160C*                                                                   MRRPG1
      08170C* IF POSITIVE RETURN CODE(GREATER THAN ZERO) BUT                    MRRPG1
      08180C*    NOT EQUAL TO 10 GO TO INVALID DATA ROUTINE                     MRRPG1
      08190C*                                                                   MRRPG1
      08200C********************************************************************MRRPG1
0043  09010C         07          GOTO INVDAT                     INV DATA ROUTINMRRPG1
      09020C********************************************************************MRRPG1
      09030C*                                                                   MRRPG1
      09040C* IF RETURN CODE=0,IND 04 IS ON AND IF                              MRRPG1
      09050C*    OPERATOR=N,GO TO RELAEASE TERMINAL ROUTINE                     MRRPG1
      09060C*                                                                   MRRPG1
      09070C********************************************************************MRRPG1
0044  09080C   04      OPRATR    COMP 'N'                      13ANY MORE DATA  MRRPG1
0045  09090C   04 13             GOTO RELEAS                     NO,RELEASE     MRRPG1
      09100C********************************************************************MRRPG1
      09110C* 1 CHECK INPUT LENGTH = 8,IF NOT 8 TURN IND 07 ON                  MRRPG1
      09120C* 2 CHECK VALID OPERATOR ,IF OPERATOR IS + TURN IND                 MRRPG1
      09130C*    14 ON,IF OPERATOR IS - TURN ON IND 15,IF OPERATOR             MRRPG1
      09140C* S  IS ANY OTHER VALUE TURN ON IND 07                              MRRPG1
      09150C* 3 CHECK VALID DATA IF NOT VALID TURN IND 07 ON                    MRRPG1
      09160C********************************************************************MRRPG1
0046  09170C   04      EFFL      COMP 8                    0707  LEN XACTLY 8   MRRPG1
0047  09180C   07                GOTO INVDAT                                    MRRPG1
0048  09190C   04      OPRATR    COMP '+'                  151514IS ADD WANTED  MRRPG1
0049  09200C   04 15   OPRATR    COMP '-'                  070715IS SUBTRACT    MRRPG1
0050  10010C   04N07   TPIPT     COMP 0                      07  VALID NUMBER   MRRPG1
      10020C********************************************************************MRRPG1
      10030C*                                                                   MRRPG1
      10040C* IF INPUT IS NOT VALID GO TO INVALID DATA ROUTINE                  MRRPG1
      10050C*                                                                   MRRPG1
      10060C********************************************************************MRRPG1
0051  10070C   04 07             GOTO INVDAT                                    MRRPG1
      10080C********************************************************************MRRPG1
      10090C*                                                                   MRRPG1
      10100C* 1 FIND PROPER ACCUMULATOR                                         MRRPG1
      10110C* 2 ADD OR SUBTRACT INPUT TO ACCUMULATOR                            MRRPG1
      10120C*                                                                   MRRPG1
      10130C********************************************************************MRRPG1
0052  10140C   04 14   ACMY,N    ADD  TPIPT     ACMY,N           ADD TO ACMLATR MRRPG1
0053  10150C   04 15   ACMY,N    SUB  TPIPT     ACMY,N           SUB FROM ACMLTRMRRPG1
      10160C********************************************************************MRRPG1
      10170C*                                                                   MRRPG1
      10180C* DETERMINE IF THE ACCUMULATOR IS NEGATIVE-LESS THAN 0-             MRRPG1
      10190C*   TURN ON IND 16 WHICH ALLOWS A MINUS SIGN TO                     MRRPG1
      10200C*   OVERRIDE  THE PLUS SIGN ON OUTPUT SPECIFICATION                 MRRPG1
      11010C*                                                                   MRRPG1
      11020C********************************************************************MRRPG1
0054  11030C         04ACMY,N    COMP 0                      16  RESULT NEG     MRRPG1
      11040C********************************************************************MRRPG1
      11050C*                                                                   MRRPG1
```

Figure 6-22 (Part 2 of 6). Example 2 — RPG II MRT Program

```
      11060C*                                                                   MRRPG1
      11070C********************************************************************MRRPG1
0055  11080C           OPTPUT    TAG                                            MRRPG1
0056  11090C         18          SETOF                     18                   MRRPG1
0057  11100C         04          MOVE '52'      TPRY,3           OUT LEN        MRRPG1
0058  11110C         04          EXCPT                           SEND CURNT VAL MRRPG1
      11120C********************************************************************MRRPG1
      11130C*                                                                   MRRPG1
      11140C*                                                                   MRRPG1
      11150C********************************************************************MRRPG1
0059  11160C      91             GOTO OPTERR                     NO GO TO ER RTNMRRPG1
      11170C********************************************************************MRRPG1
      11180C*                                                                   MRRPG1
      11190C** IF SUCCESSFUL DO INVITE INPUT FOR THIS TERM AND THEN GO TO ACCEPTMRRPG1
      11200C** INPUT FROM ANY ONE                                               MRRPG1
      12010C*                                                                   MRRPG1
      12020C********************************************************************MRRPG1
0060  12030C           INVIT     TAG                                            MRRPG1
0061  12040C         01          MOVE ' E'      TPRY,2           INVITE OP CODE MRRPG1
0062  12050C         01          MOVE '22'      TPRY,4           XPECTED MAX LENMRRPG1
0063  12060C         01          EXIT SUBR91                     INVITE WITHOUT MRRPG1
0064  12070C                     RLABL          TPRY             SPECIAL        MRRPG1
0065  12080C                     RLABL          TNAME                           MRRPG1
      12090C********************************************************************MRRPG1
      12100C*                                                                   MRRPG1
      12110C**ONLY NAME AND LENGTH NEEDED FOR INVITE.THIS COULD HAVE BEEN DONE  MRRPG1
      12120C**VIA EXCPT. IF SO SUBR91 WOULD NOT HAVE BEEN NEEDED.               MRRPG1
      12130C*                                                                   MRRPG1
      12140C********************************************************************MRRPG1
0066  12150C         01          GOTO ACPIPT                     GO ACCEPT INPUTMRRPG1
      12160C********************************************************************MRRPG1
      12170C*                                                                   MRRPG1
      12180C*****END OF MAIN LINE.SPECIAL ROUTINES FOLLOW.                      MRRPG1
      12190C*                                                                   MRRPG1
      12200C********************************************************************MRRPG1
      13010C*                                                                   MRRPG1
      13020C** INPUT ERROR ROUTINE(IPTER)-MINUS RETURN CODE. ENTERED ON INDICA- MRRPG1
      13030C** TOR 03                                                           MRRPG1
      13040C** SUBROUTINE                                                       MRRPG1
      13050C*                                                                   MRRPG1
      13060C********************************************************************MRRPG1
0067  13070C           IPTER     TAG                                            MRRPG1
0068  13080C         03          EXSR CONSB                      TALK TO OPERATRMRRPG1
0069  13090C         13          GOTO RELEAS                     UPON RETURN 13 MRRPG1
      13100C********************************************************************MRRPG1
      13110C*                                                                   MRRPG1
      13120C*MEANS RELEASE THIS TERMINAL. NOT 13 SAYS SEND MESSAGE AND INVITE.  MRRPG1
      13130C*                                                                   MRRPG1
      13140C********************************************************************MRRPG1
0070  13150C         18          MOVE '36'      TPRY,3           OUT LEN        MRRPG1
0071  13160C         18          EXCPT                           SEND MSG       MRRPG1
      13170C********************************************************************MRRPG1
      13180C*                                                                   MRRPG1
      13190C* SINCE NOWAIT WAS SPECIFIED NO RETURN CODE IS AVAILABLE TO CHECK.  MRRPG1
      13200C*                                                                   MRRPG1
      14010C********************************************************************MRRPG1
0072  14020C         18          SETOF                     18                   MRRPG1
0073  14030C         03          GOTO INVIT                                     MRRPG1
      14040C** END OF IPTER                                                     MRRPG1
      14050C********************************************************************MRRPG1
      14060C*                                                                   MRRPG1
      14070C** OUTPUT ERROR ROUTINE(OPTERR)-NON 0 RET CODE                      MRRPG1
      14080C*                                                                   MRRPG1
      14090C********************************************************************MRRPG1
0074  14100C           OPTERR    TAG                                            MRRPG1
0075  14110C         01          SETON                     17                   MRRPG1
0076  14120C         17          EXSR CONSB                      TALK TO OPERATRMRRPG1
0077  14130C         17          SETOF                     17                   MRRPG1
0078  14140C         13          GOTO RELEAS                     13,RELS TERM   MRRPG1
0079  14150C         01          GOTO OPTPUT                     TRY AGAIN      MRRPG1
      14160C** END OF OPTERR                                                    MRRPG1
      14170C********************************************************************MRRPG1
      14180C*                                                                   MRRPG1
      14190C** INVALID DATA ROUTINE(INVDAT)-INPUT LEN NOT 8,INVALID OPERATOR,   MRRPG1
      14200C** (NOT N,+,-),INVALID DIGITS ENTERED,ETC                           MRRPG1
```

Figure 6-22 (Part 3 of 6). Example 2 – RPG II MRT Program

```
      15010C*                                                                   MRRPG1
      15020C********************************************************************MRRPG1
0080  15030C           INVDAT    TAG                                            MRRPG1
0081  15040C         07          SETON                     18                   MRRPG1
0082  15050C         07          MOVE '36'      TPRY,3           OUT LEN 18     MRRPG1
0083  15060C         07          EXCPT                           TELL TERMINAL  MRRPG1
0084  15070C         07          SETOF                     18                   MRRPG1
0085  15080C         07          GOTO INVIT                      INVITE MORE    MRRPG1
      15090C*                                                    INPUT FROM THISMRRPG1
      15100C*                                                    TERMINAL       MRRPG1
      15110C** END OF INVDAT ROUTINE                                            MRRPG1
      15120C********************************************************************MRRPG1
      15130C*                                                                   MRRPG1
      15140C**RELEASE TERMINAL ROUTINE(RELEAS) RELEASES TERMS, CLEARS ATTACHED  MRRPG1
      15150C**LIST AND ACCUMULATOR LIST ENTRIES AND DETERMINES WHEN TO GO TO EOJMRRPG1
      15160C*                                                                   MRRPG1
      15170C********************************************************************MRRPG1
0086  15180C           RELEAS    TAG                                            MRRPG1
0087  15190C         09          GOTO RELCLR                     CLEAR LISTS    MRRPG1
      15200C*                                                                   MRRPG1
      16010C* NOTE 09 MEANS A TERMINAL ATTACHED TO THIS PROGRAM HAS ENTERED     MRRPG1
      16020C* COMMAND INTERRUPT MODE AND ENTERED THE RELEASE COMMAND.           MRRPG1
      16030C*                                                                   MRRPG1
0088  16040C         13          MOVE ' K'      TPRY,2           REL TERM OP CODMRRPG1
0089  16050C         13          EXIT SUBR91                                    MRRPG1
0090  16060C                     RLABL          TPRY                            MRRPG1
0091  16070C                     RLABL          TNAME                           MRRPG1
0092  16080C           RELCLR    TAG                                            MRRPG1
0093  16090C   09                                                               MRRPG1
0094  16100COR       13          MOVE '      '  ATRY,N           CLEAR THIS NTRYMRRPG1
0095  16110C   09                                                               MRRPG1
0096  16120COR       13          MOVE '000000'  ACMY,N                          MRRPG1
0097  16130C   09                                                               MRRPG1
0098  16140COR       13          GOTO ACPIPT                                    MRRPG1
      16150C********************************************************************MRRPG1
      16160C*                                                                   MRRPG1
      16170C**SHUTDOWN ROUTINE (SHTDWN) 04 RET CODE. ISSUES STOP INVITES AND    MRRPG1
      16180C**SHUTDOWN MESSAGE TO ALL ATTACHED TERMS BEFORE GOING TO EOJ        MRRPG1
      16190C*                                                                   MRRPG1
      16200C********************************************************************MRRPG1
0099  17010C           SHTDWN    TAG                                            MRRPG1
0100  17020C         06          SETON                   11SHUTDOWN  IND  MRRPG1
0101  17030C           SHDWNO    TAG                                            MRRPG1
0102  17040C         11N         ADD  1         N                ADD TO INDEX   MRRPG1
0103  17050C         11ATRY,N    COMP '      '                 19TERMINAL HERE  MRRPG1
0104  17060C         19          GOTO SHDWN1                     NO CHECK NEXT  MRRPG1
0105  17070C         11          MOVE ATRY,N    TPRY,5           TNAME TO ARY   MRRPG1
0106  17080C         11          MOVE ' D A'    TPRY,2           STOP INVITE    MRRPG1
0107  17090C         11          MOVE '22'      TPRY,4           MAX XPECTO LEN MRRPG1
0108  17100C         11          READ TPCONSIO                                  MRRPG1
0109  17110C         11          EXSR RETCHK                     CHECK TRN CODE MRRPG1
0110  17120C         09          GOTO SHDWN1                     TERM CANCELLED MRRPG1
0111  17130C         11          MOVE '48'      TPRY,3            OUT LEN       MRRPG1
0112  17140C         11          EXCPT                           APPROPRIATE MSGMRRPG1
0113  17150C           SHDWN1    TAG                                            MRRPG1
```

Note: When the last terminal attached to an MRT program is processed, issue a Release Terminal operation to that terminal in order to check the count of outstanding Invite Inputs. If the count is greater than zero, the program can issue an Accept Input operation. For example, suppose an MRT program is servicing the maximum number of requestors and one or more additional requests are queued to the program. If the program receives a shutdown-requested return code (04) and goes to end of job without checking the count of outstanding Invite Inputs, the program terminates with a 2C termination code (going to end of job with outstanding Invite Inputs) and each of the queued terminals receives an S06 message (program cancelled – shutdown).

Figure 6-22 (Part 4 of 6). Example 2 – RPG II MRT Program

```
0114  17160C         11N         COMP 4                        LRDONE           MRRPG1
0115  17170C        NLR          GOTO SHOWNO                     NO,NEXT TERM   MRRPG1
0116  17180C         LR          GOTO END                        YES,EOJ        MRRPG1
0117  17190C           END       TAG                                            MRRPG1
      17200C********************************************************************MRRPG1
      18010C*                                                                   MRRPG1
      18020C** RETURN CODE CHECKING ROUTINE(RETCHK)                             MRRPG1
      18030C*                                                                   MRRPG1
      18040C********************************************************************MRRPG1
0118  18050CSR         RETCHK    BEGSR                                          MRRPG1
0119  18060CSR       01          SETOF                     060708               MRRPG1
0120  18070CSR       01          SETOF                     0910                 MRRPG1
0121  18080CSR       01RETCOD    COMP 00                   050304               MRRPG1
0122  18090CSR       03                                                         MRRPG1
0123  18100COR       04          GOTO ENDRET                                    MRRPG1
0124  18110CSR       05RETCOD    COMP 04                   080706SHUT DOWN      MRRPG1
0125  18120CSR       06                                                         MRRPG1
0126  18130COR       07          GOTO ENDRET                                    MRRPG1
0127  18140CSR       08RETCOD    COMP 08                       09TERM CANCELLED MRRPG1
0128  18150CSR      N09RETCOD    COMP 10                       10STOP INVITE  OKMRRPG1
0129  18160CSR      N09                                                         MRRPG1
0130  18170COR   N10             SETON                         07CATCHALL       MRRPG1
0131  18180CSR         ENDRET    TAG                                            MRRPG1
0132  18190CSR                   ENDSR                                          MRRPG1
      18200C**END OF RETCHK                                                     MRRPG1
      19010C********************************************************************MRRPG1
      19020C*                                                                   MRRPG1
      19030C** CONSOLE I/O ROUTINE.                                             MRRPG1
      19040C*                                                                   MRRPG1
      19050C********************************************************************MRRPG1
0133  19060CSR         CONSB     BEGSR                                          MRRPG1
0134  19070CSR       01          MOVE TNAME     SAVE    6        SAVE TNAME     MRRPG1
0135  19080CSR       91          SETON                     81    CONSLO EXCPT   MRRPG1
0136  19090CSR       91          SETOF                     91    CLEAR NEG RETCDMRRPG1
0137  19100CSR       01          MOVE '47'      TPRY,3           OUT LEN        MRRPG1
0138  19110CSR       01          MOVE '16'      TPRY,4           MAX INPUT LEN  MRRPG1
0139  19120CSR       01          EXCPT                           PUT CONSOLE    MRRPG1
0140  19130CSR       01          READ TPCONSIO                   GET CONSOLE    MRRPG1
0141  19140CSR       01          MOVE SAVE      TNAME            RESTORE TNAME  MRRPG1
0142  19150CSR       01CONSIP    COMP 'TA'                 131318DOES OPERATOR -MRRPG1
0143  19160CSR       81          SETOF                     81                   MRRPG1
0144  19170CSR         CONSE     ENDSR                           WANT TO        MRRPG1
      19180C**END OF CONSB SUBROUTINE                            TRY AGAIN      MRRPG1
0145  200100TPCONSIOE              81                                           MRRPG1
0146  200200                         TPRY,3    08                               MRRPG1
0147  200300                                   04 'C'                           MRRPG1
0148  200400                                   14 'CONSOL'                      MRRPG1
0149  200500                       03          40 'INPUT  TP ERROR TNAME-'      MRRPG1
0150  200600                       17          40 'OUTPUT TP ERROR TNAME-'      MRRPG1
0151  200700                         TNAME     47                               MRRPG1
0152  200800        E           18                                              MRRPG1
0153  200900                         TPRY,3    08                               MRRPG1
0154  201000                                   04 'CF'                          MRRPG1
0155  201100                         TNAME     14                               MRRPG1
0156  201200                                   36 'TRY AGAIN'                   MRRPG1
0157  201300                       07          26 'INV DATA'                    MRRPG1
0158  201400                       03          26 'TP ERROR'                    MRRPG1
0159  201500        E        04N17N07                                           MRRPG1
0160  201600                         TPRY,3    08                               MRRPG1
0161  201700                                   04 'CB'                          MRRPG1
0162  201800                         TNAME     14                               MRRPG1
0163  201900                                   30 'CURRENT VAL-'                MRRPG1
0164  202000                                   31 '+'                           MRRPG1
0165  210100                 16                31 '-'                           MRRPG1
0166  210200                                   52 'ENTER DATA'                  MRRPG1
0167  210300                         ACMY,N3   41                               MRRPG1
0168  210400        E        11                                                 MRRPG1
0169  210500                         TPRY,3    08                               MRRPG1
0170  210600                                    4 'CF'                          MRRPG1
0171  210700                         ATRY,N    14                               MRRPG1
0172  210800                                   28 'CCP SHTDWN'                  MRRPG1
0173  210900                                   38 'LAST REC-'                   MRRPG1
0174  211000                       03          48 'TP ERROR'                    MRRPG1
0175  211100                       07          48 'BAD DATA'                    MRRPG1
0176  211200                       04OPRATR    41                               MRRPG1
0177  211300                       04TPIPT     48                               MRRPG1
0178  211400                       10          48 ' NO DATA'                    MRRPG1
      211500* END OF PROG                                                       MRRPG1
```

Figure 6-22 (Part 5 of 6). Example 2 – RPG II MRT Program

```
INDICATORS USED
       LR 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 81 91

           EXECUTION TIME TABLES AND ARRAYS
STMT#   TABLE/  DEC  ENTRY  NUMBER OF   DTT      T/A
DEFINED  ARRAY  POS  LENGTH  ENTRIES    DISP     DISP
 0004   TPRY          006   00005      0100     002D
 0005   ATRY          006   00004      0108     004B
 0006   ACMY     0    010   00004      0110     0009

 FIELD NAMES USED
STMT#  NAME   DEC  LGTH  DISP
 0009 RETCOD  0    002   006F
 0010 EFFL    0    004   0073
 0011 TNAME        006   0063
 0012 OPRATR       001   0064
 0013 TPIPT   0    007   007A
 0014 CONSIP       003   0067
 0019 N       0    001   007B
 0134 SAVE         006   006D

 LABELS USED
STMT#  NAME    TYPE
 0015 ACPIPT  TAG
 0025 LUP1    TAG
 0033 LUP2    TAG
 0039 GO1     TAG
 0041 GO2     TAG
 0055 OPTPUT  TAG
 0060 INVIT   TAG
 0067 IPTER   TAG
 0074 OPTERR  TAG
 0080 INVDAT  TAG
 0086 RELEAS  TAG
 0092 RELCLR  TAG
 0099 SHTDWN  TAG
 0101 SHDWN0  TAG
 0113 SHDWN1  TAG
 0117 END     TAG
 0118 RETCHK  BEGSR
 0131 ENDRET  TAG
 0133 CONSB   BEGSR
 0144 CONSE   ENDSR

 ERROR NUMBER  STATEMENT NUMBER
   RG 097          0008
   RG 558          0022
   RG 558          0108
   RG 558          0140

 ERROR SEVERITY                                    TEXT
RG  097 W        NO FIELDS DESCRIBED FOR THIS OR PREVIOUS RECORD.
RG  558 W        INVALID USE OF, OR MISSING, RESULTING INDICATORS WITH THIS OP CODE.  ASSUME
                  INVALID RESULTING INDICATORS BLANK.
```

Figure 6-22 (Part 6 of 6). Example 2 – RPG II MRT Program

Chapter 7: Basic Assembler Programming for CCP

As an Assembler programmer, you must be familiar with the information included in *Chapter 2: Standard Application Program Interface to the CCP.* To assist you in supplying codes needed for your source program, the CCP provides six macro instructions, each of which generates information needed by the source program.

Four of these macros generate equates for values significant to communications under CCP: $NCOM, $NPLO, $NOPV, and $NRTV. The fifth macro – $NPL – generates a parameter list, and the sixth macro – $NCIO – generates a request for a communications operation.

Each of the supplied macro-definitions is a member of the Source Library on your program-preparation pack.

Note: Because several of these macros use macro processor facilities not available prior to version 08, modification level 00 of System/3 Model 10 Disk System Management, they should not be used for program preparation with an earlier version of the Macro Processor on that system.

Symbols Used in Defining Macro Instructions

The symbols [ ] and { } are used in this publication to help define the macro instructions. You do not code these symbols; they are only used to indicate how a macro instruction may be written.

[ ] indicates an optional operand. The operand enclosed in the brackets may or may not be coded, depending on whether or not the associated option is desired. If more than one item is enclosed in brackets, for example $\begin{bmatrix}\text{GET}\\\text{PUT}\end{bmatrix}$, either one or none of the items may be coded.

{ } indicates that a choice must be made. One of the operands from the vertical stack within braces, for example $\begin{Bmatrix}\text{YES}\\\text{NO}\end{Bmatrix}$ *must* be coded, depending on which of the associated services is desired.

Options that are underlined are the default values used by the CCP if you do not provide an operand. For example, for $\begin{Bmatrix}\text{YES}\\\text{NO}\end{Bmatrix}$, YES is the assumed value.

For cases in which YES is appropriate, Y may be coded; for cases in which NO is appropriate, N may be coded.

For more information concerning the coding of macro instructions, see the following manuals:

- *IBM System/3 Models 10 and 12 Control Programming Macros Reference Manual,* GC21-7562
- *IBM System/3 Model 15 System Control Programming Macros Reference Manual,* GC21-7608

Mnotes

Mnotes applicable to the supported Assembler macros are described at the end of this chapter. Each mnote description addresses the severity of the problem, the issuing macro, an explanation of the problem, system action, and suggested programmer action.

GENERATE EQUATES FOR COMMON VALUES ($NCOM)

The $NCOM macro generates a set of symbolic equates, each of which represents a value commonly used in CCP Assembler language communications programming. The symbols generated and the values they represent are:

Symbol	*Decimal Value*	*Value Represented*
$NIXR1	1	Index register 1
$NIXR2	2	Index register 2
$NSENT	4	Address of General Entry
$NSCCR	1	DSM RIB for CCP
$NSCCS	0	CCP sub-RIB for communications operation
$NLPL	16	Length of a parameter list
$NLPLF	2	Length of a parameter list field
$NLSTN	6	Length of a symbolic terminal name

This macro need be used only once in an assembly to generate the desired symbols. However, if this macro is used more than once in an assembly, duplicate symbols are not to be generated and no assembly error or error mnote is generated. A warning mnote is issued, however, each time this macro is used after the first use.

The symbols generated by this macro are used by the $NCIO macro. If the $NCIO macro is issued in an assembly and the $NCOM macro has not previously been issued, the $NCIO macro generates the symbols. However, each subsequent time the $NCOM macro is issued, a warning mnote is issued.

The format of the $NCOM macro is:

1	8	14
	$NCOM	

Notes:

- This macro has no operands.
- The name field of this macro is not used; any symbol entered in this field is ignored.

GENERATE EQUATES FOR PARAMETER LIST OFFSETS ($NPLO)

The $NPLO macro generates a set of symbolic equates. Each symbol generated represents a field in a parameter list, and is equated to the displacement (offset from the first byte of the parameter list) of the rightmost byte of that field.

The symbols generated, and the fields they represent are:

Symbol	*Decimal Value*	*Field Represented*
$NPRTC	1	Return code field
$NPOPC	3	Operation code/modifier field
$NPOUL	5	Output data length field (see note)
$NPEFL	5	Effective (actual) input data length field (see note)
$NPATI	5	Attributes identifier field (see note)
$NPINL	7	Maximum input data length field
$NPRAA	9	Record area address field
$NPWKA	11	Internal work field
$NPWKB	13	Internal work field
$NPWKC	15	Internal work field

Note: Symbols $NPOUL, $NPEFL, and $NPATI represent the same field within a parameter list and are equated to identical displacements.

This macro need be used only once in an assembly to generate the desired symbols. If used more than once, it does not cause duplicate symbols to be generated and no assembly error or error mnote is generated. A warning mnote is issued, however, each time this macro is issued after the first.

The symbols generated by this macro are used by the $NCIO macro. If the $NCIO macro is used in an assembly but the $NPLO macro has not been previously issued, the $NCIO macro generates the symbols itself. However any subsequent use of the $NPLO macro only causes a warning mnote to be issued (duplicate symbols are not generated).

The format of the $NPLO macro is:

1	8	14
	$NPLO	

Notes:

- This macro has no operands.
- The name field of this macro is not used; any symbol entered in this field is ignored.

GENERATE OPERATION CODE/MODIFIER VALUES ($NOPV)

The $NOPV macro generates a set of symbolic equates. Each symbol generated represents the value of a CCP communications operation code or operation modifier (see *Appendix E* for the hexadecimal values of the operation code/modifier combinations). The symbols generated, and the operation code or modifier each represents, are:

Symbol	*Operation defined*
$NCAQC	Acquire Command-mode Terminal
$NCGET	Get
$NCPUT	Put
$NCPTG	Put-Then-Get
$NCPNW	Put-No-Wait
$NCINV	Invite Input
$NCACC	Accept Input
$NCSPI	Stop Invite Get
$NCGTA	Get Terminal Attributes
$NCACQ	Acquire Terminal
$NCREL	Release Terminal
$NCSHQ	Shutdown Inquiry
$NCCPY	Copy (3270 DFF only)
$NCEAU	Erase All Unprotected (3270 DFF only)
$NCTCH	Chain Task Request
	Modifier defined
$NMMSG	Send end-of-transmission
$NMBLK	End of current data block
$NMRVI	Send Reverse Interrupt
$NMKPL	Keep control of communications line
$NMSTA	Set Terminal attributes
$NMNNL	Record does not start a new line (not New Line)
$NMNEL	Record does not end the current line (not End Line)
$NMOVR	Override/Selected Field List (3270 DFF only)
$NMPRF	Program request under format

This macro need be used only once in an assembly to generate the desired symbols. If used more than once, this macro does not cause duplicate symbols to be generated and no assembly error or error mnote is generated. However, a warning mnote is issued each subsequent time this macro is issued in the assembly.

The symbols generated by this macro are used by the $NCIO macro. If the $NCIO macro is issued in an assembly but the $NOPV macro has not previously been issued, the $NCIO macro generates the symbols itself. However, any subsequent use of the $NOPV macro only causes a warning mnote to be issued (duplicate symbols are not generated).

The format of the $NOPV macro is:

1	8	14
	$NOPV	

Notes:

- This macro has no operands.
- The label field of this macro is not used; if a symbol is specified in the label field, it is ignored.

GENERATE EQUATES FOR RETURN CODE VALUES ($NRTV)

This macro generates a set of symbolic equates. Each symbol generated represents the two-byte signed numeric value of a return code issued by CCP. The symbols generated, and the meaning and value of the return code specified by each, follow:

Type of Return Code	Symbol	Return Code Value	Meaning
No error or exception	$NOK	0	Successful operation
	$NACTC	14	Successful chain task data accept operation
Exception	$NXDTR	1	Data truncated
	$NXEOT	2	EOT received/non-PRUF data returned to PRUF program
	$NXEDT	3	EOT received and data truncated
	$NXSHD	4	Shutdown requested
	$NXDPD	5	Data pending on BSCA line
	$NXRVI	6	RVI/Terminal Interrupt received
	$NXCLR	7	3270 CLEAR key
	$NXNAV	8	Terminal no longer available
	$NXOFF	9	Terminal offline
	$NXSPI	10	Stop Invite Input successful
	$NXNAQ	11	Acquire terminal failed
	$NXMAX	12	Maximum number of chain task requests already queued
	$NXTCP	13	Insufficient TP buffer available for this request
	$NXADT	15	Chain task data was truncated
Error	$NRDCK	-1	Data check
	$NRTRN	-2	Invalid character
	$NRLST	-3	Lost data
	$NRPBS	-4	Permanent BSCA error
	$NRABN	-5	Abnormal response
	$NRXRA	-6	Transmit/Receive abort
	$NRATO	-7	No response to polling/addressing
	$NRTTO	-8	Text timeout
	$NRWTO	-9	Wait time exceeded
	$NRNOC	-10	No connection
	$NRIID	-11	Invalid ID
	$NRABD	-12	Abort, disconnect
	$NRADC	-13	Adapter check
	$NRNAK	-14	Negative response to addressing
Error (3270 only)	$NR2DU	-20	Device unavailable or not ready
	$NR2ED	-22	Equipment check, device end
	$NR2TE	-23	Terminal control unit detection of BSCA error
	$NR2CD	-24	Control check, data check
	$NR2PD	-25	Data check on Copy command
	$NR2PO	-26	Operation check on Copy command
	$NR2PB	-27	Device busy on Copy Command
	$NR2PC	-28	Control check, operation check, data check on Copy Command
	$NR2PI	-29	Invalid data received from 3270 using DFF (Get, Accept Input, Stop Invite Input operations)

Type of Return Code	Symbol	Return Code Value	Meaning
Error (3735 only)	$NR5SR	-40	Attempted send before receive
	$NR5IC	-41	Invalid character
	$NR5BF	-42	3735 buffer overflow
	$NR5DF	-43	Disk full
	$NR5RF	-44	Directory full
	$NR5UH	-45	Undefined header
	$NR5DE	-46	3735 disk error
Error (3741, 5234, and 5235)	$NR7TE	-50	Transparency error occurred
	$NR7NA	-51	No activity in 20 seconds
	$NR7DC	-52	Data check
	$NR7LB	-53	Received line bid error
	$NR7WL	-54	Wrong length error
	$NR7RP	-55	Reset was pressed on 3741
	$NR7SC	-56	Security check
	$NR7DO	-57	Disk overflow
	$NR7BE	-58	Bad extent error
	$NR7BT	-59	Both stations transmit
	$NR7LE	-60	Length error
	$NR7NF	-61	No record found on disk
	$NR7SE	-62	Seek error
	$NR7RE	-63	Read error
	$NR7WE	-64	Write error
	$NR7NR	-65	3741 not ready
	$NR7WP	-66	Diskette is write-protected

For more information concerning these return codes, and recommended user actions, see *Appendix E: Return Codes.*

This macro need only be used once in an assembly to generate the desired symbols. If it is used more than once, duplicate symbols are not generated and no assembly error is forced. However each subsequent time this macro is used, a warning mnote is issued.

The format of the $NRTV macro is:

1	8	14
	$NRTV	

Notes:
1. This macro has no operands.
2. The label field of this macro is not used; if a symbol is specified in the label field, it is ignored.

GENERATE PARAMETER LIST ($NPL)

The $NPL macro generates a communications parameter list. You can specify the initial value of each field of this list. This macro may be used any number of times in an assembly; a separate parameter list is generated each time this macro is used. When the parameter list is generated, the operand values specified are not checked for validity; therefore, care must be taken that only valid operands are specified.

The format of the $NPL macro is:

1	8	14
[label]	$NPL	[OP—valuex] [{ ,OUTLEN-valuex ,ATTRID-valuex }] [,INLEN-valuex] [,RECA-addrx]

See *Note* under $NCIO macro for the meaning of *valuex* and *addrx.*

If you specify a label with the $NPL macro, an EQUATE is generated. This EQUATE sets the specified symbol equal to the address of the first byte of the parameter list generated.

OP-valuex specifies an initial value for the operation/modifiers field of the parameter list. If this operand is omitted, a value of X'0000' is generated for the operation/modifiers field.

The operand value should represent a valid CCP operation. Any valid absolute expression may be used, but it is recommended that operation and modifier values generated by the $NOPV macro be used.

OUTLEN-valuex specifies an initial value for the output data length field. If this operand is omitted (and the ATTRID operand is also omitted), a value of X'0000' is generated for the output data length field.

Because the output data length field (generated by OUTLEN) and the attributes identifier field (generated by ATTRID) occupy the same locations in the parameter list, both operands cannot be specified in one macro instruction. If both are specified, an error mnote is generated.

The operand value may be any valid absolute expression. Note that a data length entry does not include the six-byte symbolic terminal name found at the beginning of a record area.

ATTRID-valuex specifies an initial value for the attributes identifier field of the parameter list. If this operand is omitted and the OUTLEN operand is also omitted, a value of X'0000' is generated for the attributes identifier field.

Because the attributes identifier field generated by ATTRID and the output data length field (generated by OUTLEN) occupy the same locations in the parameter list, both operands cannot be specified in one macro instruction. If both are specified, an error mnote is generated. The operand value, which may be any valid absolute expression, should represent a positive number that corresponds to the identifier of a terminal-attributes set that has been defined for your installation. This definition is performed in a CCP Assignment Build run by a // TERMATTR statement.

INLEN-valuex specifies an initial value for the maximum input data length field of the parameter list; if this operand is omitted, a value of X'0000' is generated for that field.

This operand, which may be any valid absolute expression, should represent a positive number which is no greater than the length of the data portion of the record with which this parameter list will initially be used. The six-byte symbolic terminal name at the beginning of the record area is not included as part of the input data length.

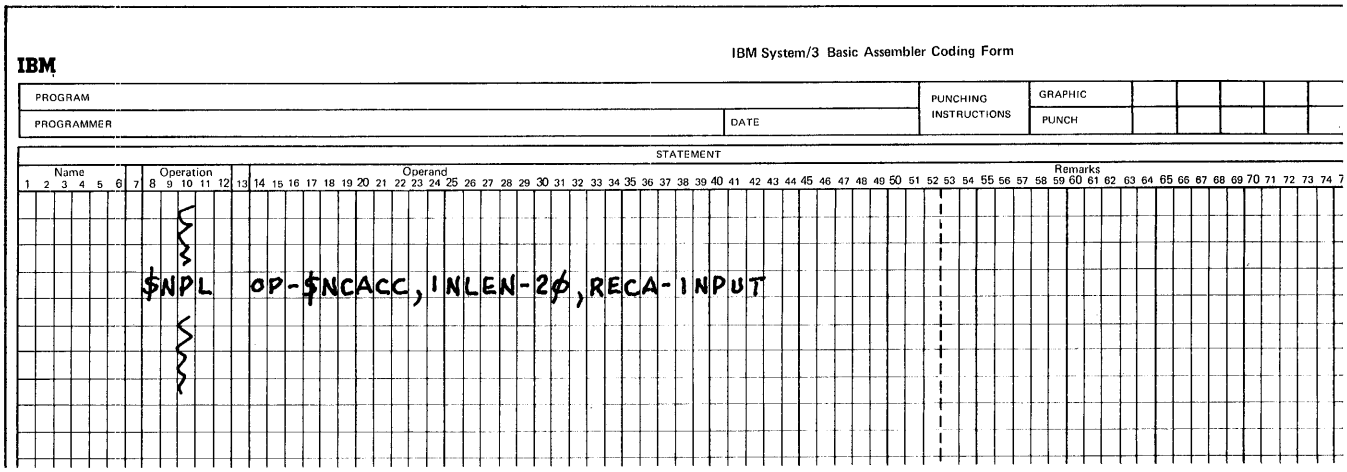
RECA-addrx specifies an initial value for the record area address field in the parameter list; if this operand is omitted, a relocatable value equal to the beginning of the parameter list plus 16 is generated for that field.

This operand, which may be any valid relocatable expression, should represent the high-order (leftmost) byte of the record area. Note that the high-order byte of the record area is the leftmost byte of the name field in the record area, *not* the address of the first byte of the data portion of the record area.

Each time this macro is used, a 16-byte parameter list (composed of eight successive 2-byte DC fields) is generated. Any fields which will not be affected by the operands of this macro are set to X'0000'. If you specify a label in this macro instruction, the specified symbol is equated to the address of the high-order (leftmost) byte of the generated parameter list. No additional symbols are generated by this macro. You can cause symbols to be generated for offsets of fields within a parameter list by issuing a $NPLO macro instruction or by issuing a $NCIO macro instruction without issuing a $NPLO macro instruction.

Example

In the following example, initial values are placed in a parameter list using the $NPL macro:



IBM

IBM System/3 Basic Assembler Coding Form

PROGRAM

PROGRAMMER

DATE

PUNCHING INSTRUCTIONS

GRAPHIC

PUNCH

STATEMENT

```
       $NPL  OP-$NCACC,INLEN-20,RECA-INPUT
```

As a result of issuing the $NPL macro as shown above, a parameter list is generated with the operation code set to Accept Input, the maximum input length set to 20, and the address of the record area set to the address of INPUT (a record area defined elsewhere in the program).

SET CONTROL INFORMATION FOR COMMUNICATIONS OPERATION ($NCIO)

The $NCIO macro provides control information needed to identify a communications operation and request CCP to perform that operation.

The format of the $NCIO macro is:

```
1      8        14

       $NCIO    [PLIST-      ( addrx            )
                             ( dispx(,regx)     )
                             ( (1)              )  ]
                             ( (2)              )
                             ( (addrx)          )
                             ( (dispx(,regx))   )

                             / GET [,RVI ]                                                   \
                             ( {PUT}[,{BLK}] [NNL] [,NEL]  [,OVR] [,PRF]                      )
                             ( {PNW}  {MSG}                                                   )
                             (  PTG[,NNL]  [,NEL]                                             )
                             ( INV                                                            )
                             ( ACC                                                            )
                             ( SPI                                                            )
                             ( GTA                                                            )
                             ( ACQ [,{CMD}]                                                   )
                [,OP-        (       {STA}                                                    )  ]
                             ( REL[,KPL]                                                      )
                             ( CPY                                                            )
                             ( EAU                                                            )
                             ( SHQ                                                            )
                             ( TCH                                                            )
                             ( WAT                                                            )
                             ( valuex                                                         )
                             ( (1)                                                            )
                             ( (address)                                                      )
                             \ (dispx(,regx))                                                 /

                  {        }   { addrx          }
                [,{OUTLEN  } - { (1)            }  ]
                  {ATTRID  }   { (addrx)        }
                               { (dispx(,regx)) }

                               { valuex         }
                [,INLEN  -     { (1)            }  ]
                               { (addrx)        }
                               { (dispx(,regx)) }

                               { addrx          }
                [,RECA-        { (1)            }  ]
                               { (addrx)        }
                               { (dispx(,regx)) }

                               { chars          }
                [,TNAME-       { (addrx)        }  ]
                               { (dispx(,regx)) }

                [,EXEC-        {YES}  ]
                               {NO }
```

Note: The following operand forms must be enclosed in apostrophes:

'operation,modifier' (OP – operand)
'chars' (TNAME – operand)
'(dispx(,regx))'

Notes:

- All operands in this macro are optional.
- Several syntactic classes are included in these descriptions, and are defined as follows:

  valuex — an absolute expression representing a number whose assembled value will fall in the range $0 \leq \text{value} \leq 32{,}767$

  dispx — an absolute expression (representing a displacement from a base address) whose assembled value will fall in the range $0 \leq \text{value} \leq 255$.

  regx — an absolute expression (representing the number of an index register) whose assembled value will be either 1 or 2.

  addrx — a relocatable expression representing a main-store address in your program.

  chars — one to six alphameric characters.

- Certain operand values may be written with surrounding parentheses to specify indirect addressing. If the first character of such an operand value is a left-parenthesis, the last character of that value must be a right-parenthesis. If this is not the case, an error is issued and the macro instruction is not generated.
- If an operand value is written enclosed in parentheses, the total number of characters within the parentheses must not exceed 16; if the number of characters exceeds 16, an error is issued, and the macro instruction is not generated.
- The $NCIO macro can be used any number of times within an assembly.
- If you specify a label in the $NCIO macro instruction, an equate is generated. This equate sets the specified symbol equal to the address of the first byte of the first instruction generated.
- The first time a $NCIO instruction is used in an assembly, any or all of three sets of symbolic equates may be generated. If any of three macros ($NCOM, $NPLO, or $NOPV) had not been issued before in that assembly, any equates which would have been produced by that macro are generated by the $NCIO macro. Any subsequent issuance of any of these macros produces a warning mnote.
- In the generation of the $NCIO macro, no check is made that any expression is syntactically valid to the Assembler, nor that the value generated is valid for its intended use.

$$[\text{PLIST} \quad \left\{\begin{array}{l} \text{addrx} \\ \text{dispx(,regx)} \\ \text{(1)} \\ (\underline{2}) \\ \text{(addrx)} \\ \text{(dispx(,regx))} \end{array}\right\}]$$

The *PLIST* operand specifies the address of the high-order (leftmost) byte of the communications parameter list being used.

When a request is made of CCP to perform a communications operation, the address of the parameter list used with this operation must be in index register 2. Therefore, you must either ensure that the address of your parameter list is in index register 2 when the instructions generated by this macro are executed, or code this operand in order to set index register 2 to the appropriate operand.

Omit this operand or code (2) to signify that index register 2 already contains the address of the parameter list. Specifying a value of other than (2) causes an instruction to be generated which loads index register 2 with the parameter list address you specify. The source of this address is determined by the form in which you specify the operand:

Form	*Index Register 2 set to:*
addrx	The value of the expression itself.
dispx(,regx)	An address equal to the value of the specified displacement added to the contents of the specified index register.
(1)	The contents of index register 1.
(addrx)	The contents of a 2-byte field in main storage whose rightmost byte is located at the specified address.
(dispx(,regx))	The contents of a 2-byte field in main storage whose rightmost byte is located at the specified displacement from an address contained in the specified index register.

```
      ⎧ GET[,RVI]                                      ⎫
      ⎪ {PUT}[,{BLK}] [,NNL] [,NEL] [,OVR] [,PRF]      ⎪
      ⎪ {PNW}  {MSG}                                   ⎪
      ⎪ PTG [,NNL] [,NEL]                              ⎪
      ⎪ INV                                            ⎪
      ⎪ ACC                                            ⎪
      ⎪ SPI                                            ⎪
      ⎪ GTA                                            ⎪
      ⎪ ACQ[,{CMD}]                                    ⎪
[,OP  ⎨        {STA}                                   ⎬ ]
      ⎪ REL[,KPL]                                      ⎪
      ⎪ CPY                                            ⎪
      ⎪ EAU                                            ⎪
      ⎪ SHQ                                            ⎪
      ⎪ TCH                                            ⎪
      ⎪ WAT                                            ⎪
      ⎪ valuex                                         ⎪
      ⎪ (1)                                            ⎪
      ⎪ (address)                                      ⎪
      ⎩ (dispx(,regx))                                 ⎭
```

Note: If one (or more) modifiers is specified, the entire operand must be enclosed within apostrophes (for example, OP-'PUT,MSG').

The *OP* operand specifies the setting of the operation field of your parameter list. If this operand is omitted, no instructions are generated to set the operation field.

This operand can identify the actual value to which the field is to set, by specifying:

- an abbreviation of an operation code, and any desired associated modifiers (see Appendix D for meanings of the abbreviations).
- an absolute expression
- the name of a location from which the field's value can be obtained when the instruction is executed.

If the abbreviation of an operation code is used, the field is set to the proper numeric value for that operation (and associated modifier). If one or more modifiers are specified, each must be preceded by a comma; in addition, the entire operand must be enclosed within apostrophes to prevent the Macro Processor from interpreting the operation code and the (first) modifier as a delimiter of the operand. For example, if you specified NNL for the PTG operand, it would be coded OP-'PTG,NNL'.

If several modifiers are used they may be specified in any order after the operation code. In the generation of this macro, no check is made to determine if a valid modifier is used with the operation code.

If the operand value begins with a left-parenthesis, it indicates that the value to be set into the operation field is to come from a specified location when the generated instruction is executed. This location is determined as follows:

If the form is	*The field is set to*
(1)	The contents of index register 1.
(addrx)	The contents of 2-byte field in main storage the rightmost byte of which is located at the specified address.
(dispx(,regx))	The contents of a 2-byte field in main storage, the rightmost byte of which is located at the specified displacement from the specified index register.

If the operand value is neither a 3-character operation code abbreviation (with or without modifiers) nor an expression beginning with a left-parenthesis, it is assumed to be an absolute expression, the assembled numeric value of which is to be set into the operation field.

```
                    ( valuex           )
[ ,(OUTLEN) --------( (1)              ) ]
   (ATTRID)         ( (addrx)          )
                    ( (dispx(,regx))   )
```

These optional operands allow you to specify either the setting of the output data length field (if OUTLEN is specified). If both operands are omitted, no instructions are generated to set the field (the attributes identifier field and the output data length field are the same field in a parameter list). If both OUTLEN and ATTRID are specified in the same macro instruction, an mnote is issued, and the macro instruction is not generated.

The operand may specify either the actual value to be set into the field, or a location from which the value can be obtained at the time the instruction is executed. The source of the value is determined by the form in which the operand value is specified:

If the form is	*The field is set to*
valuex	The value of the expression itself.
(1)	The contents of Index Register 1.
(addrx)	The contents of a 2-byte field in main storage, whose rightmost byte is located at the specified address.
(disp(,regx))	The contents of a 2-byte field in main storage, whose rightmost byte is located at the specified displacement from an address contained in the specified index register.

```
            ( valuex           )
            ( (1)              )
[,INLEN  -- ( (addrx)          ) ]
            ( (dispx(,regx))   )
```

This operand specifies the setting of the maximum input data length field of your parameter list. If this operand is omitted, no instructions are generated to set this field.

The operand may specify either the actual value to be set into the field, or a location from which the value can be obtained at the time the instruction is executed. The source of the value is determined by the form in which the operand value is specified. The possible forms and the resultant setting of each follow.

Operand form	*Resultant setting*
valuex	The value of the expression itself.
(1)	The contents of Index Register 1.
(addrx)	The contents of a 2-byte field in main storage, whose rightmost byte is located at the specified address.
(dispx(,regx))	The contents of a 2-byte field in main storage, whose rightmost byte is located at the specified displacement from an address contained in the specified index register.

```
           ( addrx            )
           ( (1)              )
[,RECA  -- ( (addrx)          ) ]
           ( (dispx(,regx))   )
```

This optional operand specifies the setting of the record area address field of the user's parameter list; if this operand is omitted, no instruction is generated to set that field.

The operand may specify either the actual address to be set into the field, or a location from which the address can be obtained at the time the instruction is executed. The source of the address is determined by the form in which the operand value is specified. The operand forms used, and the field setting for each follow.

Operand form	*Field set to*
addrx	The value of the expression itself.
(1)	The contents of Index Register 1.
(addrx)	The contents of a 2-byte field in main storage, whose rightmost byte is located at the specified address.
(dispx(,regx))	The contents of a 2-byte field in main storage, whose rightmost byte is located at the specified displacement from an address contained in the specified index register.

$$[,\mathrm{TNAME}-\left\{\begin{array}{l}\text{chars}\\ \text{(addrx)}\\ \text{(dispx (,regx))}\end{array}\right\}]$$

This optional operand specifies the setting of the name of the program to be requested or the symbolic terminal name in the name field of the user's record area. When this operand is specified, instructions are generated to set the field; these instructions make use of the record area address in the parameter list as a pointer to the leftmost byte to which the specified name should be moved. If a RECA operand was specified in this macro instruction, the record area address specified by that operand is used; if a RECA operand was not specified in this macro instruction, the address presently contained in the record area address field of the parameter list is used. If this operand is omitted, no instructions are generated to set the program or the symbolic terminal name in the name field.

The operand can specify the program or symbolic terminal name to be set into the field, or a location from which the name can be obtained at the time the instruction is executed. The source of the name is determined by the form in which the operand value is specified. The possible forms of these operands, and the field setting generated by each follow.

Operand form	*Field set to*
chars	The character string specified.
(addrx)	The contents of a 6-byte field in main storage, whose rightmost byte is located at the specified address.
(dispx(,regx))	The contents of a 6-byte field in main storage, whose rightmost byte is located at the specified displacement from an address contained in the specified index register.

$$[,\mathrm{EXEC}-\left\{\begin{array}{l}\underline{\text{YES}}\\ \text{Y}\\ \text{NO}\\ \text{N}\end{array}\right\}]$$

This optional operand specifies whether or not (after setting any control fields specified in other operands of the $NCIO macro instruction) instructions are generated to cause control to be transferred to CCP to perform the operation. If YES (or Y) is specified, or if this operand is omitted (YES is the default value), instructions are generated to request the CCP to perform the operation specified by the programmer, using information either set by this macro instruction or already available in your parameter list and record area.

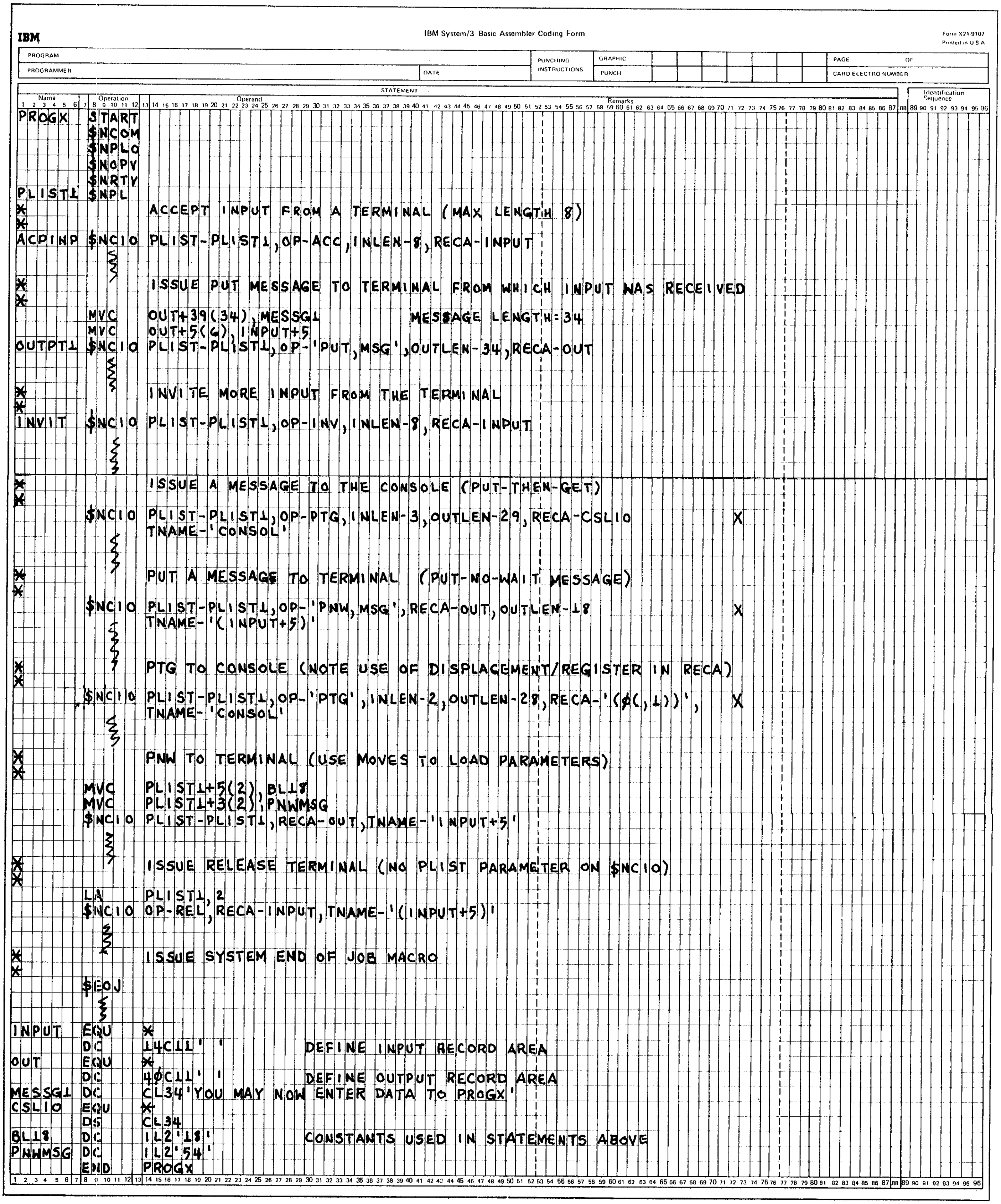
If a NO (or N) is specified, no branch is made to General Entry, and no RIB and sub-RIB generated. You might choose to specify this option when you only want to set certain fields in your parameter list or record area, but you won't be performing the operation until a later point in your program.

Examples of Using $NCIO

Figure 7-1 shows several examples of valid $NCIO macro instructions as you might code them in a program. The examples show various ways of specifying keyword operands for the macro. After issuing the $NCIO macro instruction, your program should test the return code to determine whether the operation was successful or whether it resulted in an error or exception condition. Return codes are summarized in Appendix E.

Use of the $EOJ system macro instruction is also shown in Figure 7-1. You can use non-CCP System/3 macro instructions in your CCP programs. These System/3 macro instructions are described in:

- *IBM System/3 Models 10 and 12 Control Programming Macros Reference Manual,* GC21-7562
- *IBM System/3 Model 15 System Control Programming Macros Reference Manual,* GC21-7608



```
PROGX  START
       $NCOM
       $NPLO
       $NOPV
       $NRTV
PLIST1 $NPL
*            ACCEPT INPUT FROM A TERMINAL (MAX LENGTH 8)
*
ACPINP $NCIO PLIST-PLIST1,OP-ACC,INLEN-8,RECA-INPUT

*            ISSUE PUT MESSAGE TO TERMINAL FROM WHICH INPUT WAS RECEIVED
*
       MVC   OUT+39(34),MESSG1              MESSAGE LENGTH:34
       MVC   OUT+5(6),INPUT+5
OUTPT1 $NCIO PLIST-PLIST1,OP-'PUT,MSG',OUTLEN-34,RECA-OUT

*            INVITE MORE INPUT FROM THE TERMINAL
*
INVIT  $NCIO PLIST-PLIST1,OP-INV,INLEN-8,RECA-INPUT

*            ISSUE A MESSAGE TO THE CONSOLE (PUT-THEN-GET)
*
       $NCIO PLIST-PLIST1,OP-PTG,INLEN-3,OUTLEN-29,RECA-CSLIO          X
             TNAME-'CONSOL'

*            PUT A MESSAGE TO TERMINAL  (PUT-NO-WAIT MESSAGE)
*
       $NCIO PLIST-PLIST1,OP-'PNW,MSG',RECA-OUT,OUTLEN-18              X
             TNAME-'(INPUT+5)'

*            PTG TO CONSOLE (NOTE USE OF DISPLACEMENT/REGISTER IN RECA)
*
       $NCIO PLIST-PLIST1,OP-'PTG',INLEN-2,OUTLEN-28,RECA-'(0(,1))',   X
             TNAME-'CONSOL'

*            PNW TO TERMINAL (USE MOVES TO LOAD PARAMETERS)
*
       MVC   PLIST1+5(2),BL18
       MVC   PLIST1+3(2),PNWMSG
       $NCIO PLIST-PLIST1,RECA-OUT,TNAME-'INPUT+5'

*            ISSUE RELEASE TERMINAL (NO PLIST PARAMETER ON $NCIO)
*
       LA    PLIST1,2
       $NCIO OP-REL,RECA-INPUT,TNAME-'(INPUT+5)'

*            ISSUE SYSTEM END OF JOB MACRO
*
       $EOJ

INPUT  EQU   *
       DC    14CL1' '                DEFINE INPUT RECORD AREA
OUT    EQU   *
       DC    40CL1' '                DEFINE OUTPUT RECORD AREA
MESSG1 DC    CL34'YOU MAY NOW ENTER DATA TO PROGX'
CSLIO  EQU   *
       DS    CL34
BL18   DC    IL2'18'                 CONSTANTS USED IN STATEMENTS ABOVE
PNWMSG DC    IL2'54'
       END   PROGX
```

Figure 7-1. Examples of $NCIO Macro Instructions

PROGRAMMING RESTRICTIONS

The following restrictions apply when programming for the standard interface to CCP using Assembler Language.

- Input/Output cannot be performed on either the 5471 Printer/Keyboard (Model 10 Disk System and Model 12) or the CRT/Keyboard (Model 15) using the standard DSM Data Management; instead, the console must be addressed as the "terminal" CONSOL, governed by the standard CCP restrictions concerning operations that may be performed on that device. (See the *Standard Communications Interface* for a description of these restrictions.)
- If the *(dispx(,regx))* operand format is used in the $NCIO macro with index register 1 as *regx*, the original value of index register 1 is not returned after using the macro. Therefore, you should save and restore the register when using $NCIO.
- User DTFs and IOBs must be placed in the first 24K of the user program.

ASSEMBLER MACRO SUPPORT MNOTES

Mnotes are error messages pertaining to macro instruction formats. They are included in your assembly listing, printed beneath the macro instruction to which each applies.
The Mnotes which follow are issued if an error is encountered when using the Assembler Language support macros.

N2001 CONFLICTING OPERANDS—OUTLEN/ATTRID

Severity:	Error (08)
Issuing macro(s):	$NPL,$NCIO
Explanation:	If a $NPL or $NCIO macro instruction, you have specified both the OUTLEN and the ATTRID operands. Because the output data length field (specified by OUTLEN) and the attributes identifier field (specified by ATTRID) are the same field in a parameter list, they are mutually exclusive, and only one can be specified at a time.
System Action:	This macro instruction is not generated.
Programmer Action:	Correct the macro instruction by using only one of the two operands, and repeat the macro-generation/assembly run.

N3001 INVALID OPERATION CODE SPECIFIED

Severity:	Error (08)
Issuing macro:	$NCIO
Explanation:	The parameter specified in the OP operand is in the form which indicates an operation code followed by operation modifiers. However, the first element of the list is not a valid operation code abbreviation.
System Action:	This macro instruction is not generated.
Programmer Action:	Correct the parameter by using a valid operation code and repeat the macro-generation/assembly run.

N3002 INVALID OPERATION MODIFIER SPECIFIED

Severity:	Error (08)
Issuing macro:	$NCIO
Explanation:	The parameter of the OP operand is in the form which signifies an operation code followed by one or more operation modifier. However, an operation modifier specified is not a valid abbreviation.
System Action:	This macro instruction is not generated.
Programmer Action:	Correct the parameter by specifying a valid operation modifier abbreviation and repeat the macro-generation/assembly run.

N3003 PARAMETER MISSING FINAL RIGHT-PAREN

Severity:	Error (08)
Issuing macro:	$NCIO
Explanation:	An invalid form for a parameter was specified. The first character was a left parenthesis, but the last character was not a right parenthesis.
System Action:	This macro instruction is not generated.
Programmer Action:	Correct the parameter by enclosing it properly with a right parenthesis and repeat the macro-generation/assembly run.

N3004 PARENTHESIZED PARAMETER TOO LONG

Severity:	Error (08)
Issuing macro:	$NCIO
Explanation:	A parameter enclosed by parentheses was composed of more than 16 characters (excluding the parentheses).
System Action:	This macro instruction is not generated.
Programmer Action:	If the error was due to a keypunching error, correct the parameter and repeat the macro-generation/assembly run. If the error was due to an overly complex expression being coded within the parentheses, simplify that expression (by creating an equate for it), use the newly created symbol with the parentheses, and repeat the macro-generation/assembly run.

N6001 OFFSET VALUES PREVIOUSLY GENERATED

Severity:	Warning (04)
Issuing macro:	$NPLO
Explanation:	A $NPLO macro instruction was used but the offset equate values to be generated from it had previously been generated in this assembly (either by another $NPLO macro instruction or by a $NCIO macro instruction).
System Action:	The offset equates are not generated; to avoid creation of duplicate symbols in this assembly.
Programmer Action:	None required.

N6002 OPERATION VALUES PREVIOUSLY GENERATED

Severity:	Warning (04)
Issuing macro:	$NOPV
Explanation:	A $NOPV macro instruction was used, but the values to be generated by it had previously been generated in this assembly (either by a $NOPV macro instruction or by a $NCIO macro instruction).
System Action:	Operation code and modifier value equates are not generated by this statement; to avoid creation of duplicate symbols in the assembly.
Programmer Action:	None required.

N6003 RETURN-CODE VALUES PREVIOUSLY GENERATED

Severity	Warning (04)
Issuing macro:	$NRTV
Explanation:	A $NRTV macro instruction was used, but the return code value equates to be generated from it had previously been generated in this assembly.
System Action:	Return code value equates are not generated; to avoid creation of duplicate symbols in this assembly.
Programmer Action:	None required.

N6004 COMMON VALUES PREVIOUSLY GENERATED

Severity:	Warning (04)
Issuing macro:	$NCOM
Explanation:	A $NCOM macro instruction was used, but the common equate values to be generated from it had been generated in this assembly (either by a $NCOM macro instruction or by a $NCIO macro instruction).
System Action:	Common equate values are not generated by this macro instruction; to avoid creation of duplicate symbols in this assembly.
Programmer Action:	None required.

PROGRAMMING A USER SECURITY ROUTINE – MODELS 10 AND 12

The user of CCP may, if he chooses, write his own terminal sign on security routines rather than use the CCP password facility supplied with his system. To implement and use such routines, the following must be considered.

- This option must be selected at generation time by the "SECURE-USER" operand of the $ESEC statement.

- The security data which will be used at terminal sign on time by the security routines must have been previously written to the security module $CC4Z9 by User Security Data Program, $CCPAU (see *CCP System Reference Manual*).

- The user security routines must be written in Basic Assembler Language (or an equivalent machine-level language) and must be structured such that they comprise four basic parts (statement numbers refer to the sample program, Figure 7-2):

  1. System equates. They provide the necessary offsets and pointers to various system tables, as well as other common equates.

  2. The transient prologue and equates. The function of this code is to provide the following:

     a. a temporary two-byte offset value pointing to the relocatable address constants (statement 1087)

     b. a one-byte offset to the first executable instruction (1091)

     c. a one-byte ID with a binary value of 1, which defines the CCP transient area in which this transient will be running (1092)

     d. a two-byte field of hex 0000 to permit the passing of a parameter from this transient to another (1094)

     e. a two-byte displacement from the beginning of this module pointing to the first character past the ID of the transient to be called next (1095)

f. the two-character ID of the transient to be called next (last two characters of the module name) (1097)

g. three bytes for disk control which are used when this transient is read from disk (1098-1099); the first byte is always *1*, the second and third bytes are set by CCP startup with the cylinder/sector address of the transient specified by the two-character transient ID. A one-character delimiter ($) and the two-byte ID of this transient follow (1100-1101).

3. The main body of code, which in this example begins with statement 1108 and ends with statement 1191. This sample code will: determine the length of, and move the sign-on data to an area within this transient; determine which terminal is attempting to sign on and then verify the sign-on data for that terminal, as found in the user security work area; pass the result of the verification to the CCP sign-on transient, $CC4SO, by setting a value in "TAXPRM" prior to exiting from this transient. The "TAXPRM" field of any CCP transient (at relative locations 4 and 5 of the transient) is the field in which one transient passes information to another. The total length of parts 2 and 3 cannot exceed hex length 1FF.

4. Relocation Address Table.

   Because any sign-on security routine you write is a CCP transient, your routine must conform to the special way in which the addresses in CCP transients are established and relocated.

   In this special relocation method, any (two-byte) address, used in an instruction, which refers to a location within your transient itself requires an entry in a table, at the end of your transient, called the Relocatable Address Table. This method also allows you to address elements, outside your transient, which are in the CCP Communications Area; it also permits you to use any of a selected set of addresses which refer to routines or areas within the remainder of the CCP resident code. Any use of either of these types of addresses also requires an entry in the Relocatable Address Table. In effect, any use of a two-byte address which does not refer to an absolute location requires an entry in this table.

In this method, any address you code in an instruction is *entirely replaced,* when CCP begins to run, by an address derived from an entry in the Relocatable Address Table. There must be *exactly* as many entries in this table as there are relocatable addresses in your transient. Further the first relocatable address in your transient is replaced by an address derived from the first Relocatable Address Table entry, the second relocatable address by an address derived from the second entry, and so forth. Thus, if you wish to make any of the three kinds of address references described in the previous paragraph, it does not matter whether, in an instruction, you code an appropriate relocatable address, but only that you code an appropriate entry in the table.

Each Relocatable Address Table entry is of one of three types, depending on the type of address you need to use in the corresponding instruction:

a. Address within the transient

b. Address within the CCP Communications Area

c. Address of a special routine or area

Each entry is two bytes long. The form of each entry is as follows:

Address within transient: The entry must contain the *displacement* of the location within the transient being referred to. For example, the entry at statement 1198, corresponding to the address within the instruction at statement 1144, represents a reference to the location 0042 within the transient. The two-byte displacement is formed in table entry by subtracting the address value of the beginning of the transient ($CC4YA) from the address within the transient being referred to (YA0100).

Address within CCP Communications Area: The entry must contain the hex value C0xx, where xx is the *displacement* within the Communications Area of the element being addressed. In this example, the symbol "COM" has been equated to the value X'C000', and the symbol "@TUSTG" has been defined (by the macro $ECOM) as representing the displacement of that field in the Communications Area which contains the address of the Terminal Unit Block for the terminal attempting to sign on. Thus, the table entry at statement 1196, corresponding to the address used in statement 1108, is formed by defining a two-byte constant of AL2(COM+@TUSTG).

Special Address of CCP Routine or Work Area: The entry must contain the hex value 80xx, where xx is a number used by CCP to signify which special address is to be referenced. Two such entries are used in this example. The symbol "PGM" has been equated to the value X'8000', and the symbols "#CC4TX" and "USI" have been generated by the macro $ETRC, and represent the numbers for the special addresses, respectively, of:

a. $CC4TX -- the location to which you must branch at the completion of execution of your transient.

b. The first byte of the user security information (from the module $CC4Z9) which you will use for checking the validity of the terminal's sign on data.

The last entry in a Relocatable Address Table must be followed by a one-byte constant of hex FF (statement 1201).

The Relocatable Address Table is used only at the beginning of a CCP run to establish the addresses used in your transient. Therefore, it does not have to be present in main storage during each execution of your transient. Because of this, the table may extend beyond the 512 bytes which is the maximum size of the executable portion of a transient.

- The first user transient to which control will be passed must be named $CC4YA. The first transient, ($CC4YA), may pass control to other user written transients, providing such additional transients are written and named according to established conventions. Any user-written transient receiving control after $CC4YA must be named such that the 1st five characters of the name are $CC4Y. The sixth character of the name may be any character in the range B-Z.

- The last transient to be called, (or $CC4YA if it is the only one used), must transfer control to the transient area scheduler after setting the desired parameter value in location "TAXPRM". The transfer of control is performed by branching to the CCP routine $CC4TX. Reference sample program statements 1160, 1167, and 1176.

- The security data which was previously written in the modules $CC4Z9, will be available for reference by any user written transient in a user security work area. The leftmost byte of this work area will contain the first byte from the module $CC4Z9. The size of the work area and the size of $CC4Z9 is specified at Generation by the operand "LUSI" in the $ESEC statement. The address of the leftmost byte of this work area is available to the user's transient by the value "P + USI". See the sample sample program, statement 1129.

Sample Program — Model 10 or Model 12

Figure 7-2 is an example of a user sign-on security routine. The following notes explain the logic of the example:

- A total of six macros must be included in the source code. These macros produce equates used elsewhere in the program. Their names are as follows:

  1. $EEQU
  2. $ECOM
  3. $ECPL
  4. $ETUB
  5. $ETNT
  6. $ETRC

  These macros are available only on the CCP distribution disk cartridge (PID001). Either copy these to your own source library or perform the macro processing step by loading $MPXDV from the distribution pack.

- This sample program expects sign-on data in the form /ONƀSSSSSS, where SSSSSS is the security code to be checked by $CC4YA.

- As used by this program, the security data found in $CC4Z9 must be of the following form:

  $C_1C_1C_1C_1C_1C_1S_1S_1S_1S_1S_1S_1C_2C_2C_2C_2C_2C_2S_2S_2S_2S_2S_2S_2 \ldots \underline{00}$

  CC ... represents a six-character symbolic terminal name and SS ... represents a six-position security field. There should be as many sets of CC ... SS ... data residing in $CC4Z9 as there are terminals to be used by an assignment set for CCP. The intent of this data is to provide a vehicle by which $CC4YA can verify a unique six-character sign-on code for each terminal so specified by the symbolic terminal name.

- Statement 1129 loads XR2 with the address of the left-most byte of the security data residing in the security data work area. Statement 1151 compares the data entered from the terminal after the 'ON', and the data in the security data work area that is associated with one symbolic terminal name.

- Statement 1140 compares the symbolic terminal name to the names in the security data area. The program loops between statements 1137 and 1144 and is exited when the end of the security data area is reached (1139), or when the name of the terminal signing on compares equal to one in the security data area (1142).

- Statement 1160 puts '01' in symbolic location 'TAXPRM'. This value indicates that the security data for the selected terminal verified correctly. After control is returned to $CC4TX and given to the CCP transient $CC4SO, a message will be sent to the selected terminal which will indicate that the sign on was successful.

- Statement 1167 puts 'FF' in symbolic location 'TAXPRM'. This value indicates that the security data for the selected terminal did *not* verify correctly. After control is returned to $CC4TX and given to the CCP transient $CC4SO, a message will be sent to the selected terminal which will say that the sign on was unsuccessful.

- Statement 1176 causes the control to be passed to the CCP transient $CC4SO. This is accomplished as follows:

  a. The field TAXTID (at relative location 6 in the transient) contains the displacement from the beginning of the transient of the first three bytes (location 0A-0C of the transient) which address the transient $CC4SO. At CCP startup, the bytes at locations 0B and 0C are set to the disk address of that transient.

  b. The branch at statement 1176 gives control to the CCP Transient Area Scheduler, requesting it to pass control to the transient ($CC4SO) pointed to by the TAXTID field.

```
       $CC4YA

ERR LOC  OBJECT CODE      ADDR STMT SOURCE STATEMENT

                               1072 *      CCP TRANSIENT ROUTINE EQUATES

                          0001 1074 TARLD@ EQU   1                        OFFSET TO TRANSIENT
                               1075 *                                     CCP RELOCATION CONSTANTS
                          0001 1076 TAJUMP EQU   TARLD@                   DISPLACEMENT FOR JUMP OP + Q
                          0003 1077 TAID   EQU   TARLD@+2                 OFFSET TO TRANSIENT PROGRAM
                          0005 1078 TAXPRM EQU   TAID+2                   DISPLACEMENT TO PARM BYTES
                          0007 1079 TAXTID EQU   TAXPRM+2                 OFFSET TO NCS VALUE@
                          0008 1080 TAXCID EQU   TAXTID+1                 OFFSET TO TRANSIENT XCTL TABLE
                          000A 1081 TAXNCS EQU   TAXCID+2                 OFFSET TO FIRST NCS PARAMETER
                          0005 1082 TAXCLN EQU   5                        LENGTH OF AN XCTL TABLE ENTRY


                               1084 *      TRANSIENT PROLOG

                          0000 1086        USING $CC4YA,XR1               DEFINE BASE REGISTER
    0000 0084             0001 1087        DC    AL2(YA@RLC-$CC4YA)       DISPL OF CCP RELOCATE ADCONS
                               1088 *                                     NOTE, THESE BYTES ARE OVERLAID
                               1089 *                                     WITH A JUMP OP CODE AND X'87'
                               1090 *                                     Q-BYTE BY $CC4TA
    0002 0E               0002 1091        DC    AL1(YAGO-$CC4YA-3)       OFFSET TO FIRST INSTRUCTION
    0003 01               0003 1092        DC    XL1'1'                   TRANSIENT AREA ID, USED BY
                               1093 *                                     TRANSIENT RELOCATION ROUTINE
    0004 0000             0005 1094        DC    XL2'0'                   PARAMETER BYTES
    0006 000A             0007 1095        DC    AL2(YASO-$CC4YA)         DISPLACEMENT TO FIRST XCTLEE

    0008 E2D6             0009 1097        DC    CL2'SO'                  SPECIFIES XCTL TO $CC4SO
    000A 01               000A 1098 YASO   DC    AL1(1)                   N BYTE FOR DISK
    000B C3E2             000C 1099        DC    CL2'CS'                  DISK C/S BYTES, SET BY CCP START
    000D 5B               000D 1100        DC    CL1'$'                   END OF XCTL TABLES FIELD
    000E E8C1             000F 1101        DC    CL2'YA'                  $CC4YA EYECATCHER CONSTANT
    0010 03               0010 1102        DC    XL1'03'                  LEVEL NUMBER
                          0011 1103 YAGO   EQU   *                        BEGINNING OF EXECUTABLE CODE

                               1105 *      CHECK THE LENGTH OF THE TERMINAL MESSAGE AND IF CORRECT
                               1106 *      THEN MOVE IT TO THE TRANSIENT DATA AREA.

    0011 35 02 0038            1108 ##0010 L     C+@TUSTG,XR2                  LOAD POINTER TO TUB
    0015 74 02 83              1109        ST    YATUB(,XR1),XR2          SAVE TUB POINTER
    0018 6C 01 78 09           1110        MVC   YAENDP(2,XR1),TPRECA(,XR2)    SAVE BEGINNING @ OF MSG.
    001C 8D 0A 05              1111        CLI   TPEFFL(,XR2),10          TEST FOR CORRECT INPUT LENGTH
    001F F2 01 41              1112        JNE   YAERR                    JUMP IF NOT

    0022 6E 01 78 05           1114        ALC   YAENDP(2,XR1),TPEFFL(,XR2)    ADD LENGTH OF MESSAGE
    0026 5F 01 78 6F           1115        SLC   YAENDP(2,XR1),YAXONE(,XR1)    DECREMENT POINTER
    002A 75 02 78              1116        L     YAENDP(,XR1),XR2         XR2 POINTS TO END OF INPUT
    002D 6C 09 79 00           1117        MVC   YAENDD(10,XR1),0(,XR2)   MOVE SIGN ON DATA TO TRANSIENT

                               1119 *      MOVE THE 6 CHARACTER NAME OF THE TERMINAL ATTEMPTING
                               1120 *      TO SIGN ON INTO AN AREA WITHIN THIS TRANSIENT.

    0031 75 02 83              1122        L     YATUB(,XR1),XR2          LOAD TUB POINTER
    0034 85 02 21              1123        L     TUBTNT(,XR2),XR2         LOAD ADDRESS OF TERMINAL NAME T.
    0037 6C 05 81 05           1124        MVC   YANAME(6,XR1),TNTNAM(,XR2)    MOVE TERMINAL NAME

                               1126 *      LOAD XR2 WITH THE ADDRESS OF THE LEFTMOST BYTE OF THE
                               1127 *      SECURITY DATA FOUND IN THE SECURITY DATA WORKAREA.

    003B C2 02 001D            1129 ##0020 LA    P+USI,XR2                LOAD POINTER TO SECURITY DATA
    003F E2 02 05              1130        LA    5(,XR2),XR2              BUMP POINTER

                               1132 *      COMPARE THE 6 BYTE TERMINAL NAME PREVIOUSLY SAVED AND THE
                               1133 *      6 BYTE TERMINAL NAMES FOUND IN THE SECURITY DATA WORKAREA.
                               1134 *      KEEP COMPARING TILL A MATCH IS FOUND OR TILL THE END OF
                               1135 *      THE SECURITY DATA AREA IS REACHED
```

Figure 7-2 (Part 1 of 2). Sample User Security Routine for Models 10 and 12

```
       $CC4YA

ERR LOC  OBJECT CODE      ADDR STMT SOURCE STATEMENT

                         0042 1137 YA0100 EQU   *
    0042 8D 00 00             1138        CLI   0(,XR2),0                TEST FOR END OF DATA
    0045 F2 81 1B             1139        JE    YAERR                    JUMP IF END HAS BEEN REACHED
    0048 6D 05 81 00          1140        CLC   YANAME(6,XR1),0(,XR2)    COMPARE NAME ENTERED & NAME IN
                              1141 *                                     SECURITY DATA AREA
    004C F2 81 07             1142        JE    YA0110                   JUMP IF A MATCH IS FOUND
    004F E2 02 0C             1143        LA   12(,XR2),XR2              STEP POINTER TO NEXT NAME FIELD
    0052 C0 87 0042           1144 ##0030 B     YA0100                   TO TEST NEXT NAME

                              1146 *      COME HERE WHEN A POSITIVE MATCH HAS BEEN MADE BETWEEN THE
                              1147 *      TERMINAL NAME AND THE NAME IN THE SECURITY DATA AREA.
                              1148 *      NOW COMPARE THE SIGN ON DATA ASSOCIATED WITH THE TERMINAL NAME.

                         0056 1150 YA0110 EQU   *
    0056 9D 05 06 79          1151        CLC   6(6,XR2),YAENDD(,XR1)    COMPARE SIGN ON CODE FOR
                              1152 *                                     TERMINAL WHO'S NAME WAS JUST
                              1153 *                                     FOUND AND CODE IN SECURITY
                              1154 *                                     DATA FIELD
    005A F2 01 06             1155        JNE   YAERR                    JUMP TO ERROR EXIT IF CODE DOES
                              1156 *                                     NOT COMPARE

                              1158 *      THE SIGN ON DATA HAS COMPARED OK, SO PUT A X'01' IN 'TAXPRM'.

    005D 7C 01 05             1160        MVI   TAXPRM(,XR1),YAEQU1      PUT '01' IN PARAMETER
    0060 F2 87 03             1161        J     YAOUT                    TO EXIT FROM THIS TRANSIENT

                              1163 *      THE SIGN ON DATA DID NOT COMPARE CORRECTLY,
                              1164 *      SO PUT A X'FF' IN 'TAXPRM'.

                         0063 1166 YAERR  EQU   *
    0063 7C FF 05             1167        MVI   TAXPRM(,XR1),YAEQUF      PUT 'FF' IN PARAMETER
                              1168 *                                     THIS SIGNIFIES THAT THERE WAS
                              1169 *                                     AN ERROR IN THE SIGN ON
                              1170 *                                     VALIDATION .

                              1172 *      COME HERE TO EXIT FROM THIS TRANSIENT

                         0066 1174 YAOUT  EQU   *
    0066 3A C0 0500           1175 ##0260 SBN   C+$CPWK+$CPFLG,$CPII+$CPFR
    006A C0 97 0009           1176 ##0270 BC    P+#CC4TX,BR97            TO XCTL

                              1178 *      CONSTANTS AND DATA AREAS

    006E 0001            006F 1180 YAXONE DC    XL2'01'                  CONSTANT
    0070 000000000000000 0079 1181 YAENDD DC    XL10'0'                  INPUT DATA GOES HERE
    0078 0000                 1181
    007A 0000            007B 1182 YAENDP DC    XL2'0'                   LENGTH OF MESSAGE
    007C 000000000000    0081 1183 YANAME DC    XL6'0'                   TERMINAL NAME GOES HERE
    0082 0000            0083 1184 YATUB  DC    XL2'0'                   SAVE AREA FOR TUB POINTER

                         00FF 1186 YAEQUF EQU   X'FF'
                         0001 1187 YAEQU1 EQU   1
                         8000 1188 PGM    EQU   X'8000'
                         C000 1189 COM    EQU   X'C000'
                         0000 1190 C      EQU   $CC4YA
                         0000 1191 P      EQU   $CC4YA

                              1193 *      RELOCATION ADDRESS TABLE

                         0084 1195 YA@RLC EQU   *
    0084 C03B            0085 1196 @@0010 DC    AL2(COM+@TUSTG)
    0086 801D            0087 1197 @@0020 DC    AL2(PGM+USI)
    0088 0042            0089 1198 @@0030 DC    AL2(YA0100-P)
    008A C500            008B 1199 @@0260 DC    AL2(COM+$CPWK+$CPFLG)
    008C 8009            008D 1200 @@0270 DC    AL2(PGM+#CC4TX)
    008E FF              008E 1201        DC    XL1'FF'                  STOPPER BYTE
                         0000 1202.       END   $CC4YA

TOTAL STATEMENTS IN ERROR IN THIS ASSEMBLY =    0
```

Figure 7-2 (Part 2 of 2). Sample User Security Routine for Models 10 and 12

PROGRAMMING A USER SECURITY ROUTINE – MODEL 15

The user of CCP may, if he chooses, write his own terminal sign on security routines rather than use the CCP password facility supplied with his system. To implement and use such routines, the following must be considered.

- This option must be selected at generation time by the "SECURE-USER" operand of the $ESEC statement.

- The security data which will be used at terminal sign on time by the security routines must have been previously written to the security module $CC4Z9 by User Security Data Program, $CCPAU (see *CCP System Reference Manual*).

- The user security routines must be written in Basic Assembler Language (or an equivalent machine-level language) and must be structured such that they comprise three basic parts (statement numbers refer to the sample program, Figure 7-3):

  1. System equates. They provide the necessary offsets and pointers to various system tables, as well as other common equates.

  2. The transient prologue and equates. The function of this code is to provide the following:

     a. JUMP instruction to the start of executable code (statement 8).
     b. A two-byte field of hex 0000 to permit the passing of a parameter from this transient to another (statement 10).
     c. A two-byte address pointing to the third character past the ID of the transient to be called next (statement 11).
     d. The two-character ID of the transient to be called next, consisting of the last two characters of the module name (statement 12).
     e. Three bytes for disk control which are used when this transient is read from disk (statement 12). A one-character delimiter ($) and the two-byte ID of this transient follow (statement 13).

  3. The main body of code, which in this example begins with statement 836 and ends with statement 909. This sample code will: determine the length of, and move the sign-on data to an area within this transient; determine which terminal is attempting to sign on and then verify the sign-on data for that terminal, as found in the user security work area; pass the result of the verification to the CCP sign-on transient, $CC4SO, by setting a value in "TAXPRM" prior to exiting from this transient. The "TAXPRM" field of any CCP transient (at relative locations 4 and 5 of the transient) is the field in which one transient passes information to another. The total length of parts 2 and 3 cannot exceed hex length 1FF.

- The first user transient to which control will be passed must be named $CC4YA. The first transient, ($CC4YA), may pass control to other user written transients, providing such additional transients are written and named according to established conventions. Any user-written transient receiving control after $CC4YA must be named such that the 1st five characters of the name are $CC4Y. The sixth character of the name may be any character in the range B-Z.

- The last transient to be called, (or $CC4YA if it is the only one used), must transfer control to the transient area scheduler after setting the desired parameter value in location "TAXPRM". The transfer of control is performed by branching to the CCP routine $CC4TX. Reference sample program statements 883, 890, and 898.

- The security data which was previously written in the modules $CC4Z9, will be available for reference by any user-written transient in a user security work area. The leftmost byte of this work area will contain the first byte from the module $CC4Z9. The size of the work area and the size of $CC4Z9 is specified at Generation by the operand "LUSI" in the $ESEC statement. The address of the leftmost byte of this work area is available to the user's transient by the value @USECW. See the sample program, statement 852.

Sample Program – Model 15

Figure 7-3 is an example of a user sign-on security routine. The following notes explain the logic of the example:

- A total of five macros must be included in the source code. These macros produce equates used elsewhere in the program. Their names are as follows:

  1. $EEQU
  2. $ECOM
  3. $ECPL
  4. $ETUB
  5. $ETNT

  These macros are available only on the CCP distribution disk cartridge (PID001). Either copy these to your own source library or perform the macro processing step by loading $MPXDV from the distribution pack.

- This sample program expects sign-on data in the form /ONb̸SSSSSS, where SSSSSS is the security code to be checked by $CC4YA.

- As used by this program, the security data found in $CC4Z9 must be of the following form:

  $C_1C_1C_1C_1C_1C_1S_1S_1S_1S_1S_1S_1C_2C_2C_2C_2C_2C_2S_2S_2S_2S_2S_2S_2 \ldots 00$

  CC . . . represents a six-character symbolic terminal name and SS . . . represents a six-position security field. There should be as many sets of CC . . . SS . . . data residing in $CC4Z9 as there are terminals to be used by an assignment set for CCP. The intent of this data is to provide a vehicle by which $CC4YA can verify a unique six-character sign-on code for each terminal so specified by the symbolic terminal name.

- Statement 852 loads XR2 with the address of the leftmost byte of the security data residing in the security data work area. Statement 874 compares the data entered from the terminal after the 'ON', and the data in the security data work area that is associated with one symbolic terminal name.

- Statement 863 compares the symbolic terminal name to the names in the security data area. The program loops between statements 860 and 867 and is exited when the end of the security data area is reached (862), or when the name of the terminal signing on compares equal to one in the security data area (865).

- Statement 883 puts '01' in symbolic location 'TAXPRM'. This value indicates that the security data for the selected terminal verified correctly. After control is returned to $CC4TX and given to the CCP transient $CC4SO, a message will be sent to the selected terminal which will indicate that the sign on was successful.

- Statement 890 puts 'FF' in symbolic location 'TAXPRM'. This value indicates that the security data for the selected terminal did *not* verify correctly. After control is returned to $CC4TX and given to the CCP transient $CC4SO, a message will be sent to the selected terminal which will say that the sign on was unsuccessful.

- Statement 898 causes the control to be passed to the CCP transient $CC4SO. This is accomplished as follows:

  a. The field TAXTID (at relative location 6 in the transient) contains the displacement from the beginning of the transient of the first three bytes (location 0A-0C of the transient) which address the transient $CC4SO. At CCP startup, the bytes at locations 0B and 0C are set to the disk address of that transient.

  b. The branch at statement 898 gives control to the CCP Transient Area Scheduler, requesting it to pass control to the transient ($CC4SO) pointed to by the TAXTID field.

```
      $CC4YA

ERR LOC OBJECT CODE      ADDR STMT SOURCE STATEMENT

                                 2 *       $EBEG N-YA,X1-SO,TID-1
   4000                          3 $CC4YA START 16384                     TRANSIENT START DEFINITION
                         4000    4 $CC4$$ EQU   *                         $CC4$$ DEFINITION
                                 5        LEVEL 02
                                 6        RLD   N
                                 7
                                 7
   4000 F2 87 0D                 8        J     YAGO                      BYPASS PHASE ID'S, C/S'S
                         4000    9        USING $CC4YA,1                  DEFINE BASE ON TRANSIENT ENTRY
   4003 0000             4004   10 TAXPRM DC    XL2'0000'                 TRANSIENT COMMUNICATION AREA
   4005 400B             4006   11 TAXTID DC    AL2(YASO)                 INITIALLY 1ST CSN DISPLACEMENT
   4007 E2D6404040       400B   12 YASO   DC    CL5'SO   '                PHASE ID, SPACE FOR C/S/N
   400C 5BE8C1           400E   13        DC    CL3'$YA'                  EYECATCHER CONSTANT
   400F 02               400F   14        DC    XL1'02'                   RELEASE LEVEL
                         4010   15 YAGO   EQU   *                         END OF $EBEG CONSTANTS
                               833 *      COME CHECK THE LENGTH OF THE TERMINAL MESSAGE AND IF CORRECT
                               834 *      THEN MOVE IT TO THE TRANSIENT DATA AREA.
                               835
   4010 0D 00 44E6 405C        836        CLC   $CPEFL,YATEN              TEST FOR CORRECT INPUT LENGTH
   4016 F2 01 3B               837        JNE   YAERR                     JUMP IF NOT
                               838
   4019 35 02 44E8             839        L     $CPRCA,XR2                XR2 POINTS TO END OF INPUT
   401D 6C 05 62 09            840        MVC   YAENDD(6,XR1),9(,XR2)     MOVE SIGN ON DATA TO TRANSIENT
                               841
                               842 *      MOVE THE 6 CHARACTER NAME OF THE TERMINAL ATTEMPTING
                               843 *      TO SIGN ON INTO AN AREA WITHIN THIS TRANSIENT.
                               844
   4021 35 02 4467             845        L     @TUSTG,XR2                LOAD TUB POINTER
   4025 B5 02 17               846        L     TUBTNT(,XR2),XR2          LOAD ADDRESS OF TERMINAL NAME T.
   4028 6C 05 68 05            847        MVC   YANAME(6,XR1),TNTNAM(,XR2) MOVE TERMINAL NAME
                               848
                               849 *      LOAD XR2 WITH THE ADDRESS OF THE LEFTMOST BYTE OF THE
                               850 *      SECURITY DATA FOUND IN THE SECURITY DATA WORKAREA.
                               851
```

Figure 7-3 (Part 1 of 2). Sample User Security Routine for Model 15

```
        $CC4YA

  ERR LOC OBJECT CODE       ADDR STMT SOURCE STATEMENT

  402C 35 02 4411                852         L      @USECW,XR2                 LOAD POINTER TO SECURITY DATA
  4030 E2 02 05                  853         LA     5(,XR2),XR2                BUMP POINTER
                                 854
                                 855 *       COMPARE THE 6 BYTE TERMINAL NAME PREVIOUSLY SAVED AND THE
                                 856 *       6 BYTE TERMINAL NAMES FOUND IN THE SECURITY DATA WORKAREA.
                                 857 *       KEEP COMPARING TILL A MATCH IS FOUND OR TILL THE END OF
                                 858 *       THE SECURITY DATA AREA IS REACHED.
                                 859
                            4033 860 YA0100  EQU    *
  4033 BD 00 00                  861         CLI    0(,XR2),0                  TEST FOT END OF DATA
  4036 F2 81 1B                  862         JE     YAERR                      JUMP IF END HAS BEEN REACHED
  4039 6D 05 68 00               863         CLC    YANAME(6,XR1),0(,XR2)      COMPARE NAME ENTERED & NAME IN
                                 864 *                                         SECURITY DATA AREA
  403D F2 81 07                  865         JE     YA0110                     JUMP IF A MATCH IS FOUND
  4040 E2 02 0C                  866         LA     12(,XR2),XR2               STEP POINTER TO NEXT NAME FIELD
  4043 C0 87 4033                867         B      YA0100                     TO TEST THE NEXT NAME
                                 868
                                 869 *       COME HERE WHEN A POSITIVE MATCH HAS BEEN MADE BETWEEN THE
                                 870 *       TERMINAL NAME AND THE NAME IN THE SECURITY DATA AREA.
                                 871 *       NOW COMPARE THE SIGN ON DATA ASSOCIATED WITH THE TERMINAL NAME.
                                 872
                            4047 873 YA0110  EQU    *
  4047 9D 05 06 62               874         CLC    6(6,XR2),YAENDD(,XR1)      COMPARE SIGN ON CODE FOR
                                 875 *                                         TERMINAL WHO'S NAME JUST
                                 876 *                                         FOUND AND CODE IN SECURITY
                                 877 *                                         DATA FIELD
  404B F2 01 06                  878         JNE    YAERR                      JUMP TO ERROR EXIT IF CODE DOES
                                 879 *                                         NOT COMPARE
                                 880
                                 881 *       THE SIGN ON DATA HAS COMPARED OK, SO PUT A X'01' IN 'TAXPRM'.
                                 882
  404E 7C 01 04                  883         MVI    TAXPRM(,XR1),YAEQU1        PUT '01' IN PARAMETER
  4051 F2 87 03                  884         J      YAOUT                      TO EXIT FROM THIS TRANAIENT
                                 885
                                 886 *       THE SIGN ON DATA DID NOT COMPARE CORRECTLY,
                                 887 *       SO PUT A X'FF' IN 'TAXPRM'.
                                 888
                            4054 889 YAERR   EQU    *
  4054 7C FF 04                  890         MVI    TAXPRM(,XR1),YAEQUF        PUT 'FF' IN PARAMETER
                                 891 *                                         THIS SIGNIFIES THAT THERE WAS
                                 892 *                                         AN ERROR IN THE SIGN ON
                                 893 *                                         VALIDATION.
                                 894
                                 895 *       COME HERE TO EXIT FROM THIS TRANSIENT
                                 896
                            4057 897 YAOUT   EQU    *
  4057 35 10 4403                898         L      @CC4TX,IAR                 TO XCTL
                                 899
                                 900 *       CONSTANTS AND DATA AREAS
                                 901
  405B 000A                 405C 902 YATEN   DC     XL2'000A'
  405D 000000000000         4062 903 YAENDD  DC     XL6'0'                     INPUT DATA GOES HERE
  4063 000000000000         4068 904 YANAME  DC     XL6'0'                     TERMINAL NAME GOES HERE
                                 905
                            00FF 906 YAEQUF  EQU    X'FF'
                            0001 907 YAEQU1  EQU    1
  41FC                           908         ORG    $CC4YA+508
                            4000 909         END    $CC4YA
```

Note: The following names, used in this figure, are defined in macros; the macros are not shown in this figure:

Name	*Macro Defined in*
$CPEFL	$ECOM
$CPRCA	$ECOM
@TUSTG	$ECOM
@CC4TX	$ECOM
TUBTNT	$ETUB
TNTNAM	$ETNT

Figure 7-3 (Part 2 of 2). Sample User Security Routine for Model 15

Chapter 8. 3270 Display Format Facility (DFF)

GENERAL INFORMATION

The 3270 Display Format Facility is an optional feature of the Communications Control Program (CCP). This facility allows programs to control printer and display formats on the IBM 3270 Information Display System with a minimum of coding. Instead of requiring a special assembler language subroutine, programs can interface with the 3270 in a high level language (RPG II, COBOL, or FORTRAN IV). For those programs written in assembler language, CCP provides interfacing macros that can be used with DFF (see Chapter 7. *Basic Assembler Programming for CCP*).

Overview

The 3270 Display Format Facility offers:

- An easy way to define printer and display formats (use special form for offline generation).
- Formats that are program independent (stored on disk, not in the application program).
- Formats that can be used by several programs concurrently (the format remains unmodified on disk, therefore can be used by several programs).
- An easy way to handle data (all data is arranged in fields).
- Two ways of supplying data—at generation time (as part of the field definition) or during execution time (by the application program).
- The capability to change the characteristics or contents of a field on the display screen.
- Testing formats offline before writing the application program.
- Testing a terminal without writing a teleprocessing program.

Prerequisite Information

In order to fully utilize DFF, it is essential that you have a basic understanding of the concepts and operation of the IBM 3270 Display system. This includes understanding the uses of:

- Write Control Character (WCC)
- New Line, End of Message, and Forms Feed (NL,EM,FF)
- Selector Pen
- Operator Identification Card Reader
- Copy Control Character (CCC)
- Attention Identification (AID)
- Modified Data Tag (MDT)
- Keyboard keys and functions

For information on any of the above, refer to *IBM 3270 Information Display System Component Description*, GA27-2749.

DFF Routines

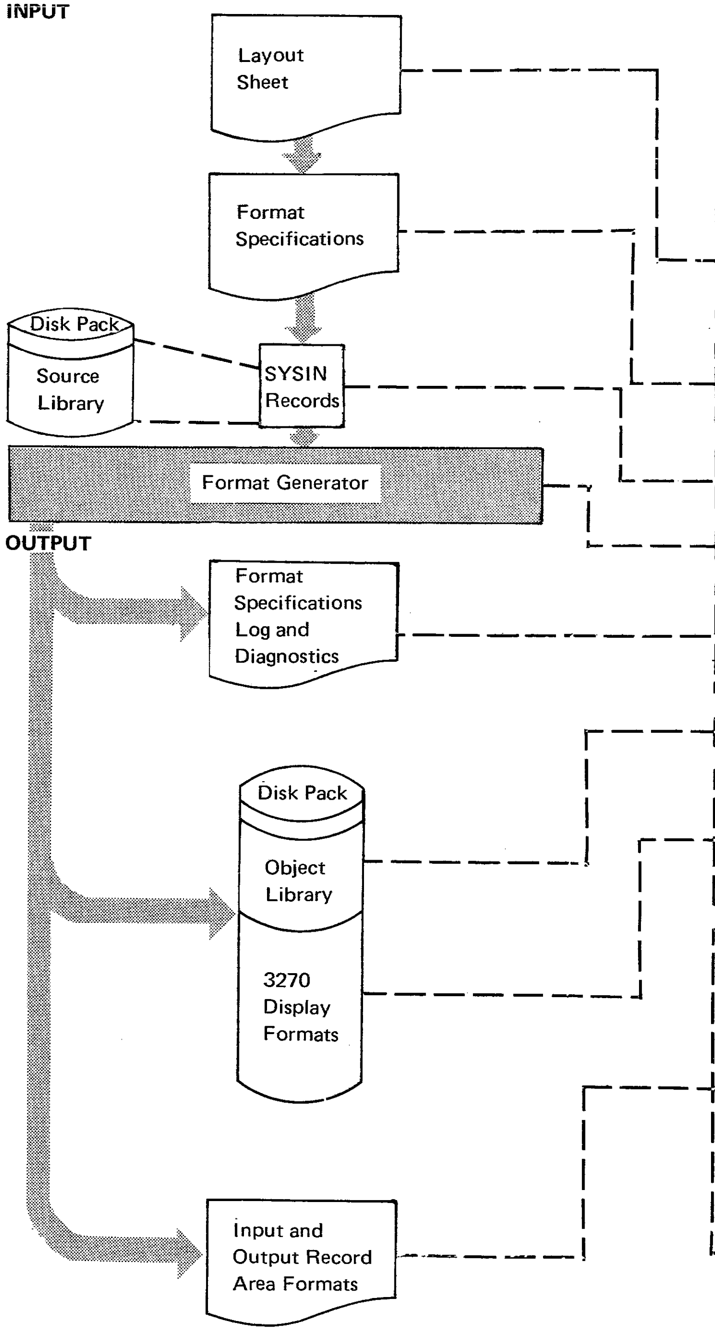
The Display Format Facility provides four routines – the Display Format Generator, the Printer Format Generator, the Display Format Control, and the Display Format Test:

1. The Display Format Generator routine runs offline; that is, it does not run under control of CCP. The display format generated by this routine is used by the Display Format Control Routine (DFCR), which does run under CCP. The Display Format Generator can run in either level of a DPF system, and it can run while CCP is executing. If DFGR is running while CCP is executing in the other level, the format being processed cannot be placed on the pack from which CCP was loaded; if this is attempted, an EO F PP halt occurs.

2. The Printer Format Generator runs offline; that is, it does not run under control of CCP, although the printer format it generates is used by the Display Format Control Routine (DFCR), which does run under CCP. The Printer Format Generator can run in either level of a DPF system, and it can run while CCP is running. If PFGR is running while CCP is executing in the other level, the format being processed cannot be placed on the pack from which CCP was loaded; if this is attempted, an EO F PP halt occurs.

3. The Display Format Control routine helps the transfer of data to and from the 3270 terminal. This routine does run under control of CCP.

4. The Display Format test routine runs offline; that is, it does not run under control of CCP. This routine is used as a development tool for designing and testing printer and display formats.



Two forms are used in preparing material for either the printer or the display format generators: the printer/display layout sheet, and either the printer format specifications sheet (for PFGR) or the display format specifications sheet (for DFGR). The following describes the procedure used to generate a format. Descriptions applicable only to a particular routine are contained solely within its column; descriptions applicable to both routines span both columns.

Printer Format Generator

Display Format Generator

Arrange the fields on the layout sheet just as they are to appear on the form or display.

If the format has more than 33 lines, more than one sheet is needed.

Include all fields that can be written to and/or received from the 3270.

Use the completed layout sheet as a guide in completing the two parts of the format specifications sheet (control and field definition forms). Provide for each field the name, type, location, associated data, and other needed information.

Transfer the information from the specifications sheet to the system input device or to the source library using $MAINT.

System input records or source library statements are read by the format generator routine.

The format generator routine:

- Produces a printout of the specifications forms.
- Analyzes specifications for errors.
- Logs diagnostic error messages.

The format generator routine:

- Produces a printout of the specification forms.
- Analyzes specifications for errors.
- Logs diagnostic error messages.

The formats are cataloged into an object library under a user-designated name.

The format is built in two parts:

- Field descriptor table containing the symbolic field names and is used to identify those fields for which data must be supplied in the user's output record area, and to support overrides to fields within the format.
- Complete data stream including control characters.

The printed information includes:

- Information used by the application program:
  - Required output data and the order of output data fields that must be provided in the user's output record area
- Information used in preparing the CCP assignment set under which the application program will execute:
  - The decimal length of the field descriptor table
  - The decimal length of the output data stream

The printed information includes:

- Information used by the application program:
  - Required output data and the order of output data fields that must be provided in the user's output record area
  - Input data and the order of input data fields as they are passed to the application program in the user's input record area
- Information used in preparing the CCP assignment set under which the application program will execute:
  - The decimal length of the field descriptor table
  - The decimal length of the 3270 output data stream
  - The decimal length of the 3270 input data stream

Modifiers to existing operations and three additional operations (Copy, Put Override, and Erase) support the 3270 functions. The Copy operation is used to transfer a format between devices attached to the same 3271 control unit. The Put Override operation is used to (1) change the type, reposition the cursor, modify the data content (or any combination of these) of any field or fields defined in the format, and/or (2) request input from only selected fields within the display format. The Erase operation fills the data positions of all unprotected fields (input field types 1, 2, 3, 4 and output/input field types 1, 2, 3, 4) with null (hex 00) characters.

In all cases, additional entries in the CCP application program's output record area are required. For example, when requesting that a format be written to a 3270, the name of the format must be given in the record area. In the input record area, allowance must be made for the AID character.

Requests for display or printer format services use the same application interface as do other CCP requests; the application program passes a parameter list and a record area.

It is essential that the printer/display layout and specification sheets be completed accurately so that the control routine can operate exactly as intended. To do this, you need a working knowledge of such things as the *field concept* of handling data and the characteristics of each *type* of field within each of the *field classes.* You need to know how to determine *lengths of fields,* what field *attributes* are and how the *cursor* is positioned.

FIELD CONCEPTS

Definition

All 3270 display information is treated as a set of fields within a record rather than as a string of data. Each field has certain characteristics associated with it—such as whether it is alphameric or numeric. Field characteristics are defined by *type* and *class.*

Class describes whether the field is output, input, output/input, or selector pen detectable.

Type describes what group of characteristics are associated with the field.

Field Classes

The field class is selected at format generation time by the application programmer when using the Display Format Generator. When using the Printer Format Generator, the field class is assumed to be output. The field class determines what the terminal operator can or cannot do with that field (see Figure 8-1). For prompting or displaying messages to the terminal operator, an output class would be used. If data for a field is to be provided by the terminal operator, an input class would be used. If data for a field is to be initially provided by the application program but allowed to be changed (using the keyboard) by the terminal operator, an output/input class would be used. Lastly, a field class has been provided solely in support of the selector pen.

A description of the four field classes follows:

- Output field—contains data that cannot be changed by the terminal operator. The data for the field is supplied either during format generation or during execution of the application program.
- Input field—is an area reserved for keyboard entry; data for the field is entered by the terminal operator.
- Output/Input field—contains data which has been supplied either during format generation or during execution of the application program. This data can be changed by the terminal operator using the keyboard.
- Selector Pen Detectable (SPD) field—allows the terminal operator to select fields by using the selector pen.

All classes of fields may be used within the same display except when the SPD field is used as an attention field (see *Attention Fields*).

		FIELD CLASSES																									
		OUTPUT			INPUT								OUTPUT/INPUT								SELECTOR PEN DETECTABLE (SPD)						
	TYPES	1	2	5	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7
	Designator Character																				?	?	>	>	?	b̸	b̸
CHARACTERISTICS	PROTECTED	*	*	*					*	*							*	*	*	*	*	*	*	*	*	*	*
	UNPROTECTED				*	*	*	*			*	*	*	*	*	*											
	ALPHAMERIC	*	*	*	*	*			*		*		*	*			*		*	*	*	*	*	*	*	*	*
	NUMERIC						*	*		*		*			*	*		*									
	MODIFIED DATA TAG – OFF	*	*	*	*	*	*	*	*	*	*	*					*	*			*	*			*	*	*
	MODIFIED DATA TAG – ON												*	*	*	*			*	*			*	*			
	NORMAL INTENSITY	*			*		*						*		*					*	*		*			*	
	HIGH INTENSITY		*			*		*						*		*						*		*			*
	NON-DISPLAY			*					*	*	*	*					*	*	*						*		
	DETECTABLE		▨*			▨*		▨*						*		*					*	*	*	*		*	*
	NONDETECTABLE	*		*	*		*		*	*	*	*	*		*		*	*	*	*					*		

(This information also appears on the reverse side of the display layout sheet.)

Note: Shaded squares indicate that these fields are not intended to be used as detectable fields. To prevent accidental detection of such a field, users should avoid using one of the characters b̸, ?, >, or null (X'00') as the first character in the field.

Figure 8-1. Field Classes; Types Within Classes; and Characteristics Associated With Each Type

The field class selected determines, to some extent, the characteristics of a field. Differences in characteristics by class are:

- *Protected or Unprotected* — A field is protected if the terminal operator cannot use the keyboard or operate the identification card reader to enter, modify, or erase data within that field. Output and selector pen detectable fields are protected. Input field types 5 and 6 and output/input field types 5-8 are protected.

- *Alphameric or Numeric* — All output and selector pen detectable fields are alphameric. Input and output/input fields may be either alphameric or numeric (see *Field Types*).

- *Modified Data Tag ON or OFF* — The modified data tag associated with each field causes the data from that field to be returned (MDT-ON) or not returned (MDT-OFF) during an input operation from the terminal. The modified data tag may be set ON by (1) a keyboard input to the field, (2) a selector pen detection in the field, (3) a magnetic card read-in operation, (4) application program control, or (5) using the ERASE EOF key. The modified data tag can be set OFF by (1) a selector pen detection in the field, (2) application program control, or (3) use of the ERASE INPUT key.

When data for a particular field *is not received* from the terminal, blanks are passed to the application program.

When data for a field *is received* from the terminal, it is passed on to the application program.

Setting the modified data tag conditions what is received as input from the terminal and passed to the application program. Therefore, field classes affected by setting the modified data tag are: input, output/input, and selector pen detectable fields. For input fields, data will be received from the terminal only if the terminal operator has performed a keyboard input, ERASE EOF, or a magnetic card read-in operation. For output/input fields, data will normally be received from the terminal (see *Output/Input Field Types* for a discussion on output/input fields that have the MDT set to OFF, types 5 and 6). The terminal operator should not use the ERASE INPUT key with an output/input field. For selector pen detectable fields, data may or may not be received from the terminal, even though the field type selected (see *Field Types*) required that the modified data tag be set to ON initially. Detection by the terminal operator, on a selector pen detectable field can set the MDT from ON to OFF or from OFF to ON.

Field Types

Within a field class, the field type selected also determines characteristics of a field (see Figure 8-1). The type is selected at format generation time by the application programmer when using the Display Format Generator. When the Printer Format Generator is used, the field type does not apply.

Choice of characteristics by type are:

- *Alphameric or Numeric* — Input and Output/input fields may be specified as either alphameric or numeric.

- *Modified Data Tag ON or OFF* — An output/input field would normally have its modified data tag set to ON. For special use of an output/input field with its modified data tag set to OFF, refer to types 5 and 6 under *Output/Input Field Types.*

  A selector pen detectable field may be specified with its modified data tag set to either ON or OFF. The initial setting can be changed by the terminal operator using the selector pen.

- *Intensity of Normal, High, or OFF (nondisplay)* — Nondisplay fields are not visible on the screen or printed on the printer. Field types are also provided which allow a field to be displayed with normal intensity or high intensity.

With the 3270 terminal, both the application programmer and the terminal operator should be aware that *all high-intensity fields, regardless of class*, have the potential of being detectable by the selector pen (see the note on Figure 8-1). To prevent an erroneous detection on a high-intensity non-SPD field, the first character in the field should not be a blank, null, question mark, or greater than character. This caution must be exercised by the application programmer when providing data for an output or output/input field class at format generation time or application program execution time. This condition can also be caused by the terminal operator when keying data or when using the cursor positioning keys.

If an erroneous detection on a high-intensity non-SPD field occurs, the interpretation of the data passed to the application program is the responsibility of the user (the designator character will not be separated from the data, and the data will be handled as usual for alphameric and numeric fields). Following is a breakdown of characteristics of each type under each class.

Output Field Types

Type	1	2	5
Characteristics	Protected Alphameric MDT-OFF	Protected Alphameric MDT-OFF	Protected Alphameric MDT-OFF
	Normal intensity	High intensity	Nondisplay
	Nondetectable	Detectable	Nondetectable

All types of output fields have the characteristics of being protected, alphameric with the modified data tag set to OFF.

On input operations, data from output fields will not be passed to the application program.

The data for output fields is always handled as an alphameric value. Data will be displayed exactly as presented, whether supplied at format generation time or during execution time by the application program. If there are numeric values in the field, the application programmer is responsible for such editing of data as insertion of decimal points and other characters to properly display positive and negative quantities.

Type 1 (normal intensity) and type 2 (high intensity) output fields are used where data is to remain displayed. For example, headings and labels would appear on the screen and would not be subject to change by the terminal operator. Type 2 is indicated as being detectable only because it also has the high intensity characteristic; it is not intended that the selector pen be used. See the discussion of intensity under *Field Types.*

A type 5 field with the nondisplay characteristic can be changed using the override facility at execution time to become a type 1 or type 2 with the corresponding intensity characteristic. This is used to display appropriate error messages or comments as they are needed (see *Put Override*).

Input Field Types

Type	1	2	3	4	5	6	7	8
Characteristics	Unprotected	Unprotected	Unprotected	Unprotected	Protected	Protected	Unprotected	Unprotected
	Alphameric	Alphameric	Numeric	Numeric	Alphameric	Numeric	Alphameric	Numeric
	MDT-OFF	MDT-OFF	MDT-OFF	MDT-OFF	MDT-OFF	MDT-OFF	MDT-OFF	MDT-OFF
	Normal intensity	High intensity	Normal intensity	High intensity	Non-display	Non-display	Non-display	Non-display
	Non-detectable	Detectable	Non-detectable	Detectable	Non-detectable	Non-detectable	Non-detectable	Non-detectable

All input fields have the modified data tag set to OFF.

Type 1 is the normal alphameric input field.

Type 2 allows for accenting an alphameric field (high intensity).

Type 3 is the normal numeric input field.

Type 4 allows for accenting a numeric field (high intensity).

A field specified as type 5 at format generation time can be changed using the override facility at execution time to become a type 1 with normal intensity or type 2 with high intensity.

A field specified as type 6 at format generation time can be changed using the override facility at execution time to become a type 3 with normal intensity or type 4 with high intensity. Note that type 5 is alphameric while type 6 is numeric.

Types 2 and 4 are indicated as being detectable only because they also have the high intensity characteristic; it is not intended that the selector pen be used. See the discussion of intensity under *Field Types.*

Type 7 input field is intended primarily for use as a security/authorization field. Data can be entered from the keyboard without displaying the data on the screen. Handling of the security/authorization data is left to the user. This field type may be changed using the override facility at execution time to a type 1, 2, or 5.

Type 8 input field is intended primarily for use as a security/authorization field. Data can be entered from the keyboard without displaying the data on the screen. Handling of the security/authorization data is left to the user. This field type may be changed using the override facility at execution time to a type 3, 4, or 6. Note that type 7 is alphameric while type 8 is numeric.

Output/Input Field Types

Type	1	2	3	4	5	6	7	8
Characteristics	Unprotected	Unprotected	Unprotected	Unprotected	Protected	Protected	Protected	Protected
	Alphameric	Alphameric	Numeric	Numeric	Alphameric	Numeric	Alphameric	Alphameric
	MDT-ON	MDT-ON	MDT-ON	MDT-ON	MDT-OFF	MDT-OFF	MDT-ON	MDT-ON
	Normal intensity	High intensity	Normal intensity	High intensity	Non-display	Non-display	Non-display	Normal intensity
	Non-detectable	Detectable	Non-detectable	Detectable	Non-detectable	Non-detectable	Non-detectable	Non-detectable

The word *Output* in the class designation indicates that the field contains data which has been supplied at generation time (see *Field Definition Form*) or by the application program at execution time. The *Input* indicates that the data may be changed by the terminal operator using the keyboard.

An example of using the output/input field would be in checking a "SHIP TO" address. The address is placed on the screen, is checked to see that it is still correct, is changed if necessary, and is returned to the application program.

Type 1 is the normal alphameric output/input field.

Type 2 allows for accenting an alphameric field in the display (high intensity).

Type 3 is the normal numeric output/input field.

Type 4 allows for accenting a numeric field (high intensity).

Types 2 and 4 are indicated as being detectable only because they also have the high intensity characteristic; it is not intended that the selector pen be used. See the discussion of intensity under *Field Types.*

A field specified as type 5 at format generation time can be changed using the override facility at execution time to become a type 1 with normal intensity or type 2 with high intensity.

A field specified as type 6 at format generation time can be changed using the override facility at execution time to become a type 3 with normal intensity or type 4 with high intensity. Note that type 5 is alphameric while type 6 is numeric.

A field specified as type 7 or 8 at format generation time can be changed using the override facility at execution time to become a type 1 with normal intensity, a type 2 with high intensity, or a type 5 nondisplay. Note that types 1 and 2 have modified data tag on while type 5 has modified data tag off.

Type 3, 4, or 6 fields cannot be overridden to types 7 or 8. Also, type 7 and 8 fields are not interchangeable by means of the Put Override facility.

Note: You will be unable to copy a display using the Copy operation if the field whose data begins in row 1 column 2 is a type 5, 7, or 8 output/input field.

Selector Pen Detectable Field (SPD) Types

Type	1	2	3	4	5	6	7
Designator	?	?	>	>	?	b̸	b̸
Characteristics	Protected	Protected	Protected	Protected	Protected	Protected	Protected
	Alphameric	Alphameric	Alphameric	Alphameric	Alphameric	Alphameric	Alphameric
	MDT–OFF	MDT–OFF	MDT–ON	MDT–ON	MDT–OFF	MDT–OFF	MDT–OFF
	Normal intensity	High intensity	Normal intensity	High intensity	Non-display	Normal intensity	High intensity
	Detectable	Detectable	Detectable	Detectable	Non-detectable	Detectable	Detectable
	Selection fields				Non-display	Attention fields	

As indicated, SPD fields are selection fields, nondisplay, or attention fields.

Selection: For fields specified as types 1, 2, 3, or 4 at format generation time, the designator character is a visible indicator on the screen and indicates whether the MDT is off or on. The designator is automatically assigned during generation of the display format based on type specified. Therefore, the user should not include the designator as part of the data for an SPD field. When sensed with a selector pen, the designator changes as shown below:

Designator	*Selector Pen Detection Results*
? (type 1)	Changes to > (type 3) and MDT set to ON
? (type 2)	Changes to > (type 4) and MDT set to ON
> (type 3)	Changes to ? (type 1) and MDT set to OFF
> (type 4)	Changes to ? (type 2) and MDT set to OFF

Nondisplay: Since type 5 is a nondetectable field, it cannot be changed by the use of the selector pen. A field specified as type 5 at format generation time can, however, be changed using the override facility at execution time. All SPD types are interchangeable by using the Put Overrides facility.

Attention: If an attention field (type 6 or 7) is present, *only output and SPD fields can be contained in the same display format.* Use of the selector pen to generate I/O pending will result in transmission of only the addresses of fields in which the modified data tag was set on (field data not included). Users who wish to combine SPD field input with keyed input must use the keyboard (ENTER or PF keys) to cause the data to be sent to the application program rather than using SPD attention.

PLANNING THE PRINTER/DISPLAY LAYOUT

Before working with the printer/display layout sheet (Figure 8-2), the application programmer must be aware of the space requirements for each field class. The fields, as designed on the printer or display layout form, will have a direct correspondence with the information as it appears in the buffer of the 3270 screen or printer.

LEGEND:

▨	Defining attribute
←→	Data field length
□	Terminating attribute
↑ SL	Starting location (first data position) of the field
[D]	Designator
⬚	Null character (X'00') appears as a blank space on the screen

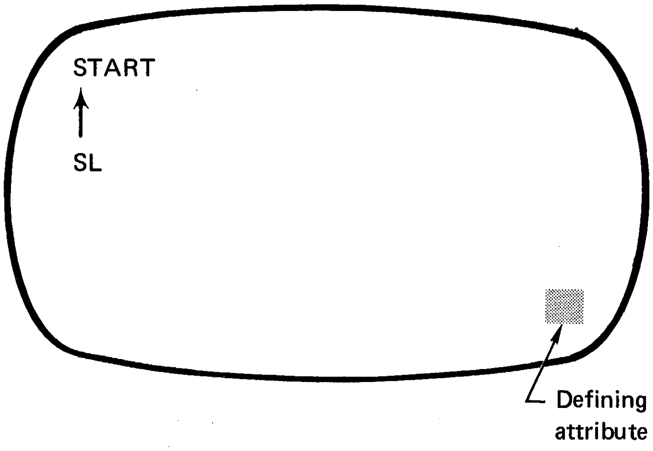
Items in the legend apply to the illustrations in the following discussion.

Attributes

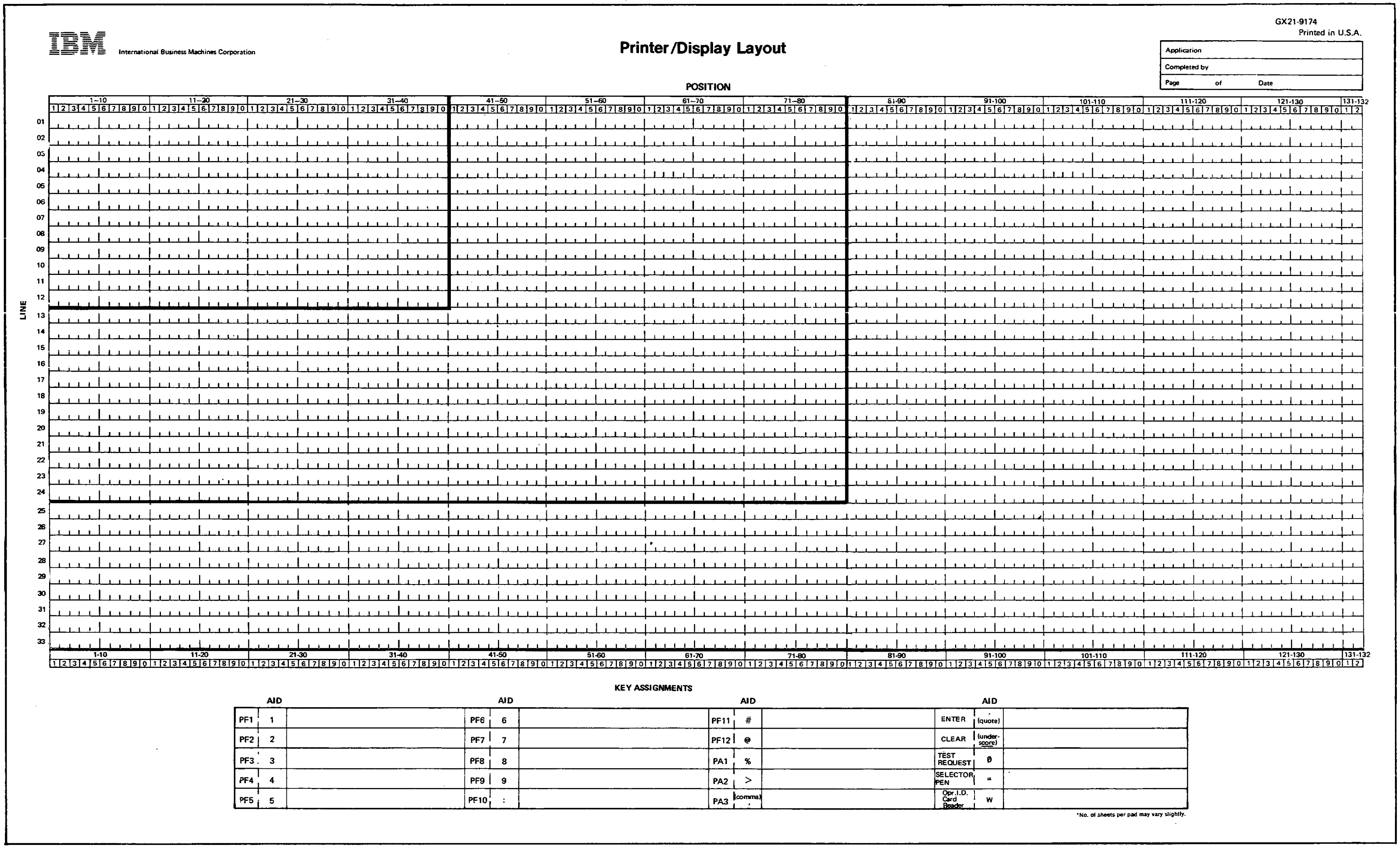
Attributes are generated only when the Display Format Generator is used; they are not generated when the Printer Format Generator is used.

The defining attribute is a nondisplay character located in the character position immediately preceding a data field and defines the characteristics of the display field that follows. The code for the attribute is developed by the format generation program based on field class and type. If data in an output, input, or output/input field must start at line 1, position 1, its defining attribute will be placed in the last display location (line 12, position 40 on Model 1 or line 24, position 80 on Model 2). Be sure this space is reserved when planning the rest of the display.

Note: When data for an output, input, or output/input field begins in line 1, position 1 of a display, that field is the *last* field transmitted in the 3270 text stream. The location of the field in the user program record area, however, corresponds to its location in the display.



The terminating attribute is a nondisplay character located in the character position immediately following a data field of an input or output/input class. This terminating attribute keeps the terminal operator from keying beyond the defined limits (data length) of the field and provides the function of autoskip/nonautoskip as defined at format generation time (see *Autoskip and Cursor Positioning*).



GX21-9174
Printed in U.S.A.

IBM International Business Machines Corporation

Printer/Display Layout

Application

Completed by

Page of Date

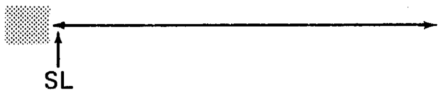
KEY ASSIGNMENTS

	AID			AID			AID			AID	
PF1	1		PF6	6		PF11	#		ENTER	' (quote)	
PF2	2		PF7	7		PF12	@		CLEAR	(underscore)	
PF3	3		PF8	8		PA1	%		TEST REQUEST	0	
PF4	4		PF9	9		PA2	>		SELECTOR PEN	=	
PF5	5		PF10	:		PA3	, (comma)		Opr. I.D. Card Reader	W	

*No. of sheets per pad may vary slightly.

Figure 8-2. Display Layout Sheet

Output Class



The total length of each output field on the printer/display layout sheet = data field length + one for the defining attribute when the Display Format Generator is used. When the Printer Format Generator is used, the total length of each field on the layout sheet equals the data field length only.

▨ The defining attribute determines the characteristics of the display field that follows. This attribute character is determined at format generation time based on the type as designated on the field definition entry. One position on the layout must be reserved for this nondisplayable character located immediately preceding the data field.

↑ SL The location of the first data position is entered in the field starting location on the field definition form. It must be the location immediately following the defining attribute character.

←→ Data field length (does not include defining attribute) is entered on the field definition form. Positions on the layout must be reserved equal to the data length.

Input and Output/Input Classes

Total length on the printer/display layout sheet = field length + two for beginning and ending attributes (or field length + one if there is no allowance for a terminating attribute (see part three under *Autoskip and Cursor Positioning*).

▨ The defining attribute determines the characteristics of the display field that follows. This attribute character is determined at format generation time based on the type as designated on the field definition entry. One position on the layout must be reserved for this nondisplayable character located immediately preceding the data field.

↑ SL The location of the first data position is entered in the field starting location on the field definition form. It must be the location immediately following the defining attribute character.

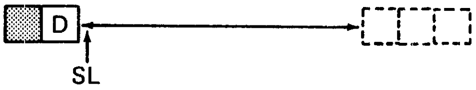
←→ The data field length is entered on the field definition form. Positions on the layout form must be reserved equal to the field length. The field length does not include either the defining or the terminating attribute.

☐ The terminating attribute limits the amount that can be keyed in. Based on autoskip/nonautoskip indication on the field definition form, this terminating attribute will reposition the cursor after a data character is entered into the last position of the field.

SPD Class

For SPD fields, use the following guidelines for reserving space on the printer/display layout sheet.

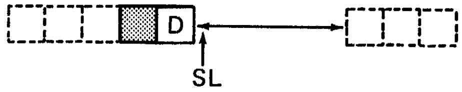
1



SPD field is the first field on a line and not the last field on the line, or, the previous field on the line is SPD and this SPD field is not the last field on the line.

Total length allowed for this SPD field on the layout sheet is the field data length plus five.

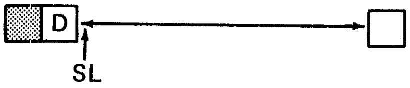
2



The preceding field on the line is another class and this SPD field is not the last field on the line.

Total length allowed for this SPD field on the layout sheet is the field data length plus eight.

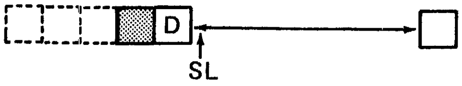
3



The SPD field is the last field on the line and the previous field on the line is SPD, or, this SPD field is the only field on the line.

Total length allowed for this SPD field on the layout sheet is the field data length plus three.

4



The preceding field on the line is another class and this SPD field is the last field on the line.

Total length allowed for the SPD field on the layout sheet is the field data length plus six.

▨ The defining attribute determines the characteristics of the display field that follows. This attribute character is determined at format generation time, based on the type as designated on the field definition entry. One position on the layout must be reserved for this non-displayable character.

D The designator character must immediately follow the defining attribute character. The designator character is determined at format generation time, based on the field definition type entry. One position on the layout must be reserved for this character.

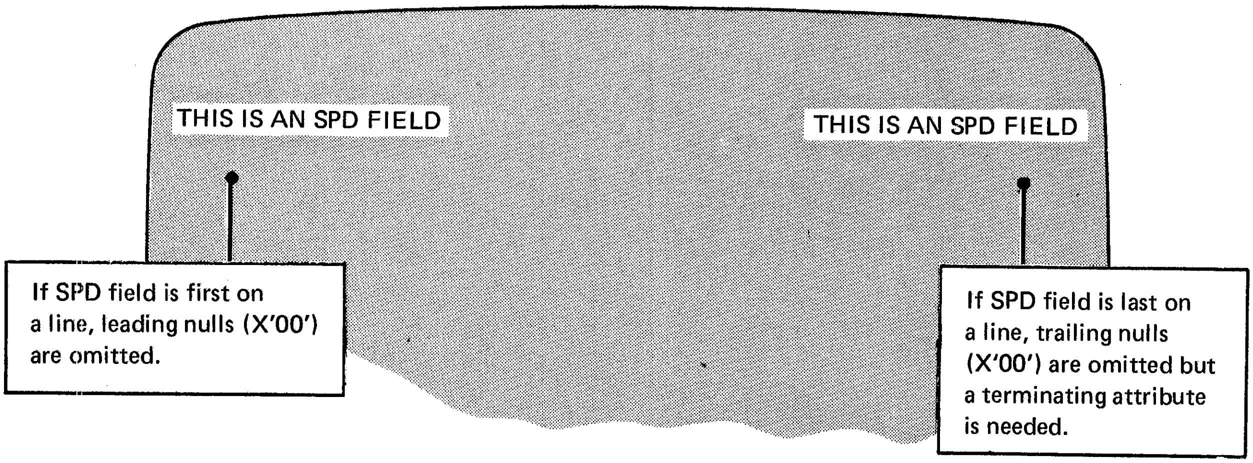
↑ SL The location of the first data position must be entered in the field starting location on the field definition form. This position must be located immediately following the designator character.

↔ The field data length is entered on the field definition form. Positions on the layout form must be reserved equal to the field length. The field length does not include leading nulls, defining attribute, designator character, trailing nulls, or terminating attribute.

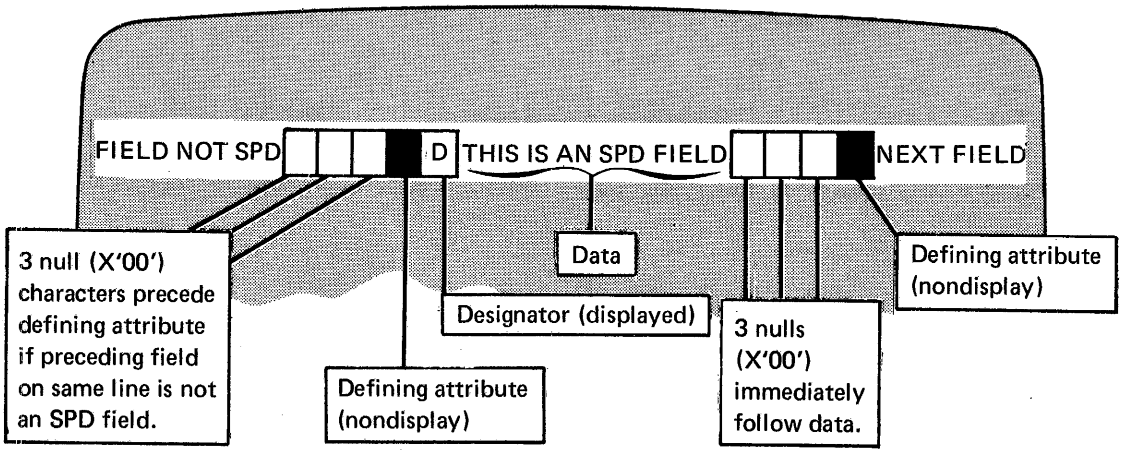
⬚ Leading nulls are required when the preceding field on the same line is of another class. Trailing nulls are required unless the SPD field is the only, or last, field on the line. To reserve the correct number of positions on the layout form, refer to the guidelines above.

□ A terminating attribute is required when the SPD field is the only, or last, field on the line. In either of these cases, one position on the layout must be reserved for this non-displayable character located immediately after the data field. The terminating attribute for an SPD field is used to prevent extraneous data, at the end of the current line or from the next line, from being transmitted along with the data for the SPD field during an input operation. Even though such a circumstance could occur only when using *overlay screens* (see index entry), all SPD fields ending a line are required to have the terminating attribute.

When SPD is first or last field on a line:



When SPD is not first or last field on a line:



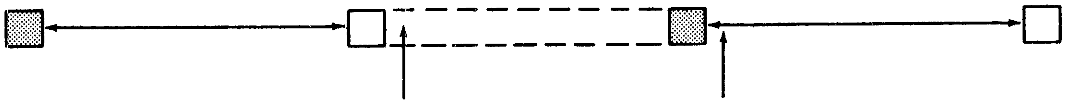
The entire field with its attributes and designator must be on the same line.

Note: For a type 5 SPD field, the designator and data are also not displayed.

AUTOSKIP AND CURSOR POSITIONING

The way autoskip functions with input and output/input fields depends upon the relative positioning of successive fields.

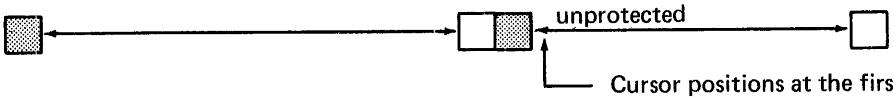
1. When there are one or more spaces between the trailing attribute of one field and the defining attribute of the next field:



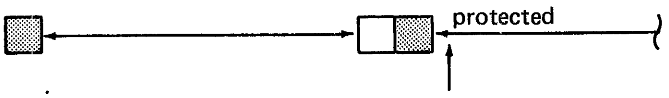
Without autoskip, the cursor is positioned after the trailing attribute. TAB or SKIP must then be pressed to move the cursor to the first character position of the next unprotected field.

With autoskip, the cursor is positioned at the first data character of the next unprotected field.

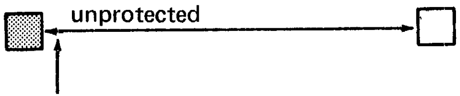
2. When the trailing and defining attributes are in adjacent positions:



Cursor positions at the first character of the unprotected field with or without autoskip.

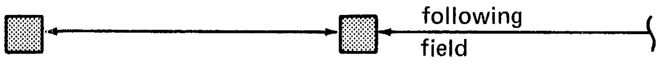


Without autoskip, the cursor positions at the first character of the protected field (unless this field is a type 6 input or output/input field). Use TAB or SKIP to move cursor to next unprotected field.

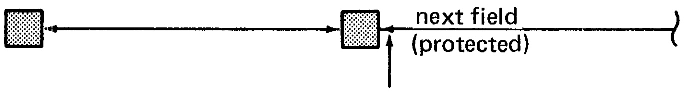


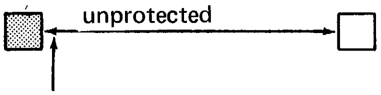
With autoskip or if protected field is a type 6 input or output/input, the cursor positions at the first character of the next unprotected field.

3. When two spaces were not allowed between fields:



If two spaces were not allowed by the application programmer during layout of the fields, the terminating attribute is dropped. The single space between the fields will be used for the attribute character of the next field.





The cursor positions at the first data character of the next field (unless this field is a type 6 input or output/input field). Use TAB or SKIP to move the cursor to the next unprotected field.

If the next field is a type 6 input or output/input field, the cursor positions at the first data character of the next unprotected field.

Defining Data

Defining Data at Format Generation Time

During generation time, the user may provide data on the field definitions for output, output/input, and SPD fields. Such data is in the form of characters and/or spaces up to the specified field length.

The length of each field is defined at format generation time (see Figures 8-3 and 8-4). Each SPD field must be contained on one line. Therefore, the field length of SPD fields cannot exceed 37 for a Model 1 screen or 77 for a Model 2 screen. All other fields cannot exceed 240 characters. Minimum length for all fields is one.

See *Data in Numeric Fields* for techniques in handling numeric data.

Defining Data at Execution Time

Data can be provided for all but input fields during execution time. The length of data to be provided must equal the field length specified at format generation time. Less data than the amount specified by the field length cannot be provided.

See *Data in Numeric Fields* for techniques in handling numeric data.

Data Entry at the Terminal

The terminal operator, when keying data for input fields, must start with the first character location of the field. Starting with any other position causes the control routine to return all blanks in the field.

See *Data in Numeric Fields* for techniques in handling numeric data.

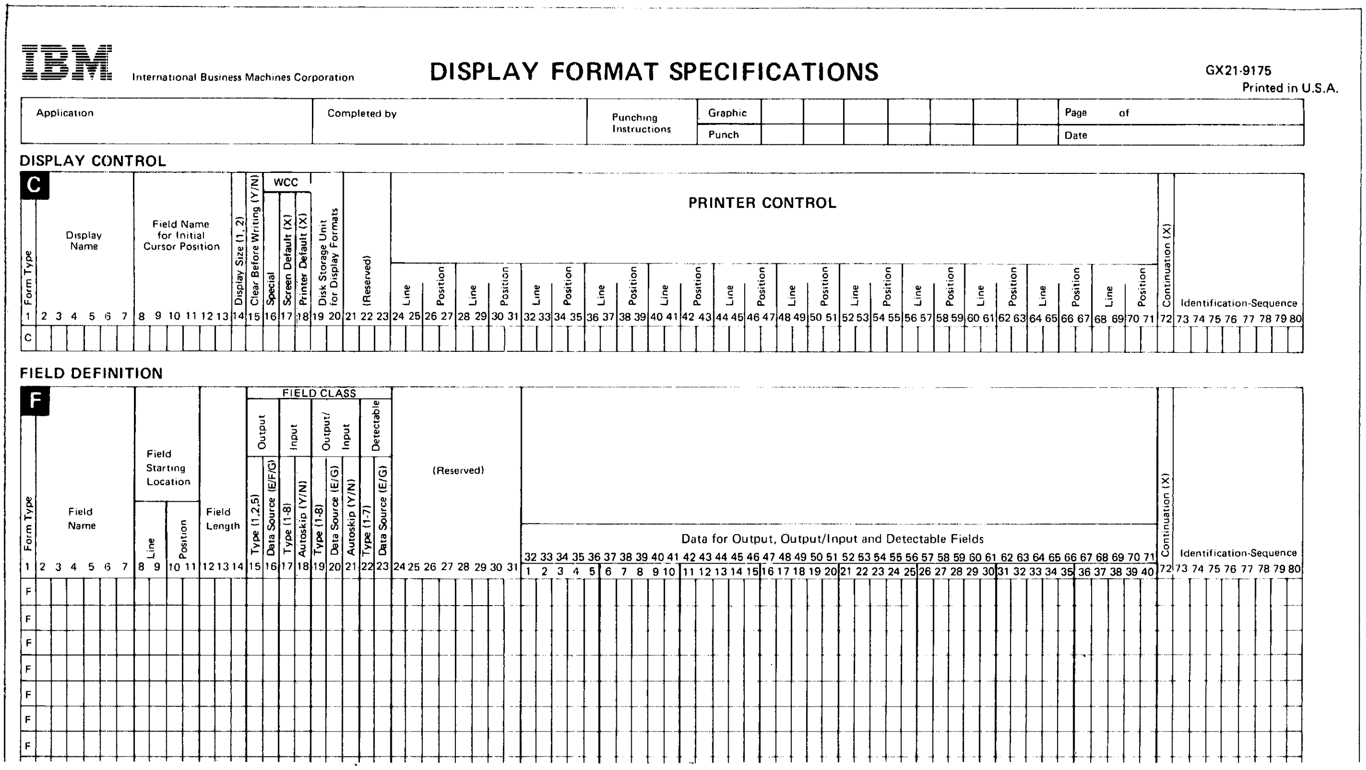
Data Passed to the Application Program

On input from the 3270 terminal, alphameric data is padded on the right with spaces to the field length when less data than that required by the field length is entered by the terminal operator.

Numeric data, received from numeric fields, is right-adjusted and padded with blanks on the left to the field length when less data than that required by the field length is entered by the terminal operator.

For input and output/input fields, it is assumed that data will always be received from the terminal. If no data is received, the fields are returned with blanks.

When the terminal operator uses the ENTER or PF keys to initiate the input operation and data is not received from the terminal for SPD selection, the field (alphameric) will be filled with spaces. Since the designator is not passed as data, the field length should not include the designator character.



IBM International Business Machines Corporation

DISPLAY FORMAT SPECIFICATIONS

GX21-9175
Printed in U.S.A.

Application
Completed by
Punching Instructions
Graphic
Punch
Page of
Date

DISPLAY CONTROL

C

Form Type 1
Display Name 2 3 4 5 6 7
Field Name for Initial Cursor Position 8 9 10 11 12 13
Display Size (1,2) 14
Clear Before Writing (Y/N) 15
WCC: Special 16; Screen Default (X) 17; Printer Default (X) 18
Disk Storage Unit for Display Formats 19 20
(Reserved) 21 22 23

PRINTER CONTROL
Line / Position 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
Continuation (X) 72
Identification-Sequence 73 74 75 76 77 78 79 80

C

FIELD DEFINITION

F

Form Type 1
Field Name 2 3 4 5 6 7
Field Starting Location: Line 8 9; Position 10 11
Field Length 12 13 14

FIELD CLASS
Output: Type (1,2,5) 15; Data Source (E/F/G) 16
Input: Type (1-8) 17; Autoskip (Y/N) 18
Output/Input: Type (1-8) 19; Data Source (E/G) 20; Autoskip (Y/N) 21
Detectable: Type (1-7) 22; Data Source (E/G) 23

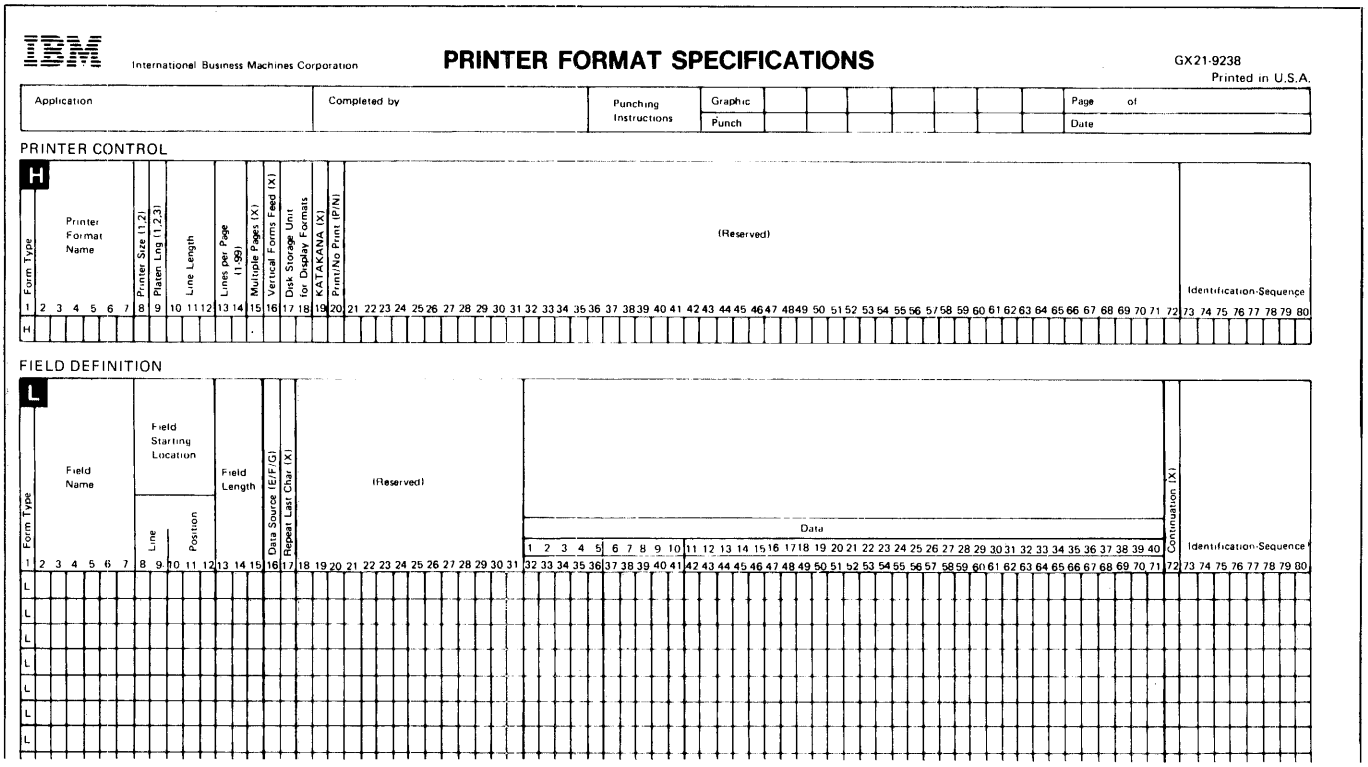
(Reserved) 24 25 26 27 28 29 30 31

Data for Output, Output/Input and Detectable Fields
32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

Continuation (X) 72
Identification-Sequence 73 74 75 76 77 78 79 80

F
F
F
F
F
F
F

Figure 8-3. Display Format Specifications Sheet



IBM International Business Machines Corporation

PRINTER FORMAT SPECIFICATIONS

GX21-9238
Printed in U.S.A.

Application
Completed by
Punching Instructions
Graphic
Punch
Page of
Date

PRINTER CONTROL

H

Form Type 1
Printer Format Name 2 3 4 5 6 7
Printer Size (1,2) 8
Platen Lng (1,2,3) 9
Line Length 10 11 12
Lines per Page (1-99) 13 14
Multiple Pages (X) 15
Vertical Forms Feed (X) 16
Disk Storage Unit for Display Formats 17 18
KATAKANA (X) 19
Print/No Print (P/N) 20
(Reserved) 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72
Identification-Sequence 73 74 75 76 77 78 79 80

H

FIELD DEFINITION

L

Form Type 1
Field Name 2 3 4 5 6 7
Field Starting Location: Line 8 9; Position 10 11 12
Field Length 13 14 15
Data Source (E/F/G) 16
Repeat Last Char (X) 17
(Reserved) 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Data
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71

Continuation (X) 72
Identification-Sequence 73 74 75 76 77 78 79 80

L
L
L
L
L
L
L

Figure 8-4. Printer Format Specifications Sheet

When the SPD attention field is used to generate the I/O pending condition, field data is not included with input from SPD selection and SPD attention fields from the terminal. The fields passed to the application program are filled with spaces except for a greater than (>) character in the leftmost position for any field in which the modified data tag was ON. By testing a field, the application programmer can determine those fields in which the modified data tag was or was not set.

Fields in the users input record area must be the same lengths as the field lengths specified on the field definition forms. Field lengths are used by the Display Format Control Routine in moving data into the user's input record area.

Data in Numeric Fields

All data in numeric fields should be right-justified when entered at generation time. Negative values in numeric output/input fields are provided at generation time by entering the minus sign (-) after the rightmost numeric digit. For example, a negative thirty-five would be given as 35-. Space for the negative sign must be allocated in the generated format when defining the field length. If numeric data is to be later entered by the terminal operator, the numeric fields may be set to zeros so that the field is visible to the operator.

Note: Continuation cards must be provided if the numeric field is designated as being longer than forty digits (or thirty-nine digits and a minus sign).

Data provided (with Put Message or Put Override operations) in numeric fields at execution time must be the same length as the field length specified at generation time. Numeric fields are always right justified. Negative values provided for numeric input and output/input fields must combine the minus sign (-) with the rightmost digit. For example, a negative thirty-five is given as 3N. Before sending the message to the 3270, DFCR will move the numeric digits one position to the left, convert the N to a five and place a negative sign in the rightmost position of the field. Space for the negative sign must have been allocated at generation time. DFCR also moves the digits of a positive number one digit to the left.

Note: In a one-position numeric output field, the minus sign would be all that would be sent for a negative value.

To enter data in numeric fields, the terminal operator should either

- Right-justify data in the field and left pad with zeros or blanks, or
- First key in the numeric data left-justified; press ERASE EOF; and then press either SKIP or TAB. The cursor will be positioned at the next designated cursor location. On input, DFCR will right-justify the data in the field and pad with leading blanks if less data than the field length is received. DO NOT press the space bar after pressing ERASE EOF.

Numeric fields are not examined by DFF for valid numeric characters. The application program is responsible for validation of its input data.

The terminal operator must enter negative numerics in a numeric field by entering a trailing negative sign in the field. For example, a 35– is entered. DFCR will right-adjust the numerics and pad with blanks on the left to the field length when less data than that required is entered. The five will be converted to an N and the application program receives a right-adjusted 3N as data input for the field.

Note: If the minus sign (–) was the only character received, an X'D0' (equivalent to a –0) is returned to the application program.

Since some languages are more restrictive than others, particularly in the form of numeric data supported, the application programmer must be aware of their differences and inform the terminal operator what characters can be used. If the data conventions of the language are not enforced by the compiler generated object code, the application programmer must validate the data keyed by the terminal operator.

Number of Fields

A total of 256 fields can be defined for a printer or display format. This does not include F-type output fields. Any number of these fields may be defined. The combined total of Input, Output/Input, and SPD fields cannot exceed 200 fields.

A maximum of seven SPD fields in the 3277 or 3275 Model 1 or thirteen SPD fields in the 3277 or 3275 Model 2 may be on any given display line. This is, of course, because the minimum length of an SPD field is six with no trailing attribute or four if there is a trailing attribute. The minimum of six consists of: the defining attribute, the designator, one data character, and three trailing nulls. The last SPD field on a line can require as few as four positions since the trailing nulls are not required.

When mixing detectable and nondetectable fields, a maximum of 15 defining and/or terminating attributes may be on a given line. Whereas all fields generate a defining attribute, input and output/input fields generate a defining and terminating attribute.

Note: It is possible to define up to 15 fields on a line by positioning fields following the input and output/input fields so that their defining attribute overlays the terminating attribute of the previous field. However an SPD field following an input and output/input field will not overlay the previous terminating attribute. The leading nulls cannot overlay terminating attributes. See Chapter 8 for the use of nulls with SPD fields.

RECORD CONCEPTS

Fields are received from and passed to the application program as data records. The user defines data record formats by defining the fields on the field definition forms.

Display Output Record Format

When writing the initial display format, data can be supplied during execution time for output, output/input, and SPD fields. If data is to be supplied, the format of the associated output record is determined by the order and field lengths of the fields as they are defined on the field definition form. Field names, field lengths, field end positions (for RPG SUBR92 use), and length of output record area required are listed on the printed output from DFGR.

Printer Output Record Format

When the initial printer format is written, data can be supplied during execution time. If data is to be supplied, the format of the associated output record is determined by the order and field lengths of the fields as they are defined on the field definition form. Field names, field lengths, field end positions (for RPG SUBR92 use), and length of output record area required are listed on the printed output from PFGR.

Input Record Format

Since it is possible to receive data from each input, output/input and SPD field defined, the input record area must provide an assigned location for every field. The format of the associated input record area is determined by the order and field lengths of the fields as they are defined on the field definition form. The symbolic name, field length, assigned end position for each input field (for RPG SUBR92 use), and length of input record area required are listed on the printout from DFGR.

Note: With the Put Overrides operation, the application programmer can choose between receiving input from all fields or only from selected fields (see *Put Override*).

The order of processing an input record area is:

1. Examine the CCP return code.

2. Examine the attention identifier (AID).

3. Process the fields in the input record area.

The attention identifier (AID) is a single character immediately preceding the input fields in the user's input record area. The AID is set by the terminal when the operator takes any action that produces an I/O interruption. The AID identifies the action (such as using the selector pen on an SPD attention field) or key (program function or program access keys) that caused the condition to be generated. For a complete discussion on AID, refer to *IBM 3270 Information Display System Component Description,* GA27-2749. The return code and the AID must be examined before processing of fields in the input record area. The effective input length includes the AID character.

Note: AID characters are shown at the bottom of the printer/display layout sheet (Figure 8-2). The AID for TEST REQUEST (0) is received by the application program only when the block length specified in the terminal attributes set is not large enough for the test being run (see BLKL parameter of TERMATTR assignment statement in *CCP System Reference Manual*).

For CCP return code considerations, see Appendix E.

DISPLAY FORMAT GENERATOR

The display format generator routine does not run under the control of CCP. DFGR generates a 3270 display format from display format specifications. DFGR performs the following functions:

1. Reads display format specification statements.
2. Produces a printout of the specification statements, analyzes the specifications for errors, and logs diagnostic error messages as required.
3. Builds the display format as a two-part table structure:
    a. Field Descriptor Table (FDT) – a table of descriptive field information including the symbolic name of the field.
    b. 3270 Data Stream – containing output data if provided, and 3270 device-dependent control information required for formatting all fields defined.
4. Provides a printout of field names, in the order in which they must appear in the output record area if data from the Field Descriptor Table is required by the application program using the Display Format Facility.
5. Produces a printout of all fields defined for input and the order in which they will appear in the input record area.
6. Calculates and prints the following:
    a. Length of the output record area required in DFF program
    b. Length of the input record area required in DFF program
    c. Decimal length of the field descriptor table
    d. Decimal length of the 3270 output data stream
    e. Decimal length of the 3270 input data stream
7. Places the display format in a work file ($WORK) on disk and then catalogs the display format in an object library on disk.

Note: If printer control on DFGR is used for a Katakana printer, unpredictable results can occur because of new line and end-of-message considerations. For this reason, PFGR should be used to build a printer format for a Katakana printer.

Printer/Display Layout Sheet

The printer/display layout sheet (Figure 8-2) is a planning device. The application programmer uses it to plan the format and layout of the fields on the display. The completed layout is then used as a guide when filling out the display control and field definition forms (see Figures 8-6 and 8-7).

Notice the heavy line after position 40 and line 12 which marks the boundary of the 480-character display. The heavy line after position 80 and line 24 marks the boundary of the 1920-character display. The entire page is used for the layout of printer formats.

Display Control Form

The display control form provides special information about the display format which, in general, is unrelated to the fields being defined. One display control form is required and must precede all field definition forms. (Both forms appear on the Display Format Specifications sheet—see Figures 8-5 and 8-7. Additionally, both forms appear on the reverse of the sheet to be used as a template to verify the position of data in the DFGR listings.)

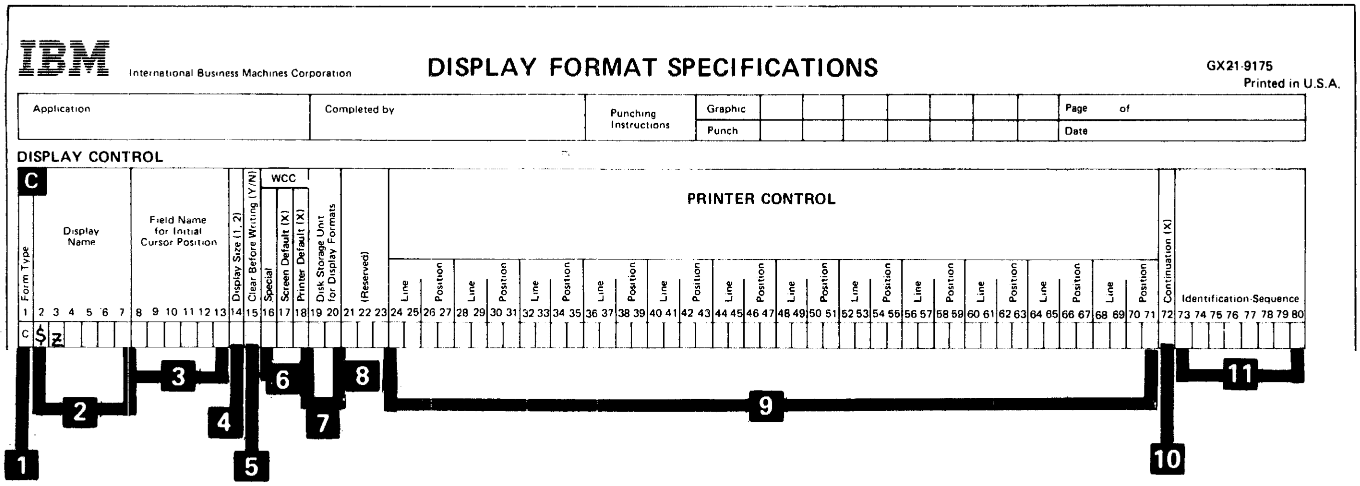


Figure 8-5. Display Control Form is the First of Two Forms on the Display Format Specifications Sheet

See Figure 8-5 for the location of the following items:

1 *Form Type*—Column 1

The preprinted character C identifies this as the display control form.

2 *Display Name*—Columns 2-7

This entry is used to assign a unique name to a display format. Entries in columns 2 and 3 are $Z. The remaining characters in the name may contain any combination of alphabetic and/or numeric characters plus any of the characters $, #, or @. Blanks may not appear between characters in the name. All application programs using a particular display format must refer to it by its assigned symbolic name because each display format is catalogued in the object library under its symbolic name. The application program uses the format's symbolic name when issuing a PUT Message.

3 *Field Name for Initial Cursor Position*—Columns 8-13

Enter the name of the field where the cursor is to be positioned. If a field name is specified, the cursor will be positioned at the first character location of the data field. The field must be unprotected. The field name must begin with an alphabetic character or one of the characters $, #, or @. The remaining characters can be any combination or alphabetic, numeric characters or any of the characters $, #, or @. No imbedded blanks are allowed.

If the field name is not specified, the clear before writing entry (column 15) determines the initial cursor position.

4 *Display Size*—Column 14

Enter a 1 in this column if the display format is to be used with a 480-character display or printer.

Enter a 2 in this column if the display format is to be used with a 1920-character display or printer.

If more fields are defined than can be displayed, an error message occurs and all remaining field definition forms will be read but not processed.

5 *Clear Before Writing*—Column 15

Enter Y if the screen is to be cleared before writing this display format. An entry of Y will also cause the cursor to be positioned at line 1, position 1, of the display. The cursor can be repositioned by specifying a field name in columns 8-13.

Enter N if the screen is not to be cleared before writing this display format. In this case, the cursor will not be positioned unless columns 8-13 contain a field name; it remains at whatever position it happened to be on the screen before the display format was written to the screen.

If this column is blank, the default entry Y is assumed.

The entry N must be used if the format is to be an *overlay format* (see index entry).

6 *WCC* – Columns 16-18

Enter the write control character in column 16 or leave blank and place an entry (X) in either column 17 or 18. Use Figure 8-6 to select an entry for column 16. The WCC allows the user full control over certain device operations such as starting the printer and resetting the keyboard.

If there is an entry (X) in either column 17 or 18, a default write control character is assigned and any entry in column 16 will be ignored.

If columns 16, 17, and 18 are all blank, it is assumed that the space character (X'40') is to be used for the WCC.

Default WCC selections when column 17 or column 18 contain an X, and operations associated with each default are as follows:

Column	*Default WCC (column 16)*	*Operations Performed*
17 (Screen)	Character - C	Restore the keyboard. Reset the modified data tags.
18 (Printer) if Display Size entry is 1	Character - Q	Start the print operation. Set length of character line to 40.
if Display Size entry is 2	Character - 8	Start the print operation. Set length of character line to 80.

7 *Disk Storage Unit for Display Formats*—Columns 19-20

Enter R1, F1, R2, or F2 to specify the location of the object library where the display format is to be stored. If columns 19 and 20 are blank, the display format will be placed on the disk from which the display format generation routine was loaded.

When executing with CCP, all display formats must be stored either on the CCP program pack or on the DSM system pack.

Operation				**Output Device Format**			
Sound Alarm	**Restore Keyboard**	**Start Printer (No for displays)**	**Reset MDTs**	**Display or Printer NL/EM Control**	**40-Character Print Line**	**64-Character Print Line**	**80-Character Print Line**
Yes	Yes	Yes	Yes	|	¬	?	"
			No	+	;	>	=
		No	Yes	G	P	X	7
			No	F	O	W	6
	No	Yes	Yes	(	)	—	'
			No	<	*	%	@
		No	Yes	E	N	V	5
			No	D	M	U	4
No	Yes	Yes	Yes	.	$	,	#
			No	¢	!	}[1]	:
		No	Yes	C	L	T	3
			No	B	K	S	2
	No	Yes	Yes	I	R	Z	9
			No	H	Q	Y	8
		No	Yes	A	J	/	1
			No	ƀ	&	-	0

[1] This character is converted internally to hex 6A for a WCC by DFGR when generating a format, and by DFCR when using the WCC in a Put Override operation.

Figure 8-6. Write Control Characters

8 *(Reserved)*—Columns 21-23 are reserved and must be left blank.

9 *Printer Control*—Columns 24-71

New line and end-of-message orders can be included in the display format for control of printouts. Each order occupies a data position in the display and is executed only when printing. The orders appear as the graphics '5' and '9' respectively on a display screen or during a printout when using a specified line length format in the WCC. New line and end-of-message orders are ignored and treated as spaces if the field in front of either of these orders is a non-display/nonprint field.

If WCC is specified in column 16, which will define a format for a printer in an unformatted mode (not 40 or 80 characters per line), then new line (NL) and end-of-message (EM) orders should be specified. This may be accomplished in one of two ways (or both); specify up to 23 NL orders and one EM in the control card, and/or specify any number of NL orders and one EM order in the field definition statement by use of the reserved keywords @@@NL and @@@EM. It is suggested that all NL and EM orders be specified using only one or the other form (control card or field definition statement using the keywords). If both forms are used and an NL is specified on the field definition statement (@@@NL) for a position in a format after the last new line specified on the control card (which is assumed to be an EM), that last control card entry will still be considered an EM order. Since the reserved keywords allow NL and EM orders to be specified in the same order and method as fields, it is suggested that the keyword method of specifying NL and EM orders be used for unformatted printer operations (See *Additional Functions for the Field Definition Statement* Chapter 8). For the 3288 printer equipped with the vertical forms control feature, a reserved keyword (@@@FF) will insert the forms feed order into the text stream. There is no way of specifying this order on the control card.

To specify control card NL and EM orders, each entry consists of a line (two columns) and a position (two columns). If the column 14 entry is 1 (for small screen), enter a number from 01 to 12 under line and a number from 01 to 40 under position. If the column 14 entry is 2 (for large screen), enter a number from 01 to 24 under line and a number from 01 to 80 under position.

Each entry, with the exception of the last entry, will cause an NL order character to be inserted into the specified location. The last entry will cause an EM order character to be inserted. If only one entry is specified, the EM order character will be inserted.

The new line and end-of-message orders specified on the display control form will not be diagnosed. An NL or EM may overlay another field, or an attribute with no error messages or halts given.

If NL or EM orders specified on the control card are used with the line/partial-line duplication function (@@@DP), a warning message and a halt (U-F1) is issued at the end of generation. See the Display Format Generator messages.

Notes:

1. For a discussion of new line and end-of-message orders, refer to *IBM 3270 Information Display Component Description,* GA27-2749.
2. If printer control on DFGR is used for a Katakana printer, unpredictable results can occur because of new line and end-of-message considerations. For this reason, PFGR should be used to build a printer format for a Katakana printer.

10 *Continuation*—Column 72

If more than twelve printer control entries are required, place an X in column 72 and make remaining entries in columns 24-71 of the second card. (Columns 2-23 of the second card must be blank.) One continuation card is allowed. This provides for NL control for up to 23 lines with EM control for the last line.

11 *Identification-Sequence*—Columns 73-80

Enter any character for sequential identification. These columns will be ignored other than to print them as part of the statement.

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Field Definition Form

An understanding of how to define fields (see *Field Concepts*) is necessary to correctly complete the field definition form. Refer to the printer/display layout sheet and the display control form while completing the field definition form. Each field in the display format must be specified on a field definition form. Enter an * in column 1 to identify a comment statement. Comments can be used to include notes on the listing produced by the Display Format Generator program. Placement of the statements is not restricted (may appear before the display control form, between continuation cards, etc) during a single-format build. Placement of comments is not restricted when using multiple-format builds, but all comments before the display control form of the next format build are printed with the previous format build. See Figure 8-7 for location of items described below:

1 *Form Identifier*—Column 1

The preprinted character 'F' identifies this as a field definition form.

2 *Field Name*—Columns 2-7

Enter in columns 2-7 a unique field name (up to six characters in length). The first character must be alphabetic or one of the characters, $, #, or @. Remaining characters can be any combination of alphabetic or numeric characters or the characters, $, #, or @. Imbedded blanks are not allowed.

The field names as defined are the symbolic names used with Put Overrides applications.

Note: For more considerations, see *Additional Functions for the Field Definition Statement* in this chapter.

3 *Field Starting Location*—Columns 8-11

A line (two columns) and a position (two columns) entry define the leftmost character position of the field. Allowable entries are limited by the display size (see column 14 of the display control form). If the display size entry is 1 (for small screen), enter a number from 01 to 12 under line and a number from 01 to 40 under position. If the display size entry is 2 (for large screen), enter a number from 01 to 24 under line and a number from 01 to 80 under position. Field starting locations must be specified in numerically increasing order (see *Planning the Printer/Display Layout*).

4 *Field Length*—Columns 12-14

The minimum field length is one. The maximum length for an output, input, or an output/input field is 240 positions. An SPD field must be contained on one line and is therefore limited to a length of 37 or 77 depending upon the display size (see *Planning the Printer/Display Layout*).

Note: For more considerations, see *Additional Functions for the Field Definition Statement* in this chapter.

5 *Output, Type*—Column 15

Enter 1, 2, or 5 (see *Field Concepts*, earlier in this chapter).

6 *Output, Data Source*—Column 16

Enter E if data is provided when writing the initial display format during execution by the application program.

Enter a G if data is generation-defined (data is entered in columns 32-71) and a Put Override is used to override the field during execution. To save main storage, enter an F for an output field having generation-defined data (in columns 32-71). Entering an F eliminates the Field Descriptor Table (FDT) entry, which saves 14 characters of storage. However, the lack of this FDT entry eliminates the capability of overriding the field during execution.

Either a G or an E can be entered and a Put Override can still be used to override the field at execution time.

If this entry is blank, the default G is assumed.

7 *Input, Type*—Column 17

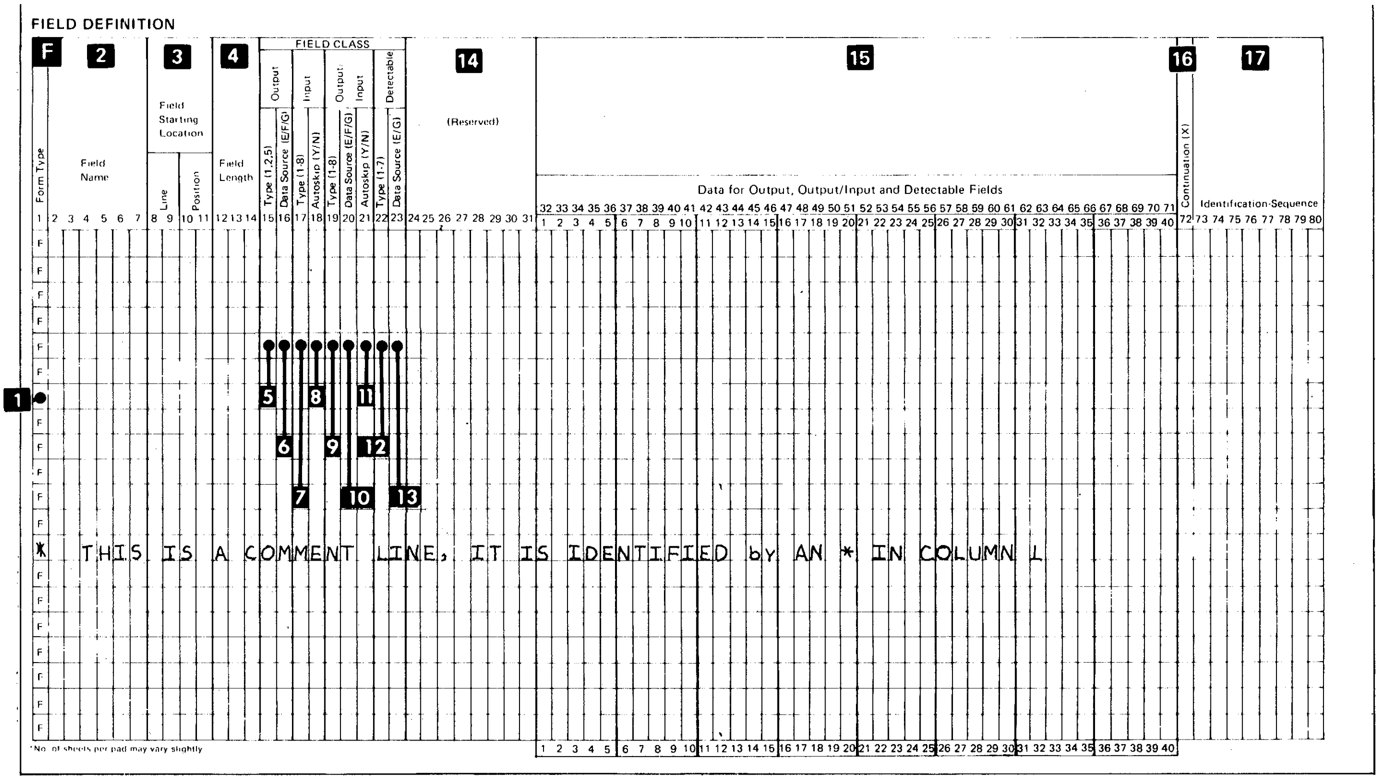
Enter 1, 2, 3, 4, 5, 6, or 7 (see *Field Concepts*, earlier in this chapter).

8 *Input, Automatic Skip*—Column 18

This entry determines the terminating attribute. Enter Y in column 18 if automatic skip function is to be performed (see *Autoskip and Cursor Positioning).*

Enter N if automatic skip function is not to be performed.

Default is N if entry is left blank.



* THIS IS A COMMENT LINE, IT IS IDENTIFIED BY AN * IN COLUMN 1

Figure 8-7. Field Definition Form on the Display Format Specifications Sheet

9 *Output/Input, Type*—Column 19

Enter 1,2,3,4,5,6,7, or 8 (see *Field Concepts,* earlier in this chapter).

10 *Output/Input, Data Source*—Column 20

Enter E if data is provided when writing the initial display fromat during execution by the application program.

Enter a G if data is generation-defined and data is entered in columns 32-71. Either a G or an E may be entered and a Put Override can still be used to override the field at execution time.

If this entry is blank, the default G is assumed.

11 *Output/Input, Automatic Skip*—Column 21

This entry determines the terminating attribute of the field. Enter Y if the automatic skip function is to be performed (see *Autoskip and Cursor Positioning*).

Enter N if automatic skip function is not to be performed. Default of N is assumed if entry is left blank.

12 *SPD, Type*—Column 22

Enter 1, 2, 3, 4, 5, 6, or 7. See *Field Concepts*, earlier in this chapter.

13 *SPD, Data Source*—Column 23

Enter E if data is provided when writing the initial display format during execution by the application program.

Enter a G if data is generation-defined and data is entered in columns 32-71. Either a G or an E may be entered and a PUT Override can still be used to override the field at execution time.

14 *(Reserved)*—Columns 24-31 must be left blank.

15 *Data*—Columns 32-71

Data may be provided for Output, Output/Input, or SPD fields. Data must not exceed field length as specified in columns 12-14.

If data exceeds 40 characters in length, place an X in column 72 and continue entering data in column 32 of the next line (leave columns 2-31 blank).

16 *Continuation*—Column 72

If the data entry must continue beyond column 71, place an X in column 72 and continue entering data in column 32 of the next line. A maximum of five continuation lines are allowed.

17 *Identification-Sequence*—Columns 73-80

Since these columns are ignored other than to print them as part of the statement, they may contain any characters.

Additional Functions for the Field Definition Statement

Printer Control

An optional method of providing new line and end-of-message printer control is to request the generation of these orders on Field Definition statements. An additional control called forms feed can be specified for those printers having the Vertical Forms Control feature. The new line, end-of-message, and forms feed orders on field definition statements are checked for position. If there are control characters overlapping other fields or attributes, an error message and halt are issued. The position of the new line and end-of-message orders on the display control form are not checked.

If printer control on DFGR is used for a Katakana printer, unpredictable results can occur because of new line and end-of-message considerations. For this reason PFGR should be used to build a printer format for a Katakana printer.

To specify printer control on a Field Definition statement:

Form Type—Column 1
Contains the preprinted character F.

Name—Columns 2-7

@@@NL — Signifies a new line order is to be generated in the display format (see note).

@@@EM — Signifies an end-of-message order is to be generated in the display format.

@@@FF — Signifies a forms-feed order is to be generated in the display format. This order is valid only for printers having the Vertical Forms Control feature. When valid, the forms-feed order is printed as a blank; when invalid, it is displayed as a graphic < (see note). See *IBM 3270 Information Display System Component Description,* GA27-2749.

Note: There is no restriction on the number of new line (@@@NL) or forms-feed (@@@FF) orders that can be generated.

Field Starting Location—Columns 8-11
Enter the line number in columns 8 and 9, the position number in columns 10 and 11. These numbers indicate where the order will be in the format. Each order occupies one position in a format. These orders should be provided in numerically increasing order.

DFGR Line/Partial-Line Duplication

Line/partial-line duplication allows generation of duplicate fields on consecutive lines without requiring Field Definition statements for each duplicate field. Instead, one Field Definition statement is required to place the duplicate fields on the desired line. To allow duplication, enter the following on the Field Definition form:

Form Type—Column 1
Contains the preprinted character F.

Field Name—Columns 2-7
@@@DP identifies this as a duplication statement. This means that this is a request to duplicate a field(s) defined in the Field Definition statement(s) for the previous line.

Field Starting Location—Columns 8-11
The line number, columns 8 and 9, identifies on which line to generate the duplicated fields. The fields will be duplicates of the fields for the last defined line. Any number of blank lines can be left between the original line and the line on which the duplicate fields are being generated. The position number, columns 10 and 11, is an optional entry. It gives the position number on the line where duplication is to begin. If no entry is made, the default is position 1. If the position specified is in the middle of a field, DFGR starts to duplicate at the start of the next field.

Field Length—Columns 12-14

Number of Fields: The number entered specifies the number of fields to duplicate (see columns 8-11 for start position). If the number of fields is not specified or if the number of fields specified is greater than the number of fields available to be duplicated, all fields after the start position of that line (columns 8-11) are duplicated.

Number of Lines: If an @ is entered in column 12, followed by a number in 13 and 14, this number specifies the number of times to duplicate the last line with field definitions. If columns 13 and 14 are left blank it will duplicate the line once.

No other entries on the duplication statement are recognized.

DFGR Considerations for the Duplication Function

- If a line being duplicated contains both fields defined by Field Definition statements and fields generated by a previous duplication statement, only the fields defined by Field Definition statements are duplicated.
- Field names are assigned to fields generated under the duplication process. The names have the format 'DPllpp'. The 'DP' indicates it is a duplicate field and 'llpp' are the line and position where it is located. You should avoid defining other fields using this convention because you could get duplicate field names.
- If a field being duplicated extends to another line, or lines, the entire field is copied.
- If any DFGR warning messages were issued (but no termination messages), a halt (U-F1) is issued. The options available are:

  0 — Catalog the format and ignore the warnings.

  3 — Cancel the program and DFGR will go to end of job.

Examples of Duplication Functions: The following examples are some of the ways to use the line and field duplication functions. The duplication function is indicated by '@@@DP' in columns 2-6. The fields that are generated from this duplication function are between the lines of asterisks, starting with the line with the comment 'GENERATED DUPLICATION FIELDS' and ending with the line with the comment 'END OF GENERATED DUPLICATION FIELDS'.

```
C$ZTST1      2Y  XR1
FA      2 2  31E
FB      3 5 402G                 DUPLICATED ON LINE 4
F@@@NL  350                      DUPLICATED ON LINE 4
```

A

```
F@@@DP  4
**************************************************** GENERATED DUPLICATION FIELDS
FDP040504 5 402G               DUPLICATED ON LINE 4
F@@@NL 0450                    DUPLICATED ON LINE 4
**************************************************** END OF GENERATED DUPLICATION FIELDS
```

```
FC      7 9  21G              **
F@@@FF  716                    *
FD      718 205E               ** DUPLICATED ON LINES 9,10,11
FE      741  82G               *
F@@@NL  750  3                **
```

B

```
F@@@DP  9  @ 3
**************************************************** GENERATED DUPLICATION FIELDS
FDP090909 9  21G              **
F@@@FF 0916                    *
FDP09180918 205E               ** DUPLICATED ON LINES 9,10,11
FDP09410941  82G               *
F@@@NL 0950  3                **
FDP100910 9  21G              **
F@@@FF 1016                    *
FDP10181018 205E               ** DUPLICATED ON LINES 9,10,11
FDP10411041  82G               *
F@@@NL 1050  3                **
FDP110911 9  21G              **
F@@@FF 1116                    *
FDP11181118 205E               **
FDP11411141  82G               *
F@@@NL 1150  3                **
**************************************************** END OF GENERATED DUPLICATION FIELDS
```

```
F@@@FF 12 3  9
FTESTA 14 2  3   7GY
FTESTB 14 6  8   8GY


FTESTC 1420 30   7GN           DUPLICATED ON LINE 15
FTESTD 1454  22G               DUPLICATED ON LINE 15
```

C

```
F@@@DP 1520@ 1
**************************************************** GENERATED DUPLICATION FIELDS
FDP15201520 30   7GN           DUPLICATED ON LINE 15
FDP15541554  22G               DUPLICATED ON LINE 15
**************************************************** END OF GENERATED DUPLICATION FIELDS
```

```
FTEST1 20 2  3   7GY
FTEST2 20 6  8   8GY
FTEST3 2020 30   7GN           DUPLICATED ON LINE 22
FTEST4 2054  22G               DUPLICATED ON LINE 22
```

D

```
G@@@DP 2220  3
**************************************************** GENERATED DUPLICATION FIELDS
FDP22202220 30   7GN           DUPLICATED ON LINE 22
FDP22542254  22G               DUPLICATED ON LINE 22
**************************************************** END OF GENERATED DUPLICATION FIELDS
```

```
FTST1  23 1 20   7GY           DUPLICATED ON LINE 24
FTST2  2325 151G               DUPLICATED ON LINE 24
FTST3  2345  11F
FTST4  2349  5   8GN
```

E

```
F@@@DP 24 1  2
**************************************************** GENERATED DUPLICATION FIELDS
FDP240124 1 20   7GY           DUPLICATED ON LINE 24
FDP24252425 151G               DUPLICATED ON LINE 24
**************************************************** END OF GENERATED DUPLICATION FIELDS
```

```
F@@@EM 2525
```

A *Whole Line Duplication (Columns 12-14 blank)*

The duplication instruction (@@@DP) indicates duplication of fields on line 4. Columns 12-14 on the duplication card are blank, so the default is to duplicate one whole line. This would be the same as specifying @01 in columns 12-14. One field and one new line are defined on line 3, which is the line previous to line 4. This field and new line are duplicated on line 4.

B *Whole Line Duplication (Columns 12-14 non-blank)*

The duplication instruction (@@@DP) indicates duplication on lines 9, 10 and 11. Column 12 contains the character '@' which indicates line duplication. The character 3 in column 14 indicates the previously defined line is to be duplicated three times. Since nothing is specified in the position columns (columns 10 and 11), the whole line will be duplicated. There are three fields, a forms-feed order (@@@FF) and a new line order (@@@NL) on line 7. Since line 8 contains no fields or forms-feed orders, the entries on line 7 will be duplicated on lines 9, 10 and 11.

C *Partial Line Duplication*

The duplication instruction (@@@DP) indicates duplication on line 15 of everything on the previous nonblank line from position 20 to the end of that line. Column 12 contains the character @ which indicates line duplication. The character 1 in column 14 indicates the line is to be duplicated one time. The characters 20 in columns 10 and 11 indicate everything from position 20 to the end of the line should be duplicated. In this case two fields, TESTC and TESTD, will be duplicated on line 15.

D *Field Duplication*

The duplication instruction (@@@DP) indicates duplication on line 22 of three fields from the previous nonblank line, beginning at position 20. Column 12 is blank, and column 14 contains a character 3 indicating field duplication. Three fields were specified to be duplicated but only two fields were specified on line 20 from position 20 to the end of the line. In this case only these two fields are duplicated.

E *Field Duplication*

The duplication instruction (@@@DP) indicates duplication on line 24 of the two fields from the previous nonblank line beginning at position 1. Column 12 is blank indicating field duplication, and column 14 contains a character 2, indicating two fields are to be duplicated. In this case the first two fields from line 23 are duplicated on line 24.

OCL Considerations for the Display Format Generator

The following OCL statements are required when either single or multiple formats are built:

```
// LOAD $CCPDF,unit

                          (R1)
// FILE NAME-$WORK,UNIT-  )F1( ,PACK-packid,
                          (R2)
                          (F2)
     RETAIN-S,TRACKS-2

// RUN
```

When reading from the system input device, be sure that the display format statements immediately follow the RUN statement. A /* follows the format statements. The statements are read from the system input device and written into a $SOURCE file. If the display format statements require more than five tracks of a file, define a $SOURCE file with an adequate number of tracks. If a $SOURCE file OCL statement is not specified, a 5-track $SOURCE file is automatically allocated on the unit from which $CCPDF was loaded.

When reading from the source library, specify a $SOURCE file with enough tracks to contain all the display format statements in the source library. A COMPILE is also required with the following parameters:

```
                                                 (R1)
// COMPILE SOURCE-name of source data,UNIT-      )F1(
                                                 (R2)
                                                 (F2)
```

where UNIT is the location of the source library

Notes:

1. For multiple format builds in a single run, the input stream must not contain delimiters between the display formats. Instead, the C in column 1 of the display control form indicates the start of another input.
2. Enter an asterisk (*) in column 1 to identify a comment statement. Comments may be used to include notes on the listing produced by the Display Format Generator routine. Comments can be placed anywhere in the format build; however, on multiple format builds, all comments entered before the display control form of the second or later format builds are printed with the previous format build.

Display Format Generator Diagnostic Messages

During its processing, the display format generator (DFGR) diagnoses errors in the Display Format Specifications and logs diagnostic messages on the system logging device. Refer to the *CCP Messages Manual,* GC21-5170, for a list of the diagnostic messages.

Since DFGR calls the Overlay Linkage Editor to put the formats into the object library, it is possible to get Overlay Linkage Editor halts when using the DFGR.

PRINTER FORMAT GENERATOR ROUTINE (PFGR)

The Printer Format Generator routine does not run under the control of CCP. PFGR generates a 3270 printer format from printer specifications in the following functional steps:

1. Reads printer format specifications statements.
2. Produces a printout of the specification statements, analyzes the specifications for errors, and logs diagnostic error messages as required.
3. Builds the printer format as a two-part table structure:
   a. Field Descriptor Table (FDT) – containing descriptive field information, including the symbolic name of the field
   b. 3270 Data Stream – containing output data, if provided, and 3270 device-dependent control information required for formatting all fields defined
4. Provides a printout of field names, in the order in which they must appear in the output record area if data from the Field Descriptor Table is required by the application program using the Display Format Facility.
5. Calculates and prints:
   a. Length of the output record area required in the DFF program
   b. Decimal length of the Field Descriptor Table
   c. Decimal length of the 3270 output data stream
6. Places the printer format in a work file ($WORK) on disk, then catalogs the printer format in an object library on disk.

Printer/Display Layout Sheet

The printer/display layout sheet is the same as that used for DFGR (Figure 8-2). The application programmer uses this form to plan the format and layout of the fields on the printer. The completed layout is then used as a guide to complete the printer control and field definition forms (see Figures 8-8 and 8-9).

The layout is 132 positions per line, the maximum platen length. Other platen lengths used are 120 and 126 positions per line.

Printer Control Form

The printer control form provides special information about the printer format which, in general, is unrelated to the fields being defined. One printer control form is required and must precede all field definition forms. (Both forms appear on the Printer Format Specifications sheet—see Figures 8-4 and 8-8.)

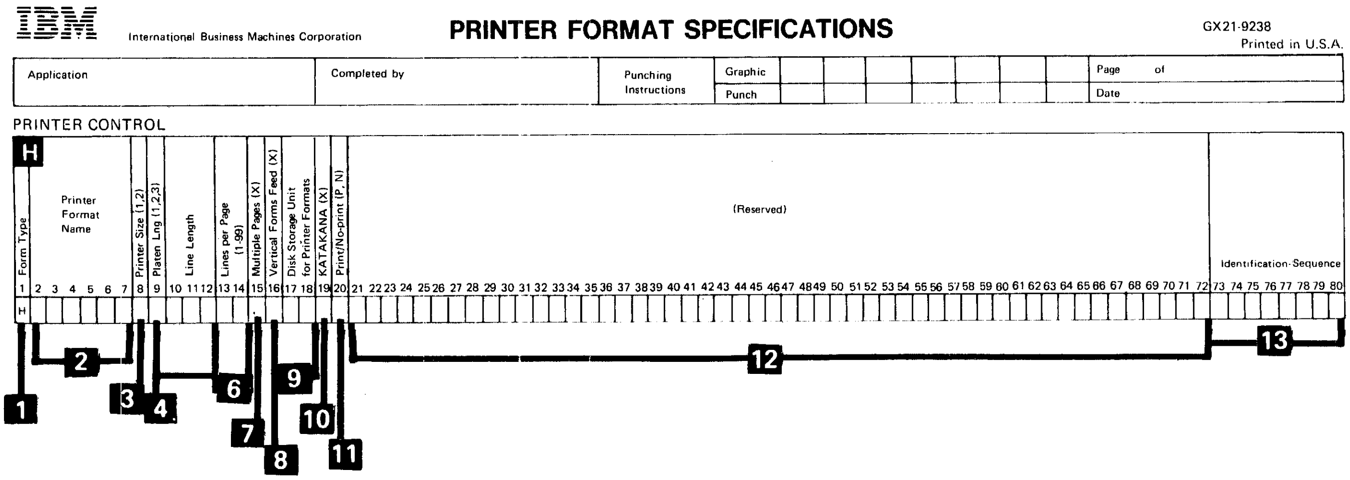


Figure 8-8. Printer Control Form is the First of Two Forms on the Printer Format Specifications Sheet

Entries on the printer control form are as follows:

1 *Form Type*—Column 1

The preprinted character H identifies this as the printer control form.

2 *Printer Format Name*—Columns 2-7

This entry is used to assign a unique name to a printer format. Entries in columns 2 and 3 are $Z. The remaining characters in the name can consist of any combination of alphabetic and/or numeric characters plus any of the characters $, #, or @. Blanks may not appear between characters in the name. The length of the name can be from three to six characters. All application programs using a particular printer format must refer to it by its assigned symbolic name, because each printer format is cataloged in the object library under its symbolic name.

3 *Printer Size*—Column 8

Enter a 1 or leave this column blank if the printer format is to be used with a 480-character printer.

Enter a 2 in this column if the printer format is to be used with a 1920-character printer.

If more fields are defined than can be displayed, an error message is issued; and all remaining field definition forms are read but not processed.

4 *Platen Length*—Column 9

Enter a 1 in this column if the printer used has a 120-character platen.

Enter a 2 in this column if the printer has a 126-character platen;

Enter a 3 or leave this column blank if the printer has a 132-character platen.

5 *Line Length*—Columns 10-12

Enter in these columns the length of the line to be printed. Valid line length can be from 001 to the platen length specified (see column 9). A field cannot extend beyond the line length specified.

6 *Lines Per Page*—Columns 13-14

Enter the total number of lines (page length), from 1 through 99, that can be printed on a single page. If columns 13-14 are left blank, the default value is 66 lines per page.

7 *Multiple Pages*—Column 15

Enter an X in this column if the printer format requires more than one page. If this column is blank, all fields are printed on one page. Any field that has a *line/position* value less than the previous field specified is flagged with an error message, and the format is not built. If this column contains an X and a field has a *line/position* value less than the previous field specified, the field is placed on the next page at the *line/position* value given. Processing of the remaining field continues.

8 *Vertical Forms Feed*—Column 16

Enter an X in this column if a 3288 printer is used with the option to support the forms-feed function. Forms-feed is not used if this column is left blank.

Note: The Katakana feature does not support vertical forms feed.

9 *Disk Storage Unit for Printer Formats*—Columns 17-18

Enter R1, F1, R2, or F2 to specify the location of the object library in which the printer format is to be stored. If columns 14 and 15 are blank, the printer format is stored on the disk from which the printer format generation routine was loaded.

When CCP is executing, all printer formats must be stored on either the CCP program pack or the DSM system pack.

10 *Katakana Printer Format*—Column 19

Enter an X in this column if the format to be generated is to be used on a Katakana printer. Leave this column blank for all other printers. Formats generated for a Katakana printer should not be used on a non-Katakana printer because unpredictable results will occur. Non-Katakana formats should not be run on Katakana printers.

11 *Print/No-print*—Column 20

Enter P or leave this column blank if the initial format (not modified by an operation) is to be printed on the 3270 printer.

Enter N if the initial format is not to be printed.

12 *(Reserved)*—Columns 21-72

These columns are reserved and are to be left blank.

13 *Identification-Sequence*—Columns 73-80

Enter any characters for sequential identification. These columns are ignored other than to be printed as part of the statement.

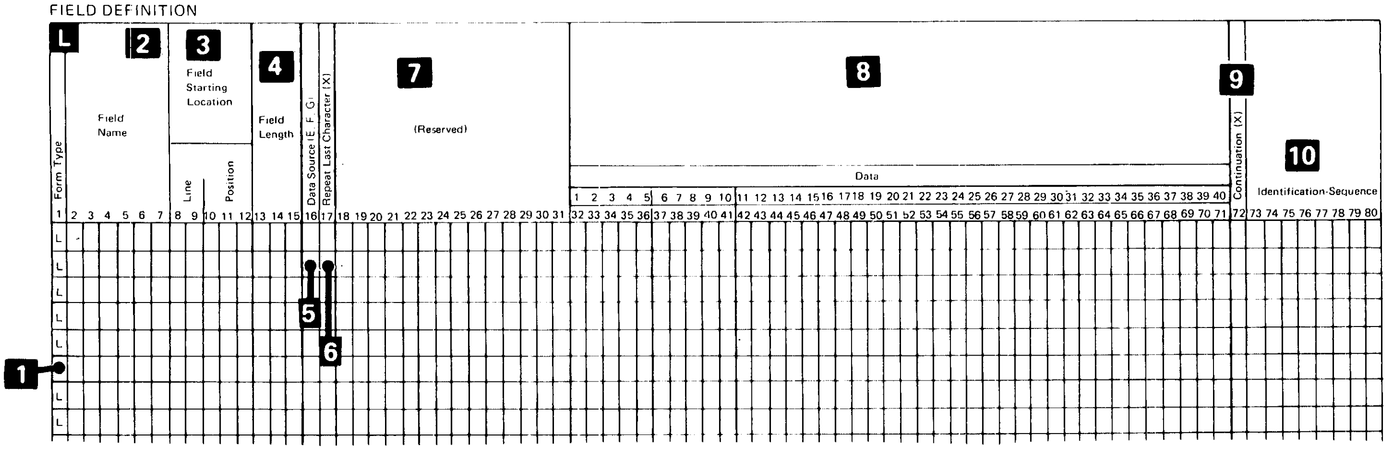


Figure 8-9. Field Definition Form on the Printer Format Specifications Sheet

Field Definition Form

Refer to the printer/display layout sheet and the printer control form while completing the field definition form. Each field in the printer format must be specified on a field definition form. When defining fields using PFGR, do not allow space for defining and terminating attributes, as PFGR does not generate field defining or terminating attributes. The amount of printer buffer space specified need only be the length of the data and the printer control characters (NL, EM, FF). See Figures 8-4 and 8-9 for the location of the following items:

1 *Form Type*—Column 1

The preprinted character L identifies this as a field definition form for the Printer Format Generator.

2 *Field Name*—Columns 2-7

Enter in these columns a unique field name that is from one to six characters in length. The first character must be alphabetic or a $, #, or @. The remaining characters can consist of any combination of alphabetic and/or numeric characters plus any of the characters $, #, or @. Avoid assigning names beginning with @@@ because these characters identify special function requests. Avoid field names starting with D followed by five numeric characters when using the field duplication function. Embedded blanks are not allowed.

3 *Field Starting Location*—Columns 8-12

A *line* entry (two columns) and a *position* entry (three columns) define the leftmost character of the field. Allowable entries are limited by the *printer size, line length,* and *lines per page* entries (see columns 8, 10-12, and 13-14 of the printer control form).

In the *line* field (columns 8-9), enter the number (01-99 not to exceed the value in the *lines per page* field) of the line that the field is to occupy in the output.

In the *position* field (columns 10-12), enter the number (001 to the value specified in the *line length* field) of the position on the line that the field is to occupy.

The field starting locations must be consecutive and must not exceed the length of the printer buffer. Determine the number of characters used in the printer buffer as follows:

- If the vertical forms-feed order is not active (blank in column 16 of the printer control form), add the following to calculate the buffer required to build the format:
  a. Total length of all fields defined.
  b. Number of all unused positions on a line that precede the last field in the line.

c. One character for each new line (NL) order when building a format for a non-Katakana printer, or two characters for each NL order when building a Katakana format. An NL occurs each time that the last position in a line does not contain a character. Only the last line that contains a field and all previous lines are included in this count. If the last position in a line contains a character and the line length is equal to the platen length, the printer automatically advances to the next line and an NL is not required.
d. One character for an end-of-message (EM) order when building a format for a non-Katakana printer, or two characters for an EM order when building a format for a Katakana printer.

- If the vertical forms-feed order is active (an X in column 16 of the printer control statement), add the following to calculate the buffer required to build the format:
  a. Total length of all fields defined.
  b. Number of all unused positions that precede the last field in a line. Exclude line 01, position 001, from this count on all but the first page of the format (this position is unusable after a forms-feed order).
  c. One character for each new line (NL) order. An NL occurs each time that the last position in a line does not contain a character. Only the last line to contain a field on each page and all previous lines on that page are included in this count. If the last position in a line contains a character and the line length is equal to the platen length, the printer automatically advances to the next line and an NL is not required.
  d. One character for each page (excluding the last page) that does not contain any fields on the last line of that page.
  e. One character for an end-of-message (EM) order.

  Note: When a small print buffer is used (1 in column 8 of the printer control form), the preceding calculations must not exceed 480 characters. When a large printer buffer is used (2 in column 8 of the printer control form), the preceding calculations must not exceed 1920 characters.

4 *Field Length*—Columns 13-15

The minimum field length is 1. The maximum field length is the line length value entered in columns 10-12 of the printer control form.

5 *Data Source*—Column 16

Enter an E if data is provided at the initial printer format during execution by the application program. Enter a G if the data is supplied in columns 32-71. Enter an F if the data is supplied in columns 32-71 and a Field Descriptor Table entry is not required for this field. Data in columns 32-71 is ignored if E is entered in column 16. If column 16 is left blank, G is assumed.

6 *Repeat Last Character*—Column 17

Enter an X in this column if the last character entered in columns 32-71 is to be repeated to the end of the field. For example, if 20 asterisks (*) are to be printed, define a field 20 characters long; place an asterisk in column 32; and enter an X in column 17. The result will be a field of 20 asterisks.

7 *Reserved*—Columns 18-31

These columns are reserved and must be left blank.

8 *Data*—Columns 32-71

Enter the data for the generation-defined fields. Data must not exceed the field length specified in columns 13-15. If the data exceeds 40 characters, place an X in column 72 and continue entering data in column 32 of the next line (leave columns 2-31 blank). If an execution-defined field is specified (E in column 16), columns 32-71 are ignored.

9 *Continuation*—Column 72

If the data entry exceeds 40 characters, enter an X in column 72 and continue entering data in columns 32-71 of the next line. No more than three continuation lines are allowed.

10 *Identification-Sequence*—Columns 73-80

Enter any characters for sequential identification. These columns are ignored other than to be printed as part of the statement.

Printer Control on the Field Definition Statement

A method of supplying forms-feed printer control is to request the generation of these orders on field definition statements.

Notes:

1. Multiple pages must be specified (an x in column 15 on the printer control form) if printer control is used.
2. The Katakana feature does not support vertical forms feed.

To specify printer control (forms feed) on a field definition statement, enter the following:

1 *Form Type*—Column 1

The preprinted character L identifies this as a field definition for the Printer Format Generator.

2 *Field Name*—Columns 2-7

To indicate either a forms-feed order (for 3288 printers with the Vertical Forms Control feature) or to generate multiple NL orders to advance the printer to line 01, position 001 of the next page, enter @@@FF.

Note: If a 3288 printer with the Vertical Forms Control feature is given the forms-feed order, the printer is advanced to line 01, position 002, of the next page.

PFGR Line/Partial-Line Duplication

PFGR supports a line/partial-line duplication feature to allow a defined field (the master) to be duplicated on following output lines. The master line must be defined first; the duplicated lines must be defined immediately following the master line definition and must be entered in ascending order. Any number of blank lines can be left between the master and duplicated lines on the output form. The duplication request is entered as follows:

1 *Form Type*—Column 1

The preprinted character L identifies this as a field definition for the Printer Format Generator.

2 *Field Name*—Columns 2-7

Enter @@@DP to indicate the duplication request. The master field must immediately precede this entry. This request causes the field(s) defined in the master field definition statement to be duplicated in a new location.

3 *Field Starting Location*—Columns 8-12

A *line* entry (two columns) and a *position* entry (three columns) define the horizontal output line where the master line is to be duplicated and the position of the first character to be duplicated.

In the *line* entry (columns 8-9), enter the output line number that is to contain the duplicate of the master. Line numbers must be in ascending order, though any number of blank lines can be left between the output lines.

The *position* entry (columns 10-12), an optional entry, defines the first position of the master to be duplicated. If the position specified is not the starting position of the field within a line, duplication starts at the beginning of the next field. If the *position* entry is left blank, duplication begins at position 001.

4 *Field Length*—Columns 13-15

This entry, an optional entry, specifies the number of fields to be duplicated from the master. If no entry is made in these columns, all fields beginning at the point specified in the *position* entry are duplicated. If the number specified is greater than the number of master fields on the line, duplication begins with the first field specified and continues to the last field of the master.

If the master is to be duplicated on a number of consecutive output lines, enter the character @ in column 13 and the number of times the line is to be duplicated on the output in columns 14 and 15.

The remainder of the duplication statement must be left blank.

Notes:

1. If a duplication request statement contains both field definition statements and fields generated by a previous duplication statement, only those fields defined directly by field definition statements are duplicated.
2. Field names are assigned to fields generated under the duplication process. Such names have the form Dllppp, where llppp indicates the line and position locations. Avoid defining other fields using this convention because duplicate field names could result.

Example of a Format Written for the Printer Format Generator: Following is an example of a format written for the Printer Format Generator. The *line* and *position* values (columns 8-12) on the field definition statements in the example (part **A**) are the placement of each field on the page when printed on the 3270 printer (part **B**).

When generation-defined data is specified (G in column 16), the data supplied in columns 32-71 for the length specified in columns 13-15 is printed on the 3270 printer.

When execution-time data is specified (E in column 16) and the Display Format Test routine (DFTR) is being run, asterisks are placed in the field and printed. The DFTR can be used for either printer or display formats. When execution-time data is used with the Display Format Control routine, the data supplied during execution is placed in these fields.

When the repeat-last-character function is specified, the last character supplied in columns 32-71 is repeated to the end of the field.

The duplicate line function for PFGR is the same as the duplicate line function for DFGR (see *Examples of Duplication Function*). The only variation is the method of supplying field names on the duplicated line statements; the *position value* is three characters instead of two characters.

A

```
H$ZPF021311099X R1
LB2     02010 18G              CUSTOMER NUMBER -
LB3     02029  6E
LB4     04001 93GX             *
LB5     06010 10G              ADDRESS -
LB6     06020 30E
LB7     07020 30E

L@@@DP 08
**************************************************** GENERATED DUPLICATION FIELDS
LD0802008020 30E
**************************************************** END OF GENERATED DUPLICATION FIELDS

LB8     09040 10E
LB9     11010 11G              QUANTITY -
LB10    11021  3E
LB11    13010 14G              ITEM NUMBER
LB12    13024  2E
LB13    15001 93GX             *


                              $ZPF02 PRINTER FORMAT INFORMATION

   EXECUTION TIME DATA - OUTPUT AREA FORMAT - END POSITIONS FOR RPG PROGRAMS
   -------------------------------------------------------------------------

*  FIELD     FIELD      END    *  FIELD     FIELD      END    *  FIELD     FIELD      END    *
*  NAME      LENGTH   POSITION *  NAME      LENGTH   POSITION *  NAME      LENGTH   POSITION *
*  ------    ------   -------- *  ------    ------   -------- *  ------    ------   -------- *
*  OPCODE     004       0004   *  LENGTH     004       0008   *  TMNAME     006       0014   *
*  $CPF02     006       0020   *  B3         006       0026   *  B6         030       0056   *
*  B10        003       0129   *  B12        002       0131   *

LENGTH OF OUTPUT RECORD AREA REQUIRED IN DFF PROGRAM
        RPG *SUBR92* - 0131      OTHER - 0123

   INFORMATION FOR USE DURING CCP ASSIGNMENT STAGE
   -----------------------------------------------

THE DECIMAL LENGTH OF THE FIELD DESCRIPTOR TABLE IS 0112
THE DECIMAL LENGTH OF THE OUTPUT TEXT IS 0213
```

B

```
         CUSTOMER NUMBER -   ******

*********************************************************************************************

         ADDRESS -  ******************************
                    ******************************
                    ******************************
                                       **********

         QUANTITY - ***

         ITEM NUMBER - **

*********************************************************************************************
```

OCL Considerations for the Printer Format Generator

The following OCL statements are required when either single or multiple formats are built:

```
// LOAD $CCPPF,unit
                                  (R1)
// FILE NAME-$WORK,UNIT-          )F1(  ,PACK-packid,
                                  (R2)
                                  (F2)
      RETAIN-S,TRACKS-2

// RUN
```

When reading from the system input device, be sure that the printer format statements immediately follow the RUN statement. A /* follows the printer format statements. The statements are read from the system input device and written into a $SOURCE file. If the printer format statements require more than five tracks of a file, define a $SOURCE file with an adequate number of tracks. If a $SOURCE file OCL statement is not specified, a 5-track $SOURCE file is automatically allocated on the unit from which $CCPF was loaded.

When reading from the source library, specify a $SOURCE file with enough tracks to contain all the printer format statements in the source library entry. A COMPILE is also required with the following parameters:

```
                                                  (R1)
// COMPILE SOURCE-name of source data,UNIT-       )F1(
                                                  (R2)
                                                  (F2)
```

where UNIT is the location of the source library.

Notes:
1. For multiple format builds in a single run, the input stream must not contain delimiters between the printer formats. Instead, the H in column 1 of the printer control form indicates the start of another input.
2. Enter an asterisk (*) in column 1 to identify a comment statement. Comments may be used to include notes on the listing produced by the Printer Format Generator routine. Comments can be placed anywhere in the format build; however, on multiple format builds, all comments entered before the printer control form of the second or later format builds are printed with the previous format build.

Printer Format Generator Diagnostic Messages

During its processing, the printer format generator (PFGR) diagnoses errors in the Printer Format Specifications and logs diagnostic messages on the system logging device. Refer to the *CCP Messages Manual,* GC21-5170, for a list of the diagnostic messages.

Because the PFGR also calls the Overlay Linkage Editor to put the formats into the object library, it is possible to get Overlay Linkage Editor halts during PFGR processing.

DISPLAY FORMAT CONTROL ROUTINE (DFCR)

The display format control routine operates under CCP to support formatted displays (screen or printer), as generated by DFGR and PFGR, for the IBM 3270 Information Display System.

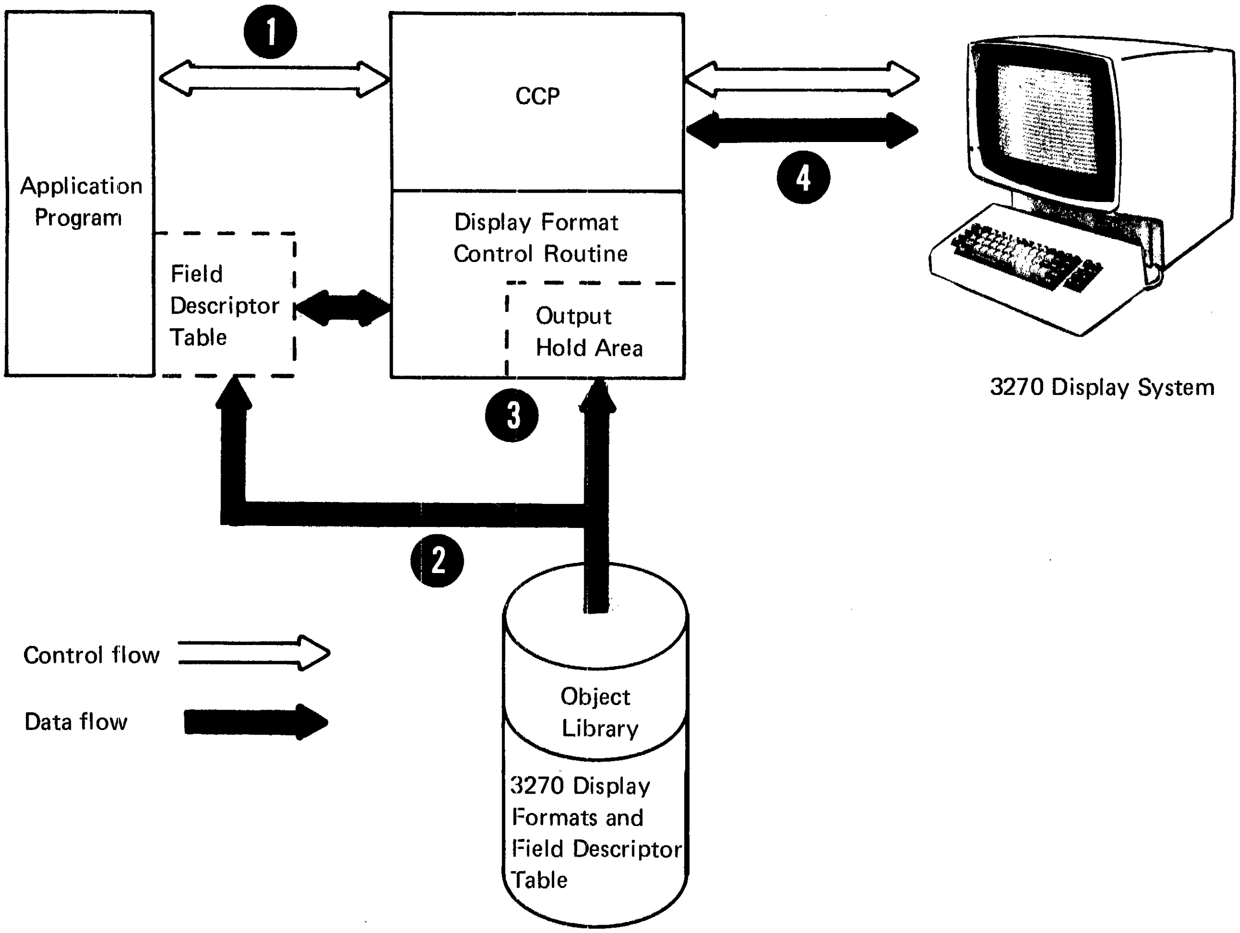
Model 10 and Model 12 DFCR: The control routine is loaded along with the first application program that requires DFF. In addition to the usual user allocation and initiation tests, CCP must make sure there is enough storage for DFCR before the program can start. The DFCR and the output hold area(s) are loaded at either the upper or lower boundary of the user program area and remain in main storage until the last application program using DFF terminates. The space occupied by the DFCR will then be made available for other uses.

Model 15 DFCR: The DFCR is loaded into the resident portion of CCP during Startup and remains resident in main storage throughout the CCP run.

The facilities can best be described in terms of output and input operations. Figure 8-10 shows an example of the operations performed by DFCR.

DFCR Functions for Output are:

- Automatically retrieves the printer or display format requested by the application program.
- Merges execution time data supplied by the application program with the 3270 data stream at the proper field location; checks numeric fields for negative values.
- If necessary, splits the 3270 data stream into blocks and sends each block separately to the 3270. See *Hold Area* for a discussion of blocking.
- Provides application programs with the capability of modifying (overriding) the attributes, data content, or both of any field currently at the display. It also allows the application program to receive input from only selected fields.
- Provides the Copy operation which can be used to transfer a printer or display format between devices attached to the same control unit.
- Provides the Erase operation which can be used to clear all unprotected fields and reset the device for data entry for the terminal operator.



① An application program running under CCP requests a particular format by issuing a Put Message operation, specifying the symbolic name of the format. (The symbolic name is defined in columns 2-7 of the display control form.)

② The Display Format Control Routine (DFCR) reads the requested format from the object library. (Format was placed in the object library by the Display Format Generator or the Printer Format Generator.)

The first part, the field descriptor table, is read into an area appended to the user program.

③ The second part, the 3270 data stream for this format, is read into the output hold area appended to the DFCR.

④ The format is passed from the output hold area to CCP for transmission to the display station.

Figure 8-10. DFCR Functions

DFCR Functions for Input are:

- Creates a data record area based on fields received, or not received, from the display format at the terminal.
- Pads alphameric data on the right with spaces; right-justifies data in numeric fields and pads it on the left with spaces.
- Examines numeric fields for negative values.

3270 DISPLAY OPERATIONS

Requests for 3270 display operations are like other CCP communications I/O requests; that is, each request is issued through the communication service subroutine (by means of a macro in Basic Assembler) and must be accompanied by a parameter list and a record area. The parameter list contains information necessary for the operation requested as well as a location in which CCP will set a return code indicating the results of the operation. For certain operations, the programmer must supply additional information in the record area besides the terminal name and data. For example, when requesting that a display format be written to a 3270, the name of the display format is given in the record area following the terminal name.

See the sections for each language to determine such things as: the placement of op codes, return codes, input/output lengths, and symbolic terminal names.

DFF operations are always in *message mode* (see index entry). Record and block mode operations are not valid when using DFF.

Operation Considerations With DFF

Copy, Erase, and Put Override are operations provided specifically for DFF users. These operations are described in detail in this section. Use of the Put Message operation to place the initial format on the screen or printer is also described. Considerations for using the remaining CCP operations under DFF are given in this section and under *Operations* in *Chapter 2.* See *Examples* at the end of this chapter for examples of using CCP operations under DFF.

Put Message

The Put Message is used to request that a particular printer or display format be retrieved from the object library and sent to the designated terminal. This operation is used to send either a complete new format or an overlay format to a terminal (see *Display Concepts* for *Overlay Screens*).

Hex	Dec	RPG II	Meaning
0032	50	ƀƀCB	PUT Message

One of the above values must be used depending upon the programming language. The name of the printer or display format to be sent to the terminal must appear in the first six positions of the record area immediately after the terminal name. If the name of the format is less than six characters in length, it must be left justified and padded with blanks. The output length must include the six-character format name. If there is no data to be added to the format (no fields defined as requiring execution time data), the output length is 20 (six for non-RPG SUBR92).

If data is to be added to the format at execution time, that data should start in the first data position after the format name. The amount of space to be provided for each field must be equal to the length of each field as defined on the format description sheet. The order of the fields provided must be the same as the order that they were defined to DFGR or PFGR. The output length specified with the operation is determined by using the format generator printout for this format. Use the end position of the last output field for RPG SUBR92 (less 14 for all others) as your length (the format name is included in this end position). The result of the Put Message is controlled also by the display format itself. Functions controlled by the display format are:

- Positioning of the cursor.
- Whether or not the display will be cleared before writing the requested display format.
- Device operations as initiated by the WCC.
- Printer control through new line and end-of-message orders.

The Put Message is changed automatically to Put Block by the control routine if blocking is required. (Refer to *Storage Areas — Output Hold Area.)*

Program Request under Format Put Message

The PRUF Put message is used to format the screen with data to be used by the next program requested from the designated terminal. The PRUF-Put override or PRUF-Put message operation normally is the last operation before releasing the terminal or going to end of job.

Hex	Dec	RPG II	Meaning
0072	114	b̸b̸GB	PRUF Put Message

One of the above values must be used depending upon the programming language. The name of the format to be sent to the terminal must appear in the first six positions of the record area immediately after the terminal name. If the name of the format is less than six characters in length, it must be left justified and padded with blanks. The output length must include the six-character format name. If there is no data to be added to the format (no fields defined as requiring execution time data), the output length is 20 (six for non-RPG SUBR92).

As with the Put Message operation, DFF will automatically block this operation if blocking is required. See *Example 4* at the end of this chapter for more information on this operation.

Put-No-Wait

This operation is defaulted automatically by DFF to a Put Message operation.

Hex	Dec	RPG II	Meaning
0036	54	b̸b̸CF	Put-No-Wait

Put Override

The purpose of the Put Override operation is to (1) change the type, reposition the cursor, modify the data content, or any combination of these things for any fields defined in the format, or to (2) restructure the input record (only selected input fields are received).

Operation Code

Hex	Dec	RPG II	Meaning
0832	2098	b̸HCB	Put override

Note: RPG II allows the Put Override to be combined with an Invite Input operation (see index entry *Put with Invite Input*).

Additional Requirements

- The format must have been previously sent to the printer or display by a Put Message or Copy operation.
- The output length specified by the user in the parameter list must define the exact length of the override list for RPG SUBR92 (less 14 for all others), starting with the WCC and including all field information in the list. (Can be only the WCC, if desired.)
- A DFF numeric field with a negative numeric content must have the sign over the units position. Space must be allocated in the format for the sign. DFCR moves the sign from over the units position to a position after the data (see *DATA in Numeric Fields).*
- Information for a Put Override must appear in the user's output record area. Fields are to be defined in the same order as defined at generation time.

Information Returned

- Return codes (see explanation in *Appendix E):*

0	Successful
9	Terminal offline
-n	Negative return codes (I/O errors)

Function and Use of Put Override

The Put Override allows the application programmer to change the field where the cursor is to be positioned, or to change the type, modify the data content, or do both for any field currently being displayed. Only the display is changed, not the display format in the object library or the field descriptor table in main storage. By specifying the appropriate WCC with the Put Override, the programmer controls device operations such as starting the printer, resetting the keyboard, and sounding the alarm (see *Selecting the WCC*).

The application programmer can also elect to receive input on the next input operation from the terminal from only those input, input/output, and SPD fields in the override list by specifying the appropriate WCC. The control routine checks the WCC. If the reset modified data tag bit is OFF in the WCC, the modified data tags for all fields are not changed and, on the next input request, data will be provided for all input fields, output/input fields, and for SPD fields that would have been received normally. If the reset modified data tag bit is ON in the WCC, the modified data tags for all fields, protected or unprotected, are turned to OFF. On the next input request, data from only those input, output/input, and SPD fields specified in the override list will be passed to the application program.

When selecting input fields using a Put Override, the reset modified data tag bit in the WCC must be ON (described previously). The user must be aware that this sets the modified data tag OFF for Input types 1, 2, 3, 4, and 7, output/input field types 1, 2, 3, 4, 7, and 8, and SPD field types 3 and 4. Also, for the SPD fields, the designator (>) is not changed to the designator (?). If any of the selected input fields are one of these field types, the application programmer should not leave the type entry for that field blank but should instead provide the type entry for that field as override information even though the field type is not to be changed. This sets the modified data tag ON as required by the definition of these field types.

The format of the input record area, when selecting input fields, is determined by the order, and field length, of the fields as they are defined in the override list. The program logic must indicate the last output operation to the terminal and process the data on the next input from the terminal according to that indication. The layout of the input record area must be defined for each variation of input structure. Regardless of the input, the AID character always precedes the fields in the user's input record area and should be examined by the application programmer before the field data is processed.

Program Request under Format Put Override

Hex	Dec	RPG II	Meaning
0872	2162	ƀHGB	PRUF Put Override

The PRUF Put Override functions just like the normal Put Override operation with the added feature of formatting the screen with the data to be passed to a following program. The PRUF-Put Override or the PRUF-Put message operation is normally the last operation issued before releasing the terminal or going to end of job.

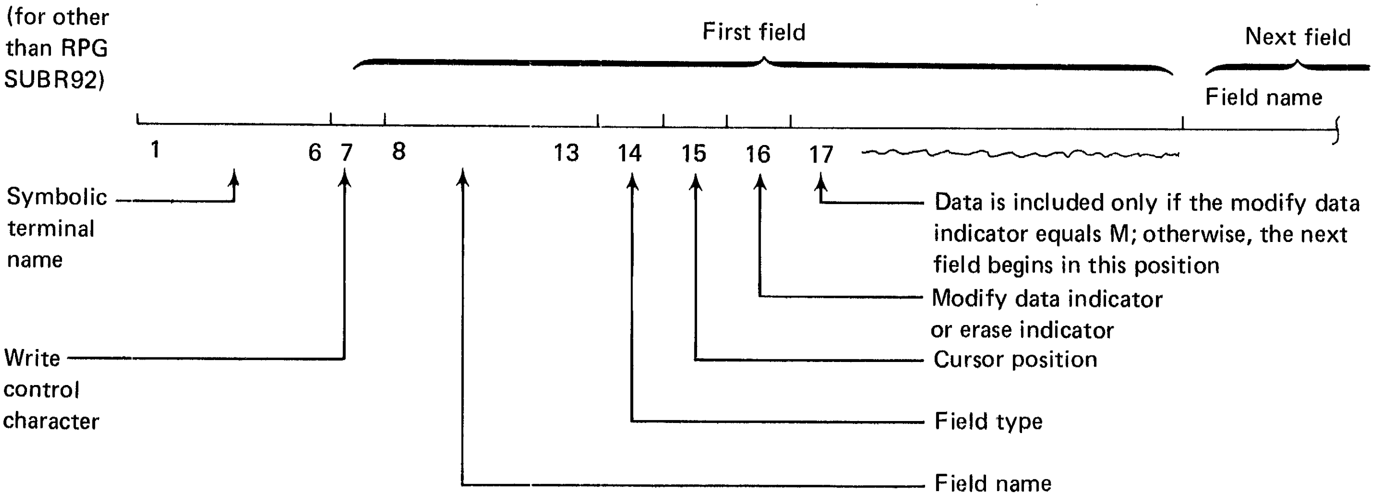
The information in the output record area, shown in Figure 8-11, consists of:

- Field Name. As defined in columns 1-6 of the field definition form. The name must be left justified and padded with blanks to a length of six characters. Use the same symbolic name as defined to PFGR or DFGR. Fields in an override list must be specified in the same order as during format generation.
- Field Type. If the field type is to be changed, this entry must contain the number of the type wanted. Leave blank if type is not to be changed. Allowable changes are:
  - Output Fields—all types are interchangeable.
  - Input Fields—types 1, 2, 5, and 7 are interchangeable; types 3, 4, 6, and 8 are interchangeable.
  - Output/Input Fields—types 1, 2, 5, 7 and 8 are interchangeable; types 3, 4, and 6 are interchangeable.
  - SPD Fields—all types are interchangeable.
- Cursor Position. A C entry positions the cursor in the first character position of this field. If the cursor is specified for more than one field, the last field with a C specified positions the cursor. A blank entry does not move the cursor.

- Erase/Modify Data Indicator. Enter an M if there is override data provided in subsequent positions. Such a change can be made in output, output/input, or SPD fields. A blank entry means data in the field is not to be changed.

  Enter an E if the data input or output/input field at the terminal is to be erased to nulls. The erase indicator is valid only for input or output/input field types. If the E indicator is used, the next override field name begins in column 17.

- Data. Only include this field if M is specified for modify data indicator. The M is immediately followed by data equal in length to the field length as defined during format generation time (length of SPD fields does not include designator character). If M is not specified for the modify data indicator, the next field name begins in this position.



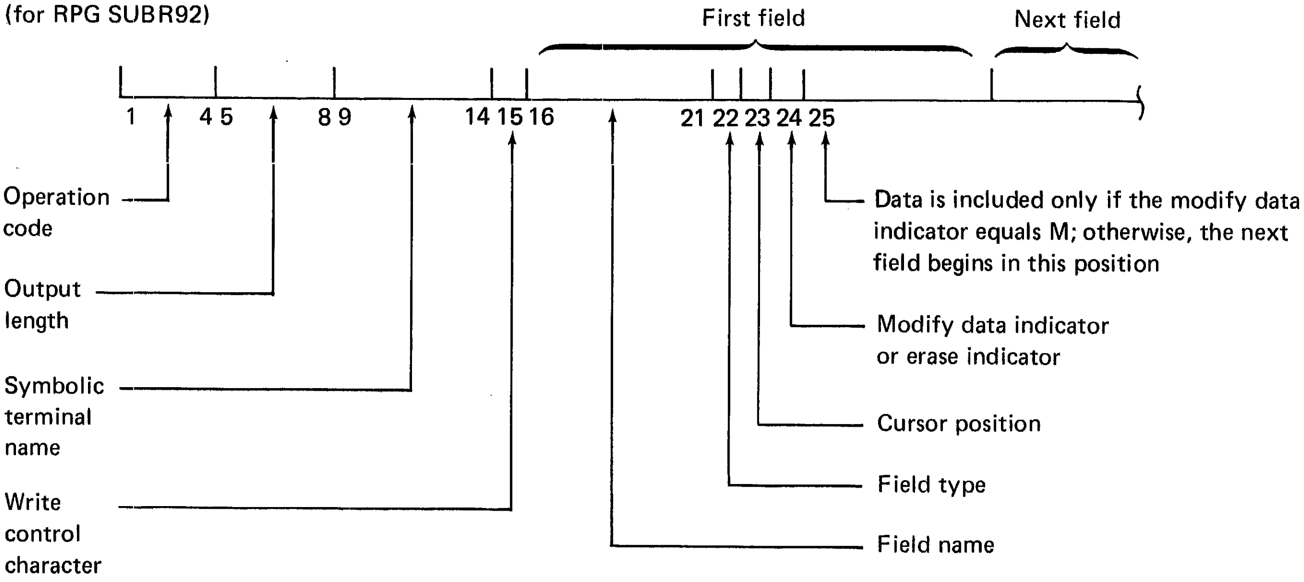


Figure 8-11. User Output Area

The output length consists of:

- One for the WCC
- Plus the sum of the following information for *all fields* to be overridden:
  - Six for the field name
  - Three (one space for each of the three possible entries for type, cursor, and modified data indicator)
  - Field data length as defined at generation time (if data is provided)
- An additional fourteen spaces if RPG SUBR92 is used.

Considerations

- With a Put Override operation, the application programmer can select to receive input from only those input, output/input and SPD fields specified in the override list. The field names must appear in the same order as they were given during format generation.
- To restore the display to its original condition, the application programmer could issue a Put Message or another Put Override.
- The override list can consist of a WCC only, if desired, (for example, to restore the keyboard). In this case, input received from the terminal may be affected (although there are no fields specified), if reset MDT is also ON in the WCC. A Put Override of the WCC should be used only to print the display currently on a 3275 on an attached 3284 Model 3 printer.
- An entry in a Put Override list may consist of a field name only, with blanks for type, cursor, and modify data indicator. In this case, if the WCC specifies reset MDT, then this field would be selected for input on the following input operations. If the WCC does not specify resetting of the MDT, this override entry is ignored and no 3270 text is generated.

Example 1

The structure of the record area should be as follows:

1. If RPG SUBR92 is used, the op code must be given in positions 1-4 and the output length must be given in positions 5-8.
2. The six-character symbolic name of the terminal.
3. The WCC. This field is mandatory. The WCC can be determined by following the directions in Figure 8-6.
4. For each field which is to be overridden, the following nine positions must be given or reserved in the output record area:
   a. Six positions for a field name (left justified)
   b. One position for type
   c. One position for cursor (C)
   d. One position to indicate modified data (M) or erase order (E)
5. The modified data indicator of M means that data is to be provided. If no data is to be provided (no M indicator) the record continues with the next symbolic field name.

Example 2

A primary use of the Put Override operation is interactive error detection/correction with input data being analyzed by the program logic. If any input fields are found to be in error, a Put Override operation is performed to the terminal with those fields in error displayed in intensified mode. Additionally, an error message can be displayed, the audible alarm sounded, and the cursor positioned at the first field in error. The RPG II programming example in Figure 8-12 illustrates the logic necessary to perform these functions.

The input fields are diagnosed in sequence, with the two arrays initialized to blanks and array index B advanced for each field. When an invalid input is diagnosed, the subroutine ERROR is executed, with indicator 63 set on for numeric fields. The cursor is positioned at the first field in error under the control of indicator 58.

When all the fields have been diagnosed, indicator 61 set on indicates that a Put Override operation should be performed.

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RPG CALCULATION SPECIFICATIONS

Form GX21-9093
Printed in U.S.A.

```
01 CSR         ERROR     BEGSR
02 CSR                   SETON                     61    ERROR FOUND
03 CSRN58                MOVE 'C'       $U,B             SET CURSOR
04 CSRN63                MOVE '2'       $V,B             INTENSIFY ALPHA
05 CSR 63                MOVE '4'       $V,B             INTENSIFY NUM
06 CSRN58                SETON                     58
07 CSR                   SETOF                     63
08 CSR                   ENDSR
09 C
10 C
11 C
12 C
13 C
```

IBM International Business Machine Corporation

RPG OUTPUT SPECIFICATIONS

GX21-9090
Printed in U.S.A.

```
01 OTERMOUT E        61
02 O                                    4 ' HCB'
03 O                                    8 '0098'
04 O                         PL,5      14
05 O                                   15 'F'
06 O                                   24 'ERRMSG2 M'
07 O                                   48 '**ERROR** INTENSIFIED DA'
08 O                                   62 'TA IN ERROR   '
09 O                                   68 'FIELD1'
10 O                         $V,1      69
11 O                         $U,1      70
12 O                                   77 'FIELD2'
13 O                         $V,2      78
14 O                         $U,2      79
15 O                                   86 'FIELD3'
16 O                         $V,3      87
17 O                         $U,3      88
18 O                                   95 'FIELD4'
19 O                         $V,4      96
20 O                         $U,4      97
   O
```

Figure 8-12. Put Override Example

Selecting the WCC

Figure 8-13 is provided to assist in selection of the Write Control Character (WCC). To use the figure, determine the characteristics of the output device and the operation to be performed, then select the code from the chart. For example, the write control code that restores the keyboard and sounds the alarm on a display but does not reset the MDTs is an F.

Operation				Output Device Format			
Sound Alarm	Restore Keyboard	Start Printer (No for displays)	Reset MDTs	Display or Printer NL/EM Control	40-Character Print Line	64-Character Print Line	80-Character Print Line
Yes	Yes	Yes	Yes	|	¬	?	"
			No	+	;	>	=
		No	Yes	G	P	X	7
			No	F	O	W	6
	No	Yes	Yes	(	)	_	'
			No	<	*	%	@
		No	Yes	E	N	V	5
			No	D	M	U	4
No	Yes	Yes	Yes	.	$	,	#
			No	¢	!	}[1]	:
		No	Yes	C	L	T	3
			No	B	K	S	2
	No	Yes	Yes	I	R	Z	9
			No	H	Q	Y	8
		No	Yes	A	J	/	1
			No	b̸	&	-	0

[1] This character is converted internally to hex 6A for a WCC by DFGR when generating a format, and by DFCR when using the WCC in a Put Override operation.

Figure 8-13. Write Control Characters

Copy

The purpose of the Copy operation is to transfer a format between devices attached to the same 3271 Control Unit. See *Selecting the Copy Control Character* in this chapter.

Operation Code

Hex	Dec	RPG II	Meaning
0042	66	ƀƀDB	Copy

Additional Requirements

The symbolic names of the terminal to receive the format (TO terminal) and the terminal to send the format (FROM terminal) appear in the output record area as follows:

Not RPG SUBR92:

TO terminal	FROM terminal	CCC
1←→6	7←→12	13

RPG SUBR92:

	TO terminal	FROM terminal	CCC
1←→8	9←→14	15←→20	21

The Copy Control Character (CCC) is optional and, if present, appears in the first position after the FROM terminal name. For a discussion of CCC, see *IBM 3270 Information Display System Component Description,* GA27-2749. A default CCC will be assumed if one is not given.

The output length should be 20 (six for other than RPG SUBR92) if the default CCC is to be assumed, or 21 (seven for other than RPG SUBR92) if a CCC is provided.

The FROM and TO terminals must be connected to the same 3271 control unit. A Put Message or a Copy operation must have been successfully issued to the FROM terminal prior to issuing a Copy operation.

This operation cannot be performed on a 3275. Data currently displayed on a 3275 screen can be printed on an attached 3286 Model III Printer using a Put Override with the proper WCC. Data can be simultaneously displayed on a 3275 screen and printed on a 3286 Model III Printer by using a Put Message.

Information Returned

Return codes (see explanation in Appendix E):

0	Successful
9	Terminal offline
-n	Negative return codes (I/O errors)

Function and Use of Copy

This operation allows a format to be transferred between two devices attached to the same 3271 Control Unit. The application programmer may choose to use this operation instead of a Put Message for performance reasons. The advantage of this operation is that line transmission time is reduced because only a few characters are sent on the BSCA line.

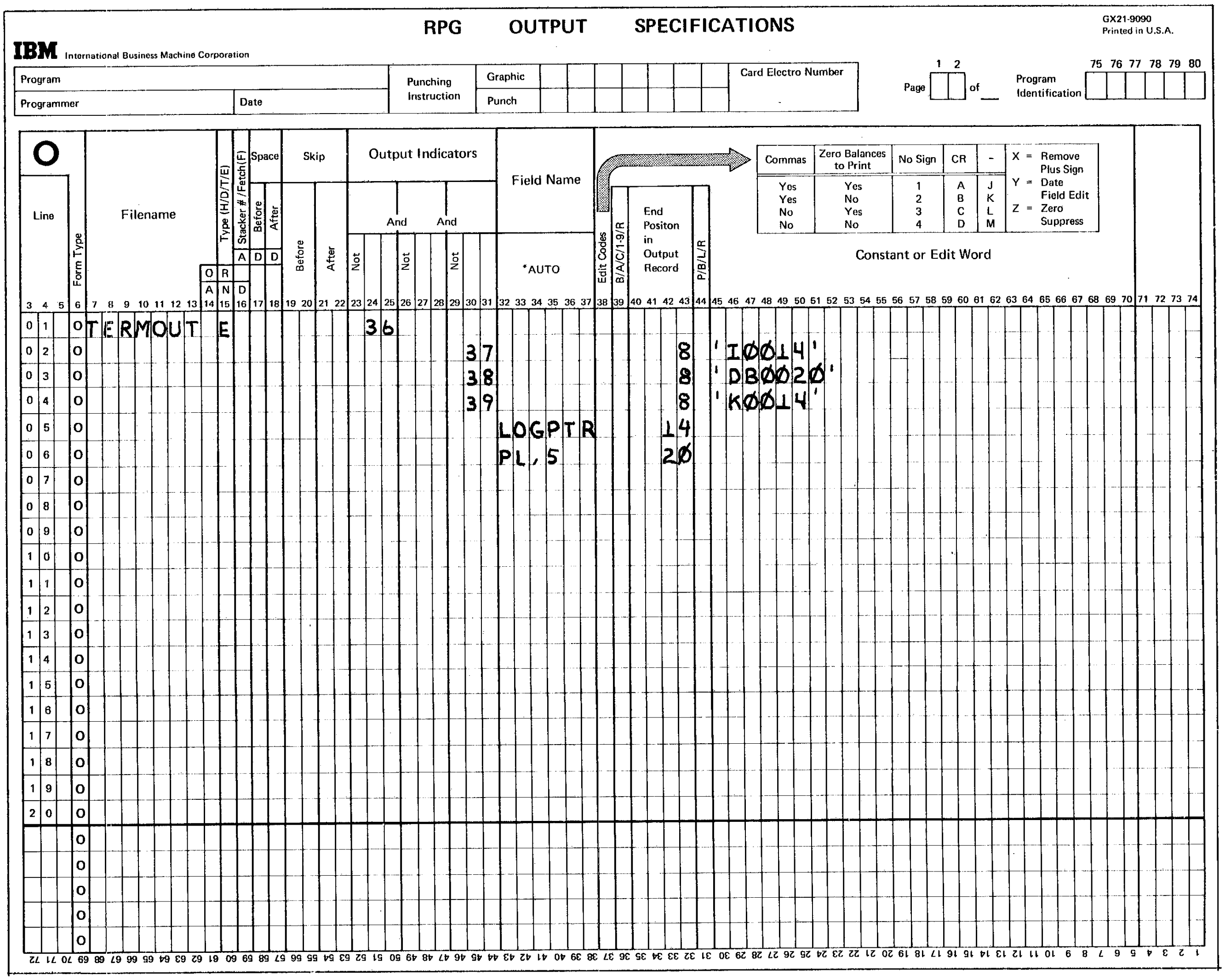
Considerations

- When a complete format image is received by the TO terminal and an overlay format (see *Display Concepts*) was the last format sent to the FROM terminal, that overlay format will be the only part processed by the Display Format Facility.
- Default CCC for a model 1 terminal is X'5B' (graphic character '$'): default CCC for a model 2 terminal is X'7B' (graphic character '#').
- A display format can be locked (made incapable of being copied) by defining a protected field starting at line 1, position 2. DFGR will automatically place the attribute (specifying protected field) at line 1, position 1.
- The output length for Copy does not include the "copy to" symbolic terminal name but does include the space for the "copy from" symbolic terminal name and, if given, the copy control character.
- If a Put Override with select input fields was previously issued to the FROM terminal, it will be assumed that the same operation was performed at the TO terminal.

Example

The RPG II example shown in Figure 8-14 illustrates the coding logic that can be used when the 3284/3286 is used by various terminals and/or programs as a log device. In this example, the printer is first acquired, copied to, then released, then acquired by the next Copy operation sequence.

Indicator 36 signifies that the AID from the last input operation was an operator log request. The calculation logic performs three exception output operations to acquire, copy to, and release the printer designated as the log device. The return code should be checked after the Acquire operation and the Copy operation.



RPG OUTPUT SPECIFICATIONS

GX21-9090
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IBM International Business Machine Corporation

Program
Programmer
Date
Punching Instruction
Graphic
Punch
Card Electro Number
Page of
Program Identification

Commas	Zero Balances to Print	No Sign	CR	-
Yes	Yes	1	A	J
Yes	No	2	B	K
No	Yes	3	C	L
No	No	4	D	M

X = Remove Plus Sign
Y = Date Field Edit
Z = Zero Suppress

Line (3-5)	Form Type (6)	Filename (7-14)	Type (H/D/T/E) (15)	Output Indicators (23-31)	Field Name (32-37)	End Position in Output Record (40-43)	Constant or Edit Word (45-70)
01	O	TERMOUT	E	36			
02	O			37		8	'I0014'
03	O			38		8	'DB0020'
04	O			39		8	'K0014'
05	O				LOGPTR	14	
06	O				PL,5	20	
07	O						
08	O						
09	O						
10	O						
11	O						
12	O						
13	O						
14	O						
15	O						
16	O						
17	O						
18	O						
19	O						
20	O						
	O						
	O						
	O						
	O						
	O						

Figure 8-14. Example 3284/3286 Coding

Selecting the Copy Control Character

Figure 8-15 is provided to assist in selection of the Copy Control Character (CCC). To use the figure, determine the characteristics of the output device and the operation to be performed, then select the code from the chart. For example, to copy the entire buffer of a display and to sound the alarm, the code is G.

Notes:

1. The default CCC for a Model 1 terminal is $ (hex 5B) and a Model 2 terminal is # (hex 7B).
2. When copying a display format to a terminal and input is expected from the copy-to terminal, it is strongly recommended that either the entire buffer or the attributes and protected CCC be specified to enable DFGR to identify all input fields.

<table>
<tr><th colspan="3">Operation</th><th colspan="4">Output Device Format</th></tr>
<tr><th></th><th>Sound Alarm</th><th>Start Printer (No for displays)</th><th>Display or Printer NL/EM Control</th><th>40-Character Print Line</th><th>64-Character Print Line</th><th>80-Character Print Line</th></tr>
<tr><td rowspan="4">Copy Attributes Only</td><td rowspan="2">Yes</td><td>Yes</td><td><</td><td>*</td><td>%</td><td>@</td></tr>
<tr><td>No</td><td>D</td><td>M</td><td>U</td><td>4</td></tr>
<tr><td rowspan="2">No</td><td>Yes</td><td>H</td><td>Q</td><td>Y</td><td>8</td></tr>
<tr><td>No</td><td>b̸</td><td>&</td><td>-</td><td>0</td></tr>
<tr><td rowspan="4">Copy Attributes and Unprotected Fields</td><td rowspan="2">Yes</td><td>Yes</td><td>(</td><td>)</td><td>_</td><td>'</td></tr>
<tr><td>No</td><td>E</td><td>N</td><td>V</td><td>5</td></tr>
<tr><td rowspan="2">No</td><td>Yes</td><td>I</td><td>R</td><td>Z</td><td>9</td></tr>
<tr><td>No</td><td>A</td><td>J</td><td>/</td><td>1</td></tr>
<tr><td rowspan="4">Copy Attributes and Protected Fields</td><td rowspan="2">Yes</td><td>Yes</td><td>+</td><td>;</td><td>></td><td>=</td></tr>
<tr><td>No</td><td>F</td><td>O</td><td>W</td><td>6</td></tr>
<tr><td rowspan="2">No</td><td>Yes</td><td>¢</td><td>!</td><td>}[1]</td><td>:</td></tr>
<tr><td>No</td><td>B</td><td>K</td><td>S</td><td>2</td></tr>
<tr><td rowspan="4">Copy Attributes and All Fields (entire contents of buffer)</td><td rowspan="2">Yes</td><td>Yes</td><td>|</td><td>¬</td><td>?</td><td>"</td></tr>
<tr><td>No</td><td>G</td><td>P</td><td>X</td><td>7</td></tr>
<tr><td rowspan="2">No</td><td>Yes</td><td>.</td><td>$</td><td>,</td><td>#</td></tr>
<tr><td>No</td><td>C</td><td>L</td><td>T</td><td>3</td></tr>
</table>

[1] This character is converted internally to hex 6A for a WCC by DFGR when generating a format, and DFCR when using the WCC in a Put Override operation.

Figure 8-15. Copy Control Characters

Erase

The purpose of the Erase operation is to clear the data portion of all unprotected fields in the current format.

Operation Code

Hex	Dec	RPG II	Meaning
0052	82	ƀƀEB	Erase

Additional Requirements

- A Put Message or Copy operation must have been issued to this terminal prior to the Erase operation.
- The symbolic terminal name must be specified in the users output record area.
- Output data length = 14 (or 0 if non-RPG SUBR92).

Information Returned

- Return codes (see explanation in Appendix E):

0	Successful
9	Terminal offline
-n	negative return codes (I/O errors)

Function and Use of Erase

The Erase operation:

- Clears the data portion of all unprotected fields to nulls (X'00').
- Sets the modified data tag on all unprotected fields to off.
- Unlocks the keyboard.
- Resets the AID byte.
- Repositions the cursor to the first character location in the first unprotected field.

If the entire display contains protected fields, the keyboard is unlocked, the AID is reset, and the cursor is positioned at line 1, position 1.

Considerations

- An Erase operation is effective only if something has been placed on the display by a Put Message or Copy operation. When Erase is used, be aware that unprotected output/input fields containing data will have data erased and MDT tags set to OFF. It is suggested a Put Message be used to restore the display to its original condition if output/input fields are being used.

Return Codes

CCP return codes, including the special meaning of the data truncated return code under 3270 DFF, are described in Appendix E.

If a negative return code is given for a Copy operation, Put Message operation, or Put Overrides operation with reset modified data tags, or if the CLEAR key exception return code is given for an input operation, DFCR treats the terminal as if no format were ever issued to it. Thus, if a negative return code is given for one of these operations (or CLEAR return code) and the next operation is a Get, the program is cancelled with a termination code of FF.

Input Operations - Accept Input, Get, Stop Invite Input

Input operations are used to request input data (message) from the terminal whose name is specified in the record area (or in the parameter array for RPG II). When using display format services, the input operation codes that require processing by DFCR are:

Get
Invite Input
Accept Input
Stop Invite Input

The control routine moves data into the input areas if data was received successfully. For the manner in which fields are handled, see *Field Concepts* and *Record Concepts.* A Put Message or Copy operation must have been successfully issued to the terminal prior to issuing one of these operations.

The structure of the input record area (beginning in position 15 of the data area when using RPG SUBR92 or position 7 for other programs) is given on the printout of the format generation. The record area must be long enough to contain the end position +14 (+6 for other than RPG SUBR92 use) specified in the format generation listing. The first character will be the AID character followed by data for all input, output/input and SPD fields, in the order defined during format generation.

If a Put Override was previously issued to the terminal, and that operation specified select input fields (reset MDT in the WCC), then the input record area will contain the AID character followed by data for all the input, output/input, and SPD fields whose names appeared in the last Put Override list.

If a Put Override was not issued to the terminal, the maximum expected input length you put in the fourth element of the parameter list or array should be the end position given for all uses, under *length of input record area required in DFF program* on the format generation printout.

If a Put Override with select input fields was issued to the terminal, the maximum expected input length to be specified in the parameter list or array must include one for the AID character plus the total data length of all input, output/input and SPD fields whose names appear in the override list +14 (+6 for non-RPG SUBR92 use).

If a maximum expected input length is given which is less than the actual length, a data truncated exception return code will be passed to the program. In this case, the truncated length reflects the full data length of all fields that could fit into the area as specified by the maximum expected input length entry in the parameter list or array. Thus, complete fields are returned; no incomplete fields are returned as in non-DFF operations.

Note: Program request data is processed by DFF if the program requested is a DFF PRUF program, and PRUF is active on the 3270 terminal at program request time. Only in this case is the AID character returned in the first position of the user's area (See Chapter 2 for more information on PRUF). The effective input length field in the input record area as filled in by RPG SUBR92 shows the data length of all fields that can fit into the area plus the AID.

Invite Input

Invite Input requires a previously issued Put Message or Copy operation. The maximum expected input length is disregarded by DFF for this operation.

Release Terminal

This operation is used by the Display Format Control routine to maintain, by program, a list of terminals using DFF.

USER PROGRAM RECORD AREA

The size of the input and output record areas (or combined input/output record area) in programs using DFF is calculated from information provided in the printed output of DFGR. Figures 8-16 and 8-17 show the printed output from DFGR for two formats -- $ZOREN and $Z0009. The sizes of the record areas for programs using these formats would be calculated as follows:

- Size of the output record area (programs using RPG SUBR92):

	$ZOREN	*$Z0009*
- Highest end position (from DFGR printout)	0020	0020
Total	0020	0020

- Size of the output record area (programs not using RPG SUBR92):

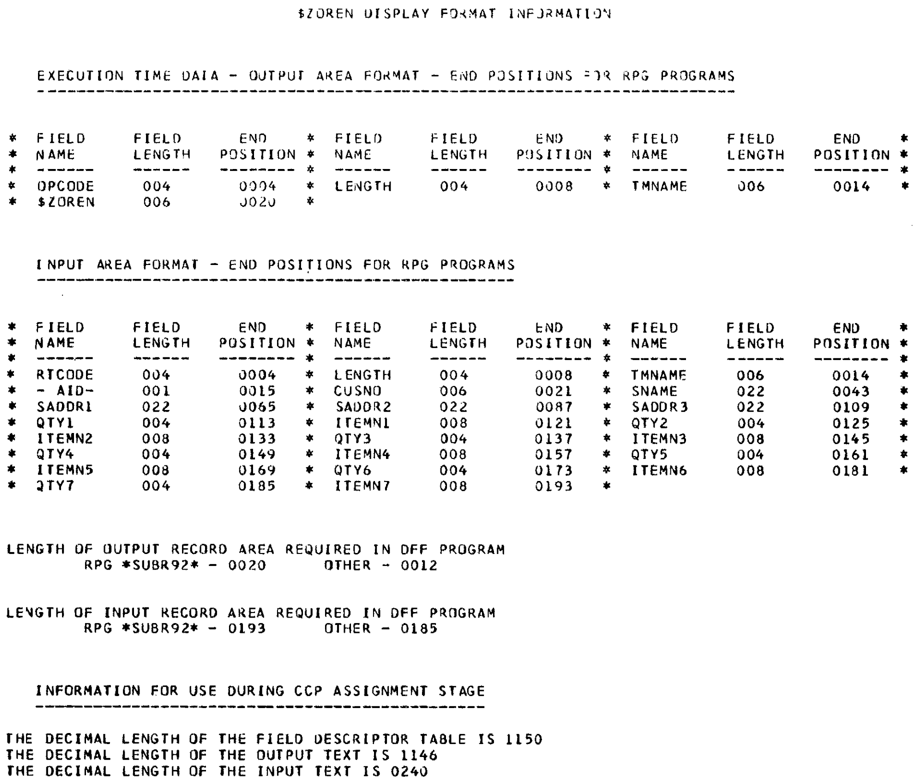
- Highest end position (from DFGR printout)	0020	0020
- Less 14 positions used in SUBR92 record area only	0014	0014
- Plus 6 positions for terminal name	0006	0006
Total	0012	0012

- Size of the input record area (programs using RPG SUBR92):

- Highest end position (from DFGR printout)	0193	0547
Total	0193	0547

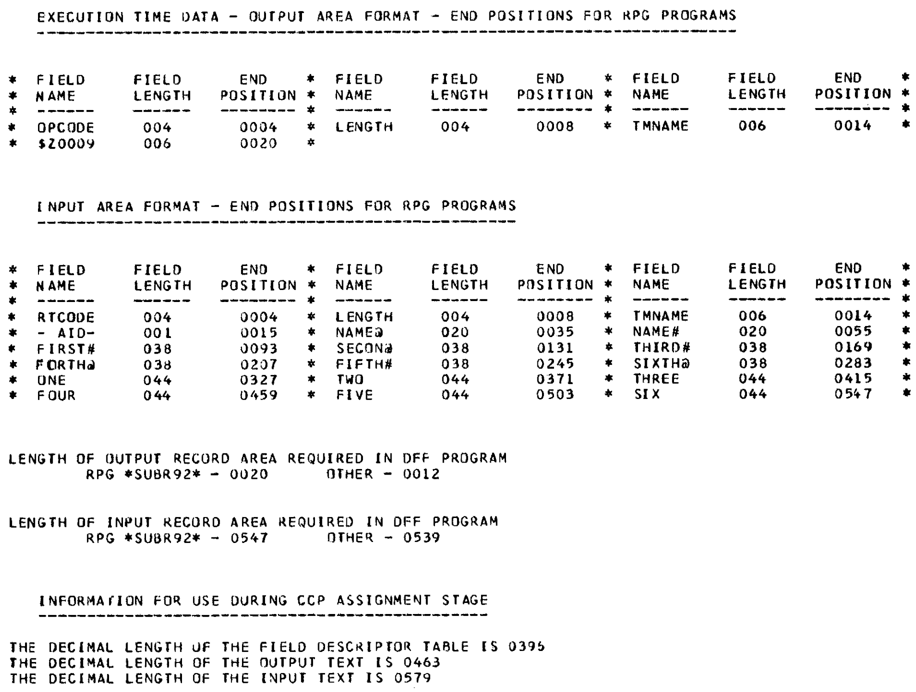
- Size of the input record area (programs not using RPG SUBR92 SPECIAL):

- Highest end position (from DFGR printout)	0193	0547
- Less 14 positions used in SUBR92 record area only	0014	0014
- Plus 6 positions for terminal name	0006	0006
Total	0185	0539



```
                          $ZOREN DISPLAY FORMAT INFORMATION

   EXECUTION TIME DATA - OUTPUT AREA FORMAT - END POSITIONS FOR RPG PROGRAMS
   -------------------------------------------------------------------------

*  FIELD      FIELD      END     *  FIELD      FIELD      END     *  FIELD      FIELD      END     *
*  NAME       LENGTH   POSITION  *  NAME       LENGTH   POSITION  *  NAME       LENGTH   POSITION  *
*  ------     ------   --------  *  ------     ------   --------  *  ------     ------   --------  *
*  OPCODE      004       0004    *  LENGTH      004       0008    *  TMNAME      006       0014    *
*  $ZOREN      006       0020    *

   INPUT AREA FORMAT - END POSITIONS FOR RPG PROGRAMS
   --------------------------------------------------

*  FIELD      FIELD      END     *  FIELD      FIELD      END     *  FIELD      FIELD      END     *
*  NAME       LENGTH   POSITION  *  NAME       LENGTH   POSITION  *  NAME       LENGTH   POSITION  *
*  ------     ------   --------  *  ------     ------   --------  *  ------     ------   --------  *
*  RTCODE      004       0004    *  LENGTH      004       0008    *  TMNAME      006       0014    *
*  - AID-      001       0015    *  CUSNO       006       0021    *  SNAME       022       0043    *
*  SADDR1      022       0065    *  SADDR2      022       0087    *  SADDR3      022       0109    *
*  QTY1        004       0113    *  ITEMN1      008       0121    *  QTY2        004       0125    *
*  ITEMN2      008       0133    *  QTY3        004       0137    *  ITEMN3      008       0145    *
*  QTY4        004       0149    *  ITEMN4      008       0157    *  QTY5        004       0161    *
*  ITEMN5      008       0169    *  QTY6        004       0173    *  ITEMN6      008       0181    *
*  QTY7        004       0185    *  ITEMN7      008       0193    *

LENGTH OF OUTPUT RECORD AREA REQUIRED IN DFF PROGRAM
        RPG *SUBR92* - 0020       OTHER - 0012

LENGTH OF INPUT RECORD AREA REQUIRED IN DFF PROGRAM
        RPG *SUBR92* - 0193       OTHER - 0185

   INFORMATION FOR USE DURING CCP ASSIGNMENT STAGE
   -----------------------------------------------

THE DECIMAL LENGTH OF THE FIELD DESCRIPTOR TABLE IS 1150
THE DECIMAL LENGTH OF THE OUTPUT TEXT IS 1146
THE DECIMAL LENGTH OF THE INPUT TEXT IS 0240
```

Figure 8-16. Display Format Generation ($ZOREN)



```
   EXECUTION TIME DATA - OUTPUT AREA FORMAT - END POSITIONS FOR RPG PROGRAMS
   -------------------------------------------------------------------------

*  FIELD      FIELD      END     *  FIELD      FIELD      END     *  FIELD      FIELD      END     *
*  NAME       LENGTH   POSITION  *  NAME       LENGTH   POSITION  *  NAME       LENGTH   POSITION  *
*  ------     ------   --------  *  ------     ------   --------  *  ------     ------   --------  *
*  OPCODE      004       0004    *  LENGTH      004       0008    *  TMNAME      006       0014    *
*  $Z0009      006       0020    *

   INPUT AREA FORMAT - END POSITIONS FOR RPG PROGRAMS
   --------------------------------------------------

*  FIELD      FIELD      END     *  FIELD      FIELD      END     *  FIELD      FIELD      END     *
*  NAME       LENGTH   POSITION  *  NAME       LENGTH   POSITION  *  NAME       LENGTH   POSITION  *
*  ------     ------   --------  *  ------     ------   --------  *  ------     ------   --------  *
*  RTCODE      004       0004    *  LENGTH      004       0008    *  TMNAME      006       0014    *
*  - AID-      001       0015    *  NAME@       020       0035    *  NAME#       020       0055    *
*  FIRST#      038       0093    *  SECON@      038       0131    *  THIRD#      038       0169    *
*  FORTH@      038       0207    *  FIFTH#      038       0245    *  SIXTH@      038       0283    *
*  ONE         044       0327    *  TWO         044       0371    *  THREE       044       0415    *
*  FOUR        044       0459    *  FIVE        044       0503    *  SIX         044       0547    *

LENGTH OF OUTPUT RECORD AREA REQUIRED IN DFF PROGRAM
        RPG *SUBR92* - 0020       OTHER - 0012

LENGTH OF INPUT RECORD AREA REQUIRED IN DFF PROGRAM
        RPG *SUBR92* - 0547       OTHER - 0539

   INFORMATION FOR USE DURING CCP ASSIGNMENT STAGE
   -----------------------------------------------

THE DECIMAL LENGTH OF THE FIELD DESCRIPTOR TABLE IS 0395
THE DECIMAL LENGTH OF THE OUTPUT TEXT IS 0463
THE DECIMAL LENGTH OF THE INPUT TEXT IS 0579
```

Figure 8-17. Display Format Generation ($Z0009)

A program using both of these formats could use a single input record area and a single output record area. The size of each would be equal to the size required for the larger format. In this case, the size of the output area would be 12 for programs not using RPG SUBR92 or 20 for programs using RPG SUBR92. The size of the input record area would be 539 for programs not using RPG SUBR92 or 547 for programs using RPG SUBR92.

The output record area in these two examples allows for only the format name. An additional consideration for a larger size output record would be if the Put Override operation is issued by the program or if the program provides output data to display format fields during program execution. The output record area would then need to be large enough for the Put Overrides list created during program execution or the total of the output fields, (value under heading *length of output record area required in DFF program* from DFGR printout) whichever is larger.

The program could also use a single combined input/output record area. The combined record area (created in RPG when SUBR92 file is used) would need to be as large as the larger of the input or output record areas.

DISPLAY CONCEPTS

New Screens

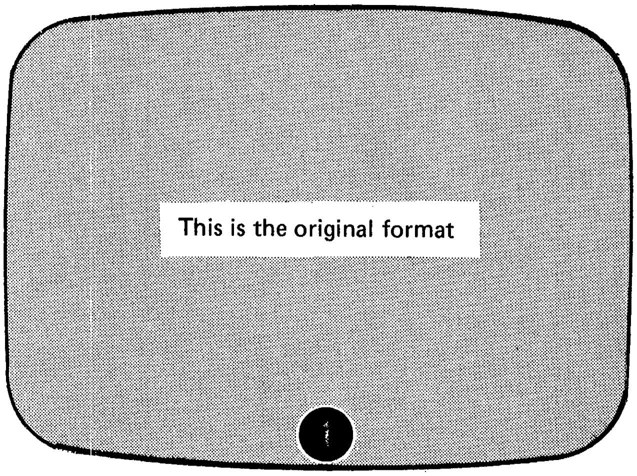
The Put Message is used to request that a particular display format be retrieved from the object library and written to the terminal. If the format is already at one terminal, a Copy operation can be used to duplicate the format from the first terminal to a second terminal attached to the same 3271 control unit. (*Note:* The format cannot be copied if a protected field starts in line 1, position 2.)

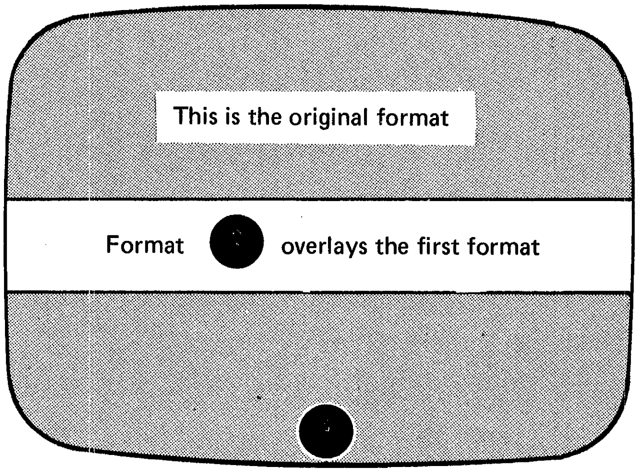
Overlay Screens

Overlay screens are useful when only a portion of the screen is subject to change.

When multiple display formats are written to the same display, the integrity of the displayed data is the user's responsibility. The following must be considered if the user places a second format over a part of a format already being displayed without specifying 'clear before writing' on the display control form.

1. MDT should be set to OFF for all fields on Format 1 when Format 2 is placed over Format 1.





2. The control routine provides support for only the last format placed on the display. Only those input fields defined by the last display format will be accepted. All other field data will be ignored.

3. Entire fields or groups of fields should be overlaid to prevent residual data from appearing between fields in the overlay format. Also, residual data following an SPD field in the overlay format may be transmitted along with the data for the SPD field during an input operation. This can cause data for other fields in the overlay screen to be lost.

4. When using overlay screens, it is important that the terminal operator does not key into a field which belongs to a previous format. This could cause data for the fields in the overlay screen to be lost.

5. The overlay format need not define complete lines of data. An overlay format can define fields between fields of an existing format. It is important, however, that fields of an overlay format and their defining and delimiting attributes do not partially overlay an existing field or are not placed within the area of an existing field. Overlay fields should either be placed in an undefined area or should completely overlay existing fields.

DFF, CCP CONSIDERATIONS

Assignment Control Statements

During the assignment stage of CCP (see *CCP System Reference Manual*), the user must define those terminals which, on a program basis, require DFF support. The assignment control statements affected and the information to be specified are as follows:

SYSTEM statement — For DFF, a parameter on this statement identifies the disk unit and object library containing the display or printer formats.

TERMATTR statement —This statement defines terminal attributes. On this statement, the user specifies whether or not DFF will be used with all terminals referencing this terminal attributes set. Under Model 10 and Model 12 CCP, the BLKL parameter is used to define the size of the output hold area (in main storage). The output hold area is used to prepare the 3270 data stream for output operations. A separate hold area is supported for each BSCA line.

PROGRAM statement — This statement defines the logical structure and resource requirements of an application program. When using the Display Format Facility, the information required on a program basis is as follows:

- The maximum number of terminals, using the Display Format Facility, allocated concurrently to the application program.
- The maximum number of display or printer formats the program will use.
- The size of the largest field descriptor table used with this program. The character length of the field descriptor table is printed by the Format Generation programs (DFGR and PFGR) for each format generated.

Storage Areas

Output Hold Area—Model 10 and Model 12 CCP

One output hold area for each BSCA line will be appended to the control routine to hold the 3270 data stream for output operations. When using Put Message or when overriding the attributes and/or contents of fields currently being displayed (see *Put Overrides* under *3270 Display Operations*) this area is used by the control routine to build a data stream based on the execution time data or the override information in the output record area of the application program.

The sizes of the output hold areas for each BSCA line need not be the same. Each may be the minimum of 256 bytes or as much larger (by multiples of 256 bytes) as needed up to the size of the output text of the largest display or printer format that uses this set. The size of the hold areas are determined by the BLKL parameter of the TERMATTR statement of the assignment set under which the program will execute.

If the assigned hold area space is less than the size of the output text of the largest display or printer format, the control routine automatically splits the data stream into output blocks and sends each block separately. If the control routine is to perform blocking, the hold area must contain at least 512 bytes in order to accommodate one 256-byte block plus information that cannot be sent in the current block. The user should be aware that if he uses blocking to achieve core economy, it will probably result in less efficient use of the BSCA line if the line has a high rate of activity.

Output Hold Area -- Model 15 CCP

The output hold area is allocated dynamically by the CCP from the TP buffer area. The size of the output hold area is determined by the CCP based on the length of the output text of the format for each particular user program operation. There may be, at most, two output hold areas allocated at one time, one for each BSCA line.

TP Buffer

Get, Invite Input, and (under Model 15 CCP) Put operations are not executed under DFF until TP buffer space is available. In calculating TP buffer area size at assignment time, the user should consider Invite Input, Get, and (under Model 15 CCP) Put operations that require DFF. See *TP Buffer (dynamic)* in *CCP System Reference Manual* for information on estimating the size of this area.

User Program Storage Considerations

In order for DFF to support multiple application programs concurrently, a storage area is appended to each application program when the program is loaded. The size and contents of this area are determined at assignment time.

The storage area contains a fixed constant area plus a variable area depending upon the following:

- Maximum number of 3270 terminals the program can service concurrently. (Take into account the maximum number of requesting terminals and program selected terminals that can be serviced at one time.)
- Number of display or printer formats used
- Length of the longest field descriptor table given on the PROGRAM statement.

The user must specify on the PROGRAM statement the size of the largest field descriptor table (information provided by the display or printer format generator). A particular field descriptor table remains in the storage area appended to the application program until an output or input request requires a different format. On output, the table identifies those fields to be supplied data by the user's output record area and also supports overrides to a field within the display. On input, the table aids in constructing the input record area from data received from a terminal. For storage size estimates, refer to *CCP System Reference Manual.*

Terminal Operator Actions

Keys

See Operator's Guide to *IBM 3270 Information Display Systems,* GA27-2742 for description of all 3270 keys and their actions.

Use of keys with DFF:

Key	*Situation/Resulting Action*
ENTER	When the operator completes an operation and presses ENTER, the fields with MDT-ON are read automatically in response to a poll request from CCP.
CLEAR	A 07 return code is returned to the application program when the operator of a terminal presses the CLEAR key (returned on the next input operation). An AID character indicating CLEAR is never returned to the user program, whether or not the program uses DFF. The 07 return code is given to the program if the terminal operator resumes communication with the application program after data mode escape.
Program Attention keys—ENTER, all Program Function (PF) keys, and the Program Access (PA) keys	When the operator presses any one of these keys, the terminal responds to an input request from the system and the Attention Identification (AID) character is generated (to identify which key was pressed). The AID is the first field in the input record. If a PA key is pressed, only the AID character appears in the input record area, no data. If selector pen attention is caused by selection of an SPD field, each field that has the modified data tag ON will have a greater than (>) sign in the leftmost position of the field in the record area and the remainder of the field will be blank.

Key	*Situation/Resulting Action*
Character oriented keys	A cluster of four keys (located on the right of the keyboard) move the cursor one location at a time. These keys are: ↑ (up), ↓ (down), → (right), and ← (left). The cursor may be moved into any character location, including unprotected and protected alphameric character and attribute character locations. All four keys have typamatic operation (keep repeating when key is held down); all four are capable of causing the cursor to 'wrap'.
Field oriented Keys	Four keys that move the cursor to the first position in a field. These are →| (Tab), |← (Backtab), |←┘ (New Line) and the SKIP key. The tab key moves the cursor to the first character location of the next unprotected data field. If the cursor is located in other than the first location of an unprotected data field, the Backtab key causes the cursor to move to the first character location of that field. If the cursor is already located in the first position of a protected field, the cursor moves to the first alphameric character location of the first preceding unprotected data field. The New Line key moves the cursor to the first unprotected character location of the next line. The SKIP key is on the Data Entry Keyboard only and performs the same functions as the Tab Key.
ERASE INPUT	This key clears all unprotected fields to nulls and repositions the cursor to the first unprotected character location on the screen. It also resets all modified data tags associated with unprotected data fields.
ERASE EOF End of Field key	If the cursor is located in an alphameric character location in an unprotected data field, this key clears the position occupied by the cursor and all remaining character positions in that field. The cursor does not move. If this key is pressed when the cursor is located in a protected field, it disables the keyboard and no character locations are cleared.
FIELD MARK	This key provides a means of informing the application program of the end of a field in an unformatted display. If the key is used in entering data, no special handling is provided when using DFF.
DUP	This key provides a unique character code to be entered into the display buffer and a standard Tab key operation to be performed. The DUP character provides a means of informing the application program that a "duplicate" operation is indicated for the rest of the field in which it is located. If key is used in entering data, no special handling is provided when using DFF.

Operator Identification Card Reader

The Operator Identification Card Reader is a special feature for attachment to a 3277 or 3275 Display Station. It reads a small magnetic card encoded with a unique identification number. When the card is placed into a reader, the text on the card is read into the display buffer. For the card read operation, the cursor must be positioned at the first character location of the input field. The field should be an unprotected alphameric field. The AID is set to indicate the operator Identification Card Reader.

The field length should always be the length of the text plus three. The alphameric data which will be presented to the application program consists of text, an End of Record (EOR) or End of Inquiry (EOI) character, the LRC character, and one blank.

This is the field	EOR or EOI	LRC	Blank

There is a hardware-generated attribute character entered automatically at the location of the cursor. This attribute character must be removed by the application program if this field is to be re-used. This can be accomplished by issuing either a Put Message or Put Override operation.

DISPLAY FORMAT TEST ROUTINE ($CCPDT)

$CCPDT is a stand-alone program which displays DFF formats on an IBM 3270 Information Display System. $CCPDT operates under the IBM System/3 Models 10, 12, and 15. Communication between $CCPDT and the 3270 is maintained using the multiline/multipoint (MLMP) binary synchronous communications (BSC) data link.

$CCPDT, shown in Figure 8-19, uses the formats generated by the Display Format Generator routine (DFGR) or the Printer Format Generator routine (PFGR). The formats must be in the object library of the program pack from which $CCPDT is loaded.

For Model 10 and Model 12, $CCPDT will use SYSIN as the input device. When $CCPDT is loaded the following option menu will be logged on SYSLOG:

```
OPTION MENU
A. SEND FORMAT TO TERMINAL
B. READ FORMAT FROM TERMINAL AND PRINT IT
C. GO TO EOJ
D. SEND FORMAT TO TERMINAL, POLL, PRINT INPUT
E. SEND FORMAT TO SYSTEM PRINTER
ENTER ALL OPTIONS DESIRED THROUGH SYSIN IN ANY ONE OF TWO FORMS BELOW
O FFFFFF PPPP AAAA
O FFFFFF *
```

For Model 15, $CCPDT will use the console as the input device. An option menu will appear on the screen describing each option. The input data may be entered starting at the cursor position.

```
A. SEND FORMAT TO TERMINAL
B. READ FORMAT FROM TERM.,AND PRINT IT
C. GO TO EOJ
D. SEND FORMAT TO TERM.,POLL,PRINT INPUT
E. SEND FORMAT TO SYSTEM PRINTER
1)O FFFFFF PPPP AAAA        2)O FFFFFF *
```

↑

Cursor

$CCPDT provides the user with two forms of input records and five options:

1. O FFFFFF PPPP AAAA
   where:

   O = A, B, C, D, or E (these options are described later in this chapter)
   F = Format name, which must begin with the characters $Z. The name must be at least three characters long but not more than six characters long.
   P = Poll characters (EBCDIC or ASCII characters) Enter immediately following the first blank after the format name.
   A = Address characters (EBCDIC or ASCII characters)

2. O FFFFFF *
   where:
   O = A, B, C, D, or E (these options are described later in this chapter)
   F = Format name, which must begin with the characters $Z. The name must be at least three characters long but not more than six characters long.
   * = Last specified poll and address characters (see note). Enter immediately following the first blank after the format name.

Note: If the poll and address characters are not specified, $CCPDT will use the last previous specified poll and address character. In this way the user can send multiple formats to the same terminal. If the user does not specify the poll and address characters at least once, $CCPDT will default to the following characters:

Poll characters = ƀƀƀƀ (40404040)
Address characters = --ƀƀ (60604040)

Options

A. *Send Format to Terminal*

$CCPDT reads the selected format from the program pack. The format is then transmitted to a terminal. This option allows the user to view the format. This option does not allow input or output data to be received or transmitted.

B. *Read Format from Terminal and Print It*

This option allows the user to test for invalid characters within the text stream. $CCPDT reads the entire format from the terminal (read buffer) and prints it. The user should compare the format on the terminal and the data portion (text stream) of the format printed. (See Figure 8-14 for example of printout.)

C. *Go to End of Job*

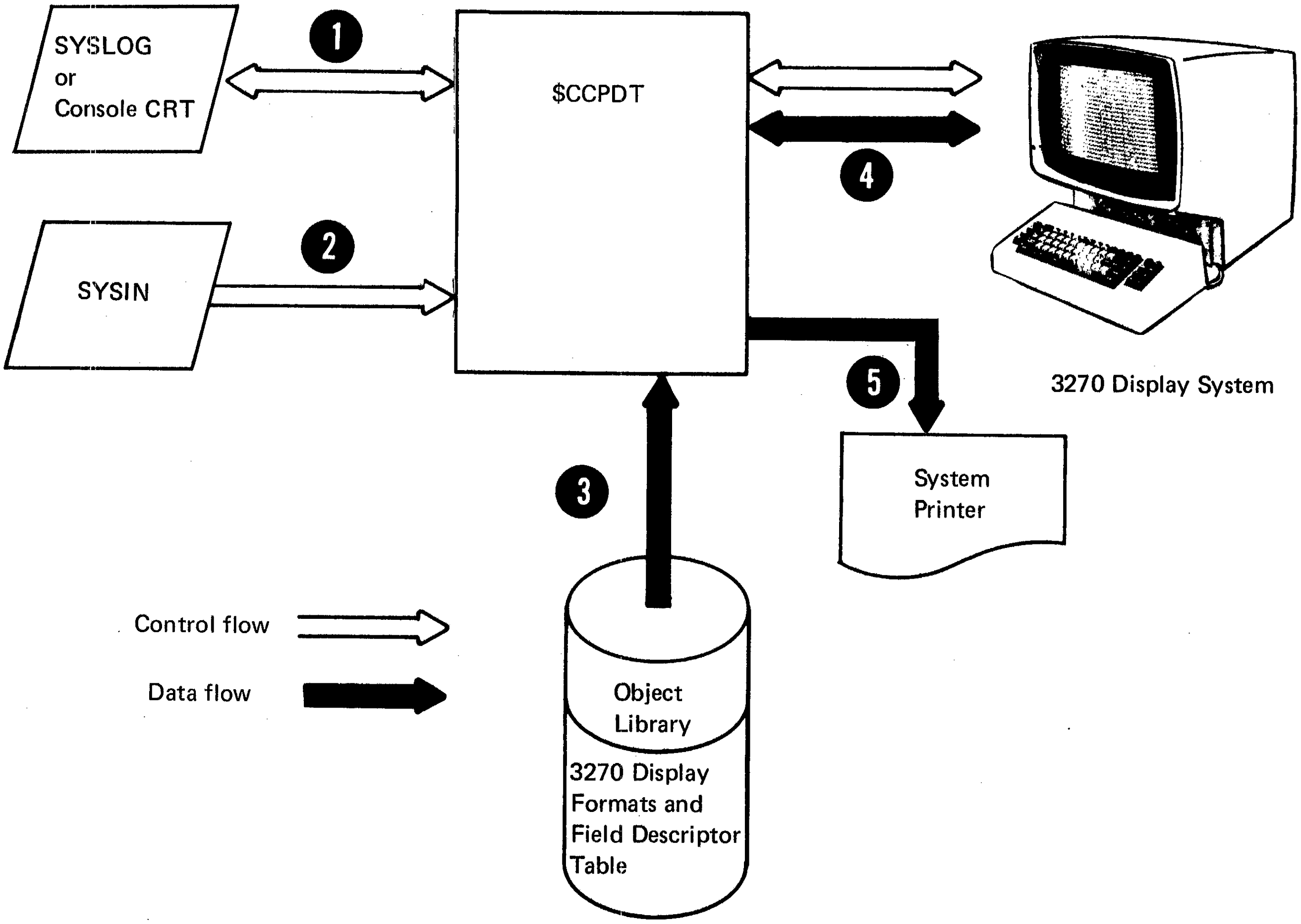
This option should be entered after the user has entered all other options to be used. $CCPDT will then go to end of job.

D. *Send Format to Terminal, Poll for Input and Print the Input Data Received*

$CCPDT sends the format to the terminal and polls the terminal for input. The user enters data on the terminal keyboard. When attention is requested by the terminal operator by pressing either the ENTER, PA or PF key, $CCPDT receives the modified data and prints it on the system printer. This is a means of verifying the modified data transmitted to $CCPDT or what the text stream would look like if sent to a non-DFF application program. (See Figure 8-14 for example.)

E. *Send Format to System Printer*

$CCPDT reads the selected format from the program pack and prints the entire format on the system printer. This allows the user to view the 3270 text stream and provides a copy for documentation. (See Figure 8-14 for example of printout.)



❶ $CCPDT prints/displays the options menu on the SYSLOG device.

❷ $CCPDT reads an option from SYSIN.

❸ $CCPDT reads the format name specified on the option record from the object library of the program pack.

❹ $CCPDT sends the format to the terminal.

❺ $CCPDT sends the format to the system printer, or sends modified data from the format to the system printer.

Figure 8-19. $CCPDT Functions

Address	Text of Format in Hex	Text of Format in Character

```
$ZRPIQ
0000   27F5C332   3211C6D4   1D60C3E4   E2E3D6D4   C5D940D5   D64B11C6        5C   FM -CUSTOMER NO. F
0018   F31DE85C   5C5C5C5C   5C11C66D   1D6CD5D6   E340D6D5   40C6C9D3       T Y****** F  %NOT ON FIL
0030   C511C8F4   1D60C3E4   E2E3D6D4   C5D940D5   C1D4C511   C9C31DE8       E H4 -CUSTOMER NAME IC Y
0048   5C5C5C5C   5C5C5C5C   5C5C5C5C   5C5C5C5C   5C5C5C5C   5C5C114B       ********************** .
0060   D41D60E2   C8C9D740   E3D6114B   E31DE85C   5C5C5C5C   5C5C5C5C       M -SHIP TO .T Y*********
0078   5C5C5C5C   5C5C5C5C   5C5C5C5C   5C114FC4   1D60C9E3   C5D440D5       *************   D -ITEM N
0090   D64B114F   D31DE85C   5C5C5C5C   5C5C5C11   4F5D1D6C   D5D6E340       O.  L Y********    %NOT
00A8   D6D540C6   C9D3C511   D1E41D60   C9E3C5D4   40C4C5E2   C34B11D1       ON FILE JU -ITEM DESC. J
00C0   F31DE85C   5C5C5C5C   5C5C5C5C   5C5C5C5C   5C5C5C5C   5C5C5C         3 Y*********************
```

Figure 8-14. Example of $CCPDT Format Printout

$CCPDT Considerations

Any format that the user wants to test must be in the program pack's object library. Before a format is sent to a terminal or the printer it is scanned for nulls (00). In fields within formats defined as having execution time data containing nulls, the nulls are replaced by asterisks. Also in overlay formats with input fields containing nulls, these nulls are replaced by asterisks. Since nulls do not appear on the terminal, by replacing the nulls with asterisks, the user is able to see the null fields.

OCL Statements

An initialized MLTERFIL must be on F1, for logging control station terminal error statistics. The OCL required to initialized MLTERFIL is:

```
// LOAD $$BSFI,unit
// FILE NAME-MLTERFIL,UNIT-F1,PACK-pack,
   TRACKS-1,LOCATION-track number (optional),
   RETAIN-P
// RUN
```

The following OCL is required to run $CCPDT:

```
 // LOAD $CCPDT,unit
[// BSCA LINE-2 ]   see notes
 // RUN
```

Notes:

1. $CCPDT uses BSCA-1; if the user wants to use the BSCA LINE-2 instead of BSCA LINE-1, include the optional BSCA LINE-2 statement in the OCL. No recompilation of the program is required.
2. For Model 8 using the ICA or local display adapter, the user must enter the BSCA LINE-2 OCL statement.

Display Format Test Routine Diagnostic Messages

During processing, DFTR checks completion codes, status of terminals, and the various types of program intervention. Messages stating the reason the completion code was given, the status of terminals, and the type of program intervention received are logged on the system printer. For the DFTR diagnostic messages, see the *CCP Messages Manual*, GC21-5170.

FORMAT FIND ROUTINE (5704-SC2 Only)

The format find routine (CCPFMT) makes formats that have been created or modified by DFGR or PFGR in another partition, available to programs in the current assignment set. The routine is executed under CCP and performs the following functions:

- Places the current object library C/S (cylinder/sector) location of the format into the format index in $CCPFILE.
- Updates the DFFSFDT value of the PROGRAM assignment statement.

To use CCPFMT, make the following entries in the assignment set:

```
// TERMATTR ATTRID-04,DATAFORM-MESSAGE,
                DFF3270-NO
// PROGRAM NAME-CCPFMT,NEVEREND-YES,
               ENDMSG-NO
```

The routine is invoked from either the system operator's console or a command terminal. For additional information on the use of CCPFMT, refer to the *Model 15 CCP System Operator's Guide*, GC21-7619.

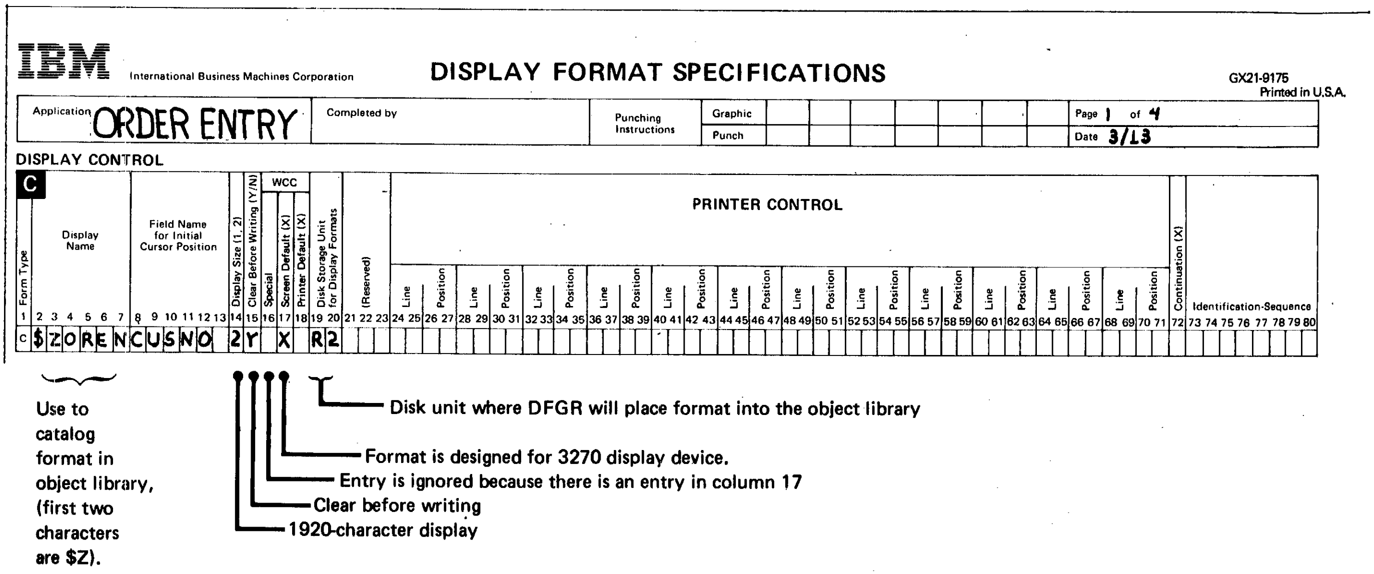
Note: When CCPFMT is included in an assignment set, ATTRID-04 is reserved for format find.

EXAMPLES

Example 1—DFF Formatting Example

Problem: Design a display format to be used on the 3270 display with an order entry program. Make the format usable with any programming language available under CCP.

Solution: Plan the format by laying out fields on a display layout sheet. This then serves as a visual guide in filling out the field definition forms.



International Business Machines Corporation

DISPLAY FORMAT SPECIFICATIONS

GX21-9175
Printed in U.S.A.

Application ORDER ENTRY
Completed by
Punching Instructions: Graphic / Punch
Page 1 of 4
Date 3/13

DISPLAY CONTROL

Form Type (1)	Display Name (2–7)	Field Name for Initial Cursor Position (8–13)	Display Size (1, 2) (14)	Clear Before Writing (Y/N) (15)	WCC: Special (16)	WCC: Screen Default (X) (17)	WCC: Printer Default (X) (18)	Disk Storage Unit for Display Formats (19–20)	(Reserved) (21–23)	PRINTER CONTROL: Line / Position (24–71)	Continuation (X) (72)	Identification-Sequence (73–80)
C	$ZOREN	CUSNO	2	Y		X		R2				

Use to catalog format in object library, (first two characters are $Z).

Disk unit where DFGR will place format into the object library

Format is designed for 3270 display device.

Entry is ignored because there is an entry in column 17

Clear before writing

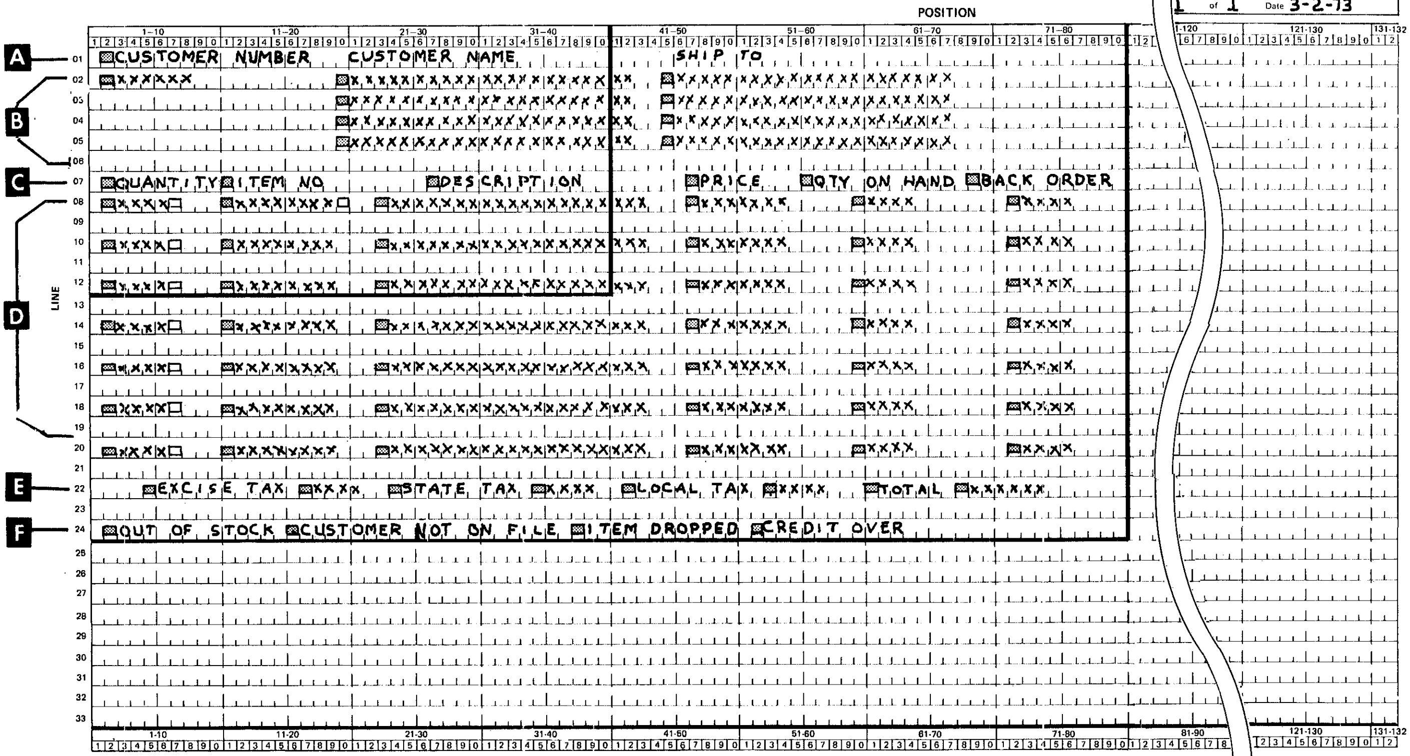
1920-character display

IBM International Business Machines Corporation

GX21-9174
Printed in U.S.A.

Printer/Display Layout

tion ORDER ENTRY
ted by
1 of 1 Date 3-2-73



KEY ASSIGNMENTS

	AID			AID			AID	
PF1	1	ENTER ORDER	PF6	6		PF11	#	
PF2	2		PF7	7		PF12	@	
PF3	3		PF8	8		PA1	%	RELEASE TERMINAL
PF4	4		PF9	9		PA2	>	CANCEL ORDER
PF5	5		PF10	:		PA3	(comma)	

▨ Shaded boxes indicate defining attribute positions.

☐ Open boxes indicate trailing attribute positions.

Note: The large letters identify a portion of the display screen with a segment of the field definition information as it appears on the field definition forms and on the listing.

A This heading is a type 1 output field which means it is to be displayed at normal intensity on the screen.

The entry on line 2 position 3 (under customer number) is a type 3 input field which means that it is a numeric field to be displayed at normal intensity.

The entry on line 2 position 21 (under customer name) is a type 1 output field which means that it is displayed at normal intensity.

The entry on line 2 position 46 (under ship to) is a type 1 output/input field. This entry is examined by the terminal operator and changed if necessary.

Line 07 contains headings (type 1 output fields with normal intensity). The items in the quantity column are type 3 (numeric) while the item numbers are type 1 input (alphameric). Automatic skip causes the cursor to move to the next quantity entry.

The fields in the rest of the line are defined as type 1 output/input fields. Note that there is a G in the data source column indicating information is provided at generation time yet no entries appear in columns 32-71. All output and output/input fields have been described as being generation-defined with no entries made in columns 32-71 because data will be provided using a Put Override during execution time.

E Display line 22 contains visible headings (type 1 output fields) and fields into which data can be placed by using Put Overrides at execution time (type 1 output fields).

F Display line 24 initially contains a series of type 5 output fields. Any one of these fields can be changed at execution time by the application program. They could, for example, be changed to displayed fields with high intensity.

The display control form is used to describe the format in such a way that it can be properly stored and retrieved.

All the information on the display control and field definition forms is transferred to cards and used as input to the display format generator.

Generation results include:

1. The display format consisting of the field descriptor table and the 3270 data stream with control information are entered into the object library under the symbolic format name.

2. Printout information:

   a. Printout of the specification forms.
   b. Log of diagnostic error messages.
   G c. Sequential list of output fields.
   H d. Input data fields and their order of appearance in the input record area.
   e. The decimal length of the field descriptor table.
   J f. The decimal length of the 3270 output data stream.
   g. The decimal length of the 3270 input data stream.

A Display line 1 contains a visible heading.

An X in column 72 allows for continuation on next line.

FIELD DEFINITION

F

Form Type	Field Name	Field Starting Location: Line	Field Starting Location: Position	Field Length	Output: Type (1,2,5)	Output: Data Source (E/F/G)	Input: Type (1-8)	Input: Autoskip (Y/N)	Output/Input: Type (1-8)	Output/Input: Data Source (E/G)	Output/Input: Autoskip (Y/N)	Detectable: Type (1-7)	Detectable: Data Source (E/G)	(Reserved)	Data for Output, Output/Input and Detectable Fields	Continuation	Identification-Sequence
1	2 3 4 5 6 7	8 9	10 11	12 13 14	15	16	17	18	19	20	21	22	23	24 25 26 27 28 29 30 31	32–71 (1–40)	72	73 74 75 76 77 78 79 80
F	HEAD1	01	03	50	1	G									CUSTOMER NUMBER CUSTOMER NAME	X	
F															SHIP TO		
F	CUSN0	02	03	6			3	N									
F	NAME	02	21	22	1	G											
F	SNAME	02	46	22					1	G	N						
F	ADDR1	03	21	22	1	G											
F	SADDR1	03	46	22					1	G	N						
F	ADDR2	04	21	22	1	G											
F	SADDR2	04	46	22					1	G	N						
F	ADDR3	05	21	22	1	G											
F	SADDR3	05	46	22					1	G	N						
F	BLANK1	06	02	1	1	G											
F	HEADR1	07	03	8	1	G									QUANTITY		
F	HEADR2	07	12	7	1	G									ITEM NO		
F	HEADR3	07	28	11	1	G									DESCRIPTION		
F	HEADR3	07	48	5	1	G									PRICE		
F	HEADR5	07	57	11	1	G									QTY ON HAND		
F	HEADR6	07	70	10	1	G									BACK ORDER		
F	QTY1	08	03	04			3	Y									
F	ITEMN1	08	12	08			1	Y									
F	DESCR1	08	24	20	1	G											

*No. of sheets per pad may vary slightly.

B Display line 2-5 contain fields for entering customer number, name, and address on left side; fields for entering ship-to name and address on the right.

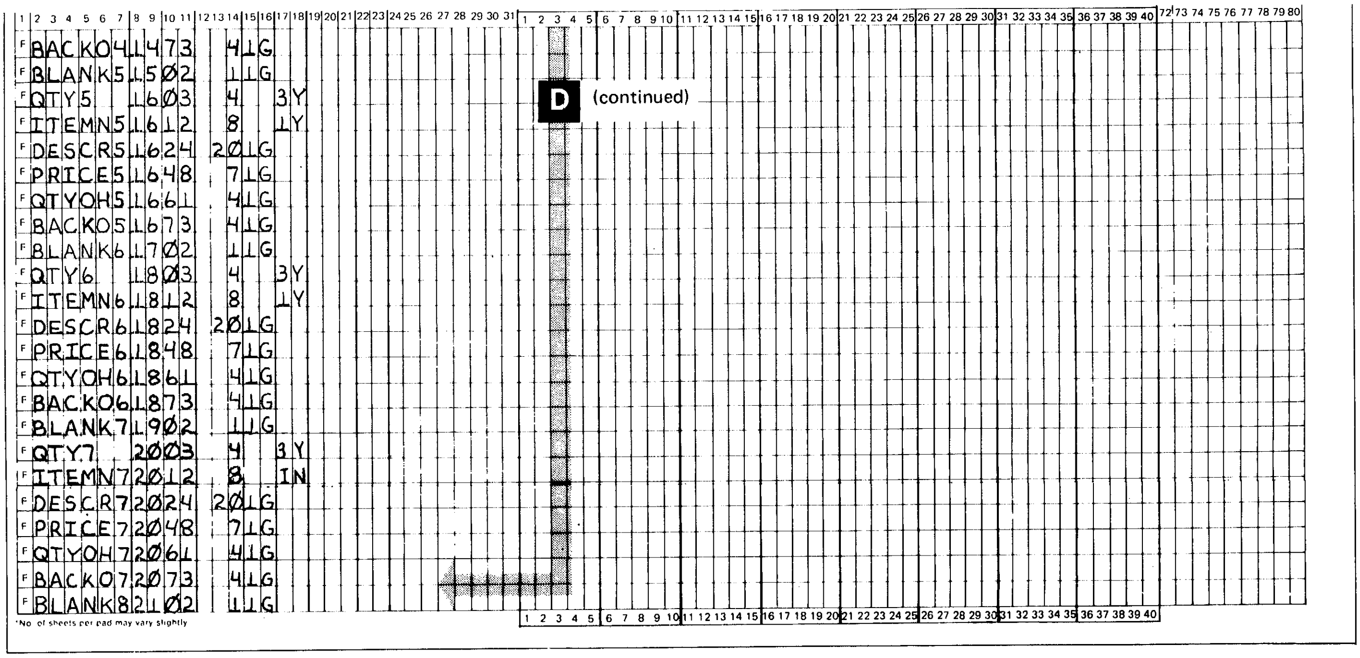
C Display line 7 contains headings.

D Even-numbered display lines 8-20 contain fields for entering order data. Odd-numbered display lines 9-23 are defined as one-character blank fields in order to cause a blank line to print on the 3284 and 3286 Model 1 and 2 printers.

1	2 3 4 5 6 7	8 9	10 11	12 13 14	15	16	17	18	19	20	21	22	23	24 25 26 27 28 29 30 31	1–40	72	73 74 75 76 77 78 79 80
F	PRICE1	08	48	7	1	G											
F	QTYOH1	08	61	4	1	G											
F	BACKO1	08	73	4	1	G											
F	BLANK2	09	02	1	1	G											
F	QTY2	10	03	4			3	Y									
F	ITEMN2	10	12	8			1	Y									
F	DESCR2	10	24	20	1	G											
F	PRICE2	10	48	7	1	G											
F	QTYOH2	10	61	4	1	G											
F	BACKO2	10	73	4	1	G											
F	BLANK3	11	02	1	1	G											
F	QTY3	12	03	4			3	Y									
F	ITEMN3	12	12	8			1	Y									
F	DESCR3	12	24	20	1	G											
F	PRICE3	12	48	7	1	G											
F	QTYOH3	12	61	4	1	G											
F	BACKO3	12	73	4	1	G											
F	BLANK4	13	02	1	1	G											
F	QTY4	14	03	4			3	Y									
F	ITEMN4	14	12	8			1	Y									
F	DESCR4	14	24	20	1	G											
F	PRICE4	14	48	7	1	G											
F	QTYOH4	14	61	4	1	G											

D (continued)

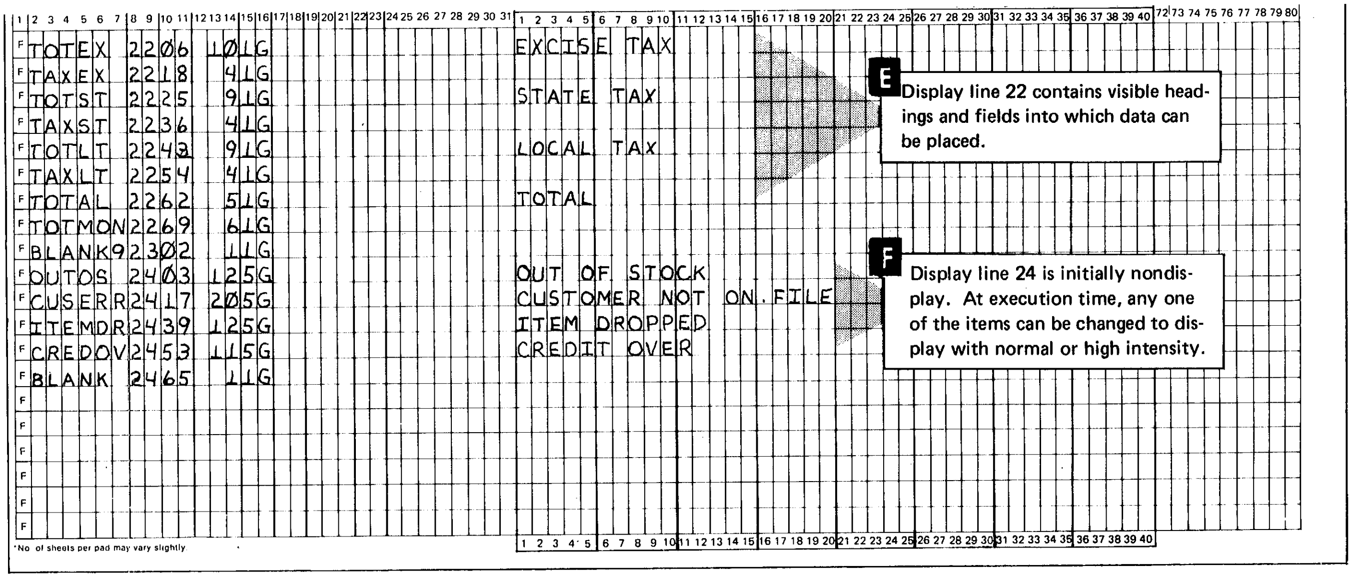
*No. of sheets per pad may vary slightly.



D (continued)

```
FBACKO41473  41G
FBLANK51502  11G
FQTY5  1603  4  3Y
FITEMN51612  8  1Y
FDESCR51624 201G
FPRICE51648  71G
FQTYOH51661  41G
FBACKO51673  41G
FBLANK61702  11G
FQTY6  1803  4  3Y
FITEMN61812  8  1Y
FDESCR61824 201G
FPRICE61848  71G
FQTYOH61861  41G
FBACKO61873  41G
FBLANK71902  11G
FQTY7  2003  4  3Y
FITEMN72012  8  1N
FDESCR72024 201G
FPRICE72048  71G
FQTYOH72061  41G
FBACKO72073  41G
FBLANK82102  11G
```

*No. of sheets per pad may vary slightly



```
FTOTEX 2206 101G               EXCISE TAX
FTAXEX 2218  41G
FTOTST 2225  91G               STATE TAX
FTAXST 2236  41G
FTOTLT 2243  91G               LOCAL TAX
FTAXLT 2254  41G
FTOTAL 2262  51G               TOTAL
FTOTMON2269  61G
FBLANK92302  11G
FOUTOS 2403 125G               OUT OF STOCK
FCUSERR2417 205G               CUSTOMER NOT ON.FILE
FITEMDR2439 125G               ITEM DROPPED
FCREDOV2453 115G               CREDIT OVER
FBLANK 2465  11G
```

E Display line 22 contains visible headings and fields into which data can be placed.

F Display line 24 is initially nondisplay. At execution time, any one of the items can be changed to display with normal or high intensity.

*No. of sheets per pad may vary slightly

```
C$ZORENCUSNO 2Y X R2
FHEAD1 0103 501G                CUSTOMER NUMBER   CUSTOMER NAME           X      A
F                                   SHIP TO
FCUSNO 0203   6  3N
FNAME  0221 221G
FSNAME 0246 22     1GN
FADDR1 0321 221G
FSADDR10346 22     1GN                                                           B
FADDR2 0421 221G
FSADDR20446 22     1GN
FADDR3 0521 221G
FSADDR30546 22     1GN
*
*  THE FIELD NAMES 'BLANK-' WILL CAUSE A BLANK LINE TO PRINT  NOT BE
*  SKIPPED  ON THE 3284 AND 3286 MODEL 1 AND 2 PRINTERS.
*
FBLANK10602  11G
FHEADR10703  81G                QUANTITY
FHEADR20712  71G                ITEM NO
FHEADR30728 111G                DESCRIPTION
FHEADR40748  51G                PRICE                                            C
FHEADR50757 111G                QTY ON HAND
FHEADR60770 101G                BACK ORDER
FQTY1  0803 04  3Y
FITEMN10812 08  1Y
FDESCR10824 201G
FPRICE10848  71G
FQTYOH10861  41G
FBACKO10873  41G
FBLANK20902  11G
FQTY2  1003  4  3Y
FITEMN21012  8  1Y
FDESCR21024 201G
FPRICE21048  71G
FQTYOH21061  41G
FBACKO21073  41G
FBLANK31102  11G
FQTY3  1203  4  3Y
FITEMN31212  8  1Y
FDESCR31224 201G
FPRICE31248  71G
FQTYOH31261  41G
FBACKO31273  41G                                                                 D
FBLANK41302  11G
FQTY4  1403  4  3Y
FITEMN41412  8  1Y
FDESCR41424 201G
FPRICE41448  71G
FQTYOH41461  41G
FBACKO41473  41G
FBLANK51502  11G
FQTY5  1603  4  3Y
FITEMN51612  8  1Y
FDESCR51624 201G
FPRICE51648  71G
FQTYOH51661  41G
FBACKO51673  41G
FBLANK61702  11G
FQTY6  1803  4  3Y
FITEMN61812  8  1Y
FDESCR61824 201G
FPRICE61848  71G
FQTYOH61861  41G
FBACKO61873  41G
FBLANK71902  11G
FQTY7  2003  4  3Y
FITEMN72012  8  1N
FDESCR72024 201G
FPRICE72048  71G
FQTYOH72061  41G
FBACKO72073  41G
FBLANK82102  11G
FTOTEX 2206 101G                EXCISE TAX
FTAXEX 2218  41G
FTOTST 2225  91G                STATE TAX
FTAXST 2236  41G
FTOTLT 2243  91G                LOCAL TAX
FTAXLT 2254  41G                                                                 E
FTOTAL 2262  51G                TOTAL
FTOTMON2269  61G
FBLANKA2302  11G
FBLANK92402  11G
FOUTOS 2404 125G                OUT OF STOCK
FCUSERR2417 205G                CUSTOMER NOT ON FILE
FITEMDR2439 125G                ITEM DROPPED                                     F
FCREDOV2453 115G                CREDIT OVER
/*
```

```
                         $ZOREN DISPLAY FORMAT INFORMATION
```

G

```
EXECUTION TIME DATA - OUTPUT AREA FORMAT - END POSITIONS FOR RPG PROGRAMS
-------------------------------------------------------------------------

*  FIELD     FIELD      END    *  FIELD     FIELD      END    *  FIELD     FIELD      END    *
*  NAME      LENGTH   POSITION *  NAME      LENGTH   POSITION *  NAME      LENGTH   POSITION *
*  ------    ------   -------- *  ------    ------   -------- *  ------    ------   -------- *
*  OPCODE     004       0004   *  LENGTH     004       0008   *  TMNAME     006       0014   *
*  $ZOREN     006       0020   *
```

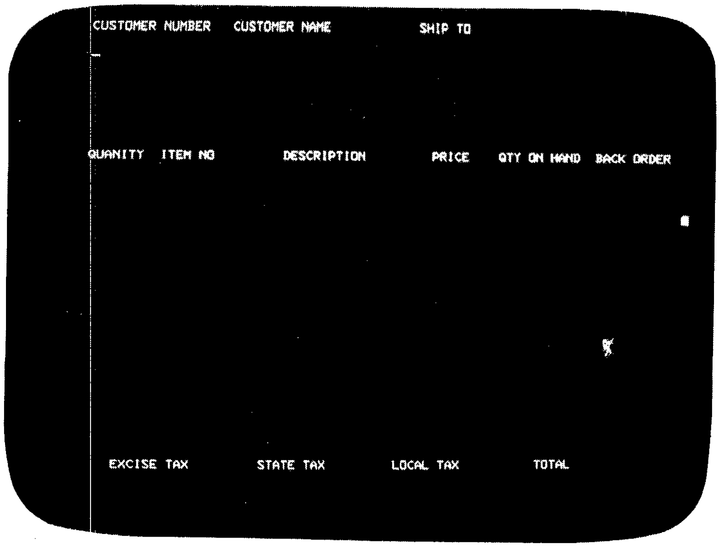
H

```
INPUT AREA FORMAT - END POSITIONS FOR RPG PROGRAMS
--------------------------------------------------

*  FIELD     FIELD      END    *  FIELD     FIELD      END    *  FIELD     FIELD      END    *
*  NAME      LENGTH   POSITION *  NAME      LENGTH   POSITION *  NAME      LENGTH   POSITION *
*  ------    ------   -------- *  ------    ------   -------- *  ------    ------   -------- *
*  RTCODE     004       0004   *  LENGTH     004       0008   *  TMNAME     006       0014   *
*  - AID-     001       0015   *  CUSNO      006       0021   *  SNAME      022       0043   *
*  SADDR1     022       0065   *  SADDR2     022       0087   *  SADDR3     022       0109   *
*  QTY1       004       0113   *  ITEMN1     008       0121   *  QTY2       004       0125   *
*  ITEMN2     008       0133   *  QTY3       004       0137   *  ITEMN3     008       0145   *
*  QTY4       004       0149   *  ITEMN4     008       0157   *  QTY5       004       0161   *
*  ITEMN5     008       0169   *  QTY6       004       0173   *  ITEMN6     008       0181   *
*  QTY7       004       0185   *  ITEMN7     008       0193   *

LENGTH OF OUTPUT RECORD AREA REQUIRED IN DFF PROGRAM
         RPG *SUBR92* - 0020        OTHER - 0012

LENGTH OF INPUT RECORD AREA REQUIRED IN DFF PROGRAM
         RPG *SUBR92* - 0193        OTHER - 0185
```

J

```
INFORMATION FOR USE DURING CCP ASSIGNMENT STAGE
-----------------------------------------------

THE DECIMAL LENGTH OF THE FIELD DESCRIPTOR TABLE IS 1150
THE DECIMAL LENGTH OF THE OUTPUT TEXT IS 1146
THE DECIMAL LENGTH OF THE INPUT TEXT IS 0240
```

The generated display format appears as follows:



```
CUSTOMER NUMBER   CUSTOMER NAME          SHIP TO
_

QUANITY  ITEM NO        DESCRIPTION        PRICE    QTY ON HAND  BACK ORDER



   EXCISE TAX         STATE TAX         LOCAL TAX         TOTAL
```

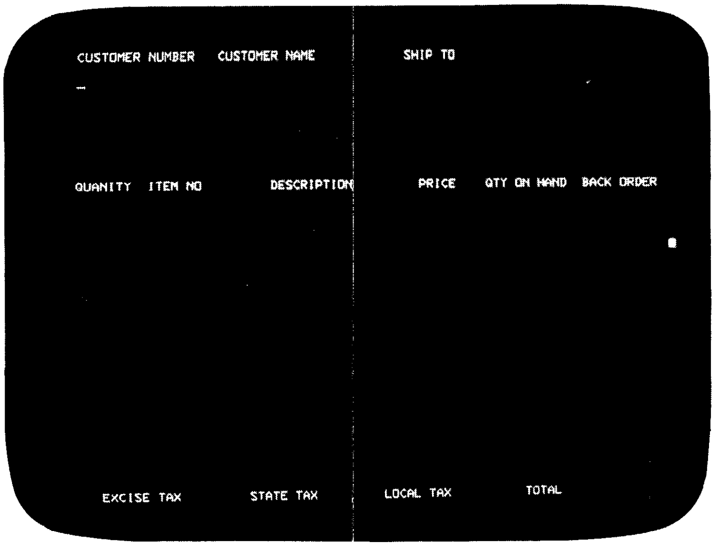
Example 2 — RPG II MRT Program Using the Display Format Facility

This RPG II Multiple Requesting Terminal (MRT) program uses the Display Format Facility (DFF) to support the 3270 terminals. Included in the example are a program description, flowcharts, and RPG II coding.

The terminal operator is requested to press the CLEAR key before entering the program name so that unwanted data is not received with the PROGRAM REQUEST.

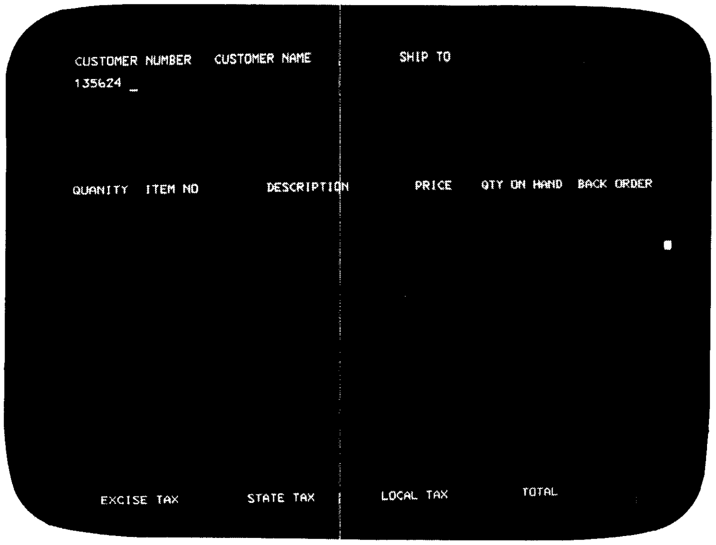
The application program will request the display format (by name) and cause it to be sent to the 3270 screen. The method of formatting the initial display for the order entry program is explained in *Example 1 — DFF Formatting Example.* The Order Entry display format was generated previously and stored in the object library with the name of $ZOREN.

When the initial format is placed on the screen, the cursor is positioned at line 2, position 3.



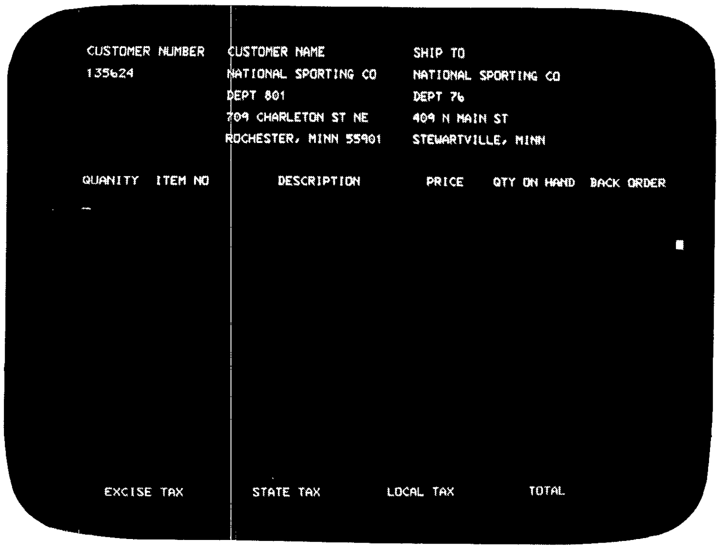
```
CUSTOMER NUMBER   CUSTOMER NAME              SHIP TO
_

QUANITY  ITEM NO          DESCRIPTION          PRICE    QTY ON HAND  BACK ORDER


EXCISE TAX          STATE TAX          LOCAL TAX          TOTAL
```

The terminal operator enters the customer number and presses ENTER.



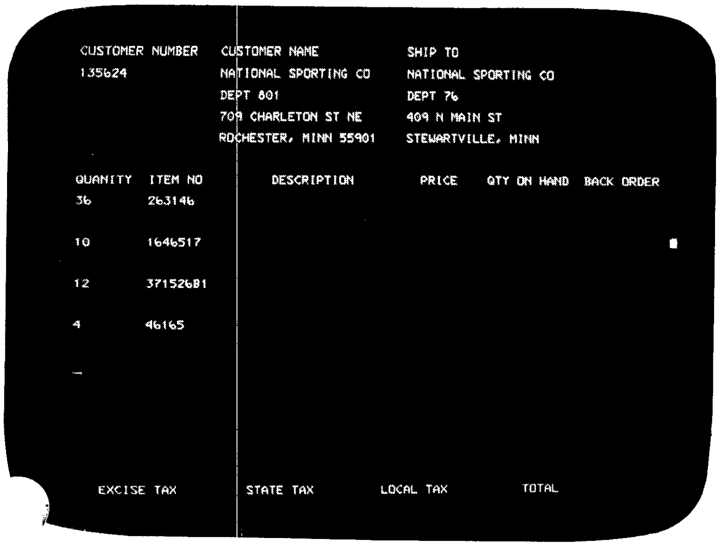
```
CUSTOMER NUMBER   CUSTOMER NAME              SHIP TO
135624 _

QUANITY  ITEM NO          DESCRIPTION          PRICE    QTY ON HAND  BACK ORDER


EXCISE TAX          STATE TAX          LOCAL TAX          TOTAL
```

The program uses the number to retrieve the customer name, customer address and ship-to information from the customer master file.



```
CUSTOMER NUMBER  CUSTOMER NAME            SHIP TO
135624           NATIONAL SPORTING CO     NATIONAL SPORTING CO
                 DEPT 801                 DEPT 76
                 709 CHARLETON ST NE      409 N MAIN ST
                 ROCHESTER, MINN 55901    STEWARTVILLE, MINN

QUANITY  ITEM NO      DESCRIPTION        PRICE   QTY ON HAND  BACK ORDER
_
                                                                       ■






    EXCISE TAX       STATE TAX        LOCAL TAX        TOTAL
```

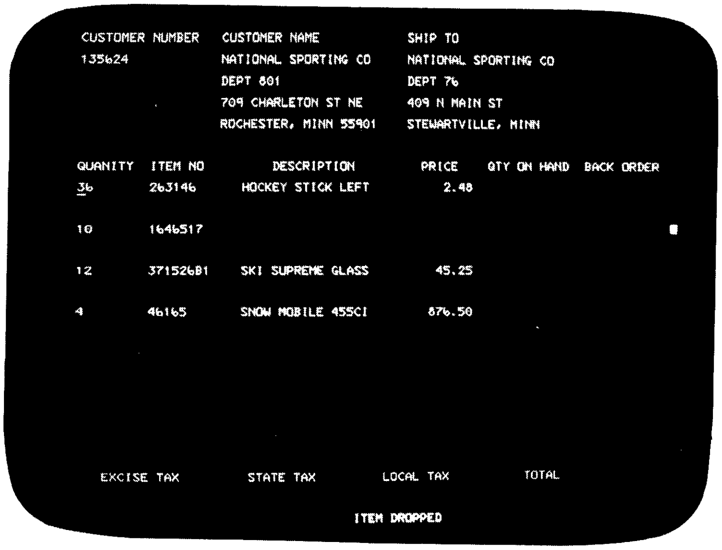
Customer name and address fields are output fields and cannot be altered, but the ship-to fields are output/input fields and can be changed by the operator if necessary. Next, the quantity and item number for each item are keyed in and ENTER is pressed.



```
CUSTOMER NUMBER  CUSTOMER NAME            SHIP TO
135624           NATIONAL SPORTING CO     NATIONAL SPORTING CO
                 DEPT 801                 DEPT 76
                 709 CHARLETON ST NE      409 N MAIN ST
                 ROCHESTER, MINN 55901    STEWARTVILLE, MINN

QUANITY  ITEM NO      DESCRIPTION        PRICE   QTY ON HAND  BACK ORDER
36       263146

10       1646517                                                       ■

12       37152681

4        46165

_


    EXCISE TAX       STATE TAX        LOCAL TAX        TOTAL
```

All data fields that have been modified are received by the application program. The items are verified by comparing against the inventory master file. If items are verified and sufficient stock is on hand, the description and price are returned to the terminal.

If an item is not found, the item number field is changed to high intensity and ITEM DROPPED is displayed at high intensity.



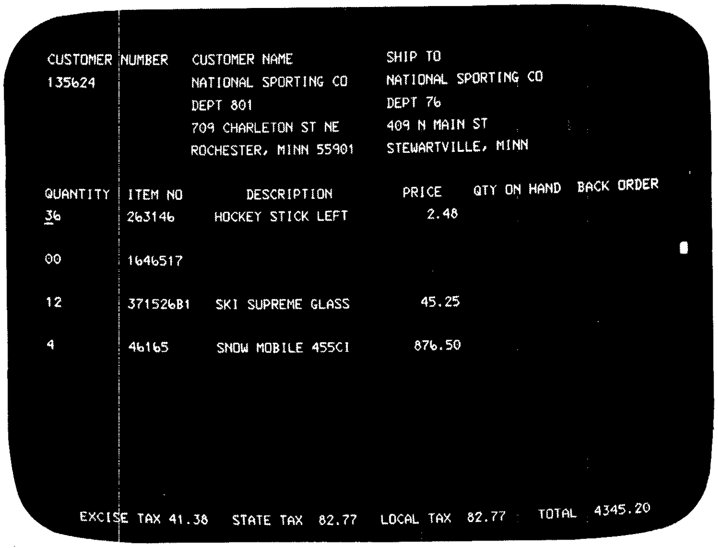
```
CUSTOMER NUMBER  CUSTOMER NAME            SHIP TO
135624           NATIONAL SPORTING CO     NATIONAL SPORTING CO
                 DEPT 801                 DEPT 76
                 709 CHARLETON ST NE      409 N MAIN ST
                 ROCHESTER, MINN 55901    STEWARTVILLE, MINN

QUANITY  ITEM NO     DESCRIPTION          PRICE   QTY ON HAND  BACK ORDER
36       263146      HOCKEY STICK LEFT      2.48

10       1646517                                                        ■

12       37152681    SKI SUPREME GLASS     45.25

4        46165       SNOW MOBILE 455CI    876.50




    EXCISE TAX       STATE TAX        LOCAL TAX        TOTAL

                          ITEM DROPPED
```

If the item number is verified but there is insufficient stock on hand, the description, price, quantity on hand, and back ordered fields are displayed. OUT OF STOCK changes from nondisplay to high intensity and the item is entered in the back order file.

Once the item information is displayed, the operator can verify the status of the order and make any changes desired. For example, when OUT OF STOCK is indicated, the quantity field could be rekeyed for the intensified items.

For ITEM DROPPED, enter zeros in the quantity field to delete the entry. (Any item can be deleted by entering zeros in its quantity field.)

After all exceptions have been satisfied, ENTER is pressed. When the program recognizes that all items have been processed and there are no exceptions, it calculates all prices and taxes and verifies customer credit status.



```
CUSTOMER NUMBER   CUSTOMER NAME            SHIP TO
135624            NATIONAL SPORTING CO     NATIONAL SPORTING CO
                  DEPT 801                 DEPT 76
                  709 CHARLETON ST NE      409 N MAIN ST
                  ROCHESTER, MINN 55901    STEWARTVILLE, MINN

QUANTITY  ITEM NO        DESCRIPTION         PRICE    QTY ON HAND  BACK ORDER
36        263146     HOCKEY STICK LEFT        2.48

00        1646517

12        37152681   SKI SUPREME GLASS       45.25

4         46165      SNOW MOBILE 455CI      876.50




   EXCISE TAX 41.38   STATE TAX  82.77   LOCAL TAX  82.77    TOTAL  4345.20
```

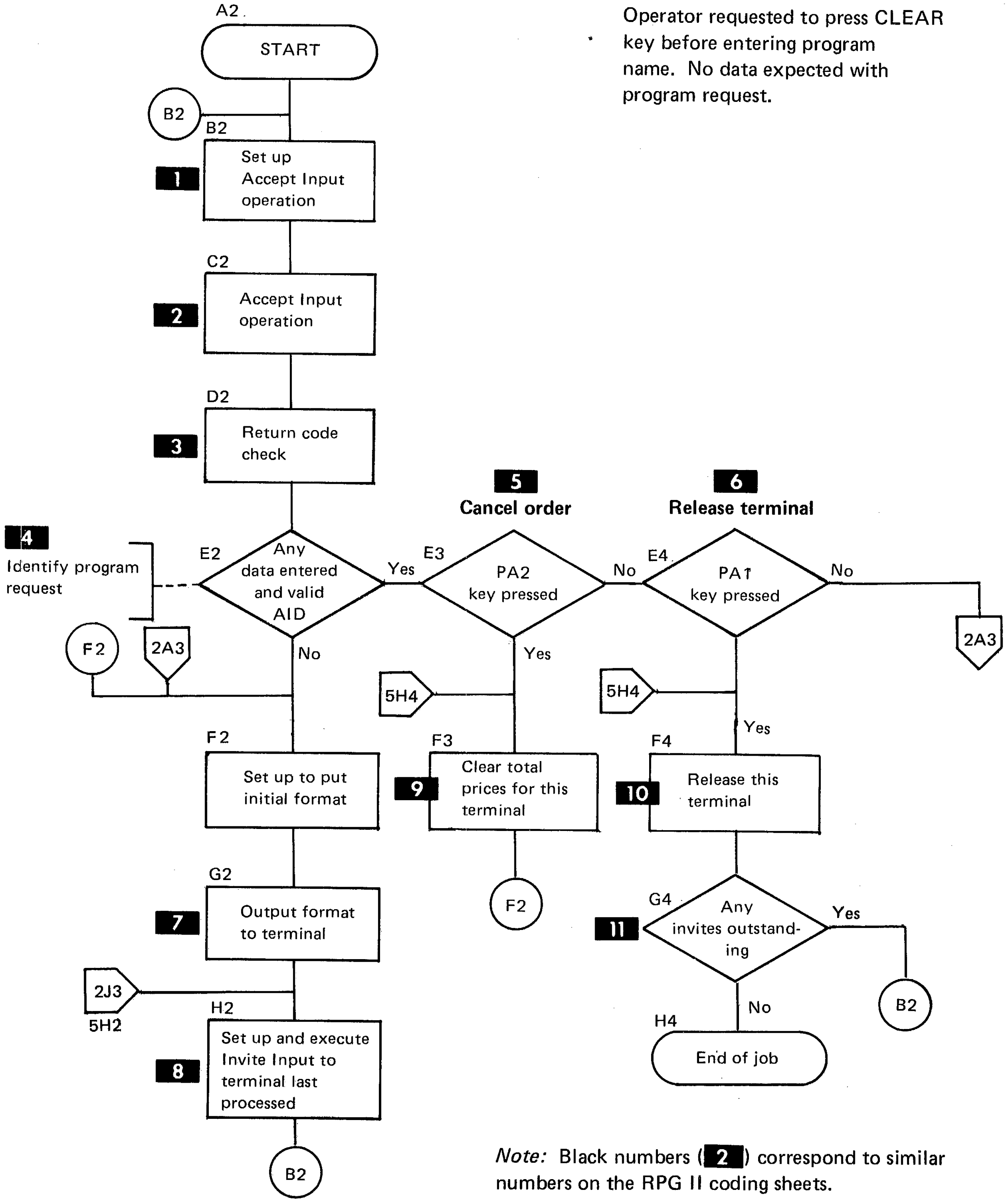
If the credit status is unacceptable, CREDIT OVER is displayed at high intensity. The display now includes the total fields.

The operator verifies the order including totals and credit. If acceptable, the PF1 key (enter order key) is pressed, and, if the credit check was good, the inventory file and customer account file are updated and the display is printed on the 3286. If the credit check was not good, the files are not updated but the display, including the credit over field, is printed on the 3286.

When the order has been completed and all files are updated, a new display format is sent to the terminal, ready for a new order.

Any order may be canceled at any time by pressing the PA2 key (cancel order key). The program then displays a new display format on the terminal.

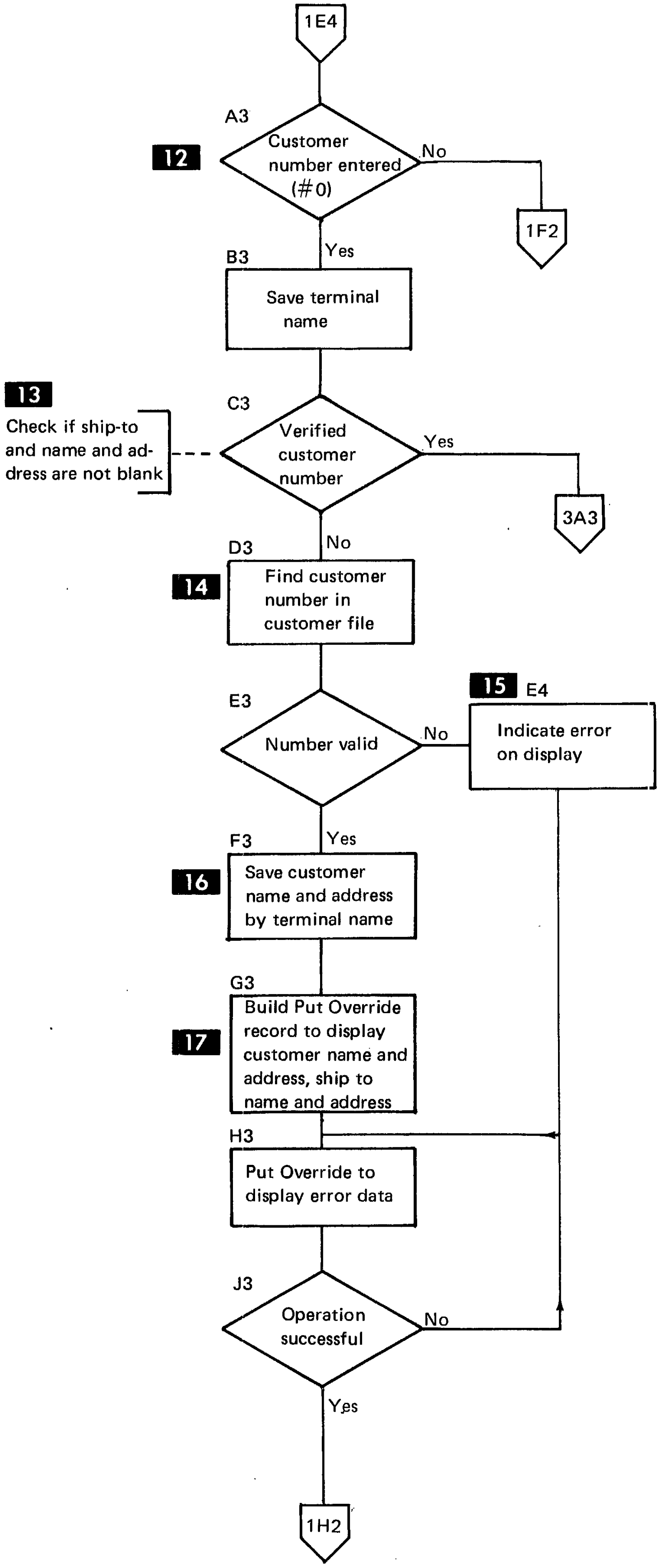
The terminal may be released from the application program by pressing the PA1 key (release terminal key). The terminal would then be free to request another application and also may request the application program when desired by rekeying the program name.



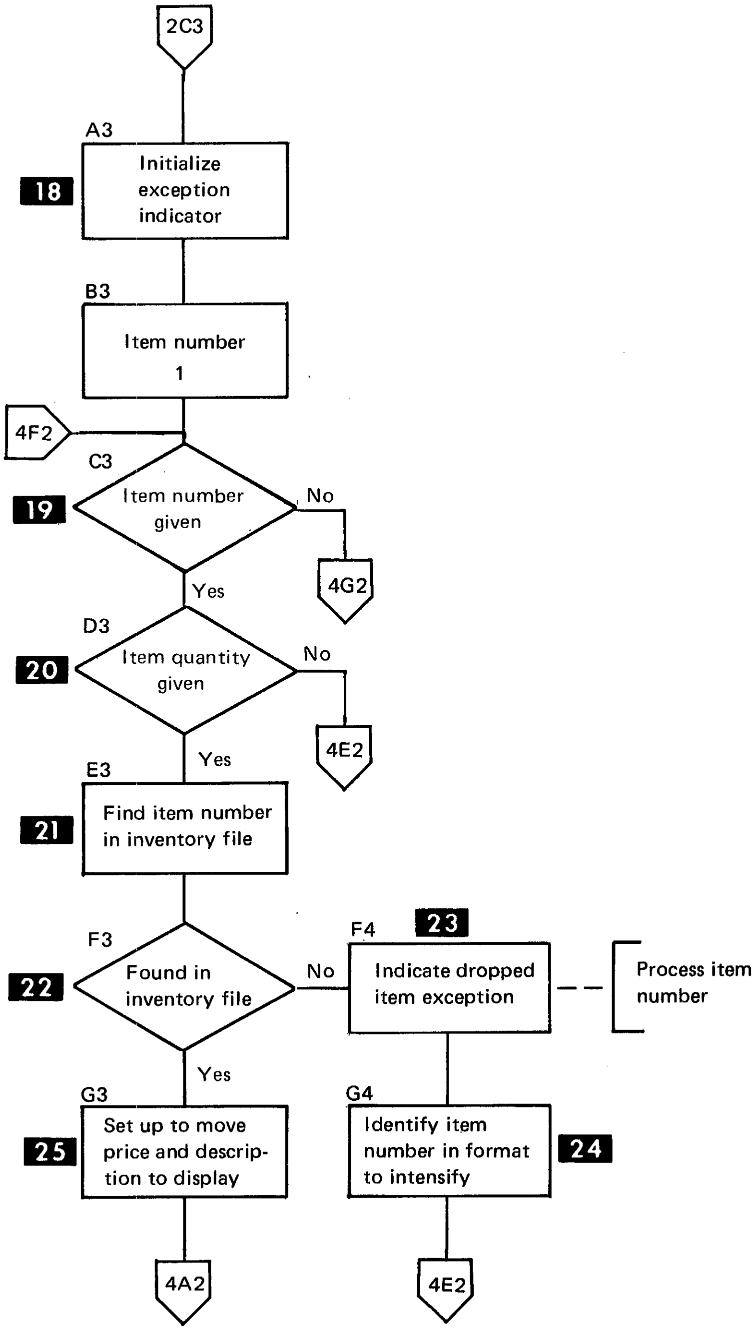
Operator requested to press CLEAR key before entering program name. No data expected with program request.

Note: Black numbers (**2**) correspond to similar numbers on the RPG II coding sheets.

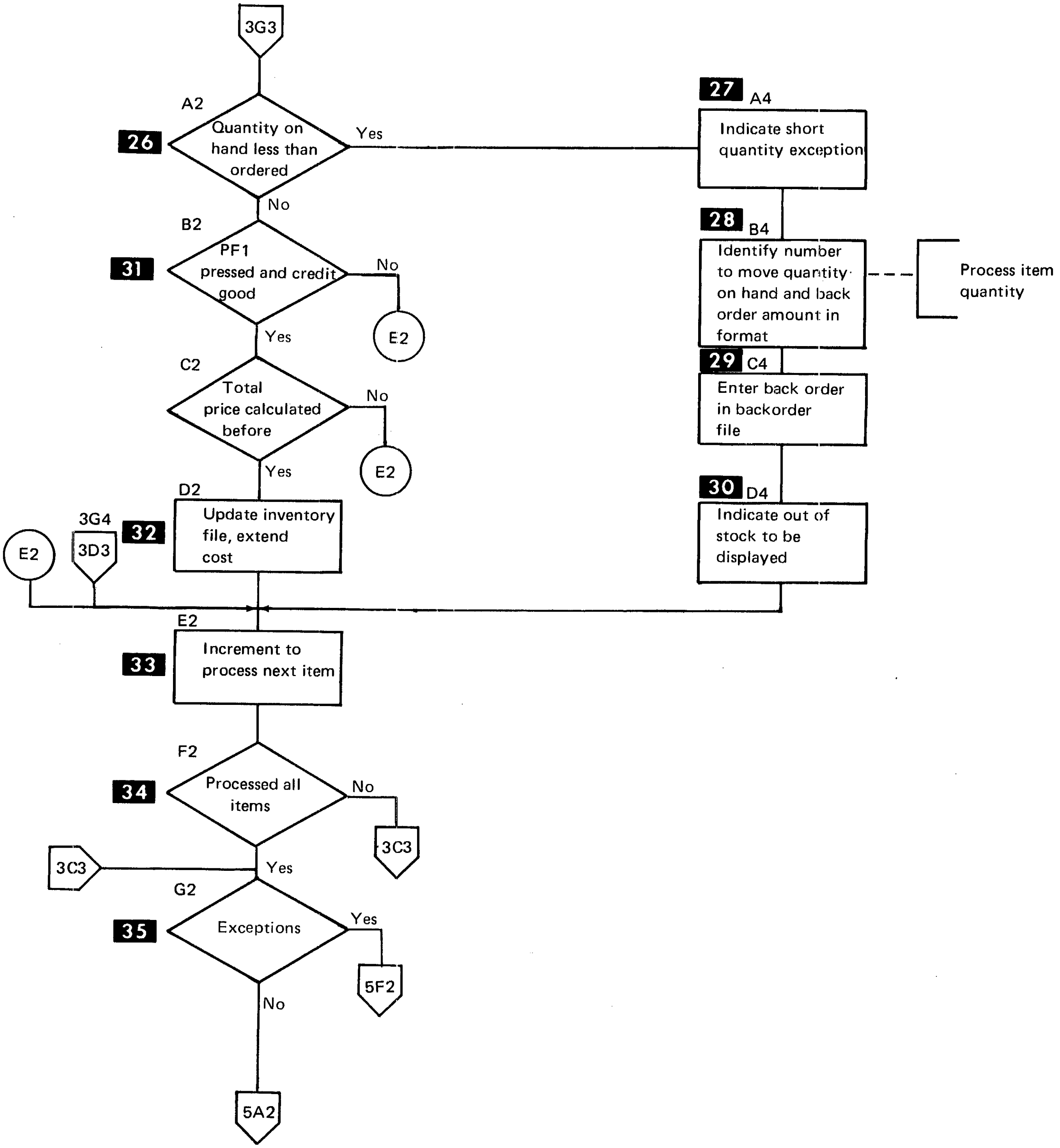
Order Entry Program Flow (Part 1 of 5)



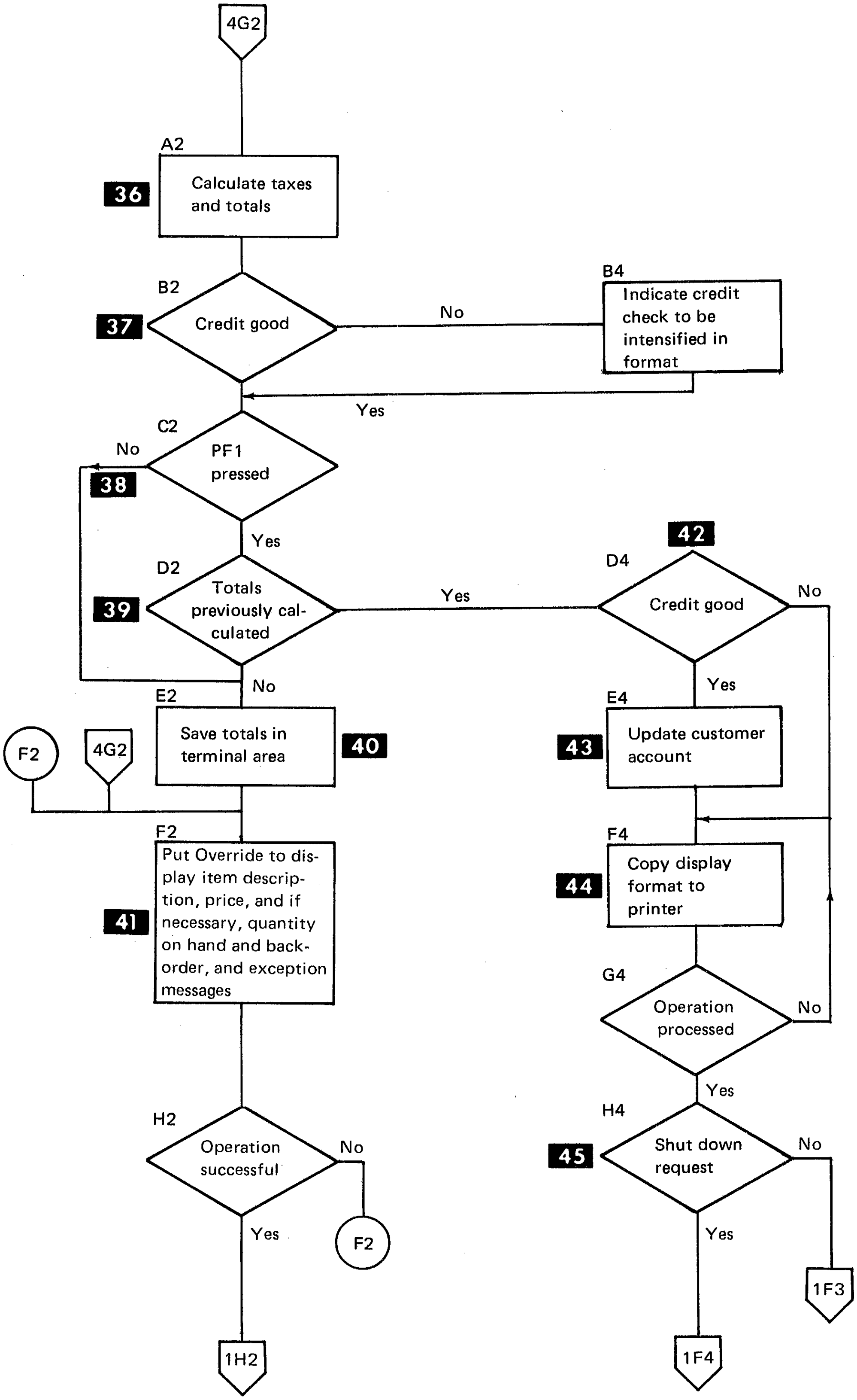
Order Entry Program Flow (Part 2 of 5)



Order Entry Program Flow (Part 3 of 5)



Order Entry Program Flow (Part 4 of 5)



Order Entry Program Flow (Part 5 of 5)

IBM International Business Machine Corporation

RPG CONTROL CARD AND FILE DESCRIPTION SPECIFICATIONS

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Control Card Specifications

```
01 H
```

File Description Specification

```
02 FTERMIN  IP    193 193            SPECIAL       SUBR92
03 F                                              KPL
04 FTERMOUT O     674 674            SPECIAL       SUBR92
05 F                                              KPL
06 FINVENTRYUC    768 256R           DISK
07 FCUSTNAMEUC    256 256R           DISK
08 FCUSTSHIPIC    256 128R           DISK
09 FHOLDORDRO     240  80            DISK
10 FONORDER O     256 128            DISK
```

IBM International Business Machine Corporation

RPG EXTENSION AND LINE COUNTER SPECIFICATIONS

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Extension Specifications

```
01 E                    PL      5   5  6               COMPILE-TIME
02 E*  PARAMETER ARRAY CONTAINS ACCEPT INPUT OP
03 E*  CODE AND INPUT LENGTH AT COMPILE TIME.
04 E*                   TNM         6  6
05 E*  TNM IS HOLD AREA OF TERMINAL NAMES THIS PROGRAM IS
06 E*  COMMUNICATING WITH.  IT IS BUILT AT EXECUTION TIME.
07 E*
08 E                    TPR         6  6
   E*  TPR IS BUILT AT EXECUTION TIME, AND IT INDICATES WHETHER
   E*  A TOTAL PRICE HAS BEEN CALCULATED PREVIOUSLY FOR A
   E*  CURRENT ORDER
```

RPG EXTENSION AND LINE COUNTER SPECIFICATIONS

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Program Identification (75–80): ORDENT

Extension Specifications

Line (3–5)	Form Type (6)	Record Sequence of the Chaining File (7–8)	Number of the Chaining Field (9–10)	From Filename (11–18)	To Filename (19–26)	Table or Array Name (27–32)	Number of Entries Per Record (33–35)	Number of Entries Per Table or Array (36–39)	Length of Entry (40–42)	P/B/L/R (43)	Decimal Positions (44)	Sequence (A/D) (45)	Table or Array Name (Alternating Format) (46–51)	Length of Entry (52–54)	P/B/L/R (55)	Decimal Positions (56)	Sequence (A/D) (57)	Comments (58–74)
01	E					QTY		7	4		0							QUANTITY ORDERED
02	E					ITMN		7	8									ITEM NUMBER
03	E					CNM		6	22									CUSTOMER NAME
04	E					CA1		6	22									CUSTOMER ADDRESS1
05	E					CA2		6	22									CUSTOMER ADDRESS2
06	E					CA3		6	22									CUSTOMER ADDRESS3
07	E					C#		6	6		0							CUSTOMER NUMBER
08	E					INT		7	1									TYPE ITEM NUMBER
	E					ONH		7	4									QNTY ON HAND
	E					BOA		7	4									BACKORDER AMNT

RPG EXTENSION AND LINE COUNTER SPECIFICATIONS

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Program Identification (75–80): ORDENT

Extension Specifications

Line (3–5)	Form Type (6)	Record Sequence of the Chaining File (7–8)	Number of the Chaining Field (9–10)	From Filename (11–18)	To Filename (19–26)	Table or Array Name (27–32)	Number of Entries Per Record (33–35)	Number of Entries Per Table or Array (36–39)	Length of Entry (40–42)	P/B/L/R (43)	Decimal Positions (44)	Sequence (A/D) (45)	Table or Array Name (Alternating Format) (46–51)	Length of Entry (52–54)	P/B/L/R (55)	Decimal Positions (56)	Sequence (A/D) (57)	Comments (58–74)
01	E					PR		7	5		2							PRICE OF ITEM
02	E					DSC		7	20									DESCRIPTION
03	E					CROK		6	1									CREDIT OKAY/NOTOK
04	E																	
05	E																	
06	E																	
07	E																	
08	E																	
	E																	
	E																	

IBM International Business Machine Corporation

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Program Identification ORDENT

	Line	Form Type	Filename	Sequence (AND/OR)	Number (1-N)	Option (O)	Record Identifying Indicator	Position	Not (N)	C/Z/D	Character	Field Location From	Field Location To	Decimal Positions	Field Name	Control Level (L1-L9)	Matching Fields or Chaining Fields	Field Record Relation	Field Indicators Plus	Field Indicators Minus	Field Indicators Zero or Blank
2	01	I	* RECEIVE DATA FROM THE TERMINAL																		
	02	I	*																		
	03	I	TERMIN	AA			95	15		C	%										
	04	I	* PA1 PRESSED OR RELEASE TERMINAL REQUEST																		
	05	I		OR			96	15		C	>										
	06	I	* PA2 PRESSED OR CANCEL ORDER																		
	07	I	*																		
	08	I		BB			01	15		C	'										
	09	I		OR			02	15		C	1										
	10	I	* ENTER KEY OR PF1 KEY DEPRESSED																		
	11	I										1	2	0	RTNCOD						
	12	I										9	14		TNAME						
	13	I										15	15		AID						
12	14	I										16	21	0	CUSNO						97
	15	I										22	43		SNAME						
	16	I										44	65		SADDR1						
	17	I										66	87		SADDR2						
	18	I										88	109		SADDR3						
	01	I										110	113		QTY,1						
	02	I										114	121		ITMN,1						
	03	I										122	125		QTY,2						
	04	I										126	133		ITMN,2						
	05	I										134	137		QTY,3						
	06	I										138	145		ITMN,3						
	07	I										146	149		QTY,4						
	08	I										150	157		ITMN,4						
	09	I										158	161		QTY,5						
	10	I										162	169		ITMN,5						
	11	I										170	173		QTY,6						
	12	I										174	181		ITMN,6						
	13	I										182	185		QTY,7						
	14	I										186	193		ITMN,7						
4	15	I		CC			97														
	16	I										1	2	0	RTNCOD						
	17	I										15	15		AID						
	18	I	***** UNIDENTIFIED RECORD, ALSO FOR NEW REQUESTOR TERMINAL																		
	19	I																			
	20	I																			
		I																			
		I																			
		I																			
		I																			
		I																			

RPG INPUT SPECIFICATIONS

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```
01 I*****
02 I*****     INPUT SPEC FOR INVENTORY FILE
03 IINVENTRYAA  12
04 I
05 I
06 I
07 I
08 I*****     INPUT SPEC FOR CUSTOMER NAME FILE
09 ICUSTNAMEAA  10
10 I
11 I
12 I*****     INPUT SPEC FOR CUSTOMER ACCOUNT FILE
13 ICUSTSHIPAA  11
14 I
15 I
```

RPG CALCULATION SPECIFICATIONS

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```
01 C*  DEFINE A 'BLANK' FIELD
02 C  N22                MOVE ' '       BLANKC 22
03 C                     SETON                     22
04 C*  RESET ALL INICATORS FROM PREVIOUS CYCLE
05 C                     SETOF                     03
06 C                     SETOF                     101112
07 C                     SETOF                     748081
08 C                     SETOF                     828385
09 C                     SETOF                     868788
10 C                     SETOF                       9899
11 C*****      CHECK RETURN CODE
12 C                     EXSR RTNCHK
13 C   98                GOTO INVITE                     REREAD IF ERROR
14 C   90                GOTO END                        OR SHUT DOWN
15 C*****
16 C*****      FIND OUT WHICH TERMINAL THIS IS
17 C                     MOVE 1         N       10        INIT INDEX
18 C           PL,5      LOKUPTNM,N                    20FIND NAME
19 C*****
20 C*****      IF NAME NOT FOUND, FIND FIRST BLANK ENTRY
   C*****      AND INSERT THIS TERMINAL NAME
   C     N20   '       ' LOKUPTNM,N                    21
   C                     MOVE PL,5      TNM,N
   C*****      SINCE ONLY 6 TERMINALS ARE IN THE SYSTEM AN ENTRY
   C*****      WILL ALWAYS EXIST
```

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```
    01 C*          HANDLE REQUEST TO CANCEL THE ORDER
    02 C*
5   03 C   96                GOTO CANCEL                     CLEAR TOTAL
    04 C*          AND SEND NEW FORMAT TO TERMINAL
    05 C* * * * * * * * * * * * * * * * * * * * * * * * * * *
    06 C*
    07 C*          HANDLE REQUEST TO RELEASE TERMINAL
6   08 C  N95                GOTO CONT1
    09 C*          IF NOT RELEASE, CONTINUE
    10 C           RELEAS    TAG
10  11 C                     SETON                     95    RELSE TERMINAL
    12 C                     EXCPT
    13 C*          IF THE FOLLOWING COMPARE OPERATION
    14 C*          WERE REPLACED WITH THE COMMENTED INSTRUCTION, THE
    15 C*          PROGRAM WOULD BE A NEVER ENDING PROGRAM.
    16 C                     MOVE PL,3      OUTSII 20        IF NO OUTSTAND-
11  17 C           00        COMP OUTSII                   LRING INVITES, EJ
    18 C                     GOTO END
    19 C* * * * * * * * * * * * * * * * * * * * * * * * * * * * *
    20 C*  90      00        COMP OUTSII                   LR   *
       C* * * * * * * * * * * * * * * * * * * * * * * * * * * * *
    01 C           CONT1     TAG
    02 C* * * * * * * * * * * * * * * * * * * * * * * * *
    03 C*    IF THIS IS A PROGRAM REQUEST, SEND THE     *
    04 C*    FORMAT TO THE TERMINAL. ALSO SEND INITIAL  *
    05 C*    FORMAT FOR CLEAR KEY, AND UNIDENTIFIED     *
    06 C*    INPUT RECORD                               *
    07 C*                                               *
9   08 C  N97                GOTO CONT2
    09 C*          CANCEL ORDER AND RESET FOR NEW ORDER
    10 C           RESET     TAG
    11 C           CANCEL    TAG
    12 C                     MOVE '5'       CROK,N           REINIT CREDIT
    13 C                     Z-ADD0         TPR,N            CLEAR TOT PRICE
    14 C                     SETON                     80
    15 C                     SETOF                     970102
    16 C  N99                GOTO INVITE
    17 C   90                GOTO RELEAS                     IF SHUTDOWN
    18 C*                                                    RELSE TERMINAL
    19 C
    20 C
       C
       C
       C
       C
       C
```

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```
    01 C           CONT2     TAG
    02 C*************************************************
    03 C*    CHECK IF CUSTOMER NUMBER HAS BEEN VERIFIED
    04 C*
13  05 C           BLANKC    COMP SNAME                    81
    06 C  N81                GOTO PROCESS
    07 C*     IF SHIP TO NAME IS NOT BLANK, CUSTOMER NUMBER
    08 C*    HAS BEEN VERIFIED
    09 C*
14  10 C*    VERIFY CUSTOMER NUMBER
    11 C                      ⌇
    12 C
15  13 C*    SETON INDR 82 IF NUMBER NOT CORRECT
    14 C*    SAVE CUSTOMER NAME, ADDRESS AND NUMBER
16  15 C  N82                MOVE CNAME     CNM,N
    16 C  N82                MOVE CADDR1    CA1,N
    17 C  N82                MOVE CADDR2    CA2,N
    18 C  N82                MOVE CADDR3    CA3,N
    19 C  N82                MOVE CNUMB     C#,N
    11 C*
    12 C*   EITHER A 5 (CREDIT OK) OR A 2 (NOT OK) IS MOVED INTO CROK,N
    13 C*                     ⌇
    14 C
18  15 C                     GOTO INVITE
    01 C           PROCESS   TAG
    02 C*    START PROCESSING ITEM NUMBERS AND QUANTITY
    03 C*
    04 C*    REINITIALIZE EXCEPTION LOGIC FLAGS AND POINTER
    05 C*    TO LINE NUMBER TO PROCESS
    06 C*
    07 C                     SETOF                     8586
    08 C*    85-ITEM NOT FOUND
    09 C*    86-BACK ORDER ITEM
    10 C                     MOVE 1         I       10
    11 C*
    12 C                     MOVE ' '       INT              BLANK OUT TYPE
    13 C                     MOVE ' '       ONH              BLANK OUT
    14 C                     MOVE ' '       BOA              OUTPUT
    15 C                     Z-ADD000.00    PR               ARRAYS
    16 C                     MOVE BLANKC    DSC
    17 C                     SETON                     73
    18 C
    19 C
    20 C
       C
       C
       C
       C
       C
```

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	Line	Form Type	Control Level (L0-L9, LR, SR, AN/OR)	Indicators	Factor 1	Operation	Factor 2	Result Field Name	Length	Decimal Positions	Half Adjust (H)	Plus / 1>2 / High	Minus / 1<2 / Low	Zero / 1=2 / Equal	Comments
	01	C	**		BEGIN LOOP TO PROCESS ITEMS										
	02	C			LOOP	TAG									
	03	C	**	IF ITEM NUMBER NOT GIVEN (BLANK, 88 ON), END OF PROCESSING											
	04	C	**	OF ITEMS FOR THIS TERMINAL.											
19	05	C			' '	COMP	ITMN,I							88	
	06	C		88		GOTO	ENDLOP								
	07	C	**												
	08	C	**	CHECK IF ITEM QUANTITY IS GIVEN											
20	09	C			0000	COMP	QTY,I							88	
	10	C	**	IF NOT GIVEN, SKIP PROCESSING OF THIS ITEM											
	11	C		88		GOTO	NXTITM								
21	12	C	**	FIND THE ITEM IN INVENTORY FILE											
	13	C			⋮	⋮									
	14	C			⋮	⋮									
22	15	C			←——→	CHAIN	INVENTRY					79			
23	16	C		79		SETON						85			
	17	C	**	INDICATOR 85 SET ON IF ITEM IS NOT FOUND IN THE FILE											
24	18	C		85		MOVE	'2'	INT,I							MAKE ITEM #
	19	C		85		GOTO	NXTITM								HIGH INTENSITY
	01	C	*	ITEM FOUND NOW MOVE PRICE AND DESCRIPTION TO											
	02	C	*	OUTPUT ARRAY ELEMENTS FOR THE PUT OVERRIDE											
	03	C				⋮									
25	04	C				⋮									
	05	C				MOVE	INVDSC	DSC,I							
	06	C				MOVE	INVPR	PR,I							
	07	C				⋮									
	08	C				⋮									
	09	C	*												
	10	C	*	NOW CHECK IF QUANTITY ORDERED EXCEEDS QUANTITY ON HAND											
26	11	C	*												
	12	C			INVQTY	COMP	QTY,I						79		
30	13	C		79		SETON							86		BACK ORDER
27	14	C		79		GOTO	BACK OR								SET UP BACK ORD
	15	C	*												
	16	C													
	17	C													
	18	C													
	19	C													
	20	C													
		C													
		C													
		C													
		C													
		C													

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```
    01 C*          SETUP FOR NO BACK ORDER
    02 C                     ~
    03 C*    UPDATE INVENTORY IF ORDER IS TO BE ENTERED AND
    04 C*    CREDIT IS OKAY AND TOTAL PRICE CALCULATED
    05 C*    PREVIOUSLY.
31  06 C*
    07 C   02      '5'       COMP CROK,N                   72
    08 C   02      0000000   COMP TPR,N                    73
    09 C*
32  10 C* OK TO UPDATE INVENTORY FILE FOR THIS ITEM IF 72 IS ON, 73 OFF
    11 C*
    12 C   72N73             EXCPT
    13 C                     SETOF                     L2
    14 C                     GOTO NXTITM
    15 C*
    01 C*    CREATE BACKORDER
    02 C*
    03 C*    INITIALIZE FIELDS FOR OVERRIDE TO TERMINAL
    04 C           BACKOR    TAG
28  05 C                     ~
    06 C                     ~
    07 C                     MOVE INVONH    ONH,I           ON HAND AMOUNT
    08 C                     MOVE INVBOA    BOA,I           BACK ORDER AMT
    09 C                     EXCPT
29  10 C                     SETOF                     L2
    11 C*
    12 C           NXTITM    TAG
33  13 C*    CHECK IF FINISHED WITH ALL 7 ITEMS OR IF MORE WORK TO DO
    14 C           I         ADD  1         I
    15 C           8         COMP I                    08
34  16 C   08                GOTO LOOP
    17 C
    18 C
    19 C
    20 C
```

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```
    01 C*   FINISHED PROCESSING THE ITEMS.
    02 C*   NOW DECIDE IF TOTALS, TAXES AND CREDIT SHOULD BE CALCULATED
    03 C*   NO CALCULATIONS IF EXCEPTION CONDITIONS EXIST
    04 C           ENDLOP    TAG
35  05 C   85
    06 COR 86                GOTO INVITE
    07 C*
    08 C*   CALCULATE TAXES AND TOTALS AND CREDIT.
    09 C
    10 C               36    EXCPT
    11 C                     SETOF                     10
37  12 C*   CREDIT NOT OKAY IF INDICATOR 87 IS ON
    13 C*   IF PF1 PRESSED, A TOTAL WAS CALCULATED PREVIOUSLY
    14 C*   (SO THE OPERATOR SAW THE TOTAL AT LEAST ONCE AND TO ENSURE
38  15 C*   THAT THE TOTAL IS AT THE TERMINAL TO BE COPIED TO THE PRINTER
    16 C*   AND CREDIT IS OKAY, FINISH THE ORDER.
39  17 C   73                MOVE TOTREC    TPR,N            TOTAL NOT CALC
    18 C   01                                                PREVIOUSLY
40  19 COR 73                GOTO INVITE
    20 C*
       C*  FINALIZE THE ORDER WITH EXCEPTION OUTPUT IF PF1 ON
    01 C   02                EXCPT
42  02 C                     SETOF                     03
43  03 C*  REINITIALIZE TERMINAL DEPENDENT DATA
44  04 C                     Z-ADD0         TPR
    05 C                     MOVE '5'       CROK,N
    06 C                     MOVE BLANK     CNM,N
    07 C                     MOVE BLANK     CA1,N
    08 C                     MOVE BLANK     CA2,N
    09 C                     MOVE BLANK     CA3,N
    10 C                     MOVE 0000      C#,N
    11 C                     Z-ADD0         TPR,N
    12 C                     SETOF                     0201
45  13 C   99                GOTO RELEAS                      SHUTDWN REL TER
    14 C                     GOTO RESET                       ISSUE NEW FORMT
8   15 C           INVITE    TAG
    16 C                     SETON                     74     INVITE
    17 C           END       TAG
    18 C   85
    19 COR 86                SETON                     83
    20 C
       C
       C
       C
       C
       C
```

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```
C
01 C*
02 C*
03 C*          SUBROUTINE TO CHECK RETURN CODE
04 CSR         RTNCHK    BEGSR
05 CSR 91                SETON                     98    IF ERROR
06 CSR 92      04        COMP RTNCOD               88  99SHUTDOWN-99
07 C*                                                    TRUNCATED-88
08 CSR 99                SETON                     90
09 CSR                   SETOF                     9192
10 CSR                   ENDSR
11 C
12 C
```

RPG OUTPUT SPECIFICATIONS

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Commas	Zero Balances to Print	No Sign	CR	-
Yes	Yes	1	A	J
Yes	No	2	B	K
No	Yes	3	C	L
No	No	4	D	M

X = Remove Plus Sign
Y = Date Field Edit
Z = Zero Suppress

Constant or Edit Word

```
O
01 OINVENTRYE        12N73 72
02 O
03 O
04 OCUSTNAMEE        02 10N87
05 O
06 O
07 OHOLDORDRD        02 12 86
08 O
09 O
10 OONORDER E        02 12N86
11 O
12 O
13 O*
14 O*  THIS IS UPDATING THE CUSTOMER'S ACCOUNT
15 O*
16 O
17 O
18 O
19 O
20 O
```

42
43

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7

17

```
01 O* FIRST OUTPUT IS FOR PUT WHOLE FORMAT TO TERMINAL.
02 O*
03 OTERMOUT D        80
04 O                                    8 '20'
05 O                                    4 '  CB'
06 O                         PL,5      14
07 O                                   20 '$ZOREN'
08 O
01 O* PUT OUT THE CUSTOMER NAME, ADDRESS, AND SHIP TO INFORMATION
02 O        D        81
03 O                                    8 '272'
04 O                                    4 ' HCB'
05 O                         PL,5      14
06 O*THE FOLLOWING WCC REFLECTS NO CHANGE TO MDT'S
07 O                                   15 'F'
08 O*** PUT OVERRIDE HEADER               ' NAME   TCM'
09 O                                  024 'NAME      M'
10 O                N82      CMN,N    046
11 O* REPOSITION THE CURSOR
12 O                                  055 'SNAME    CM'
13 O                N82      SNAME    077
14 O                                  086 'ADDR1     M'
15 O                N82      CA1,N    108
16 O                                  117 'SADDR1    M'
17 O                N82      SADDR1   139
18 O                                  148 'ADDR2     M'
19 O                N82      CA2,N    170
20 O                                  179 'SADDR2    M'
   O                N82      SADDR2   201
   O                                  210 'ADDR3     M'
   O                N82      CA3,N    232
   O                                  241 'SADDR3    M'
   O                N82      SADDR3   263
   O                N82               272 'CUSERR5   '
   O                 82               272 'CUSERR2   '
   O
12 O* NOTE THAT THE LENGTH GIVEN IN COLUMNS 1-4 GIVES A LENGTH FOR
13 O* A FULL OVERRIDE LIST.  THE TYPE WAS CHANGED FOR CUSERR, BUT
14 O* ROOM MUST BE LEFT TO SHOW BLANK ENTRIES FOR CURSOR AND
15 O* MODIFY DATA FLAGS.
01 O*  PUT OVERRIDES TO DISPLAY PROCESSING OF ITEMS, AND INDICATE
02 O*  TAXES, TOTALS, EXCEPTION CONDITIONS IF NECESSARY.
03 O*
04 O        D       N81 01
05 O       OR       N81 02
06 O                N83                 8 ' 674'
07 O                 83                 8 ' 620'
08 O                                    4 ' HCB'
09 O                         PL,5      14
10 O                                   15 'F'
11 O                                   24 'QTY1     C '
```

RPG OUTPUT SPECIFICATIONS

IBM International Business Machine Corporation

GX21-9090
Printed in U.S.A.

Program
Programmer
Date
Punching Instruction
Graphic
Punch
Card Electro Number

Page 16 of 19
Program Identification ORDENT

Commas	Zero Balances to Print	No Sign	CR	-
Yes	Yes	1	A	J
Yes	No	2	B	K
No	Yes	3	C	L
No	No	4	D	M

X = Remove Plus Sign
Y = Date Field Edit
Z = Zero Suppress

Line | Form Type | Filename | Type (H/D/T/E) | Stacker #/Fetch(F) | Space Before After | Skip Before After | Output Indicators (Not, And, Not, And, Not) | Field Name *AUTO | Edit Codes | B/A/C/1-9/R | End Position in Output Record | P/B/L/R | Constant or Edit Word

41

```
01 O                                   30 'ITEMN1'
02 O                         INT,1     31
03 O*   MODIFY TYPE OF ITEMN1 IF NOT FOUND TO HIGH INTENSITY
04 O*   ARRAY ELEMENT CONTAINS 2 OR 1
05 O*
06 O                                   39 'DESCR1'
07 O                                   42 'M'
08 O                         DSC,1     62
09 O*   DSC ELEMENT IS BLANK IF ITEM IS NOT FOUND IN INVENTORY FILE
01 O                                   68 'PRICE1'
02 O                                   71 'M'
03 O                         PR,1  2   78
04 O* EDIT CODE WILL ENTER DECIMAL POINT IF ITEM FOUND, BLANK OUT
05 O* WHOLE FIELD IF NOT FOUND
06 O                                   84 'QTYOH1'
07 O                                   87 'M'
08 O                         ONH,1     91
09 O* VALUE WILL BE BLANK IF ENOUGH IS IN STOCK, OR ACTUAL AMOUNT
10 O* WILL APPEAR IF SHORT OF ORDER QUANTITY
11 O*
12 O                                   97 'BACK01'
13 O                                  100 'M'
14 O                         BOA,1    104
15 O* VALUE WILL BE BLANK IF ENOUGH AVAILABLE, OR SHORT AMOUNT IF
16 O* NOT ENOUGH IN STOCK. THIS AMOUNT WILL BE ENTERED IN BACK ORDER
17 O* FILE
18 O
19 O
20 O
   O
   O
   O
   O
   O
```

41

IBM International Business Machine Corporation

RPG OUTPUT SPECIFICATIONS

GX21-9090
Printed in U.S.A.

Program | Punching Instruction | Graphic | Punch | Card Electro Number
Programmer | Date

Page 17 of 19 — Program Identification ORDENT

Commas	Zero Balances to Print	No Sign	CR	-
Yes	Yes	1	A	J
Yes	No	2	B	K
No	Yes	3	C	L
No	No	4	D	M

X = Remove Plus Sign
Y = Date Field Edit
Z = Zero Suppress

```
01 O                                  110 'ITEMN2'
02 O                         INT,2    111
03 O* PROCESS SECOND ITEM
04 O                          {
05 O
06 O                         (ADDITIONAL ITEMS)
07 O                          {
08 O
09 O                                  577 'BACK07'
10 O                                  580 'M'
11 O                         BOA,7    584
01 O* THE FOLLOWING FIELDS WILL BE SENT ONLY IF TOTALS AND TAXES
02 O* WERE CALCULATED (NO EXCEPTION CONDITIONS)
03 O                N83               589 'TAXEX'
04 O                N83               593 'M'
05 O                N83      TAXEX 2  597
06 O                N83               602 'TAXST'
07 O                N83               606 'M'
08 O                N83      TAXST 2  610
09 O                N83               615 'TAXLT'
10 O                N83               619 'M'
11 O                N83      TAXLT 2  623
12 O                N83               629 'TOTMON'
13 O                N83               632 'M'
14 O                N83      TOTMON2  638
15 O
16 O
17 O
18 O
19 O
20 O
```

IBM International Business Machine Corporation

RPG OUTPUT SPECIFICATIONS

GX21-9090 Printed in U.S.A.

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Program Identification ORDENT

41

```
01 O                N83               643 'OUTOS'
02 O                N83               645 '5'
03 O                N83               653 'CUSERR'
04 O                N83               654 '5'
05 O                N83               662 'ITEMDR'
06 O                N83               663 '5'
07 O                N83               671 'CREDOV'
08 O                N83 87            674 '2   '
09 O                N83N87            674 '5   '
10 O* THE ABOVE FIELD WILL OVERRIDE THE TYPE ONLY TO NONDISPLAY OR
11 O* DISPLAY
```

41

```
01 O* THE FOLLOWING FIELDS WILL BE PUT OUT IF EXCEPTIONS OCCURRED
02 O                 83               589 'OUTOS'
03 O                 83 86            591 '2'
04 O                 83N86            591 '5'
05 O                 83               599 'CUSERR'
06 O                 83               600 '5'
07 O                 83               608 'ITEMDR'
08 O                 83 85            609 '2'
09 O                 83N85            609 '5'
10 O                 83               617 'CREDOV'
11 O                 83 87            620 '2   '
12 O                 83N87            620 '5   '
```

IBM International Business Machines Corporation

RPG OUTPUT SPECIFICATIONS

GX21-9090
Printed in U.S.A.

Program
Programmer
Date
Punching Instruction: Graphic / Punch
Card Electro Number

Page 19 of 19
Program Identification ORDENT

Commas	Zero Balances to Print	No Sign	CR	-
Yes	Yes	1	A	J
Yes	No	2	B	K
No	Yes	3	C	L
No	No	4	D	M

X = Remove Plus Sign
Y = Date Field Edit
Z = Zero Suppress

8

```
01 O* REINVITE IF NECESSARY CURRENT TERMINAL
02 O        D        74
03 O                                    8 '14'
04 O                                    4 '  E'
05 O                         PL,5      14
06 O*
```

10

```
07 O* RELEASE A TERMINAL
08 O        E        95
09 O                                    8 '14'
10 O                                    4 '  AK'
11 O                         PL,5      14
12 O*
13 O*
```

44

```
01 O* COPY THE DISPLAY TO A 3284 OR 3286 PRINTER ON 3271 CONTROL UNIT
02 O        E        02N73 03
03 O                                    8 '20'
04 O                                    4 '  DB'
05 O                                   14 'PRINTR'
06 O                         PL,5      20
07 O* DEFAULT CCC WILL BE USED.
08 O*
09 O* COPY THE DISPLAY TO A 3284 PRINTER ATTACHED TO A 3275 WITH WCC
10 O* FOR START PRINTER AND 80-COLUMN LINE.
11 O        E        02N73 03
12 O                                    4 ' HCB'
13 O                                    8 '15'
14 O                         PL,5      14
15 O                                   15 '8'
16 O
17 O
18 O
19 O
20 O
```

Example 3—SRT Inquiry Program

This example shows RPG II, COBOL, and FORTRAN IV coding for an inquiry program that uses the Display Format Facility to display information on the 3270. The three versions of the program use the same basic logic, inquire into the same three disk files, and use the same screen format. The logic flow, display layout, display format specifications, and DFGR printout are shown on the following pages.

This is a single requesting terminal (SRT) program; therefore, the program can handle only one inquiry on each execution. If sufficient main storage area is available, however, more than one copy of the program could be executing concurrently, serving different requestors.

The terminal operator uses this inquiry program as follows:

1. Signs on, keying /ONƀ [password], and presses the ENTER key.

2. Presses the ERASE INPUT key.

3. Enters a program request accompanied by input data, as follows:
   COBOL:
   COBINQƀcccccc/IIIIIIII
   RPG II:
   RPGINQƀcccccc/IIIIIIII
   FORTRAN IV:
   FORINQƀcccccc/IIIIIIII
   where *cccccc* is a six-digit customer number and IIIIIIII is an eight-digit item number. Presses the ENTER key.

4. Program returns a message to the terminal operator.

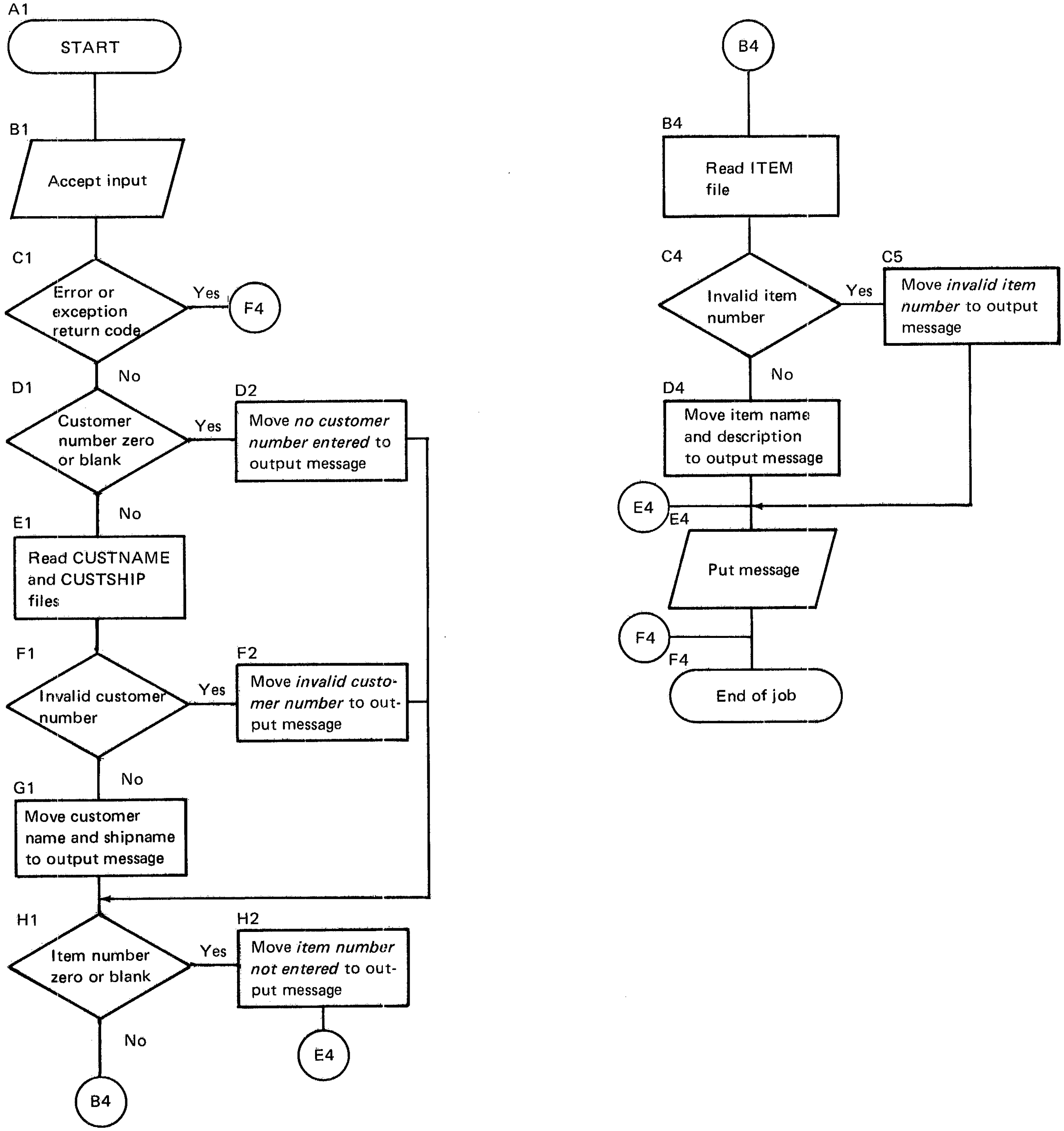
5. Program terminates.

If the input from the terminal operator is incomplete or invalid, the program issues an appropriate error message.

Notes:

- The three disk files used by the program are processed directly.

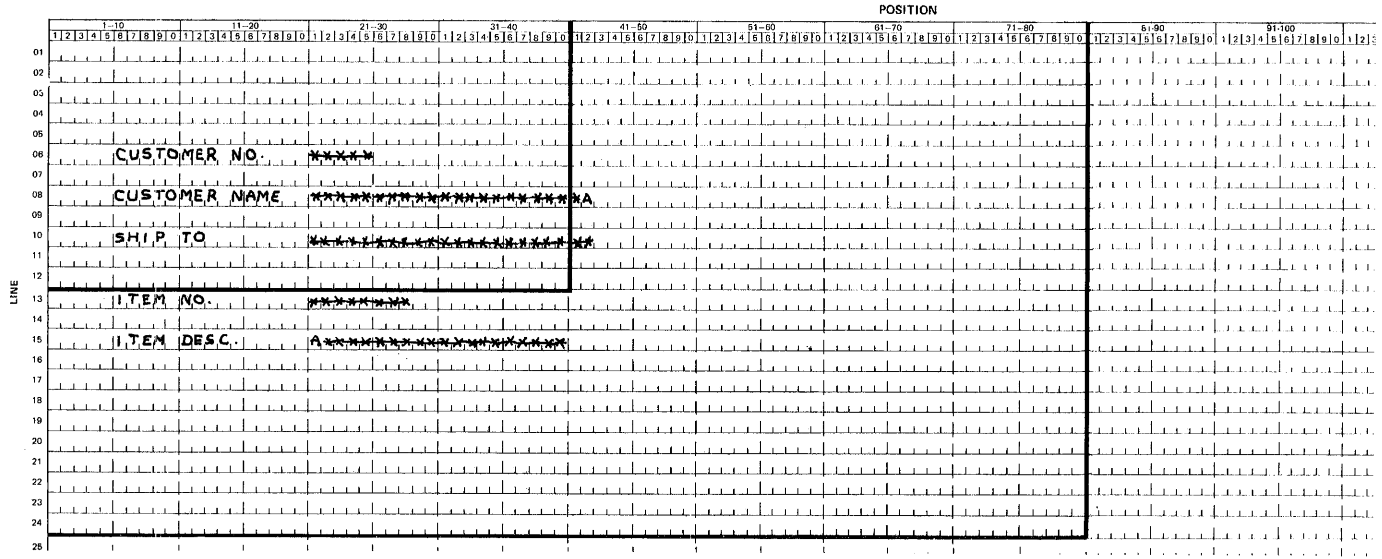
- In order to have the format remain on the screen after the program reaches end of job, ENDMSG-NO must be specified on the // PROGRAM assignment statement.



Example 3 – SRT Inquiry Program Flow

IBM International Business Machines Corporation

Printer/Display Layout



```
06     CUSTOMER NO.   XXXXXX
08     CUSTOMER NAME  XXXXXXXXXXXXXXXXXXXXXA
10     SHIP TO        XXXXXXXXXXXXXXXXXXXXXX
13     ITEM NO.       XXXXXXXX
15     ITEM DESC.     AXXXXXXXXXXXXXXXXXXX
```

Example 3 – Display Layout for SRT Inquiry Program

IBM International Business Machines Corporation

DISPLAY FORMAT SPECIFICATIONS

Application	Completed by	Punching Instructions	Graphic							
			Punch							

DISPLAY CONTROL

C

Form Type 1	Display Name 2-7	Field Name for Initial Cursor Position 8-13	Display Size (1,2) 14	Clear Before Writing (Y/N) 15	WCC Special 16	WCC Screen Default (X) 17	WCC Printer Default (X) 18	Disk Storage Unit for Display Formats 19-20	(Reserved) 21-23	PRINTER CONTROL Line 24-25	Position 26-27	Line 28-29	Position 30-31	Line 32-33	Position 34-35	Line 36-37	Position 38-39	Line 40-41	Position 42-43	Line 44-45	Position 46-47	Line 48-49	Position 50-51	Line 52-53	Position 54-55	Line 56-57	Position 58-59	Line 60-61	Position 62-63	Line 64
C	$ZRPIQ		2	Y		X		R2																						

FIELD DEFINITION

F

Form Type 1	Field Name 2-7	Field Starting Location Line 8-9	Field Starting Location Position 10-11	Field Length 12-14	FIELD CLASS Output Type (1,2,5) 15	Output Data Source (E/G) 16	Input Type (1-7) 17	Input Autoskip (Y/N) 18	Output/Input Type (1-8) 19	Output/Input Data Source (E/G) 20	Output/Input Autoskip (Y/N) 21	Detectable Type (1-7) 22	Detectable Data Source (E/G) 23	(Reserved) 24-31	Data for Output, Output/Input and Detectable Fields 32-
F	HEADR1	06	06	12	1	G									CUSTOMER NO.
F	CUSNO	06	21	6	2	E									
F	HEADR2	08	06	13	1	G									CUSTOMER NAME
F	CUSNM	08	21	22	2	E									
F	HEADR3	10	06	7	1	G									SHIP TO
F	SHPNM	10	21	22	2	E									
F	HEADR4	13	06	8	1	G									ITEM NO.
F	ITENO	13	21	8	2	E									
F	HEADR5	15	06	10	1	G									ITEM DESC.
F	ITDSC	15	21	20	2	E									
F															

Example 3 – Display Format Specifications for SRT Inquiry Program

```
C$ZRPIQ       2Y X R2
FHEADR10606 121G              CUSTOMER NO.
FCUSNO 0621  62E
FHEADR20806 131G              CUSTOMER NAME
FCUSNM 0821 222E
FHEADR31006  71G              SHIP TO
FSHPNM 1021 222E
FHEADR41306  81G              ITEM NO.
FITMNO 1321  82E
FHEADR51506 101G              ITEM DESC.
FITDSC 1521 202E
/*
```

```
                         $ZRPIQ DISPLAY FORMAT INFORMATION


   EXECUTION TIME DATA - OUTPUT AREA FORMAT - END POSITIONS FOR RPG PROGRAMS
   -------------------------------------------------------------------------


*  FIELD     FIELD       END    *  FIELD     FIELD       END    *  FIELD     FIELD       END    *
*  NAME      LENGTH    POSITION *  NAME      LENGTH    POSITION *  NAME      LENGTH    POSITION *
*  ------    ------    -------- *  ------    ------    -------- *  ------    ------    -------- *
*  OPCODE     004        0004   *  LENGTH     004        0008   *  TMNAME     006        0014   *
*  $ZRPIQ     006        0020   *  CUSNO      006        0026   *  CUSNM      022        0048   *
*  SHPNM      022        0070   *  ITMNO      008        0078   *  ITDSC      020        0098   *
*
*
*
   INPUT AREA FORMAT - END POSITIONS FOR RPG PROGRAMS
   --------------------------------------------------


*  FIELD     FIELD       END    *  FIELD     FIELD       END    *  FIELD     FIELD       END    *
*  NAME      LENGTH    POSITION *  NAME      LENGTH    POSITION *  NAME      LENGTH    POSITION *
*  ------    ------    -------- *  ------    ------    -------- *  ------    ------    -------- *
*  RTCODE     004        0004   *  LENGTH     004        0008   *  TMNAME     006        0014   *
*  - AID-     001        0015   *


LENGTH OF OUTPUT RECORD AREA REQUIRED IN DFF PROGRAM
        RPG *SUBR92* - 0098      OTHER - 0090

LENGTH OF INPUT RECORD AREA REQUIRED IN DFF PROGRAM
        RPG *SUBR92* - 0015      OTHER - 0007


   INFORMATION FOR USE DURING CCP ASSIGNMENT STAGE
   -----------------------------------------------

THE DECIMAL LENGTH OF THE FIELD DESCRIPTOR TABLE IS 0132
THE DECIMAL LENGTH OF THE OUTPUT TEXT IS 0216
THE DECIMAL LENGTH OF THE INPUT TEXT IS 0005
```

Example 3 – Display Format Generation for SRT Inquiry Program

```
SYSTEM/3                     RPGII


       0101 H   P
RG 004


       0201 F*
       0202 F*  SINGLE REQUESTOR INQUIRY PROGRAM  WHICH USES THE
       0203 F* DISPLAY FORMAT FACILITY IN CCP.
       0204 F*
 0001  0205 FTERMIN  IP     029 029            SPECIAL      SUBR92
 0002  0206 F                                              KPL
 0003  0207 FTERMOUT O      098 098            SPECIAL      SUBR92
 0004  0208 F                                              KPL
 0005  0209 FCUSTNAMEIC     300 300R           DISK
 0006  0210 FCUSTSHIPIC     256 128R           DISK
 0007  0211 FINVENTRYIC     300 300R           DISK


 0008  0301 E                     PL      5   5  6               COMPILE TIME


       0401 I***** KEY CUST. NO. 6  / ITEM NO. 8  SUCH AS XXXXXX/YYYYYYYY
 0009  0402 ITERMIN  AA  01
 0010  0403 I                                      001 0020RTNCOD
 0011  0404 I                                      015 0200CUSNO             80
 0012  0405 I                                      021 021 SLASH
 0013  0406 I                                      022 0290ITMNO             81
 0014  0407 ICUSTNAMEAA  10   1 CM   2 CA
 0015  0408 I                                      009 030 CUSNM
 0016  0409 ICUSTSHIPBB  11   1 CM   2 CB
 0017  0410 I                                      009 030 SHPNM
 0018  0411 IINVENTRYCC  12   1 CM   2 CI
 0019  0412 I                                      013 032 ITDSC


 0020  0501 C                      SETON                    LR
 0021  0502 C  N81       '/'       COMP SLASH                   05
 0022  0503 C  N05                 SETON                    858687
 0023  0504 CLRN05
 0024  0505 COR 91
 0025  0506 COR 92                 GOTO END
 0026  0507 CLRN91N80   CUSNO      CHAINCUSTNAME            85
 0027  0508 CLRN91N80   CUSNO      CHAINCUSTSHIP            86
 0028  0509 CLRN91N81   ITMNO      CHAININVENTRY            87
 0029  0510 CLR         END        TAG
 0030  0511 CLR                    SETOF                    9192


 0031  0601 OTERMOUT T         LR
 0032  0602 O                                 004 '  CB'
 0033  0603 O                                 008 '98'
 0034  0604 O                         PL,5    014
       0605 O*
 0035  0606 O                                 020 '$ZRPIQ'
       0607 O*
 0036  0608 O                         CUSNO   026
       0609 O*
 0037  0610 O                  10N80N85CUSNM  043
 0038  0611 O                    N80 85       042 'NAME NOT ON FILE'
 0039  0612 O                     80          045 'NO CUST NO. ENTERED'
       0613 O*
 0040  0614 O                  11N80N86SHPNM  070
 0041  0615 O                    N80 86       064 'NAME NOT ON FILE'
 0042  0616 O                     80          067 'NO CUST NO. ENTERED'
       0617 O*
 0043  0618 O                         ITMNO   078
       0619 O*
 0044  0620 O                  12N81N87ITDSC  098
 0045  0621 O                    N81 87       092 'ITEM NOT ON FILE'
 0046  0622 O                     81          095 'NO ITEM NO. ENTERED'


**
            D          29
```

A compilation time array is used so that the array contains the accept input operation code and the maximum input length when the TERMIN file is read.

Indicators 80 and 81 indicate when the customer number or item number are zero or blank.

Example 3 – RPG II Coding for SRT Inquiry Program

```
                  IBM SYSTEM/3 AMERICAN NATIONAL STANDARD COBOL

STNO -A...B... C O B O L   S O U R C E   S T A T E M E N T S ..........IDENTFCN SEQ/NO S

   1  IDENTIFICATION DIVISION.                                                  001010
   2  PROGRAM-ID. COBINQ.                                                       001020
   3  REMARKS. THIS IS A SINGLE REQUESTOR INQUIRY PROGRAM THAT                  001030
               USES THE DISPLAY FORMAT FACILITY OF CCP.                         001040
   4  ENVIRONMENT DIVISION.                                                     002010
   5  CONFIGURATION SECTION.                                                    002020
   6  SOURCE-COMPUTER. IBM-S3.                                                  002030
   7  OBJECT-COMPUTER. IBM-S3.                                                  002040
   8  INPUT-OUTPUT SECTION.                                                     002050
   9  FILE-CONTROL.                                                             002060
  10      SELECT CUSTNAME ASSIGN TO DA-5444-R-CUSTNAME                          002070
              ACCESS IS RANDOM                                                  002080
              ACTUAL KEY IS NAMEKEY.                                            002090
  11      SELECT CUSTSHIP ASSIGN TO DA-5444-R-CUSTSHIP                          002100
              ACCESS IS RANDOM                                                  002110
              ACTUAL KEY IS SHIPKEY.                                            002120
  12      SELECT INVENTRY ASSIGN TO DA-5444-R-INVENTRY                          002130
              ACCESS IS RANDOM                                                  002140
              ACTUAL KEY IS INVTKEY.                                            002150
  13  DATA DIVISION.                                                            003010
  14  FILE SECTION.                                                             003020
  15  FD  CUSTNAME                                                              003030
          DATA RECORD IS CUST-NAME                                              003040
          LABEL RECORDS ARE STANDARD.                                           003050
  16  01  CUST-NAME.                                                            003060
  17      05 FILLER PICTURE X(8).                                               003070
  18      05 CUSNM1 PICTURE X(22).                                              003080
  19      05 FILLER PICTURE X(270).                                             003085
  20  FD  CUSTSHIP                                                              003090
          DATA RECORD IS CUST-SHIP                                              003100
          LABEL RECORDS ARE STANDARD.                                           003110
  21  01  CUST-SHIP.                                                            003120
  22      05 FILLER PICTURE X(8).                                               003130
  23      05 SHPNM1 PICTURE X(22).                                              003140
  24      05 FILLER PICTURE X(98).                                              003145
  25  FD  INVENTRY                                                              003150
          DATA RECORD IS INVEN                                                  003160
          LABEL RECORDS ARE STANDARD.                                           003170
  26  01  INVEN.                                                                003180
  27      05 FILLER PICTURE X(13).                                              003190
  28      05 ITDSC1 PICTURE X(20).                                              003200
  29      05 FILLER PICTURE X(276).                                             003205
  30  WORKING-STORAGE SECTION.                                                  004010
  31  77  NAMEKEY   PICTURE S9(7) VALUE ZERO.                                   004020
  32  77  SHIPKEY   PICTURE S9(7) VALUE ZERO.                                   004030
  33  77  INVTKEY   PICTURE S9(7) VALUE ZERO.                                   004040
  34  77  NO-CUSNO  PIC X(22) VALUE 'NO CUST NUMBER ENTERED'.                   004041
  35  77  NO-SHPNO  PIC X(22) VALUE 'NO SHIP NUMBER ENTERED'.                   004042
  36  77  NO-ITMNO  PIC X(22) VALUE 'NO ITEM NUMBER ENTERED'.                   004043
  37  77  INVALID-C PIC X(22) VALUE 'INVALID CUST NUMBER   '.                   004044
  38  77  INVALID-S PIC X(22) VALUE 'INVALID SHIP NUMBER   '.                   004045
  39  77  INVALID-I PIC X(22) VALUE 'INVALID ITEM NUMBER   '.                   004046
     *****************************************************************          004050
     *    CCP-COBOL INTERFACE PARAMETER LIST.                        *          004060
     *****************************************************************          004070
  40  01  PARAMETER-LIST.                                                       004080
  41      05 PL-RTC PICTURE S9(4) COMP-4.                                       004090
  42      05 PL-OPC PICTURE S9(4) COMP-4 VALUE 4.                               004100
  43      05 PL-OUL PICTURE S9(4) COMP-4 VALUE 128.                             004110
  44      05 PL-EFL REDEFINES PL-OUL PIC S9(4) COMP-4.                          004120
  45      05 PL-ATI REDEFINES PL-OUL PIC S9(4) COMP-4.                          004130
  46      05 PL-INL PICTURE S9(4) COMP-4 VALUE 16.                              004140
  47      05 FILLER PICTURE X(8).                                               004150
     *****************************************************************          004160
     *    INPUT RECORD AREA.                                         *          004170
     *****************************************************************          004180
  48  01  INPUT-A.                                                              004190
  49      05 TERM-IN       PICTURE X(6).                                        004200
  50      05 CUSNO         PICTURE X(6) VALUE '000000'.                         004220
  51      05 SLASH         PICTURE X(1).                                        004230
  52      05 ITMNO         PICTURE X(8) VALUE '00000000'.                       004240
     *****************************************************************          004250
     *    PUT FORMAT OUTPUT AREA.                                    *          004260
     *****************************************************************          004270
  53  01  OUTPUT-A.                                                             004280
  54      05 TERM-OUT      PICTURE X(6).                                        004290
  55      05 SCREEN        PICTURE X(6) VALUE '$ZRPIQ'.                         004300
  56      05 CUSNO         PICTURE X(6) VALUE '000000'.                         004310
  57      05 CUSNM         PICTURE X(22) VALUE SPACES.                          004320
  58      05 SHPNM         PICTURE X(22) VALUE SPACES.                          004330
  59      05 ITMNO         PICTURE X(8) VALUE '00000000'.                       004340
  60      05 ITDSC         PICTURE X(20) VALUE SPACES.                          004350
  61  PROCEDURE DIVISION.                                                       005010
  62  OPEN-THE-FILE.                                                            005020
```

Example 3 — COBOL Coding for SRT Inquiry Program (Part 1 of 2)

```
     OPEN INPUT CUSTNAME.                                           005030
     OPEN INPUT CUSTSHIP.                                           005040
     OPEN INPUT INVENTRY.                                           005050
ACCEPT-INPUT.                                                       005060
     MOVE 4 TO PL-OPC.                                              005070
     MOVE 15 TO PL-EFL.                                             005080
     CALL 'CCPCIO' USING PARAMETER-LIST, INPUT-A.                   005090
     IF PL-RTC NOT EQUAL TO 0 GO TO END-OF-JOB.                     005100
GET-DISKDATA.                                                       005110
     MOVE CUSNO OF INPUT-A TO NAMEKEY.                              005120
     MOVE CUSNO OF INPUT-A TO SHIPKEY.                              005130
     MOVE ITMNO OF INPUT-A TO INVTKEY.                              005140
     MOVE CUSNO OF INPUT-A TO CUSNO OF OUTPUT-A.                    005142
     MOVE ITMNO OF INPUT-A TO ITMNO OF OUTPUT-A.                    005144
     IF NAMEKEY IS EQUAL TO ZERO MOVE NO-CUSNO TO CUSNM             005150
             ELSE PERFORM READ-C.                                   005160
TAG1.                                                               005165
     IF SHIPKEY IS EQUAL TO ZERO MOVE NO-SHPNO TO SHPNM             005170
             ELSE PERFORM READ-S.                                   005180
TAG2.                                                               005185
     IF INVTKEY IS EQUAL TO ZERO MOVE NO-ITMNO TO ITDSC             005190
             ELSE PERFORM READ-I.                                   005200
TAG3.                                                               005201
     GO TO CONTINUE-1.                                              005205
READ-C.                                                             005210
     READ CUSTNAME INVALID KEY GO TO ERROR-C.                       005220
     MOVE CUSNM1 TO CUSNM.                                          005230
     GO TO TAG1.                                                    005235
READ-S.                                                             005240
     READ CUSTSHIP INVALID KEY GO TO ERROR-S.                       005250
     MOVE SHPNM1 TO SHPNM.                                          005260
     GO TO TAG2.                                                    005265
READ-I.                                                             005270
     READ INVENTRY INVALID KEY GO TO ERROR-I.                       005280
     MOVE ITDSC1 TO ITDSC.                                          005290
     GO TO TAG3.                                                    005295
ERROR-C.                                                            005300
     MOVE INVALID-C TO CUSNM.                                       005310
     GO TO TAG1.                                                    005320
ERROR-S.                                                            005330
     MOVE INVALID-S TO SHPNM.                                       005340
     GO TO TAG2.                                                    005350
ERROR-I.                                                            005360
     MOVE INVALID-I TO ITDSC.                                       005370
     GO TO TAG3.                                                    005380
CONTINUE-1.                                                         005390
PUT-ROUTINE.                                                        005400
     MOVE 50 TO PL-OPC.                                             005410
     MOVE 84 TO PL-OUL.                                             005420
     MOVE TERM-IN TO TERM-OUT.                                      005430
     CALL 'CCPCIO' USING PARAMETER-LIST, OUTPUT-A.                  005440
END-OF-JOB.                                                         005500
     CLOSE CUSTNAME.                                                005510
     CLOSE CUSTSHIP.                                                005520
     CLOSE INVENTRY.                                                005530
     STOP RUN.                                                      005540
```

Example 3 – COBOL Coding for SRT Inquiry Program (Part 2 of 2)

```
      PROGRAM FORINQ
      DEFINE FILE 8(100,300,L,IR8),9(100,128,L,IR9),10(100,309,L,IR10)
      INTEGER * 2 PARM(8),RTC,OPC,OUTL,INL,ICUST,ISHIP,ITEM
      INTEGER * 2 PUTBUF(92),BUFFER(309),FNAME(6),INBUF(22)
      INTEGER * 2 MSG1(22),MSG2(22),MSG3(22),MSG4(22),MSG5(22)
      INTEGER * 2 MSG6(22),SLASH
      EQUIVALENCE (RTC,PARM(1)),(OPC,PARM(2))
      EQUIVALENCE (OUTL,PARM(3)),(INL,PARM(4))
      DATA FNAME /'$ Z R P I Q '/
      DATA MSG1 /'N O   C U S T   N U M B E R   E N T E R E D '/
      DATA MSG2 /'N O   S H I P   N U M B E R   E N T E R E D '/
      DATA MSG3 /'N O   I T E M   N U M B E R   E N T E R E D '/
      DATA MSG4 /'I N V A L I D   C U S T   N U M B E R        '/
      DATA MSG5 /'I N V A L I D   S H I P   N U M B E R        '/
      DATA MSG6 /'I N V A L I D   I T E M   N U M B E R        '/
      DATA SLASH /'/'/
      OPC=4
      OUTL=16
      INL=16
      CALL CCPFIO(PARM,INBUF)
      IF (RTC .NE. 0) GO TO 140
      XCUST=GET(INBUF,7,12,1.0)
      ICUST=XCUST
      ISHIP=ICUST
      CALL MOVE(INBUF,1,6,PUTBUF,1)
      CALL MOVE(FNAME,1,6,PUTBUF,7)
      CALL MOVE(INBUF,7,12,PUTBUF,13)
      CALL MOVE (INBUF,14,21,PUTBUF,63)
      IF (ICUST) 10,10,20
   10 CALL MOVE(MSG1,1,22,PUTBUF,19)
      GO TO 30
   20 READ (8'ICUST,1000,ERR=110)(BUFFER(I),I=1,300)
      CALL MOVE(BUFFER,9,30,PUTBUF,19)
   30 IF (ISHIP) 40,40,50
   40 CALL MOVE(MSG2,1,22,PUTBUF,41)
      GO TO 60
   50 READ (9'ISHIP,1010,ERR=120)(BUFFER(I),I=1,128)
      CALL MOVE(BUFFER,9,30,PUTBUF,41)
   60 IF (INBUF(13)-SLASH) 80,70,80
   70 XTEM=GET(INBUF,14,21,1.0)
      ITEM=XTEM
      IF (ITEM) 80,80,90
   80 CALL MOVE(MSG3,1,22,PUTBUF,71)
      GO TO 100
   90 READ (10'ITEM,1020,ERR=130)(BUFFER(I),I=1,309)
      CALL MOVE(BUFFER,14,33,PUTBUF,71)
  100 OPC=50
      OUTL=84
      CALL CCPFIO(PARM,PUTBUF)
      GO TO 140
  110 CALL MOVE(MSG4,1,22,PUTBUF,19)
      GO TO 30
  120 CALL MOVE(MSG5,1,22,PUTBUF,41)
      GO TO 60
  130 CALL MOVE(MSG6,1,22,PUTBUF,71)
      GO TO 100
  140 STOP
 1000 FORMAT(150A1)
 1010 FORMAT(128A1)
 1020 FORMAT(103A1)
      END
```

Example 3 – FORTRAN IV Coding for SRT Inquiry Program

Example 4 – RPG II Order Entry Program (Using PRUF with the DFF)

This illustrates the use of the PRUF capability with RPG II. The example is an order entry application program. Example 2 in this chapter illustrates an order entry application written as one large MRT program, and as can be seen, the logic becomes quite complicated. By using PRUF with DFF, the one program can be broken up into six smaller and logically much simpler programs. The six sample programs are described as follows:

ORDERL-SRT Program Requested from the System Console

ORDERL reads cards from the MFCU and formats the direct output HOLDORDR file (Figure 8-20), which will be used as a spool-type file to contain all orders entered from the 3270 terminals, with the master record for the file and all header records for the 3270 order entry terminals. The ORDERL program (Figure 8-21) requires input in the following format:

Card 1, Columns 1 – A
Columns 2-7 – Number of 64 character records per allocation unit

Cards 2-n, Columns 1 – H
Columns 2-7 – Symbolic terminal name of 3270 order entry terminal
Columns 8-9 – Number of allocation units to be assigned this terminal

The advantage of this order entry application is that the inventory file is not updated until the terminal's PF1 key is pressed, which indicates that the order is complete. All orders are written to the HOLDORDR file, from which they can be printed via a stand-alone print program. They also can be printed at the time the orders are processed via a print program that runs as a CCP user task.

The format of the HOLDORDR file is as follows:

Master record	Order records for terminal 1	Order records for terminal 2	....	Order records for terminal n

For this example, *n* equals a maximum of six terminals.

Prior to running the order entry program, the HOLDORDR file must be created in the following format:

Master record	Header record for terminal 1	Order record area for terminal 1

Header record for terminal 2	Order record area for terminal 2	...etc

The master record is 64 characters long and is the first record of the HOLDORDR file. The format of the master record is as follows:

Column/ Positions	Value	Meaning
1	A	Identifies the master record
2-7	RRECT	A 6-digit number, representing the number of records between header records
8-13	TERMNAME,1	Symbolic name of terminal
14-19	TERMNAME,2	
.	.	
.	.	
.	.	
38-43	TERMNAME,6	

The format of the 64 character header record is as follows:

Column/ Positions	Value	Meaning
1	H	Identifies the header record
2-7	RRECDN	Relative record number of the next available record to start an order; initialized to relative record number of header record + 1
8-13	RRECDP	Relative record number of next order to print; initialized to the same value as RRECDN
14-19	TERMNAME	Symbolic name of terminal this space is allocated to

When the HOLDORDR file was created, space was allocated (RRECT) to contain a predetermined number of order records between header records. When a terminal has been found to have a high level of order entry, it is of great value to the user to create more than one header record for that terminal. This technique can multiply the space available for a particular terminal.

When an order has been successfully entered, RRECDN will be updated to point to the record where the next order will start. When an order has been printed, RRECDP is updated to point to the next order to be printed. The printing of an order will allow another order to be entered in that record area (Figure 8-26).

Prior to starting a new order, if RRECDP = RRECDN, both values are updated to point to the header record +1. This means that all the order record areas for that terminal are available.

The HOLDORDR file is dynamic and needs to be formatted only initially.

The order entry application outputs an order in the following format:

Record Number Relative to Start of Order	**Position**	**Value**	**Meaning**
1	1	N	Identifies order heading
	2	1	
	3-10	ORDNO	Number assigned to order
	11-16	CUSNO	Customer number
	17-38	CUSNAM	Customer name
	39-60	CUSA1	Customer address field 1
2	1	N	Identifies order heading
	2	2	
	3-24	CUSA2	Customer address field 2
	25-46	CUSA3	Customer address field 3
3	1	N	Identifies order heading
	2	3	
	3-24	SHPNAM	Ship-to name
	25-46	SHPA1	Ship-to address field 1
4	1	N	Identifies order heading
	2	4	
	3-24	SHPA2	Ship-to address field 2
	25-46	SHPA3	Ship-to address field 3
	47-51	ZIPCD	Zip code
5	1	D	First detail line of order
	2-3	LN	Detail line number
	4-9	QTY	Quantity
	10-17	ITMNO	Item number
	18-37	ITMDSC	Item description
	38-48	PRICE	Price = Quantity* Price per item
R	1	T	Total line
	2-12	Cost excl.	Tax
	13-22	State tax	
	23-32	Federal tax	
	33-43	Total cost	

A detail record is written for every ITMNO entered by the order entry operator.

The order entry application functions as follows:

The order entry operator requests the order entry application by keying in ORDER1b̸CUSNO/ORDNO where CUSNO is a 6-position customer number and ORDNO is an 8-position order number field. ORDER1 (Figure 8-22) reads the CUSTNAME and CUSTSHIP files, and if found performs a PRUF-Put message to the 3270 terminal of the data retrieved. The cursor is left positioned under the ship-to information. The operator can override this information if so desired. The first field of the screen is a type 7 output/input field which has the value of ORDER2b̸. After the ship-to information has been updated, the operator presses the ENTER key. This is actually a program request for ORDER2 (Figure 8-23). ORDER2 inputs the fields using $ZORD1 as the controlling format for inputting the program request data. ORDER2 writes the four N records to the HOLDORDR file and performs a PRUF-Put message operation to format the 3270 with header information for entering QTY and ITMNO. The first field on the screen is a type 7 output/input field of value ORDER3b̸. The cursor is positioned to allow input of the QTY field. The operator keys in the QTY number and ITMNO number and presses the ENTER key. This is a program request for ORDER3 (Figure 8-24). ORDER3 inputs the QTY and ITMNO numbers using $ZORD2 as the controlling format for the program request data. If the ITMNO number is found, the following information is displayed under the QTY and ITMNO headings:

```
LINE NO.    QTY    ITMNO    ITM DES   PRICE

02
01                 xxxxxx xxxxxxxx ........... xxxx.xx
```

The cursor is positioned under the QTY field, however if line number 01 is found to be in error, the operator can backspace to the line number field and enter 01 followed by the correct QTY and ITMNO. ORDER3 will write out a D (detail) record in the HOLDORDR file if the line number field is not equal to the previous line number record. In this example, line number 01's D record is written following the successful entry of line number 02, or the PF1 key is pressed to indicate the order is complete.

When the PF1 key is pressed, ORDER3 issues a PRUF-Put message to the operator indicating to press the ENTER key which completes the order. Now a program request for ORDER4 is issued (Figure 8-25). ORDER4 inputs all D records written for this order, updates the inventory file, writes the T (total) record for the order to the HOLDORDR file, and updates the RRECDN value in the header record for that terminal. The terminal is now in command mode, and is available for the next order entry request or other program requests.

It should be noted that after issuing a PRUF-Put message, ORDER1 and ORDER2 go to end of job; that is, as the operator keys in data on the terminal, the terminal buffer is being used, not the user's program area in main storage. When the ENTER key is pressed, the next program is requested and all non-output fields with MDT-ON are passed under format control to the requested program. Figure 8-28 shows the assignment set requirements for the order entry application, and Figure 8-27 shows orders after they have been printed by ORDERP.

The formats used in this sample order entry program are illustrated in Figure 8-29. The following chart lists the programs and the formats they use:

Program	**Formats**
ORDER1	$ZORD1 $ZORD5
ORDER2	$ZORD2 $ZORD5
ORDER3	$ZORD3 $ZORD4 $ZORD5
ORDER4	$ZORD5 $ZORD6

```
*A001000N32112N32112N32142N32102N*
*32002N32002                     *
*H000018000003N32112             *
*                                *
*N100000006000006BROWN WHOLESALE *
*SUPPLY    SEVILLE               *
*N2PHILA., PENN                  *
*                                *

*N3SLAY BROS INC            WELLS*
*                                *
*N4PHILA., PENN          TRUCK   *
*              00000             *
*D0100000100000001   BLUE FLUORES*
*CE     000000000013000          *
*D0200000200000001   BLUE FLUORES*
*CE     000000000026000          *

*T0000003900000000015600000001950*
*0000042510                      *
*N100000010000010BLACK&JONES CHEM*
*ICAL C     19TH STREET          *
*N2PHILADELPHIA, PENNA.          *
*                                *
*N3SAME                          *
*                                *

*N4                      TRUCK   *
*              00000             *
*D0100000200000002   X02 PLUG    *
*       000000000003426          *
*D0200000300000003   X03 PLUG    *
*       000000000003600          *
*D0300000400000004   X04 PLUG    *
*       000000000006800          *

*T0000013826000000055300000000691*
*0000015070                      *
*                                *

*H002018002003N32142             *
*                                *
*N100000005000005FAST ELECTRONICS*
*           W GLENWOOD           *
*N2PITTSBURG, PENN               *
*                                *

*N3SAME                          *
*                                *
*N4                      AIR FREI*
*GHT           00000             *
*D0100000100000002   X02 PLUG    *
*       000000000001713          *
*D0200000100000001   BLUE FLUORES*
*CE     000000000013000          *

*D0300000400000001   BLUE FLUORES*
*CE     000000000052000          *
*T0000066713000000266800000003335*
*0000072716                      *
*N100000009000009 JOSEPH  CLARKE *
*       1520 MAPLE STREET        *
*N2MAPLEWOOD, OHIO               *
*                                *

*N3 SAM BLIZZARD         SAME    *
*                                *
*N4 SAME                  FIRST C*
*LASS MAIL     00000             *
*D0100000400000004   X04 PLUG    *
*       000000000010500          *

*T0000017300000000069200000000865*
*0000018857                      *
*                                *

*H003018003003N32102             *
*                                *
*N100000007000007BENNETT INC     *
*           CHESTNUT             *
*N2PHILA., PENN                  *
*                                *

*N3SAME                          *
*                                *
*N4                      AIR FREI*
*GHT           00000             *
*D0100000100000001   BLUE FLUORES*
*CE     000000000013000          *
*D0200000200000002   X02 PLUG    *
*       000000000003426          *

*D0300000300000003   X03 PLUG    *
*       000000000003600          *
*T0000020026000000080100000001001*
*0000021828                      *
*N100000008000008 STEPHANIE BOOKS*
*           MAPLE STREET         *
*N2 GREENVILLE, NEW YORK         *
*                                *

*N3 JOHN BOOKS           CLEMENTS*
*ON  COLLEGE                     *
*N4 GETTYSBURG, PENNA.    PONY EX*
*PRESS         00000             *
*D0100000100000001   BLUE FLUORES*
*CE     000000000013000          *
*D0200000400000004   X04 PLUG    *
*       000000000006800          *

*T0000019800000000079200000000990*
*0000021582                      *
*                                *

*H004017004003N32002             *
*                                *
*N100000003000003D & C SHIPPERS  *
*           FILBERT              *
*N2 PHILA., PENN                 *
*                                *

*N3SAME                          *
*                                *
*N4                      AIR FREI*
*GHT           00000             *
*D0100000500000005   X05 PLUG    *
*       000000000010500          *
*D0200000600000006   XZ6 PLUG    *
*       000000000010800          *

*T0000021300000000085200000001056*
*0000023217                      *
*N100000003000002CARLSON BYRNES C*
*O          N BROAD              *
*N2PHILA., PENN                  *
*                                *
*N3W K GARRISON CO           SANS*
*OM                              *

*N4PHILA., PENN          TRUCK   *
*              00000             *
*D0100000200000003   X03 PLUG    *
*       000000000002400          *
*D0200000100000002   X02 PLUG    *
*       000000000001713          *
*T0000004113000000016400000000205*
*0000004482                      *

*                                *
```

Figure 8-20. HOLDORDR File Organization

```
0101 H   R   4                                                            ORDERL
0201 FCARDIN  IPE    96  96            MFCU1                              ORDERL
0202 FHOLDORD5OC    64  64R            DISK45                             ORDERL
0203 FPRINTOUTO     132 132            PRINTER                            ORDERL
0301 E                    TERM        6  6                                ORDERL
0401 ICARDIN  AA  10   1 CA                                               ORDERL
0402 I                                        2   70RRECT           40    ORDERL
0403 I        AB  20   1 CH                                               ORDERL
0404 I       OR   30   1NCA   1NCH                                        ORDERL
0405 I                                        2   7 TRMNM                 ORDERL
0406 I                                        8   90N               85    ORDERL
0407 I                                        1  96 CARD                  ORDERL
0501 C   30                                                IF INVALID CARDORDERL
0502 CORN80N10                                             OR RRECT ZERO  ORDERL
0503 CORN80 10 40          SETON                     LR50  SET ON LR AND  ORDERL
0504 C   LR                GOTO END                        PRINT ERROR MSGORDERL
0505 C   10                Z-ADD0         I       10       CHECK FOR ORDERORDERL
0506 C   10                SETON                     80    OF INPUT CARDS ORDERL
0507 C   10                Z-ADD2         RRECDH  60       SET REC NUM=TWOORDERL
0508 C   10                GOTO END                        READ NEXT CARD ORDERL
0509 C                     MOVE RRECDH    RREC1   60                      ORDERL
0510 C           RRECDH    ADD  1         RRECDD  60       HDR REC PLUS 1 ORDERL
0511 C           LOOP      TAG                                            ORDERL
0512 C           I         ADD  1         I                               ORDERL
0513 C           7         COMP I                        70MAX OF 6 TERMS ORDERL
0514 C   70                SETON                     50LR                 ORDERL
0515 C   50                GOTO END                                       ORDERL
0516 C                     MOVE TRMNM     TERM,I                          ORDERL
0517 C           RRECDH    ADD  RRECT     RRECDH           BUMP TO NXT HDRORDERL
0518 C  N85      N         SUB  1         N            8585               ORDERL
0519 C  N85                GOTO LOOP                                      ORDERL
0520 C           RREC1     CHAINHOLDORD5             60    GET HEADER REC ORDERL
0521 C   60                SETON                     LR50  FOR THIS TERM  ORDERL
0522 C           END       TAG                                            ORDERL
0523 C                     SETOF                     85                   ORDERL
0524 CLRN50      1         CHAINHOLDORD5                   GET MASTER REC ORDERL
0601 OPRINTOUTH  201   1P                                                 ORDERL
0602 O                                   13 'RECORD NUMBER'               ORDERL
0603 O                                   30 'TERMINAL NAME'               ORDERL
0604 O        D  1     20                                                 ORDERL
0605 O                         RREC1     10                               ORDERL
0606 O                         TERM,I    25                               ORDERL
0607 O        T  3     LR 50                                              ORDERL
0608 O                         CARD      96                               ORDERL
0609 O                 10 40            125 'RECORDS/TERMINAL INVALID'    ORDERL
0610 O                 30               126 'INVALID CARD TYPE'           ORDERL
0611 O                 60               126 'END OF ORDER FILE'           ORDERL
0612 O                 70               126 'MORE THAN 9 TERMINALS'       ORDERL
0613 OHOLDORD5D        20                                                 ORDERL
0614 O                                    1 'H'                           ORDERL
0615 O                         RRECDD     7                               ORDERL
0616 O                         RRECDD    13                               ORDERL
0617 O                         TERM,I    19                               ORDERL
0618 O        T        LRN50                                              ORDERL
0619 O                                    1 'A'                           ORDERL
0620 O                         RRECT      7                               ORDERL
0621 O                         TERM,1    13                               ORDERL
0622 O                         TERM,2    19                               ORDERL
0623 O                         TERM,3    25                               ORDERL
0624 O                         TERM,4    31                               ORDERL
0625 O                         TERM,5    37                               ORDERL
0626 O                         TERM,6    43                               ORDERL
```

Figure 8-21. ORDERL Program

```
0101 H   R   4                                                            ORDER1
0201 FTERMIN  IP      29  29           SPECIAL       SUBR92               ORDER1
0202 F                                              KPL                   ORDER1
0203 FTERMOUT O     215 215            SPECIAL       SUBR92               ORDER1
0204 F                                              KPL                   ORDER1
0205 FCUSTNAMEIC    300 300R           DISK                               ORDER1
0206 FCUSTSHIPIC    256 128R           DISK                               ORDER1
0300 E* THE FOLLOWING COMPILE TIME ARRAY HAS ACCEPT INPUT LENGTH OF 29    ORDER1
0301 E                    PL      5   5  6                                ORDER1
0400 I* THE FOLLOWING INPUT IS DATA WITH PROGRAM REQUEST                  ORDER1
0401 ITERMIN  AA  01                                                      ORDER1
0402 I                                        1   20RTNCOD                ORDER1
0403 I                                       15  200CUSNO           80    ORDER1
0404 I                                       21  21 SLASH                 ORDER1
0405 I                                       22  290ORDERN          81    ORDER1
0406 ICUSTNAMEAA  10   1 CM   2 CA                                        ORDER1
0407 I                                        9  30 CUSNM                 ORDER1
0408 I                                       34  55 CUSA1                 ORDER1
0409 I                                       59  80 CUSA2                 ORDER1
0410 I                                       84 105 CUSA3                 ORDER1
0411 ICUSTSHIPAA  11   1 CM   2 CB                                        ORDER1
0412 I                                        9  30 SHPNM                 ORDER1
0413 I                                       34  55 SHIP1                 ORDER1
0414 I                                       59  80 SHIP2                 ORDER1
0415 I                                       84 105 SHIP3                 ORDER1
0416 I                                      109 1130ZIPCD                 ORDER1
0501 C                     SETON                    LR20                  ORDER1
0502 C   91                                                               ORDER1
0503 COR 92                SETON                    30                    ORDER1
0504 C   30                                                               ORDER1
0505 COR 80                                                               ORDER1
0506 COR 81                GOTO END                                       ORDER1
0507 C           '/'       COMP SLASH               8181  VALID SEPARATORORDER1
0508 C   81                GOTO END                                       ORDER1
0509 C           CUSNO     CHAINCUSTNAME            85    VALID NAME     ORDER1
0510 C  N85 10   CUSNO     CHAINCUSTSHIP            86    VALID ORDER NUMORDER1
0511 C   85                                               FOUND INPUT ERRORDER1
0512 COR 86                                               DO PUT OVERRIDEORDER1
0513 CORN10                                                               ORDER1
0514 CORN11                GOTO END                                       ORDER1
0515 C                     SETOF                    20    NO PUT OVERRIDEORDER1
0516 C           END       TAG                                            ORDER1
0600 O* IF PUT OVERRIDE OCCURS MUST MAKE ANOTHER PROGRAM REQUEST          ORDER1
0517 C                     SETOF                    9192                  ORDER1
0601 OTERMOUT D        LR 20                                              ORDER1
0602 O                                    4 '  CB'                        ORDER1
0603 O                                    8 '42'                          ORDER1
0604 O                         PL,5      14                               ORDER1
0605 O                                   20 '$ZORD5'                      ORDER1
0606 O                N11                40 'INVALID CUSSHIP FILE'        ORDER1
0607 O                N10                40 'INVALID CUSTMAS FILE'        ORDER1
0608 O                 86                40 'NO CUSSHIP RECORD   '        ORDER1
0609 O                 85                40 'NO CUSTMAS RECORD   '        ORDER1
0610 O                 81                40 'INVALID ORDER NUMBER'        ORDER1
0611 O                 80                40 'INVALID CUST. NUMBER'        ORDER1
0612 O                 30                40 'ERROR RETURN CODE = '        ORDER1
0613 O                 30      RTNCOD    42                               ORDER1
0614 O        T        LRN20                                              ORDER1
0615 O                                    4 '  GB'                        ORDER1
0616 O                                    8 '215'                         ORDER1
0617 O                         PL,5      14                               ORDER1
0618 O                                   20 '$ZORD1'                      ORDER1
0619 O                         ORDERN    28                               ORDER1
0620 O                         CUSNO     34                               ORDER1
0621 O                         CUSNM     56                               ORDER1
0622 O                         SHPNM     78                               ORDER1
0623 O                         CUSA1    100                               ORDER1
0624 O                         SHIP1    122                               ORDER1
0625 O                         CUSA2    144                               ORDER1
0626 O                         SHIP2    166                               ORDER1
0627 O                         CUSA3    188                               ORDER1
0628 O                         SHIP3    210                               ORDER1
0629 O                         ZIPCD    215                               ORDER1
**
           D          29
```

Figure 8-22. ORDER1 Program

```
0101 H   R   4                                                            ORDER2
0201 FTERMIN  IP    217 217            SPECIAL       SUBR92               ORDER2
0202 F                                              KPL                   ORDER2
0203 FTERMOUT O     280 280            SPECIAL       SUBR92               ORDER2
0204 F                                              KPL                   CRDER2
0205 FHOLDORD5UC     64  64R           DISK45                             ORDER2
0301 E                    PL      5   5  6                                ORDER2
0302 E                    TERM        6  6                                ORDER2
0401 ITERMIN  AA  01                                                      ORDER2
0402 I                                        1   20RTNCOD                ORDER2
0403 I                                       15  15 AID                   ORDER2
0404 I                                       16  22 PGMNAM                ORDER2
0405 I                                       23  300ORDNUM                ORDER2
0406 I                                       31  360CUSNO                 CRDER2
0407 I                                       37  58 CUSNM                 ORDER2
0408 I                                       59  80 SHPNM                 ORDER2
0409 I                                       81 102 CUSA1                 ORDER2
0410 I                                      103 124 SHPA1                 ORDER2
0411 I                                      125 146 CUSA2                 CRDER2
0412 I                                      147 168 SHPA2                 ORDER2
0413 I                                      169 190 CUSA3                 ORDER2
0414 I                                      191 212 SHPA3                 CRDER2
0415 I                                      213 2170ZIPCD                 ORDER2
0416 IHOLDORD5AA  30   1 CA                                               ORDER2
0417 I                                        2   70RRECT           50    ORDER2
0418 I                                        8  13 TERM,1                ORDER2
0419 I                                       14  19 TERM,2                ORDER2
0420 I                                       20  25 TERM,3                ORDER2
0421 I                                       26  31 TERM,4                ORDER2
0422 I                                       32  37 TERM,5                ORDER2
0423 I                                       38  43 TERM,6                ORDER2
0424 I        AB  40   1 CH                                               CRDER2
0425 I       OR   80   1NCH   1NCA                                        ORDER2
0426 I                                        2   70RRECDD          50    ORDER2
0427 I                                        8  130RRECDP          55    ORDER2
0428 I                                       14  19 TRMNM                 ORDER2
0501 C                     SETON                     1020LR               ORDER2
0502 C   91                                                NONE ZERO RETURPRDER2
0503 COR 92                GOTO END                        CODE PUT ERRMSGORDER2
0504 C                     SETOF                     20                   ORDER2
0505 C           1         CHAINHOLDORD5             60    GET MASTER REC ORDER2
0506 C   50                                                BAD ORDER FILE CRDER2
0507 COR 60                                                               ORDER2
0508 CORN30                GOTO END                                       CRDER2
0509 C                     Z-ADD2         RREC#   60                      ORDER2
0510 C                     MOVE 1         I       10                      ORDER2
0511 C           PL,5      LOKUPTERM,I                   70FIND THIS TERM CRDER2
0512 C  N70                SETON                     56    INVALID TERM   ORDER2
0513 C   56                GOTO END                                       ORDER2
0514 C           TAG1      TAG                                            ORDER2
0515 C           I         SUB  1         I              71               ORDER2
0516 C  N71      RREC#     ADD  RRECT     RREC#            BUMP REC NUM TCCRDER2
0517 C  N71                GOTO TAG1                       POINT TO HEADERORDER2
0518 C                     MOVE RREC#     RRECDH  60       REC FOR THIS   ORDER2
0519 C           RREC#     CHAINHOLDORD5             60    TERMINAL       ORDER2
0520 C   50                                                               ORDER2
0521 COR 55                                                               CRDER2
0522 COR 60                                                               ORDER2
0523 CORN40                GOTO END                                       ORDER2
0524 C           RRECDD    COMP RRECDP                   65IF ALL ORDERS  ORDER2
0525 C   65      RRECDH    ADD  1         RRECDD           FOR THIS TERM  ORDER2
0526 C   65                MOVE RRECDD    RRECDP           PRINTED, RESET CRDER2
0527 C   65                EXCPT                           TO FIRST RECORDORDER2
0528 C                     SETOF                     65                   ORDER2
0529 C                     MOVE RRECDD    RREC#                           ORDER2
0530 C                     EXSR READF                                     ORDER2
0531 C   60                GOTO END                                       CRDER2
0532 C                     SETON                     51    FIRST 'N' REC  ORDER2
0533 C                     EXSR CHECK                                     ORDER2
0534 C   60                GOTO END                                       ORDER2
0535 C                     SETON                     52    SECOND 'N' REC ORDER2
0536 C                     EXSR CHECK                                     CRDER2
0537 C   60                GOTO END                                       ORDER2
0538 C                     SETON                     53    THIRD 'N' REC  CRDER2
0539 C                     EXSR CHECK                                     ORDER2
0540 C   60                GOTO END                                       ORDER2
```

Figure 8-23 (Part 1 of 2). ORDER2 Program

```
0541 C                     SETON                     54    FOURTH 'N' REC ORDER2
0542 C                     EXSR CHECK                                     ORDER2
0543 C   60                GOTO END                                       ORDER2
0544 C                     SETOF                     1020                 ORDER2
0545 C           END       TAG                                            ORDER2
0546 C                     SETOF                     9192                 ORDER2
0547 CSR         READF     BEGSR                                          ORDER2
0548 CSR                   SETOF                     304080               ORDER2
0549 CSR         RREC#     CHAINHOLDORD5             60    GET NEXT RECORDORDER2
0550 CSR 60                SETON                     40                   ORDER2
0551 CSR                   ENDSR                                          ORDER2
0552 CSR         CHECK     BEGSR                                          ORDER2
0553 CSR                   EXCPT                           WRITE REC TO   ORDER2
0554 CSR         RREC#     ADD  1         RREC#            HOLDORD5 FILE  ORDER2
0555 CSR                   EXSR READF                                     ORDER2
0556 CSR                   ENDSR                                          ORDER2
0601 OHOLDORD5E        51                                                 ORDER2
0602 O                                    1 'N'                           ORDER2
0603 O                N52N53N54           2 '1'                           ORDER2
0604 O                N52N53N54ORDNUM    10                               ORDER2
0605 O                N52N53N54CUSNO     16                               ORDER2
0606 O                N52N53N54CUSNM     38                               ORDER2
0607 O                N52N53N54CUSA1     60                               ORDER2
0608 O                 52N53N54           2 '2'                           ORDER2
0609 O                 52N53N54CUSA2     24                               ORDER2
0610 O                 52N53N54CUSA3     46                               ORDER2
0611 O                 53N54              2 '3'                           ORDER2
0612 O                 53N54   SHPNM     24                               ORDER2
0613 O                 53N54   SHPA1     46                               ORDER2
0614 O                 54                 2 '4'                           ORDER2
0615 O                 54      SHPA2     24                               ORDER2
0616 O                 54      SHPA3     46                               ORDER2
0617 O                 54      ZIPCD     51                               ORDER2
0618 O        E        65                                                 ORDER2
0619 O                         RRECDD     7                               ORDER2
0620 O                         RRECDP    13                               ORDER2
0621 OTERMOUT D        10                                                 ORDER2
0622 O                                    4 '  CB'                        ORDER2
0623 O                                    8 '42'                          ORDER2
0624 O                         PL,5      14                               ORDER2
0625 O                                   20 '$ZORD5'                      ORDER2
0626 O                 20                40 'ERROR RETURN CODE = '        ORDER2
0627 O                N20N60             40 'INVALID ORDER FILE  '        ORDER2
0628 O                N20 56             40 'TERMINAL NOT IN FILE'        ORDER2
0629 O                N20 60             40 'END OF ORDER FILE   '        ORDER2
0630 O                 20      RTNCOD    42                               ORDER2
0631 O        D       N10 LR                                              ORDER2
0632 O                                    4 '  GB'                        ORDER2
0633 O                                    8 '280'                         ORDER2
0634 O                         PL,5      14                               ORDER2
0635 O                                   20 '$ZORD2'                      ORDER2
0636 O                         RRECDH    26                               ORDER2
0637 O                         RREC#     32                               ORDER2
0638 O                         ORDNUM    40                               ORDER2
0639 O                         CUSNO     46                               ORDER2
0640 O                         CUSNM     68                               ORDER2
0641 O                         SHPNM     90                               ORDER2
0642 O                         CUSA1    112                               ORDER2
0643 O                         SHPA1    134                               ORDER2
0644 O                         CUSA2    156                               ORDER2
0645 O                         SHPA2    178                               ORDER2
0646 O                         CUSA3    200                               ORDER2
0647 O                         SHPA3    222                               ORDER2
0648 O                         ZIPCD    227                               ORDER2
**
           D         217
```

Figure 8-23 (Part 2 of 2). ORDER2 Program

```
0101 H   R   4                                                            ORDER3
0201 FTERMIN  IP    103 103            SPECIAL       SUBR92               ORDER3
0202 F                                              KPL                   ORDER3
0203 FTERMOUT O     123 123            SPECIAL       SUBR92               ORDER3
0204 F                                              KPL                   ORDER3
0205 FHOLDORD5UC     64  64R           DISK45                             ORDER3
0206 FINVENTRYIC    300 300R           DISK                               ORDER3
0301 E                    PL      5   5  6                                ORDER3
0302 E                    TERM        6  6                                ORDER3
0303 E                    PRI         6 15 2                              ORDER3
0401 ITERMIN  AA  10  15 C%                                               ORDER3
0402 I        BB  35  15 C'                                               ORDER3
0403 I       OR   36  15 C1                                               ORDER3
0404 I       OR   60  15NC'  15NC1  15NC%                                 ORDER3
0405 I                                        1   20RTNCOD                ORDER3
0406 I                                       15  15 AID                   ORDER3
0407 I                                       16  22 PGMNAM                ORDER3
0408 I                                       23  280RRECDH                ORDER3
0409 I                                       29  340RRECDD                ORDER3
0410 I                                       35  360LIN1            79    ORDER3
0411 I                                       37  420QTY1            80    ORDER3
0412 I                                       43  500ITM1            81    ORDER3
0413 I                                       51  520LIN2                  ORDER3
0414 I                                       53  580QTY2                  ORDER3
0415 I                                       59  660ITM2                  ORDER3
0416 I                                       67  88 DESC                  ORDER3
0417 I                                       89 1032PR                    ORDER3
0418 IHOLDORD5AA  65   1 CH                                               ORDER3
0419 I       OR   70   1NCH                                               ORDER3
0420 I                                       14  19 TRMNM                 ORDER3
0421 IINVENTRYAA  75   1 CM   2 CI                                        ORDER3
0422 I                                       13  32 ITMDSC                ORDER3
0423 I                                       42  472PRICE                 ORDER3
0424 I                                      167 1720QTYOH                 ORDER3
0501 C                     SETOF                     2582                 ORDER3
0502 C                     SETOF                     1518                 ORDER3
0503 C                     SETON                     302019               ORDER3
0504 C                     Z-ADD1         I       10                      ORDER3
0505 C           PL,5      LOKUPTERM,I                   31               ORDER3
0506 C  N31      '      '  LOKUPTERM,I                   31               ORDER3
0507 C                     MOVE PL,5      TERM,I                          ORDER3
0508 C   91                                                               ORDER3
0509 COR 92                GOTO END                                       ORDER3
0510 C                     SETOF                     30                   ORDER3
0511 C   10                GOTO END                        PA1 CANCEL PGM ORDER3
0512 C           LIN2      COMP 0                    82    LIN2 ZERO WITH ORDER3
0513 C  N82 36             GOTO END                        PF1 KEY        ORDER3
0514 C                     SETOF                     20    LIN2 NONE ZERO ORDER3
0515 C   36 82             GOTO TAG3                       WITH PF1 KEY   ORDER3
0516 C                     SETOF                     19                   ORDER3
0517 C                     SETON                     25                   ORDER3
0518 C   79                                                NO LINE NUMBER ORDER3
0519 COR 80                                                NO QUANTITY    ORDER3
0520 COR 81                SETON                     18    NO ITEM NUMBER ORDER3
0521 C   18                GOTO END                                       ORDER3
0522 C           ITM1      CHAININVENTRY             16    ITEM INVENTORY ORDER3
0523 C   16                GOTO END                        ITEM NOT FOUND ORDER3
0524 C  N75                SETON                     15    INVALID RECORD ORDER3
0525 C   15                GOTO END                                       ORDER3
0526 C           QTYOH     COMP QTY1                   17  BACKORDER REQ'DORDER3
0527 C           LIN1      COMP LIN2                     21LIN1 = LIN2 OR ORDER3
0528 C   21                                                LIN2 = ZERO    ORDER3
0529 CORN82                GOTO TAG2                                      ORDER3
0530 C           TAG3      TAG                                            ORDER3
0531 C           RRECDD    CHAINHOLDORD5             85    END OF ORD FILEORDER3
0532 C   65                SETON                     85    HEADER RECORD  ORDER3
0533 C   85                SETON                     652019RELEASE TERM   ORDER3
0534 C   85                SETOF                     823625AND CANCEL PGM ORDER3
```

Figure 8-24 (Part 1 of 2). ORDER3 Program

```
0535 C   20                GOTO END                                       ORDER3
0536 C                     SETON                     70                   ORDER3
0537 C                     EXCPT                           PUT ORDER REC  ORDER3
0538 C                     SETOF                     70                   ORDER3
0539 C           RRECDD    ADD  1         RRECDD                          ORDER3
0540 C   36 82             SETOF                     25                   ORDER3
0541 C   36 82             GOTO END                                       ORDER3
0542 C           TAG2      TAG                                            ORDER3
0543 C                     MOVE LIN1      LIN2             MOVE FIELDS TO ORDER3
0544 C           LIN1      ADD  1         LIN1             LINE TWO ON    ORDER3
0545 C                     MOVE QTY1      QTY2             DISPLAY SCREEN ORDER3
0546 C                     MOVE ITM1      ITM2                            ORDER3
0547 C                     MOVE ITMDSC    DESC                            ORDER3
0548 C           PRICE     MULT QTY1      PR                              ORDER3
0549 C                     MOVE PR        PRI,I                           ORDER3
0550 C           END       TAG                                            ORDER3
0551 C                     SETOF                     9192                 ORDER3
0552 C   19                EXCPT                                          ORDER3
0553 C   19                MOVE '       ' TERM,I                          ORDER3
0554 C   19                MOVE PL,3      INVC   20                       ORDER3
0555 C   19      INVC      COMP 00                       LR               ORDER3
0601 OTERMOUT E        20N70                                              ORDER3
0602 O                                    4 '  CB'                        ORDER3
0603 O                                    8 '42'                          ORDER3
0604 O                         PL,5      14                               ORDER3
0605 O                                   20 '$ZORD5'                      ORDER3
0606 O                 30                40 'ERROR RETURN CODE = '        ORDER3
0607 O                 30      RTNCOD    42                               ORDER3
0608 O                 36                40 'NO ITEMS ENTERED    '        ORDER3
0609 O                 65                40 'END OF ORDER FILE   '        ORDER3
0610 O        D        25                                                 ORDER3
0611 O                                    4 '   S'                        ORDER3
0612 O                                    8 '123'                         ORDER3
0613 O                         PL,5      14                               ORDER3
0614 O                                   20 '$ZORD4'                      ORDER3
0615 O                         RRECDH    26                               ORDER3
0616 O                         RRECDD    32                               ORDER3
0617 O                         LIN1      34                               ORDER3
0618 O                 18                70 'ITEM ENTRIES INVALID'        ORDER3
0619 O                 17                70 'BACK ORDER ITEM     '        ORDER3
0620 O                 16                70 'ITEM NOT IN INVENTOR'        ORDER3
0621 O                 15                70 'INVALID INVEN. REC. '        ORDER3
0622 O                         LIN2      72                               ORDER3
0623 O                         QTY2      78                               ORDER3
0624 O                         ITM2      86                               ORDER3
0625 O                         DESC     108                               ORDER3
0626 O                         PR    2  123                               ORDER3
0627 O        E        36 82N70                                           ORDER3
0628 O                                    4 '  GB'                        ORDER3
0629 O                                    8 '32'                          ORDER3
0630 O                         PL,5      14                               ORDER3
0631 O                                   20 '$ZORD3'                      ORDER3
0632 O                         RRECDH    26                               ORDER3
0633 O                         RRECDD    32                               ORDER3
0634 O        E        19N70                                              ORDER3
0635 O                                    4 '   K'                        ORDER3
0636 O                                    8 '14'                          ORDER3
0637 O                         PL,5      14                               ORDER3
0638 OHOLDORD5E        70                                                 ORDER3
0639 O                                    1 'D'                           ORDER3
0640 O                         LIN2       3                               ORDER3
0641 O                         QTY2       9                               ORDER3
0642 O                         ITM2      17                               ORDER3
0643 O                         DESC      39                               ORDER3
0644 O                         PRI,I     54                               ORDER3
**
           D         103
```

Figure 8-24 (Part 2 of 2). ORDER3 Program

```
0101 H   R   4                                                            ORDER4
0201 FTERMIN  IP     34  34            SPECIAL       SUBR92               ORDER4
0202 F                                              KPL                   ORDER4
0203 FTERMOUT O      80  80            SPECIAL       SUBR92               ORDER4
0204 F                                              KPL                   ORDER4
0205 FHOLDORD5UC     64  64R           DISK45                             ORDER4
0206 FINVENTRYUC    300 300R           DISK                               ORDER4
0301 E                    PL      5   5  6                                ORDER4
0401 ITERMIN  AA  10                                                      ORDER4
0402 I                                        1   20RTNCOD                ORDER4
0403 I                                       15  15 AID                   ORDER4
0404 I                                       16  22 PGMNAM                ORDER4
0405 I                                       23  280RRECDH                ORDER4
0406 I                                       29  340RRECDD                ORDER4
0407 IHOLDORD5AA  20   1 CH                                               ORDER4
0408 I                                        2   70RRECD#                ORDER4
0409 I                                       14  19 TRMNM                 ORDER4
0410 I        AB  25   1 CD                                               ORDER4
0411 I       OR   30   1NCH   1NCD                                        ORDER4
0412 I                                        4   90QTY#                  ORDER4
0413 I                                       10  170ITM#                  ORDER4
0414 I                                       40  542PR                    ORDER4
0415 IINVENTRYAA  60                                                      ORDER4
0416 I                                      161 1660QTYOO                 ORDER4
0417 I                                      167 1720QTYOH                 ORDER4
0501 C                     SETON                     4050LR               ORDER4
0502 C   91                                                               ORDER4
0503 COR 92                GOTO END                                       ORDER4
0504 C                     SETOF                     50                   ORDER4
0505 C           RRECDD    CHAINHOLDORD5             83    CHECK IF NEXT  ORDER4
0506 C  N83 20   TRMNM     COMP PL,5                 8383  REC IS HEADER  ORDER4
0507 C   83                GOTO END                        FOR NEXT TERM  ORDER4
0508 C                     SETOF                     202530               ORDER4
0509 C           RRECDH    CHAINHOLDORD5             30    GET HEADER REC ORDER4
0510 C  N20                SETON                     30    FOR THIS TERM  ORDER4
0511 C   30                GOTO END                                       ORDER4
0512 C           RRECDD    ADD  1         RREC1   60       UPDATE POINTER ORDER4
0513 C                     EXCPT                           UPDATE HEADER  ORDER4
0514 C           RRECD#    ADD  4         RREC#   60       JUMP THE N RECSORDER4
0515 C                     Z-ADD0         PRICE  112                      ORDER4
0516 C           TAG1      TAG                                            ORDER4
0517 C                     SETOF                     202530               ORDER4
0518 C           RREC#     CHAINHOLDORD5                   GET ITEM RECORDORDER4
0519 C  N25                SETON                     30                   ORDER4
0520 C   30                GOTO END                                       ORDER4
0521 C           PRICE     ADD  PR        PRICE            ACCUMULAT PRICEORDER4
0522 C           RREC#     ADD  1         RREC#            BUMP RECORD CTRORDER4
0523 C           ITM#      CHAININVENTRY                                  ORDER4
0524 C           QTYOH     COMP QTY#                   27  INCREMENT QUAN-ORDER4
0525 C   27      QTY#      SUB  QTYOH     QTYT    60       TITY ON ORDER  ORDER4
0526 C   27      QTYOO     ADD  QTYT      QTYCO                           ORDER4
0527 C   27                Z-ADD0         QTYOH                           ORDER4
```

Figure 8-25 (Part 1 of 2). ORDER4 Program

```
0528 C   N27      QTYOH     SUB  QTY#      QTYOH            DECREMENT ONHANORDER4
0529 C                      SETON                     27                   ORDER4
0530 C                      EXCPT                                          ORDER4
0531 C           RREC#     COMP RRECDD                   26END OF ORDER?  ORDER4
0532 C   N26                GOTO TAG1                                      ORDER4
0533 C           PRICE     MULT .04       TAX1   102       CALC TAXES FOR ORDER4
0534 C           PRICE     MULT .05       TAX2   102       PRICE ON TOTAL ORDER4
0535 C           PRICE     ADD  TAX1      PRT    112                      ORDER4
0536 C           PRT       ADD  TAX2      PRT                             ORDER4
0537 C           RREC#     CHAINHOLDORD5                   GET NEXT RECORDORDER4
0538 C                      EXCPT                           WRITE TOTAL RECORDER4
0539 C                      SETOF                     40                   ORDER4
0540 C           END       TAG                                            ORDER4
0541 C                      SETOF                     9192                 ORDER4
0601 OHOLDORD5E       N26N27                                              ORDER4
0602 O                         RREC1      7                               ORDER4
0603 O        E        26                                                 ORDER4
0604 O                                    1 'T'                           ORDER4
0605 O                         PRICE     12                               ORDER4
0606 O                         TAX1      22                               ORDER4
0607 O                         TAX2      32                               ORDER4
0608 O                         PRT       43                               ORDER4
0609 OINVENTRYE       N26 27                                              ORDER4
0610 O                         QTYOO    166                               ORDER4
0611 O                         QTYOH    172                               ORDER4
0612 OTERMOUT D        40 LR                                              ORDER4
0613 O                                    4 '  CB'                        ORDER4
0614 O                                    8 '42'                          ORDER4
0615 O                         PL,5      14                               ORDER4
0616 O                                   20 '$ZORD5'                      ORDER4
0617 O                 50                40 'ERROR RETURN CODE = '        ORDER4
0618 O                 50      RTNCOD    42                               ORDER4
0619 O                 83                40 'END OF ORDER FILE   '        ORDER4
0620 O                 30                40 'ORDER FILE OVERLAYED'        ORDER4
0621 O        D       N40 LR                                              ORDER4
0622 O                                    4 '  CB'                        ORDER4
0623 O                                    8 '80'                          ORDER4
0624 O                         PL,5      14                               ORDER4
0625 O                                   20 '$ZORD6'                      ORDER4
0626 O                         PRICE 2   35                               ORDER4
0627 O                         TAX1  2   50                               ORDER4
0628 O                         TAX2  2   65                               ORDER4
0629 O                         PRT   2   80                               ORDER4
**
           D          34
```

Figure 8-25 (Part 2 of 2). ORDER4 Program

```
0101 H   R   4                               1                            ORDERP
0201 FDUMMY   IP  F   1   1            SPECIAL       SUBR93               ORDERP
0202 FREPORT  O     132 132            PRINTER                            ORDERP
0203 FHOLDORD5UC     64  64R           DISK45                             ORDERP
0301 E                    TERM        7  6                                ORDERP
0401 IDUMMY   AA  01                                                      ORDERP
0402 I                                        1   1 DA                    ORDERP
0403 IHOLDORD5AA  10   1 CA                                               ORDERP
0404 I                                        2   70RRECT                 ORDERP
0405 I                                        8  13 TERM,1                ORDERP
0406 I                                       14  19 TERM,2                ORDERP
0407 I                                       20  25 TERM,3                ORDERP
0408 I                                       26  31 TERM,4                ORDERP
0409 I                                       32  37 TERM,5                ORDERP
0410 I                                       38  43 TERM,6                ORDERP
0411 I        AA  11   1 CH                                               ORDERP
0412 I                                        2   70RRECDD                ORDERP
0413 I                                        8  130RRECDP                ORDERP
0414 I        AA  12   1 CN   2 C1                                        ORDERP
0415 I                                        3  100ORDNUM                ORDERP
0416 I                                       11  160CUSNUM                ORDERP
0417 I                                       17  38 CUSNM                 ORDERP
0418 I                                       39  60 CUSA1                 ORDERP
0419 I        AA  13   1 CN   2 C2                                        ORDERP
0420 I                                        3  24 CUSA2                 ORDERP
0421 I                                       25  46 CUSA3                 ORDERP
0422 I        AA  14   1 CN   2 C3                                        ORDERP
0423 I                                        3  24 SHPNM                 ORDERP
0424 I                                       25  46 SHPA1                 ORDERP
0425 I        AA  15   1 CN   2 C4                                        ORDERP
0426 I                                        3  24 SHPA2                 ORDERP
0427 I                                       25  46 SHPA3                 ORDERP
0428 I                                       47  51 ZIPCD                 ORDERP
0429 I        AA  16   1 CD                                               ORDERP
0430 I                                        4   90QTY                   ORDERP
0431 I                                       10  170ITEM                  ORDERP
0432 I                                       18  39 ITMDSC                ORDERP
0433 I                                       40  542PRICE                 ORDERP
0434 I        AA  17   1 CT                                               ORDERP
0435 I                                        2  122PRT                   ORDERP
0436 I                                       13  222TAX1                  ORDERP
0437 I                                       23  322TAX2                  ORDERP
0438 I                                       33  432COST                  ORDERP
0439 I        AA  18                                                      ORDERP
0501 C                     MOVE '      '  TRMNM   6                       ORDERP
0502 C                     Z-ADD1         RREC#   60                      ORDERP
0503 C                     EXSR READF                     GET MASTER REC ORDERP
0504 C  N10                GOTO END                                       ORDERP
0505 C                     Z-ADD1         I       10                      ORDERP
0506 C           TAG4      TAG                                            ORDERP
0507 C           TERM,I    COMP '      '                22END OF TERM LSTORDERP
0508 C   22                GOTO END                                       ORDERP
0509 C           TERM,I    COMP TRMNM                   25IF MULTI HOLD  ORDERP
0510 C   25                GOTO TAG6                      AREA GET LAST  ORDERP
0511 C                     MOVE TERM,I    TRMNM           HEADER RECORD  ORDERP
0512 C                     Z-ADD2         RREC#                           ORDERP
0513 C                     MOVE I         N       10                      ORDERP
0514 C           TAG1      TAG                                            ORDERP
0515 C           N         SUB  1         N             23                ORDERP
0516 C  N23      RREC#     ADD  RRECT     RREC#           JUMP TO HOLD   ORDERP
0517 C  N23                GOTO TAG1                      AREA FOR TERM  ORDERP
0518 C                     MOVE RREC#     RRECDH  60                      ORDERP
0519 C                     EXSR READF                     GET HEADER REC ORDERP
0520 C                     MOVE RRECDP    RREC#           NEXT TO PRINT  ORDERP
0521 C                     GOTO TAG5                                      ORDERP
0522 C           TAG2      TAG                                            ORDERP
0523 C                     EXSR READF                     READ NAME REC  ORDERP
0524 C  N15                GOTO TAG2                                      ORDERP
```

Figure 8-26 (Part 1 of 2). ORDERP Program

```
0525 C                     EXCPT                           PRINT NAME REC ORDERP
0526 C           TAG3      TAG                                            ORDERP
0527 C                     EXSR READF                      READ DETAIL RECORDERP
0528 C                     EXCPT                           PRNT DETAIL RECORDERP
0529 C  N17                GOTO TAG3                                      ORDERP
0530 C                     SETOF                     17                   ORDERP
0531 C           RRECDH    CHAINHOLDORD5                   UPDATE HDR REC ORDERP
0532 C                     EXCPT                           ORDER PRINTED  ORDERP
0533 C           TAG5      TAG                                            ORDERP
0534 C                     SETOF                     1124                 ORDERP
0535 C           RREC#     COMP RRECDD                   24               ORDERP
0536 C  N24                GOTO TAG2                                      ORDERP
0537 C           TAG6      TAG                                            ORDERP
0538 C                     SETOF                     25                   ORDERP
0539 C           I         ADD  1         I                BUMP TERM INDEXORDERP
0540 C                     GOTO TAG4                                      ORDERP
0541 C           END       TAG                                            ORDERP
0542 C                     SETON                     LR                   ORDERP
0543 CSR         READF     BEGSR                                          ORDERP
0544 CSR                   SETOF                     101112               ORDERP
0545 CSR                   SETOF                     131415               ORDERP
0546 CSR                   SETOF                     1617                 ORDERP
0547 CSR         RREC#     CHAINHOLDORD5                                  ORDERP
0548 CSR         RREC#     ADD  1         RREC#            BUMP REL RECORDORDERP
0549 CSR                   ENDSR                                          ORDERP
0601 OREPORT   E 301   15                                                 ORDERP
0602 O                                   61 'ORDER NUMBER'                ORDERP
0603 O                         ORDNUM    70                               ORDERP
0604 O                                   75 'DATE'                        ORDERP
0605 O                         UDATE Y   84                               ORDERP
0606 O         E 2     15                                                 ORDERP
0607 O                                   38 'CUSTOMER'                    ORDERP
0608 O                                  102 'SHIP TO'                     ORDERP
0609 O         E 1     15                                                 ORDERP
0610 O                         CUSNM     44                               ORDERP
0611 O                         SHPNM    110                               ORDERP
0612 O         E 1     15                                                 ORDERP
0613 O                         CUSA1     44                               ORDERP
0614 O                         SHPA1    110                               ORDERP
0615 O         E 1     15                                                 ORDERP
0616 O                         CUSA2     44                               ORDERP
0617 O                         SHPA2    110                               ORDERP
0618 O         E 2     15                                                 ORDERP
0619 O                         CUSA3     44                               ORDERP
0620 O                         SHPA3    110                               ORDERP
0621 O                         ZIPCD    116                               ORDERP
0622 O         E 2     15                                                 ORDERP
0623 O                                   20 'QUANTITY'                    ORDERP
0624 O                                   51 'ITEM'                        ORDERP
0625 O                                   88 'DESCRIPTION'                 ORDERP
0626 O                                  117 'COST'                        ORDERP
0627 O         E 1     16                                                 ORDERP
0628 O                         QTY       19                               ORDERP
0629 O                         ITEM      53                               ORDERP
0630 O                         ITMDSC    92                               ORDERP
0631 O                         PRICE 2  121                               ORDERP
0632 O         E 11    17                                                 ORDERP
0633 O                                  121 '-----------'                 ORDERP
0634 O         E 1     17                                                 ORDERP
0635 O                                  107 'TOTAL'                       ORDERP
0636 O                         PRT    2 121                               ORDERP
0637 O         E 1     17                                                 ORDERP
0638 O                                  107 'STATE TAX'                   ORDERP
0639 O                         TAX1   2 121                               ORDERP
0640 O         E 1     17                                                 ORDERP
0641 O                                  107 'FEDERAL TAX'                 ORDERP
0642 O                         TAX2   2 121                               ORDERP
0643 O         E 1     17                                                 ORDERP
0644 O                                  107 'TOTAL ORDER COST'            ORDERP
0645 O                         COST   2 121                               ORDERP
0646 OHOLDORD5E        11                                                 ORDERP
0647 O                         RREC#     13                               ORDERP
```

Figure 8-26 (Part 2 of 2). ORDERP Program

```
                              ORDER NUMBER 00000006 DATE  2/16/75

              CUSTOMER                                              SHIP TO

        BROWN WHOLESALE SUPPLY                                SLAY PROS INC
            SEVILLE                                              WELLS
        PHILA., PENN                                          PHILA., PENN
                                                              TRUCK              00000

QUANTITY                     ITEM                 DESCRIPTION                     COST

 000001                    00000001             BLUE FLUORESCE                  130.00
 000002                    00000001             BLUE FLUORESCE                  260.00
                                                                             -----------
                                                                 TOTAL          390.00
                                                             STATE TAX           15.60
                                                           FEDERAL TAX           19.50
                                                      TOTAL ORDER COST          425.10



                              ORDER NUMBER 00000010 DATE  2/16/75

              CUSTOMER                                              SHIP TO

        BLACK&JONES CHEMICAL C                                SAME
            19TH STREET
        PHILADELPHIA, PENNA.
                                                              TRUCK              00000

QUANTITY                     ITEM                 DESCRIPTION                     COST

 000002                    00000002             X02 PLUG                         34.26
 000003                    00000003             X03 PLUG                         36.00
 000004                    00000004             X04 PLUG                         68.00
                                                                             -----------
                                                                 TOTAL          138.26
                                                             STATE TAX            5.53
                                                           FEDERAL TAX            6.91
                                                      TOTAL ORDER COST          150.70



                              ORDER NUMBER 00000005 DATE  2/16/75

              CUSTOMER                                              SHIP TO

        FAST ELECTRONICS                                      SAME
        2362 W GLENWOOD
        PITTSBURG, PENN
                                                              AIR FREIGHT        00000

QUANTITY                     ITEM                 DESCRIPTION                     COST

 000001                    00000002             X02 PLUG                         17.13
 000001                    00000001             BLUE FLUORESCE                  130.00
 000004                    00000001             BLUE FLUORESCE                  520.00
                                                                             -----------
                                                                 TOTAL          667.13
                                                             STATE TAX           26.68
                                                           FEDERAL TAX           33.35
                                                      TOTAL ORDER COST          727.16
```

Figure 8-27 (Part 1 of 3). Sample Output of ORDERP Program

```
                                        ORDER NUMBER 00000006 DATE  2/16/75

                   CUSTOMER                                                                  SHIP TO

             JOSEPH  CLARKE                                                            SAM BLIZZARD
                 MAPLE STREET                                                         SAME
            MAPLEWOOD, OHIO                                                            SAME
                                                                                       FIRST CLASS MAIL       00000

QUANTITY                               ITEM                          DESCRIPTION                               COST

 000004                              00000004                       X04 PLUG                                   68.00
 000005                              00000005                       X05 PLUG                                  105.00
                                                                                                         -----------
                                                                                         TOTAL            173.00
                                                                                     STATE TAX              6.92
                                                                                   FEDERAL TAX              8.65
                                                                              TOTAL ORDER COST            188.57



                                        ORDER NUMBER 00000007 DATE  2/16/75

                   CUSTOMER                                                                  SHIP TO

            BENNETT INC                                                               SAME
                CHESTNUT
            PHILA., PENN
                                                                                      AIR FREIGHT             00000

QUANTITY                               ITEM                          DESCRIPTION                               COST

 000001                              00000001                       BLUE FLUORESCE                            130.00
 000002                              00000002                       X02 PLUG                                   34.26
 000003                              00000003                       X03 PLUG                                   36.00
                                                                                                         -----------
                                                                                         TOTAL            200.26
                                                                                     STATE TAX              8.01
                                                                                   FEDERAL TAX             10.01
                                                                              TOTAL ORDER COST            218.28



                                        ORDER NUMBER 00000008 DATE  2/16/75

                   CUSTOMER                                                                  SHIP TO

             STEPHANIE BOOKS                                                           JOHN BOOKS
                 MAPLE STREET                                                         CLEMENTSON COLLEGE
             GREENVILLE, NEW YORK                                                      GETTYSBURG, PENNA.
                                                                                       VIA BEST WAY           00000

QUANTITY                               ITEM                          DESCRIPTION                               COST

 000001                              00000001                       BLUE FLUORESCE                            130.00
 000004                              00000004                       X04 PLUG                                   68.00
                                                                                                         -----------
                                                                                         TOTAL            198.00
                                                                                     STATE TAX              7.92
                                                                                   FEDERAL TAX              9.90
                                                                              TOTAL ORDER COST            215.82
```

Figure 8-27 (Part 2 of 3). Sample Output of ORDERP Program

```
                                     ORDER NUMBER 00000003 DATE  2/16/75

                  CUSTOMER                                                           SHIP TO

          D & C SHIPPERS                                                    SAME
               FILBERT
          PHILA., PENN
                                                                            AIR FREIGHT            00000
QUANTITY                           ITEM                         DESCRIPTION                          COST

 000005                          00000005                   X05 PLUG                                105.00
 000006                          00000006                   XZ6 PLUG                                108.00
                                                                                                 -----------
                                                                                           TOTAL    213.00
                                                                                       STATE TAX      8.52
                                                                                     FEDERAL TAX     10.65
                                                                                TOTAL ORDER COST    232.17



                                     ORDER NUMBER 00000003 DATE  2/16/75

                  CUSTOMER                                                           SHIP TO

          CARLSON BYRNES CO                                                 W K GARRISON CO
               N BROAD                                                          SANSOM
          PHILA., PENN                                                      PHILA., PENN
                                                                           |TRUCK                  00000
QUANTITY                           ITEM                         DESCRIPTION                          COST

 000002                          00000003                   X03 PLUG                                 24.00
 000001                          00000002                   X02 PLUG                                 17.13
                                                                                                 -----------
                                                                                           TOTAL     41.13
                                                                                       STATE TAX      1.64
                                                                                     FEDERAL TAX      2.05
                                                                                TOTAL ORDER COST     44.82
```

Figure 8-27 (Part 3 of 3). Sample Output of ORDERP Program

```
// DISKFILE NAME-HOLDORD5,ORG-D,RECL-64
// DISKFILE NAME-CUSTSHIP,ORG-D,RECL-128
// DISKFILE NAME-CUSTNAME,ORG-D,RECL-300
// DISKFILE NAME-INVENTRY,ORG-D,RECL-300
// PROGRAM NAME-ORDERL,ENDMSG-YES,PGMDATA-NO,MFCU1-R,PRINTER-SHR,
// FILES-¤HOLDORD5/DO¤
// PROGRAM NAME-ORDER1,PGMDATA-YES,ENDMSG-NO,
// DFFMTERM-1,DFFNDF-1,DFFSFDT-182,
// FILES-¤CUSTNAME/DG/SHR,CUSTSHIP/DG/SHR¤
// PROGRAM NAME-ORDER2,PGMDATA-YES,ENDMSG-NO,
// DFFMTERM-1,DFFNDF-1,DFFSFDT-312,
// PRUFLNG-243,PRUF$Z-$ZORD1,
// FILES-¤HOLDORD5/DU/SHR¤
// PROGRAM NAME-ORDER3,PGMDATA-YES,ENDMSG-NO,
// MRTMAX-4,DFFMTERM-4,DFFNDF-2,DFFSFDT-312,
// PRUFLNG-123,PRUF$Z-$ZORD2,
// FILES-¤HOLDORD5/DU/SHR,INVENTRY/DG/SHR¤
// PROGRAM NAME-ORDER4,PGMDATA-YES,ENDMSG-YES,
// DFFMTERM-1,DFFNDF-1,DFFSFDT-70,
// PRUFLNG-30,PRUF$Z-$ZORD3,
// FILES-¤HOLDORD5/DU/SHR,INVENTRY/DU/SHR¤
// PROGRAM NAME-ORDERP,PGMDATA-NO,ENDMSG-YES,PRINTER-YES,
// FILES-¤HOLDORD5/DU/SHR¤
```

Figure 8-28. Assignment Set Considerations

$ZORD1

```
C$ZORD1SHPNM 2Y X R1
FPGMNAM0102007    7CY          ORDER2
FORDERH03010121F               ORDER NUMBER
FORDNUM0316008    8EY
FCUSTH 05010151F               CUSTOMER NUMBER
FCUSNO 0518006    8FY
FCUSNMH07010131F               CUSTOMER NAME
FSHPNMH07360071F               SHIP TO
FCUSNM 0901022    8EY
FSHPNM 0936022    1EY
FCUSA1 1001022    8FY
FSHPA1 1036022    1FY
FCUSA2 1101022    8EY
FSHPA2 1136022    1EY
FCUSA3 1201022    8FY
FSHPA3 1236022    1FY
FZIPCD 1260005    3FY
   INFORMATION FOR USE DURING CCP ASSIGNMENT STAGE
   -----------------------------------------------

THE DECIMAL LENGTH OF THE FIELD DESCRIPTOR TABLE IS 0182
THE DECIMAL LENGTH OF THE OUTPUT TEXT IS 0399
THE DECIMAL LENGTH OF THE INPUT TEXT IS 0243
```

Figure 8-29 (Part 1 of 3). Formats

$ZORD2

```
C$ZORD2QTY1  2N X R1
FPGMNAM0102007    7GY          ORDER3
FRRECDD0111012    7EY
FORDNUM03160081E
FCUSNO 05180061E
FCUSNM 09010221E
FSHPNM 09360221E
FCUSA1 10010221E
FSHPA1 10360221E
FCUSA2 11010221E
FSHPA2 11360221E
FCUSA3 12010221E
FSHPA3 12360221E
FZIPCD 12600051E
FLINEH 15010081F               LINE NO.
FQTYH  15140081F               QUANTITY
FITMH  15240081F               ITEM NO.
FDESCH 15380111F               DESCRIPTION
FPRICEH15660051F               PRICE
FLIN1  1604002    3GY          01
FQTY1  1614006    3GY
FITM1  1624008    3GY
FLIN2  1704002    7EY
FQTY2  1714006    7EY
FITM2  1724008    7EY
FDESC  1734022    7EY
FPRICE 1759015    7EY
   INFORMATION FOR USE DURING CCP ASSIGNMENT STAGE
   -----------------------------------------------

THE DECIMAL LENGTH OF THE FIELD DESCRIPTOR TABLE IS 0312
THE DECIMAL LENGTH OF THE OUTPUT TEXT IS 0513
THE DECIMAL LENGTH OF THE INPUT TEXT IS 0123
```

$ZORD3

```
C$ZORD3      2Y X R1
FPGMNAM0102007    7GY          ORDER4
FRRECDD0111012    7EY
FORDERM03010291F               PRESS ENTER TO COMPLETE ORDER

   INFORMATION FOR USE DURING CCP ASSIGNMENT STAGE
   -----------------------------------------------

THE DECIMAL LENGTH OF THE FIELD DESCRIPTOR TABLE IS 0056
THE DECIMAL LENGTH OF THE OUTPUT TEXT IS 0079
THE DECIMAL LENGTH OF THE INPUT TEXT IS 003C
```

$ZORD4

```
C$ZORD4QTY1  2N X R1
FPGMNAM0102007    7GY          ORDER3
FRRECDD0111012    7EY
FLIN1  1604002    3EY
FQTY1  1614006    3EY
FITM1  1624008    3EY
FMESG  16340221F
FLIN2  1704002    8EY
FQTY2  1714006    8EY
FITM2  1724008    8EY
FDESC  1734022    8EY
FPRICE 1759015    8EY

   INFORMATION FOR USE DURING CCP ASSIGNMENT STAGE
   -----------------------------------------------

THE DECIMAL LENGTH OF THE FIELD DESCRIPTOR TABLE IS 0168
THE DECIMAL LENGTH OF THE OUTPUT TEXT IS 0225
THE DECIMAL LENGTH OF THE INPUT TEXT IS 0123
```

Figure 8-29 (Part 2 of 3). Formats

$ZORD5

```
C$ZORD5      2Y X R1
FERRMS001020201F               ORDER CANCELED
FERRMS201230021F
FERRMS301270151F               ORDER CANCELED

   INFORMATION FOR USE DURING CCP ASSIGNMENT STAGE
   -----------------------------------------------

THE DECIMAL LENGTH OF THE FIELD DESCRIPTOR TABLE IS 0056
THE DECIMAL LENGTH OF THE OUTPUT TEXT IS 0058
THE DECIMAL LENGTH OF THE INPUT TEXT IS 0005
```

$ZORD6

```
C$ZORD6      2Y X R1
FHEAD1 03010181F               ORDER IS COMPLETED
FPRICH 05010061F               AMOUNT
FPRICE 05170151F
FHEAD2 06010131F               STATE TAX
FTAX1  06170151F
FHEAD3 07010131F               FEDERAL TAX
FTAX2  07170151F
FHEAD4 08170151F               ---------------
FTOTALH10010131F               TOTAL
FTOTAL 10170152F

   INFORMATION FOR USE DURING CCP ASSIGNMENT STAGE
   -----------------------------------------------

THE DECIMAL LENGTH OF THE FIELD DESCRIPTOR TABLE IS 0070
THE DECIMAL LENGTH OF THE OUTPUT TEXT IS 0194
THE DECIMAL LENGTH OF THE INPUT TEXT IS 0005
```

Figure 8-29 (Part 3 of 3). Formats

After you have written a program which is to be run under the CCP, you must take steps to make it usable under the CCP:

1. Compile or assemble the program to create an object module.
2. Link-edit the object module.
3. You may need to copy the program module to your production CCP disk pack or to the system pack that will be online by using the Library Maintenance program ($MAINT).
4. Prepare assignment specifications to include the program and the resources required by the program (such as disk files, terminals, and unit record devices) in one or more assignment sets in the assignment file, $CCPFILE, and execute the Assignment Build program (see *CCP System Reference Manual*).

Before taking the preceding steps, be sure to read *Disk File Considerations* and *Unit Record File Considerations*, later in this chapter.

Source programs cannot be compiled or assembled under CCP control. Programs may be compiled or assembled in the non-CCP program level of a DPF (dual partition) system; however, if the program is a recompilation of a program that is available to the CCP in the current assignment set, the new object module should be placed on a disk pack that is not being used by the CCP. New programs may be placed on a CCP program pack, but will not be available to the CCP until they are included in an assignment set.

Note: 5704-SC2 supports an application development feature that allows new or modified programs to be catalogued online to an active CCP library on the system or program pack. By specifying EXECFIND-YES on the PROGRAM assignment statement, the program is located and catalogued in the library each time the program is requested. If this function is used extensively, system performance can be degraded because the program must be located each time it is requested rather than once at Startup.

COMPILING AND LINK-EDITING THE PROGRAM – MODEL 15 CCP

Procedures for compiling or assembling a source program are given in the appropriate programming language reference manual (see *Appendix C: Bibliography*) or in *IBM System/3 Model 15 System Control Programming Reference Manual,* GC21-5077. If the program is written in Basic Assembler language and uses CCP-provided macros ($Nxxx), the source program must be processed by both the Macro Processor and the Basic Assembler.

The compilation (or assembly) output is a relocatable object module that must be link-edited to form a load module with a start address of X'8000'. CCP Startup accepts only programs that are link-edited to start at X'8000'. If compilation and link-editing are to be performed as a single step (as they can be, in RPG II, COBOL, and FORTRAN IV), the start address is specified by using the LINKADD parameter on the // COMPILE OCL statement (LINKADD–8000). If compilation and link-editing are to be separate steps, the // PHASE Overlay Linkage Editor control statement must specify LINKADD –X'8000'. Assembling and link-editing Basic Assembler programs must always be separate steps. RPG II, COBOL, and FORTRAN IV programs can be compiled and link-edited either as a single step or as separate steps, as determined by:

RPG II	– The entry in column 10 (Object Output) of the RPG II Control Card Specifications
COBOL and FORTRAN	– The LINK operand of the PROCESS statement

The maximum size of a user program under Model 15 CCP is 32K, including any program-appended storage area for DFF, but not including any additional storage for execution of memory resident overlay programs. Under 5704-SC2, external buffers can be defined and supported. The storage required for the external buffers is not included in the maximum 32K program size. See the *IBM System/3 Model 15 System Control Programming Concepts and Reference Manual*, GC21-5162, for additional information on external buffers.

Programs which use 5445/3340 disk files must be compiled/link-edited on a system of that disk-file type. This will enable the proper data management support to be included in the program.

Notes:

1. Programs running directly under Model 15 disk system management (not running under CCP) must be link-edited to start at X'4000'. A halt occurs if these programs are link-edited at X'8000'.
2. Programs that use indexed random add disk file access (IRA or IRUA – see index entry *access value*) for files that can be shared must be link-edited on a system that has been generated to support CCP.

COMPILING THE PROGRAM–MODEL 10 AND MODEL 12 CCP

Procedures for compiling or assembling a source program are given in the appropriate programming language reference manual or in the *IBM System/3 Models 10 and 12 Control Programming Reference Manual,* GC21-7512.

RPG II–Model 10 and Model 12 CCP

During generation, the CCP copies the RPG II communications service subroutines (SUBR90, SUBR91, SUBR92, and SUBR93) to the disk pack specified by the PPUNIT-xx parameter of the $EPLG generation statement. This pack must be used to compile RPG II programs to run under the CCP.

If unit record devices–MFCU, 1442 Card Read/Punch, 3741 (data mode support only), 5203 or 1403 printers–were specified as being supported by the CCP, the CCP also copies special intermediary routines for unit record data management modules to the RPG II pack specified by the PPUNIT-xx parameter. These intermediary routines are named the same as the RPG II unit record data management modules and the RPG II modules are renamed. If unit record devices were specified, this pack cannot be used to compile RPG II programs to run under disk system management (DSM) that use unit record devices. See *Link Editing the Program,* later in this section, for additional information.

COBOL and FORTRAN IV–Model 10 and Model 12 CCP

During generation, the CCP copies the COBOL and/or FORTRAN IV communications service subroutines (CCPCIO, CCPFIO) to the pack specified by the PPUNIT-xx parameter of the $EPLG generation statement for COBOL and/or the $EPLG statement for FORTRAN.

If unit record devices–MFCU, 1442 Card Read/Punch, 3741 (data mode support only), 5203 or 1403 printers–were specified as being supported by the CCP, CCP generation also copies special intermediary routines for the unit record data management modules to the COBOL or FORTRAN pack specified by the PPUNIT-xx parameter. These routines interface with the standard DSM modules; they are not replacements for the DSM modules.

The COBOL and FORTRAN IV compilers permit you to choose, by means of a PROCESS statement:

1. To produce a relocatable module that can be processed in a separate link-editing run (if the program uses unit record devices).
2. To invoke the Overlay Linkage Editor automatically to produce a load module (if not using unit record devices). (See *Link Editing the Program*.)

Basic Assembler–Model 10 and Model 12 CCP

During generation, the CCP copies the CCP-provided macros ($Nxxx) to the pack specified in the PPUNIT-xx parameter of the $EPLG statement (LANG-ASSEM).

If unit record devices–MFCU, 1442 Card Read/Punch, 3741 (data mode support only), 5203 or 1403 printers–were specified as being supported by the CCP, CCP generation also copies special intermediary routines for the unit record data management modules to the pack specified by the PPUNIT-xx parameter. These routines interface with the standard DSM modules; they are not replacements for the DSM modules. See *Link-Editing the Program* for additional information.

If your Basic Assembler program uses the CCP-provided macros, both the Macro Processor and the Basic Assembler program are required to process the source program prior to link editing. The $Nxxx macros must either be on the same pack as the Macro Processor or on the system pack. If your program does not use the CCP macros, you need only assemble and link edit the program.

LINK-EDITING THE PROGRAM—MODEL 10 AND MODEL 12 CCP

Link-editing is not a separate step when preparing an RPG II program to be run under the CCP, since RPG II compilation includes link-editing. Link-editing is always a separate step in preparing a Basic Assembler program.

When compiling COBOL and FORTRAN IV programs, you can specify that compilation and link editing be a single step by means of the LINK operand on the PROCESS statement. However, you *must not* choose to invoke the Overlay Linkage Editor automatically for programs that access one or more unit record devices (MFCU, 1442 Card Read/Punch, 5203 or 1403 printers).

If the program being prepared was written in COBOL, FORTRAN IV, or Basic Assembler and accesses one or more unit record devices, you must enter // EQUATE Overlay Linkage Editor statements to cause the special CCP-provided subroutines to be inserted in the load module between your program and the DSM unit record data management modules your program uses. These statements must be in the following form:

```
// EQUATE OLDNAME-$$xxxx,NEWNAME-$Nxxxx
```

Figure 9-1 shows the OLDNAME- and NEWNAME- parameters that must be used for various unit record files. Use Figure 9-3 and 9-4 to determine which DSM unit record data management modules will be used by your COBOL or FORTRAN program.

You must not enter // EQUATE statements if the disk pack you are using for link-editing also supports RPG II, since the DSM modules have already been renamed. Figure 9-2 shows the normal RPG II unit record data management module names and the CCP intermediary module names. Since the intermediary modules have the standard DSM module names in this case, no renaming is required.

Overlay Linkage Editor Control Statements—Model 10 and Model 12 CCP

The following Overlay Linkage Editor control statements are used for COBOL, FORTRAN IV, and Basic Assembler programs that use unit record devices (see *System/3 Overlay Linkage Editor Reference Manual,* GC21-7561, for complete descriptions of these statements):

1. Disk pack used for link-editing does not support RPG II for CCP (see Figure 9-1):

```
  // PHASE . . .
  // OPTIONS . . .
  // EQUATE OLDNAME-$$xxxx,NEWNAME-
     $Nxxxx,UNIT-xx
  // EQUATE OLDNAME-@@xxxx,NEWNAME-
     $$xxxx,UNIT-xx
  // INCLUDE NAME-user program name,... (or relo-
     catable object deck)
* // INCLUDE NAME-$$xxxx,. . .
* // INCLUDE NAME-$Nxxxx, . . .
  .
  :
  // END
```

* The INCLUDE statements can be eliminated if:

a. The data management modules reside on the same pack as the Overlay Linkage Editor.

b. The UPACK- keyword is specified on the // OPTIONS statement.

Example: Assume the following:

a. Program SAMPLE resides in the relocatable library on R1.

b. Program SAMPLE uses the printer under CCP.

c. The Overlay Linkage Editor and the data management modules reside on the same pack (R1).

d. R2 is the pack to be used during a CCP run.

The required Overlay Linkage Statements are:

```
// PHASE NAME-SAMPLE,UNIT-R2,RETAIN-P
// OPTIONS MAP-XREF
// INCLUDE NAME-SAMPLE,UNIT-R1
// EQUATE OLDNAME-$$LPRT,NEWNAME-$NLPRT
// EQUATE OLDNAME-@@LPRT,NEWNAME-$$LPRT
// END
```

MODEL 10 AND MODEL 12 UNIT RECORD DATA MANAGEMENT FUNCTION	FIRST / / EQUATE		SECOND / / EQUATE	
	OLDNAME-	NEWNAME-	OLDNAME-	NEWNAME-
1442 card read/punch	$$ARFF	$NARFF	@@ARFF	$$ARFF
5203/1403 printer	$$LPRT	$NLPRT	@@LPRT	$$LPRT
5424 MFCU read/punch	$$MFRU	$NMFRU	@@MFRU	$$MFRU
Read/print	$$MFRP	$NMFRP	@@MFRP	$$MFRP
Read only	$$MFRD	$NMFRD	@@MFRD	$$MFRD
Punch only	$$MFPU	$NMFPU	@@MFPU	$$MFPU
Print only	$$MFPR	$NMFPR	@@MFPR	$$MFPR
Print/punch	$$MFPP	$NMFPP	@@MFPP	$$MFPP
Full function	$$MFFF	$NMFFF	@@MFFF	$$MFFF
3741 Read	$$CPIP	$NCPIP	@@CPIP	$$CPIP
Punch	$$CPOP	$NCPOP	@@CPOP	$$CPOP

Figure 9-1. Unit Record Data Management Names to be used in // EQUATE Overlay Linkage Editor Statements for Model 10 and Model 12 COBOL, FORTRAN IV, and Basic Assembler Programs Using Unit Record Devices (non-RPG II Disk Pack)

2. Disk pack used for link-editing supports RPG II for CCP (see Figure 9-2):

```
  // PHASE . . .
  // OPTIONS . . .
  // INCLUDE NAME-user program name . . . (or
     relocatable object deck)
* // INCLUDE NAME-$$xxx,...
* // INCLUDE NAME-$$Uxxx,...


  // END
```

* See note under 1.

Example: Assume the following:

a. Program SAMPLE is a relocatable object deck.
b. Program SAMPLE uses the printer under CCP.
c. The Overlay Linkage Editor resides on a pack separate from the data management modules.
d. The pack to be used during the CCP run resides on R2.

The required Overlay Linkage Editor statements are:

```
// PHASE NAME-SAMPLE,UNIT-R2,RETAIN-P
// OPTIONS MAP-XREF
Object deck
// INCLUDE NAME-$$LPRT,UNIT-R1
// INCLUDE NAME-$$UPRT,UNIT-R1
// END
```

Link-Editing a Program to Run Under DSM—Models 10 and 12

Special considerations apply to link-editing programs to run directly under Model 10 and Model 12 DSM if unit record devices are used in the programs and are also supported by the CCP.

RPG II—Model 10 and Model 12 CCP

If unit record devices are being used by both the CCP RPG II programs and the non-CCP RPG II programs, you must use separate disk packs for compiling the two different types of programs. If unit record devices are not being used in both the CCP environment and the non-CCP environment, the same pack can be used for compiling both types.

Model 10 and Model 12 Unit Record Data Management Function		Unit Record Data Management Module	CCP Intermediary Module
1442 card read/punch		$$URFF	$$ARFF
5203/1403 printer		$$UPRT	$$LPRT
5424 MFCU read/punch		$$UFRU	$$MFRU
	Read/print	$$UFRP	$$MFRP
	Read only	$$UFRD	$$MFRD
	Punch only	$$UFPU	$$MFPU
	Print only	$$UFPR	$$MFPR
	Print/punch	$$UFPP	$$MFPP
	Full function	$$UFFF	$$MFFF
3741	Read	$$UPIP	$$CPIP
	Punch	$$UPOP	$$CPOP

Figure 9-2. Unit Record Data Management Names for All Languages, if the Pack Also Supports RPG II for Model 10 and Model 12 CCP. // INCLUDE Overlay Linkage Editor statements are required if the Overlay Linkage Editor is on a different pack from these modules.

Model 10 and Model 12 Data Management Module Name	Language Statements as they Appear in a COBOL Program
$$ARFF	UR-1442-RD or UR-1442-PU
$$LPRT	UR-1403-n-nnn or UR-5203-n-nnn
$$MFRU	* UR-5424 $\left\{\begin{matrix}P\\S\end{matrix}\right\}$ -RD-n UR-5424 $\left\{\begin{matrix}P\\S\end{matrix}\right\}$ -PU-n
$$MFRP	* UR-5424 $\left\{\begin{matrix}P\\S\end{matrix}\right\}$ -RD-n UR-5424 $\left\{\begin{matrix}P\\S\end{matrix}\right\}$ -PR-n
$$MFFF	* UR-5424 $\left\{\begin{matrix}P\\S\end{matrix}\right\}$ -RD-n UR-5424 $\left\{\begin{matrix}P\\S\end{matrix}\right\}$ -PU-n UR-5424 $\left\{\begin{matrix}P\\S\end{matrix}\right\}$ -PR-n
$$MFRD	UR-5424 $\left\{\begin{matrix}P\\S\end{matrix}\right\}$ -RD
$$MFPU	UR-5424 $\left\{\begin{matrix}P\\S\end{matrix}\right\}$ -PU
$$MFPR	UR-5424 $\left\{\begin{matrix}P\\S\end{matrix}\right\}$ -PR
$$MFPP	UR-5424 $\left\{\begin{matrix}P\\S\end{matrix}\right\}$ -PI

* Hopper (P or S) and association value (n) are the same in each statement.

Figure 9-3. Unit Record Data Management Used by Model 10 and Model 12 COBOL Programs

Model 10 and Model 12 Data Management Module Name	Device Option Statements and Language Statements Used in a FORTRAN Program

$$ARFF	// READ DEVICE-1442
	READ (9, . . .) . . .
	// PUNCH DEVICE-1442
	WRITE (9, . . .) . . .

$$LPRT	// PRINT DEVICE- $\left\{\begin{matrix}1403\\5203\end{matrix}\right\}$ WRITE (3, . . .) . . . CALL P1403 (. . .) CALL S1403 (. . .) } 1403 CALL SP1403 (. . .) CALL PRINT (. . .) CALL SKIP (. . .) } 5203 CALL SPACE (. . .)

$$MFRU	// READ DEVICE-MFCU2
	// PUNCH DEVICE-MFCU2
	CALL READ (. . .)
	CALL PUNCH (. . .)

$$MFRP	// READ DEVICE-MFCU2
	// PRINT DEVICE-MFCU2
	READ (2, . . .)
	WRITE (2, . . .)
	CALL READ (. . .)

$$MFFF	// READ DEVICE-MFCU2
	// PUNCH DEVICE-MFCU2
	// PRINT DEVICE-MFCU2
	READ (2, . . .)
	WRITE (2, . . .)
	CALL READ (. . .)
	CALL PUNCH (. . .)

$$MFRD	// READ DEVICE-MFCU1
	READ (1, . . .)
	// READ DEVICE-MFCU2
	READ (2, . . .)
	CALL READ (. . .)
	CALL STACK (. . .)

$$MFPU	// PUNCH DEVICE-MFCU2 WRITE (2, . . .) CALL PUNCH (. . .) CALL STACK (. . .)
$$MFPR	// PRINT DEVICE-MFCU2 WRITE (2, . . .)

$$MFPP	// PRINT DEVICE-MFCU2
	// PUNCH DEVICE-MFCU2
	WRITE (2, . . .)
	CALL PUNCH (. . .)

Figure 9-4. Unit Record Data Management Used by Model 10 and Model 12 FORTRAN Programs

COBOL, FORTRAN IV, and Basic Assembler—Model 10 and Model 12 CCP

Different considerations apply to link editing COBOL, FORTRAN, and Basic Assembler programs to run directly under Model 10 and Model 12 DSM, depending on whether or not the disk pack used for link-editing contains the CCP intermediary routines for RPG II unit record data management.

Pack Not Containing RPG II CCP Intermediary Modules: If unit record devices are used, no special INCLUDE or EQUATE statements are required for unit record data management modules. Therefore, automatic link editing can be done when compiling COBOL and FORTRAN programs.

Pack Containing RPG II CCP Intermediary Modules: If unit record devices are to be used, a separate link edit step is required. The required Overlay Linkage Editor control statements are:

```
 // PHASE ...
 // OPTIONS ..
 // EQUATE OLDNAME-$$xxxx,NEWNAME-$$Uxxx
 // INCLUDE NAME-user program name,... (or relocatable
    object deck)
*// INCLUDE NAME-$$Uxxx,...
 .
 :
 // END
```

* See note under 1.

Example: Assume the following:

a. Program SAMPLE resides in a relocatable library on R1.
b. Program SAMPLE uses the printer.
c. The Overlay Linkage Editor resides on a pack different from the data management modules.
d. The pack to be used for CCP execution resides on R1.

The required Overlay Linkage Editor statements are:

```
// PHASE NAME-SAMPLE,UNIT-R1,RETAIN-P
// OPTIONS MAP-XREF
// EQUATE OLDNAME-$$LPRT,NEWNAME-$$UPRT
// INCLUDE NAME-SAMPLE,UNIT-R1
// INCLUDE NAME-$$UPRT,UNIT-R1
// END
```

COPYING THE LOAD MODULE

During CCP execution, the programs to be executed under the CCP must be on either the pack from which the CCP was loaded (// LOAD $CCP,xx) or the pack from which DSM was initially loaded (IPL'ed). If the compile and link edit processes did not cause the program module to be located in the object library of either of these packs, you must execute the Library Maintenance program to copy the module to the appropriate pack.

MAKING ASSIGNMENTS

To permit a new program to be executed under the CCP, the program must be defined in an assignment set. A // PROGRAM statement and possibly other statements must be added to at least one of the assignment sets, and an Assignment Build run must be made (see *CCP System Reference Manual*).

You must provide the following information about your program to the person responsible for maintaining the CCP assignment sets:

- If the program uses the 3270 Display Format Facility:
  - Number of terminals in the program that use DFF
  - Number of display formats used by the program
  - Size of the largest Field Descriptor Table for display formats used by the program, rounded up to the next multiple of 256 (the size of this table is given in the printed output of the Display Format Generator)

Note: See *Assignment* in *CCP System Reference Manual* for an example of calculating storage sizes.

- Disk file usage—disk file organizations and processing methods used (see *Disk File Considerations*); are disk files sharable (see Index entry *disk file sharing*)?
- Input and output communications record area sizes.
- Terminals used by the program and whether they are required by the program in order to run or acquired by the program as it is running.
- Terminal attribute sets required for each terminal to be used in your program.
- Program type—SRT, MRT, never-ending, dedicated (runalone), reusable—if MRT, how many terminals can the program service at one time? (Dedicated and reusable types are defined for Models 10 and 12.)

- Program name.
- Programming language used.
- The unit record devices used:
  - 5203 Printer (Models 10 and 12)
  - 1403 Printer
  - MFCU
  - MFCM (Model 15 only)
  - 1442 Card Read Punch
  - 2501 Card Reader (Model 15 only)
  - 3741 Data Station Model 1 or 2 or Programmable Work Station Model 3 or 4
- Is data allowed with the program request?
- Whether or not this is a CCP/Sort program (5704-SC2 only).
- Whether or not you want a message sent to a requesting terminal when either you release the terminal or your program goes to end of job.
- The priority of this program when executing (5704-SC2 only).
- How much additional storage is desired for execution of memory resident overlay programs (Model 15).
- Whether or not this program is in the object library at CCP startup.
- If your program is written in either RPG II or FORTRAN and disk file buffer sharing is allowed (Models 10 and 12).

UNIT RECORD FILE CONSIDERATIONS—MODEL 10 AND MODEL 12 CCP

The following considerations apply to use of unit record devices by programs running under the CCP and between the CCP and non-CCP program levels of a DPF system:

- A unit record device (1442, MFCU, 3741, 1403, and 5203) cannot be shared by programs running under the CCP and cannot be shared by programs running in opposite levels of a DPF system. If the printer is spooled in the CCP program level on a Model 12, the printer can be shared by other programs in the CCP program level. If your CCP application program uses unit record devices, the CCP allocates the devices to your program before it is allowed to run. Your program keeps control of the devices until it terminates. If no program running under the CCP (or in the process of being loaded) requires a unit record device, the system operator can allocate the use of unit record devices to the non-CCP program level in a DPF system.
- You must not use the printer/keyboard (console) under the CCP except as a communications device, using CCP operations.
- A program using unit record devices compiled to run under the CCP will not run on a non-CCP system.

See *Link-Editing the Program*, earlier in this chapter, for additional considerations for using unit record devices in COBOL, FORTRAN, and Basic Assembler programs.

UNIT RECORD FILE CONSIDERATIONS—MODEL 15 CCP

The following considerations apply to use of unit record devices (1403 Printer; MFCU; MFCM; 2501 Card Reader; 3741 Model 1 and 2 Data Station and Model 3 and 4 Programmable Work Station; 1442 Card Read Punch) by programs running under CCP and among the CCP partition and non-CCP partitions:

- If your application program uses unit record devices, CCP allocates the devices to your program before your program is allowed to run. Your program retains control of the devices until it terminates.
- In general, unit record devices cannot be shared by programs running under CCP; they can never be shared among programs running in the CCP partition and programs running in a non-CCP partition. If, however, the unit record device is being spooled in the CCP partition, the device is always available to CCP, but only to one application program at a time. Also, the printer may be shared, even when it is not spooled, by CCP application programs for which PRINTER – SHR is specified in the PROGRAM assignment statement.
- The CRT/Keyboard (console) can be used only as a communications device, that is, CCP operations must be used to perform I/O to the console.
- If you request a program that uses a unit record device other than a printer (that is, a punched-card device or a 3741) and that device is not immediately available to the program, your request is rejected, whether or not a queue command is in effect.

DISK FILE CONSIDERATIONS

Models 10 and 12 Considerations

The following considerations apply to the use of disk files by programs running under Model 10 and 12 CCP:

Multivolume Files: Multivolume disk files are not supported under CCP.

Online Files: All files available to programs on the current run of CCP must be online (mounted on a 5444, 5445, or 3340) and described by FILE OCL statements at CCP startup time.

Disk File Names: If two or more programs that are meant to execute in the same CCP run reference the same disk file, the file name used in each of those programs must be the same (except if symbolic files are used – see *DISKFILE* and *SYMFILE* assignment statements in the *CCP System Reference Manual*, GC21-7588, for additional information).

Opening and Closing of Files: All disk files described by FILE and matching DISKFILE statements are opened during CCP startup according to the file organization and access methods specified at assignment time (see *Determining the Disk File Access Value* in this chapter). All files are closed during CCP shutdown.

Index Sort: If required, the index sort for index files is done during CCP shutdown.

Accessing Records Added to an Indexed File: There are special considerations when using certain file organizations and processing methods during a CCP run. Figure 9-5 illustrates special considerations when records are added to an indexed file during a CCP run.

Abnormal Termination: If CCP terminates abnormally (for example, because of a power failure, processor check, or U-halt), CCP does not automatically close files. When an abnormal termination of CCP occurs, the CCP disk file recovery programs ($CCPRB for a Model 10, $RINDX for a Model 12) can be used to close all disk files, and optionally can be used to update the necessary file pointers so that records added during the previous CCP run can be accessed in subsequent runs. See the *CCP System Operator's Guide*, GC21-7581, for a description of $CCPRB; the *Model 12 SCP Reference Manual*, GC21-5130, for a description of $RINDX.

Accessing Indexed Sequential Add and Ordered Indexed Files: Once an indexed sequential add or an ordered indexed file load is done by a program running under CCP, the file cannot be accessed by other programs during the CCP run until the program that first accesses the file closes the file.

Sharing Files Between Program Levels: The rules for sharing disk files between program levels of a DPF system are:

CCP Program Level	**Other Program Level**
Input file	Can retrieve and update.
Update file	Can retrieve.
Add file	Cannot process file.
Load file	Cannot process file.

Direct Files: A program running under CCP cannot create a direct file. When using a direct file, at least a *dummy* file (no records) must exist prior to the CCP run.

Consecutive Updates to the Same Record: When file sharing is allowed (specified by the FSHARE parameter on the $EFAC generation statement), do not attempt to update the same record in succession without an intervening read of that same record within the program.

Indexed Load Files: If a disk file, defined as indexed-load access (access value IO or IOU), is not loaded during a CCP run, the file exists after CCP shutdown but contains no records.

Master Index: A master index for 5444 disk files is built by CCP based on the MSTRINDX keyword of the DISKFILE assignment statement (see the *CCP System Reference Manual*, GC21-7588). Therefore, you should not specify a master index in your application programs.

Adding to a File by Two Programs: Two programs actually adding to the same file cannot run concurrently.

Program 1 (P1)

Accesses old records in indexed file, FILEX, and adds new records to the file (access value IRA or IRUA).

Program 2 (P2)

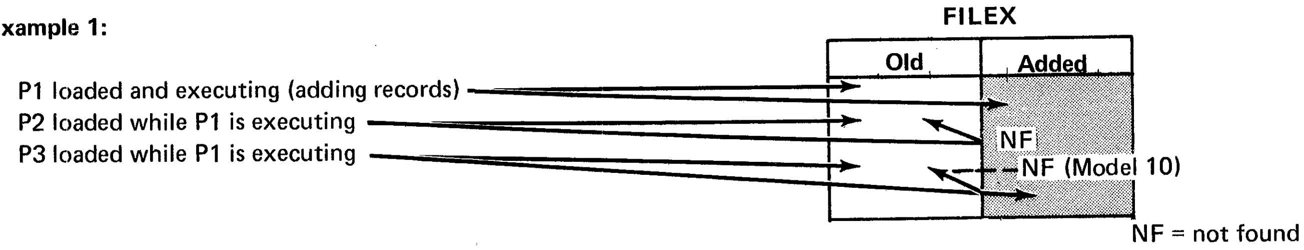
Accesses old records (access value IR or IRU).

Program 3 (P3)

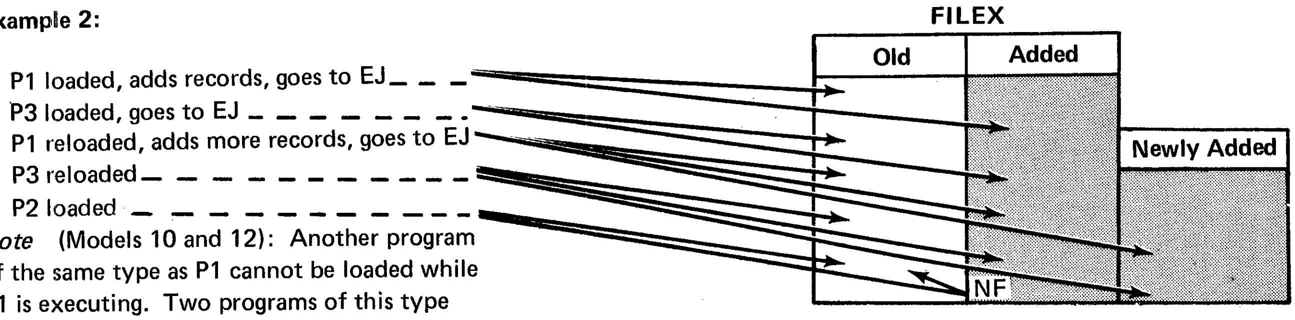
Accesses old records and records added during this CCP run, but does not add records itself (access value IRANA or IRUANA for Model 10 and Model 12 CCP, IRA or IRUA for Model 15 CCP).

(*Note:* Old records are records in the file prior to CCP startup.)

Example 1:



Example 2:



Note (Models 10 and 12): Another program of the same type as P1 cannot be loaded while P1 is executing. Two programs of this type cannot be executing concurrently.

Figure 9-5. Accessing Added Records in Indexed Files Under the CCP.

Consecutive Output Files: If a file is defined with an access value CO (consecutive output), the program loading that file will overlay records loaded previously during the same CCP run. For example, suppose program 1 loads file 1 and goes to end of job. If program 1 is loaded again, any records added during the second execution will overlay records loaded during the first execution.

Update Files: If one program in an assignment set processes a file in update mode, that file is treated as an update file at CCP startup. Therefore, the following could occur:

- Program 1 processes file 1 as a direct update (DU).
- Program 2 processes file 2 as direct update.
- At CCP startup, file 1 and file 2 are made identical by a FILE statement (// FILE NAME-FILE1, . . . , LABEL-FILE2).

In this case, CCP startup cannot open file 2. Therefore, if different programs are to access the same file in update mode, they must both reference that file by the same name.

Model 15 Considerations

The following considerations apply to the use of disk files by programs running under Model 15 CCP:

Multivolume Files: Multivolume disk files are not supported under CCP.

Online Files: All files available to programs on the current run of CCP must be online (mounted on a 5444, 5445, 3340, or 3344) and described by FILE OCL statements at CCP startup time.

Disk File Names: Different names can be used for the same file if the names are related to the file label by using the NAME and LABEL parameters of the FILE OCL statement (see *IBM System/3 Model 15 System Control Programming Reference Manual*, GC21-5077, if operating under 5704-SC1; or *IBM System/3 Model 15 System Control Programming Concepts and Reference Manual*, GC21-5162, if operating under 5704-SC2, for additional information).

Opening and Closing of Files: All disk files described by FILE and matching DISKFILE statements are opened during CCP startup according to the file organization and access method specified at assignment time (see *Determining the Disk File Access Value* in this chapter). All files are closed during CCP shutdown.

Index Sort: The index sort for index files is done by using $CCPCL while CCP is running. CCP programs can access the file again during the current CCP run if the system operator executes the $CCPOP facility. See the *IBM System/3 Model 15 CCP System Reference Manual*, GC21-7620, and the *IBM System/3 Model 15 CCP System Operator's Guide*, GC21-7619, for more information on $CCPCL and $CCPOP.

Accessing Records Added to an Indexed File: Programs using certain nonadd disk access methods can access records added to an indexed file during the current CCP run even though the index sort has not been performed. However, the programs using the add access method must either CLOSE (for COBOL and Assembler) the file, or terminate (for RPG II) before the program using the nonadd access method can open and use the file. These nonadd access methods are:

- Consecutive input (CG)
- Consecutive update (CU)—5704-SC2 only
- Direct input (DG)
- Direct input and update (DU)

Unless the file is closed and reopened via the system operator $CCPOP/$CCPCL facility causing the index sort to be performed, the programs using nonadd access methods other than those in the preceding list cannot access records added to an indexed file during the current CCP run. See *Determining the Disk File Access Value* in this chapter for a list of the disk file access methods.

Figure 9-5 illustrates special considerations when records are added to an indexed file during a CCP run.

Abnormal Termination: If CCP terminates abnormally (for example, because of a power failure, processor check, or U-halt), CCP does not automatically close files. When an abnormal termination of CCP occurs, the CCP disk file recovery program $RINDX, can be used to close all disk files and, optionally, update the necessary file pointers so that the records added during the CCP run that abnormally terminated can be accessed in subsequent runs. See the *IBM System/3 Model 15 System Control Programming Reference Manual* (5704-SC1), GC21-5077, or the *IBM System/3 Model 15 System Control Programming Concepts and Reference Manual* (5704-SC2), GC21-5162, for a description of the use of the file recovery programs.

Sharing Files Among Partitions: When operating under control of 5704-SC1, the rules for sharing disk files between partitions are:

CCP Partition	**Other Partition**
Input file	Can retrieve and update.
Update file	Can retrieve; can update if CCP update program processing this file is not currently executing.
Add file	Can retrieve or update *nonadd* records if CCP program adding records is not currently executing. Can retrieve or update *added* records if CCP program adding records has gone to end of job and the system operator $CCPOP/$CCPCL facility has been run.
Load file	Cannot process file.

When operating under control of 5704-SC2, the rules for sharing disk files using compatible access methods among partitions are determined by the SHARE parameter of the FILE OCL statement and the FILES parameter of the PROGRAM assignment statement. The compatible access methods allowed with file sharing across partitions are defined in the *IBM System/3 Model 15 System Control Programming Concepts and Reference Manual*, GC21-5162. When operating under CCP, the compatible access methods allowed with file sharing across partitions are defined in *Model 15 CCP File Sharing Considerations* in this chapter.

Basically, the SHARE value of the FILE OCL statement has effect only across partitions, while the FILES parameter of the PROGRAM assignment statement has effect within and across partitions. The relation between these parameters is shown in Figure 9-6; the symbol ● indicates that the program will be allowed to start. For example, if a batch program in a partition is using a file with SHARE-NO, then a program (including CCP startup) in another partition using that same file cannot be initiated. If CCP is started with SHARE-NO specified on the FILE OCL statement, that file is still considered shareable within CCP; the SHR/NOSHR value of the FILES parameter in the PROGRAM assignment statement determines whether the file can be shared and a second program initiated.

Direct Files: A program can create a direct file if a direct output access file exists in the assignment set.

Consecutive Updates to the Same Record: When file sharing is allowed, do not attempt to update the same record in succession without an intervening read of that same record within the program.

Updating or Adding to Disk Files: When updating or adding to disk files, do not issue an Accept Input operation between the reading and writing of a disk record if you intend to update or add the record.

Indexed Load Files: If a disk file defined as indexed-load access (access value IO or IOU) is not loaded during the CCP run, the file exists after CCP shutdown but contains no records.

Master Index: If operating under 5704-SC1, a master index for 5444 disk files is built by CCP based on the MSTRINDX keywork of the DISKFILE assignment statement (see the *CCP System Reference Manual,* GC21-7620). Therefore, you should not specify a master index in your application programs.

Consecutive Output Files (5704-SC1 Only): If a file in a FORTRAN IV program is defined with an access value CO (consecutive output), the program loading that file will overlay records loaded previously during the same CCP run. For example, suppose program 1 loads file 1 and goes to end of job. If program 1 is loaded again, any records loaded during the second execution will overlay records loaded during the first execution. More than one CO access can be done to a file and no records are overlaid in RPG II, COBOL, and Assembler programs.

Consecutive Output Files (5704-SC2 Only): If a file is defined with an access value of CO (consecutive output), the program loading that file will overlay records loaded previously during the same CCP run. For example, suppose program 1 loads file 1 and goes to end of job. If program 1 is loaded again, any records added during the second execution will overlay records loaded during the first execution.

Program Trying to Start With Same File	**OCL or Assignment Statement Value**		**Current File Status**							
			Batch (using file)		**CCP**				**CCP**	
	SHARE		YES	NO	YES		NO		YES	NO
		FILES	–	–	SHR	NOSHR	SHR	NOSHR	–	–
Batch[1]	YES	–	●		●				●	
	NO	–								
CCP	–	SHR	●		●		●		●	●
	–	NOSHR							●	●

---

[1] During startup, CCP is considered a batch program.

[2] The file is assigned to a user task that is currently executing.

[3] The file is not assigned to any user task that is currently executing.

Figure 9-6. File Sharing Across Partitions

Model 10 and Model 12 CCP File Sharing Considerations

The following considerations apply when file sharing is allowed under Model 10 and Model 12 CCP (FSHARE parameter on the $EFAC generation statement):

- Programs running concurrently under the CCP can update the same file. CCP protects the block of disk sectors containing the record to be updated until the program releases the block of sectors by writing the block to disk or reading another block. When programs are concurrently updating a disk file, a potential "lockout" condition could occur if a program does not release a block of sectors.

  For example, programs that read and update two or more files they share can be locked out of files if the following sequence of events occurs:

  1. Program A reads from file 1.
  2. Program B reads from file 2.
  3. Program A attempts to read from the same part of file 2, but cannot, because program B has not released the sectors. Likewise, if program B attempts to read from the same sectors of file 1 that were read by program A, it cannot, because program A has not released the sectors.

  Because of this possibility, you should either code your program so that it does not do consecutive reads from *different* shared files without doing an intervening write to the first file, or if consecutive reads cannot be avoided, you should inform those personnel responsible for CCP assignments that the files should not be shared.

- When updating files, do not attempt to update (write) the same record in succession without doing an intervening read of that same record within the program. If you do, the task will be terminated.

- Programs defined at assignment time with access values IRUANA or IRANA can run concurrently (see *Determining the Disk File Access Value* for the meaning of IRUANA and IRANA).

- Two IRUANA or IRANA programs can access the same file concurrently.

- If a program defined as IRUANA or IRANA attempts to add records, it will be cancelled by the CCP.

Figure 9-7 shows how two programs attempting to use the same disk file will interact.

Model 15 CCP File Sharing Considerations

Model 15 CCP allows concurrent access to a file by two or more programs whenever sharing is logically possible. If a program requires exclusive use of a file, NOSHR must be specified for the FILES parameter of the // PROGRAM assignment statement.

CCP allows programs running concurrently to update or do indexed adds to the same disk file. CCP protects the block of sectors containing the record to be updated until the program releases the block of sectors by writing the block to disk or reading another block. CCP protects the add area of an indexed file when an add is requested. The file is not protected if a record-not-found condition occurs. This could cause the following sequence of conditions to occur: A record-not-found condition, followed by an add of that record, which might give a duplicate record condition if the record had been added by another CCP task. When programs are concurrently sharing a disk file, a potential lock-out condition could occur if a program does not release a block of sectors.

Figures 9-8 and 9-9 show how two programs attempting to use the same disk file will interact. The following considerations and exceptions apply to sharing of nonexclusive disk files:

- An ordered indexed load must precede all other access and must be done only once during a CCP run.

- Double buffering is never done when files are being shared. CCP treats any double buffer accesses as single buffer accesses.

- A file processed as unordered indexed load can be shared serially, in time, with other unordered load accesses; however, no other types of file access are allowed during the CCP run.

- Consecutive load and consecutive add accesses cannot be done concurrently to the same disk file and neither access can be done concurrently with any other access of the same file.

- Indexed sequential addition to a file (with or without update) cannot be done concurrently with another access to that file. Indexed sequential addition cannot be preceded by any other indexed add access that actually adds records to the file, unless the system operator has initiated the $CCPOP/$CCPCL facility.

- Consecutive output (load) to an existing file is treated by CCP as consecutive add, except in FORTRAN IV. Therefore, consecutive output can be done more than once to the same file during a CCP run, with results the same as consecutive add. In FORTRAN IV, consecutive output can be done only once to a file during a CCP run.

- An indexed file that has been added to, but has not yet gone through a key sort, can contain records that cannot be accessed by non-add indexed data managements (see *Disk File Considerations*).

- Unlike indexed random add data managements (IRA and IRUA), indexed sequential add data managements (ISA and ISUA) do not search the area of added records. Therefore, a file opened ISA or ISUA can later be opened IRA or IRUA, but not vice versa. To open a file ISA or ISUA after a file has been opened IRA or IRUA, the system operator must execute the $CCPOP/$CCPCL facility.

- Programs that read and update (and/or add) to two or more files they share can be locked out of a file if the following sequence of events occurs:

  1. Program A reads from file 1.
  2. Program B reads from file 2.
  3. Program A attempts to read from the same part of file 2, but cannot, because program B has not released the sectors. Likewise, if program B attempts to read from the same sectors of file 1 that were read by program A, it cannot, because program A has not released the sectors.

  Because of this possibility, you should either code your program so that it does not do consecutive reads from *different* shared files without doing an intervening write to the first file, or if consecutive reads cannot be avoided, you should inform those personnel responsible for CCP assignments that the files should not be shared.

- If an MRT-NEP program uses file sharing and issues an accept input with no outstanding invite inputs, the disk file sectors protected from file sharing after the disk file was read are no longer protected. Under these conditions, if you try to add or update files, you get a disk error (invalid address). Before attempting to update files accessed by an MRT-NEP following an accept input, you must first retrieve the record to be updated.

- When updating files, do not attempt to update (write) the same record in succession without doing an intervening read of that same record within the program. If you do, the user task terminate with a 0H halt. The program logic should be reviewed and corrected.

File Already in Use (Open) As: / Attempting to use (Open) File as:	CA CO	CU	CG	IO	IOU	IS ISL IR IRU	ISU ISUL	IA IRA IRUA	ISA ISUA	DO (New File)	DU	DG
CO, CA	S	S	S	N	N	N	N	N	N	N	S	S
CU	S	Y	Y	N	N	N	N	N	N	Y	Y	Y
CG	S	Y	Y	S	N	Y	Y	Y	S	Y	Y	Y
IO	N	N	N	N#	N	N	N	N	N	N	N	N
IOU	N	N	N	N	S	N	N	N	N	N	N	N
IS, ISL, IR, IRU	N	N	Y	S	N	Y	Y	Y	S	N	Y	Y
ISU, ISUL	N	N	Y	S	N	Y	Y	Y	S	N	Y	Y
IA, IRA, IRUA	N	N	Y	S	N	Y	Y	Y	S	N	Y	Y
ISA, ISUA	N	N	S	S	N	S	S	N#	N#	N	S	S
DO	N	N	N	N	N	N	N	N	N	N	N	N
DU	S	Y	Y	S	N	Y	Y	Y	S	Y	Y	Y
DG	S	Y	Y	S	N	Y	Y	Y	S	Y	Y	Y

KEY

Y	– Access permitted.
N	– Access not permitted.
N#	– A second access is not permitted because of DSM termination key sort first.
S	– Serialized access. First access must CLOSE within program before second may OPEN.

Figure 9-7. Sharing Access to Disk Files—Model 10 and Model 12 CCP

File Already in Use (Open) As: / Attempting to use (Open) File as:	CA CO	CU	CG	IO	IOU	IS ISL IR IRU	ISU ISUL	IA IRA IRUA	ISA ISUA	DO (New File)	DU	DG
CO, CA	S	S	S	N	N	N	N	N	N	N	S	S
CU	S	Y	Y	N	N	N	N	N	N	Y	Y	Y
CG	S	Y	Y	S	N	Y	Y	Y	S	Y	Y	Y
IO	N	N	N@	N#	N	N@	N@	N@	N@	N	N@	N@
IOU	N	N	N	N	S	N	N	N	N	N.	N	N
IS, ISL, IR, IRU	N	N	Y	S	N	Y	Y	Y	S	N	Y	Y
ISU, ISUL	N	N	Y	S	N	Y	Y	Y	S	N	Y	Y
IA, IRA, IRUA	N	N	Y	S	N	Y	Y	Y	S	N	Y	Y
ISA, ISUA	N	N	S	S	N	S	S	N#	N#	N	S	S
DO	N	Y*	Y*	N	N	N	N	N	N	Y*	Y*	Y*
DU	S	Y	Y	S	N	Y	Y	Y	S	Y	Y	Y
DG	S	Y	Y	S	N	Y	Y	Y	S	Y	Y	Y

Y — Access permitted.
Y* — Direct output to an old or previously used file is treated as direct update.
N — Access not permitted.
N# — A second access is not permitted unless the file has been closed and reopened by the system operator.
N@ — IO must be first access of file if used.
S — Serialized access. First access must CLOSE within program before second may OPEN.

Figure 9-8. Sharing Access to Disk Files—Model 15 CCP (5704-SC1)

Attempting to Use (Open) File as:	File Already in Use (Open) As:									
	CO	CA	CU	CG	IO	IOU	IS ISL IR IRU ISU ISUL	IA IRA IRUA	ISA ISUA	DO	DU DG
CO	N	S	S	S	N	N	N	N	N	N	S
CA	S	S	Y	Y	N	N	N	N	N	N	Y
CU	S	Y	Y	Y	N	N	Y	Y	Y	Y[3]	Y
CG	S	Y	Y	Y	S	N	Y	Y	Y	Y[3]	Y
IO	N	N	N	N[5]	N[4]	N	N[5]	N[5]	N[5]	N	N[5]
I	N	N	N	N	N	S	N	N	N	N	N
IS	N	N	Y	Y	S	N	Y	Y	Y[1]	N	Y
ISL	N	N	Y	Y	S	N	Y	Y	Y[1]	N	Y
IR	N	N	Y	Y	S	N	Y	Y	Y[1]	N	Y
IRU	N	N	Y	Y	S	N	Y	Y	Y[1]	N	Y
ISU	N	N	Y	Y	S	N	Y	Y[2]	Y	N	Y
ISUL	N	N	Y	Y	S	N	Y	Y[2]	Y	N	Y
IA	N	N	Y	Y	S	N	Y	Y	S	N	Y
IRA	N	N	Y	Y	S	N	Y	Y	S	N	Y
IRUA	N	N	Y	Y	S	N	Y	Y	S	N	Y
ISA	N	N	Y	Y	S	N	Y[1]	N[4]	N[4]	N	Y[1]
ISUA	N	N	Y	Y	S	N	Y[1]	N[4]	N[4]	N	Y[1]
DO	N	N	Y[3]	Y[3]	N	N	N	N	N	Y[3]	Y[3]
DU	S	Y	Y	Y	S	N	Y	Y	Y	Y[3]	Y
DG	S	Y	Y	Y	S	N	Y	Y	Y	Y[3]	Y

KEY

Y – Access permitted.
N – Access not permitted.
S – Serialized access. First access must CLOSE within program before second may OPEN.

---

[1] Files accessed using the index sequential add access method under which adds have been made cannot be reopened using ISA unless the key sort has occurred. If any adds have been made and the key sort has not occurred, only random access methods can be used to add to the file.

[2] The added records are not accessed if random add has occurred.

[3] Direct output to an old or previously used file is treated as direct update.

[4] A second access is not permitted unless the file has been CLOSED and OPENED by the system operator.

[5] If ordered indexed load access method is used, it must be the first access method used to access the file.

Figure 9-9. Sharing Access to Disk Files—Model 15 CCP (5704-SC2)

Determining the Disk File Access Value

When specifying the FILES keyword for the PROGRAM assignment statement (see *CCP System Reference Manual*), an access value must be given for each disk file. The access value indicates the mode of access of a disk file used by an application program. You should inform the person responsible for completing the CCP assignments of the type of organization and the access value for each disk file you use in your program. You can determine the access value for RPG II, COBOL, and FORTRAN disk file processing from Figures 9-10, 9-11, and 9-12. The access value symbols and their meanings are:

CO — Consecutive Output
CG — Consecutive Input
CU — Consecutive Update
CA — Consecutive Add
DG — Direct Input
*DGA — Direct Input Binary Relative Record Numbers
DU — Direct Input and Update
*DUA — Direct Input and Update, Binary Relative Record Numbers
DO — Direct Output (valid only for Model 15 CCP)
IS — Indexed Sequential Input Only
ISA — Indexed Sequential Input and Add
ISL — Indexed Sequential Input with Limits
ISU — Indexed Sequential Input and Update
ISUL — Indexed Sequential Input and Update with Limits
ISUA — Indexed Sequential Input, Update, and Add
IA — Indexed Sequential Add only
IR — Indexed Random Input Only
IRA — Indexed Random Input and Add
IRU — Indexed Random Input and Update
IRUA — Indexed Random Input, Update, and Add
IO — Ordered Indexed Load
IOU — Unordered Indexed Load
**IRANA — Records which were added to the file by another program that has gone to end of job in the current CCP run will be read using Indexed Random Input and Add (IRA), but no records will be added.
**IRUANA - Records which were added to the file by another program that has gone to end of job in the current CCP run will be read and possibly updated using Indexed Random Input, Update, and Add (IRUA), but no records will be added.

*Valid for Model 10 and Model 12 CCP. For Model 15 CCP, use DG or DU.

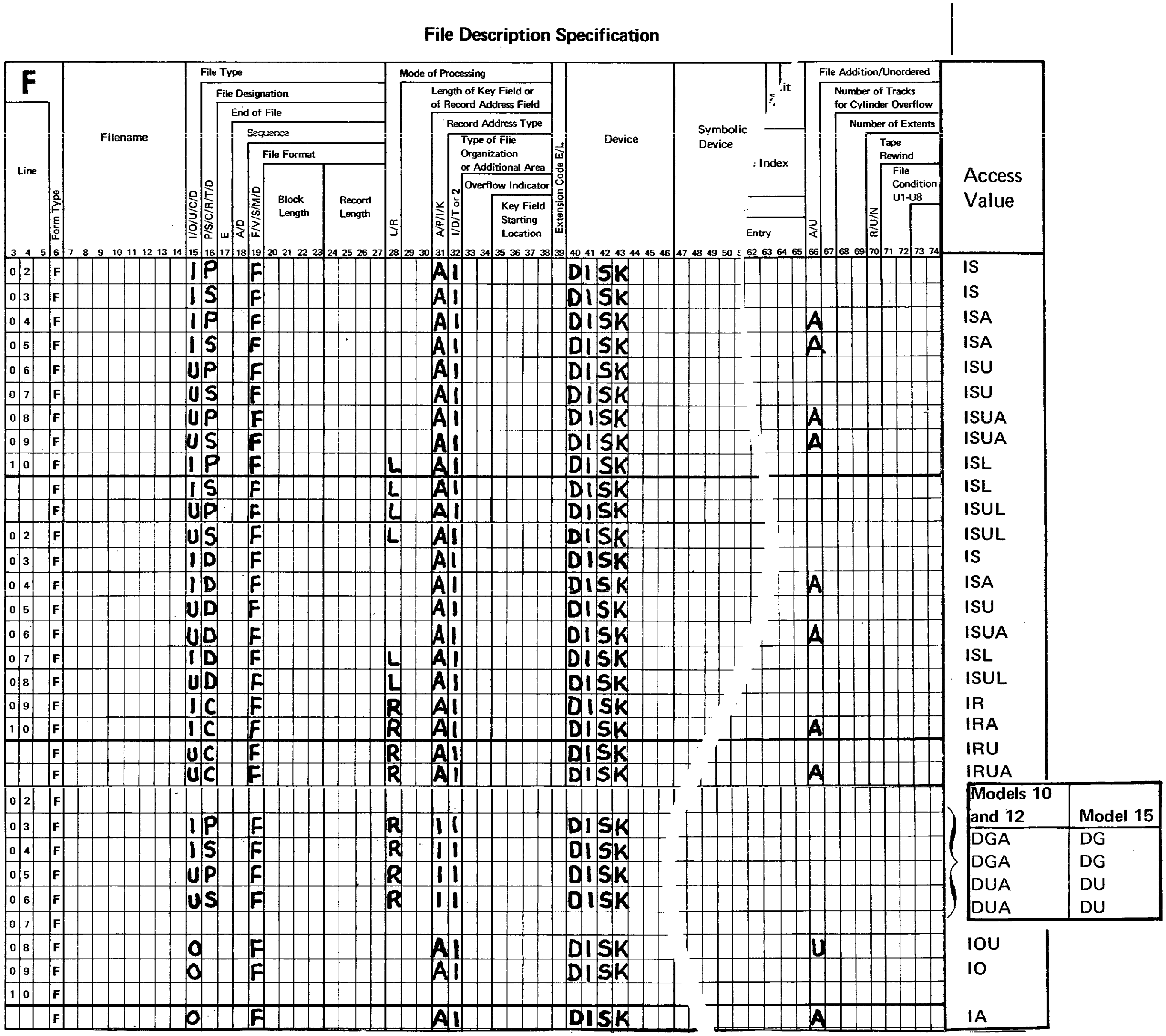
**Valid for Model 10 and Model 12 CCP. For Model 15 CCP, use IRA or IRUA.

The valid combinations of disk file organization (specified in the // DISKFILE assignment statement) and method of access (specified in the // PROGRAM assignment statement) are shown in the following chart.

Method of Access (// PROGRAM)	**Organization (// DISKFILE)**		
	Sequential	**Indexed**	**Direct**
CO & CA	YES	NO	NO
CU	YES	NO	YES
CG	YES	YES	YES
Indexed Access Methods	NO	YES	NO
DO	NO	NO	YES
DU and DUA	YES	YES	YES
DG and DGA	YES	YES	YES

INDEXED FILES

File Description Specification



Type of Processing		Line	Form Type	File Type (I/O/U/C/D) 15	File Designation (P/S/C/R/T/D) 16	File Format (F/V/S/M/D) 19	L/R 28	A/P/I/K 31	I/D/T or 2 32	Device 40-46	A/U 66	Access Value
Sequential*	by Key, no ADD	02	F	I	P	F		A	I	DISK		IS
	by Key, no ADD	03	F	I	S	F		A	I	DISK		IS
	by Key, with ADD	04	F	I	P	F		A	I	DISK	A	ISA
	by Key, with ADD	05	F	I	S	F		A	I	DISK	A	ISA
	by Key, no ADD	06	F	U	P	F		A	I	DISK		ISU
	by Key, no ADD	07	F	U	S	F		A	I	DISK		ISU
	by Key, with ADD	08	F	U	P	F		A	I	DISK	A	ISUA
	by Key, with ADD	09	F	U	S	F		A	I	DISK	A	ISUA
	by Limits (RAF)	10	F	I	P	F	L	A	I	DISK		ISL
	by Limits (RAF)		F	I	S	F	L	A	I	DISK		ISL
	by Limits (RAF)		F	U	P	F	L	A	I	DISK		ISUL
	by Limits (RAF)	02	F	U	S	F	L	A	I	DISK		ISUL
Sequential* (demand files processed by the READ operation code	by Key, no ADD	03	F	I	D	F		A	I	DISK		IS
	by Key, with ADD	04	F	I	D	F		A	I	DISK	A	ISA
	by Key, no ADD	05	F	U	D	F		A	I	DISK		ISU
	by Key, with ADD	06	F	U	D	F		A	I	DISK	A	ISUA
	by Limits (RAF)	07	F	I	D	F	L	A	I	DISK		ISL
	by Limits (RAF)	08	F	U	D	F	L	A	I	DISK		ISUL
Random	by CHAIN, noADD	09	F	I	C	F	R	A	I	DISK		IR
	by CHAIN, with ADD	10	F	I	C	F	R	A	I	DISK	A	IRA
	by CHAIN, no ADD		F	U	C	F	R	A	I	DISK		IRU
	by CHAIN, with ADD		F	U	C	F	R	A	I	DISK	A	IRUA
		02	F									
	by ADDROUT	03	F	I	P	F	R	I	I	DISK		
	by ADDROUT	04	F	I	S	F	R	I	I	DISK		
	by ADDROUT	05	F	U	P	F	R	I	I	DISK		
	by ADDROUT	06	F	U	S	F	R	I	I	DISK		
		07	F									
Load	Unordered	08	F	O		F		A	I	DISK	U	IOU
	Ordered	09	F	O		F		A	I	DISK		IO
		10	F									
Add records only	ADD only		F	O		F		A	I	DISK	A	IA

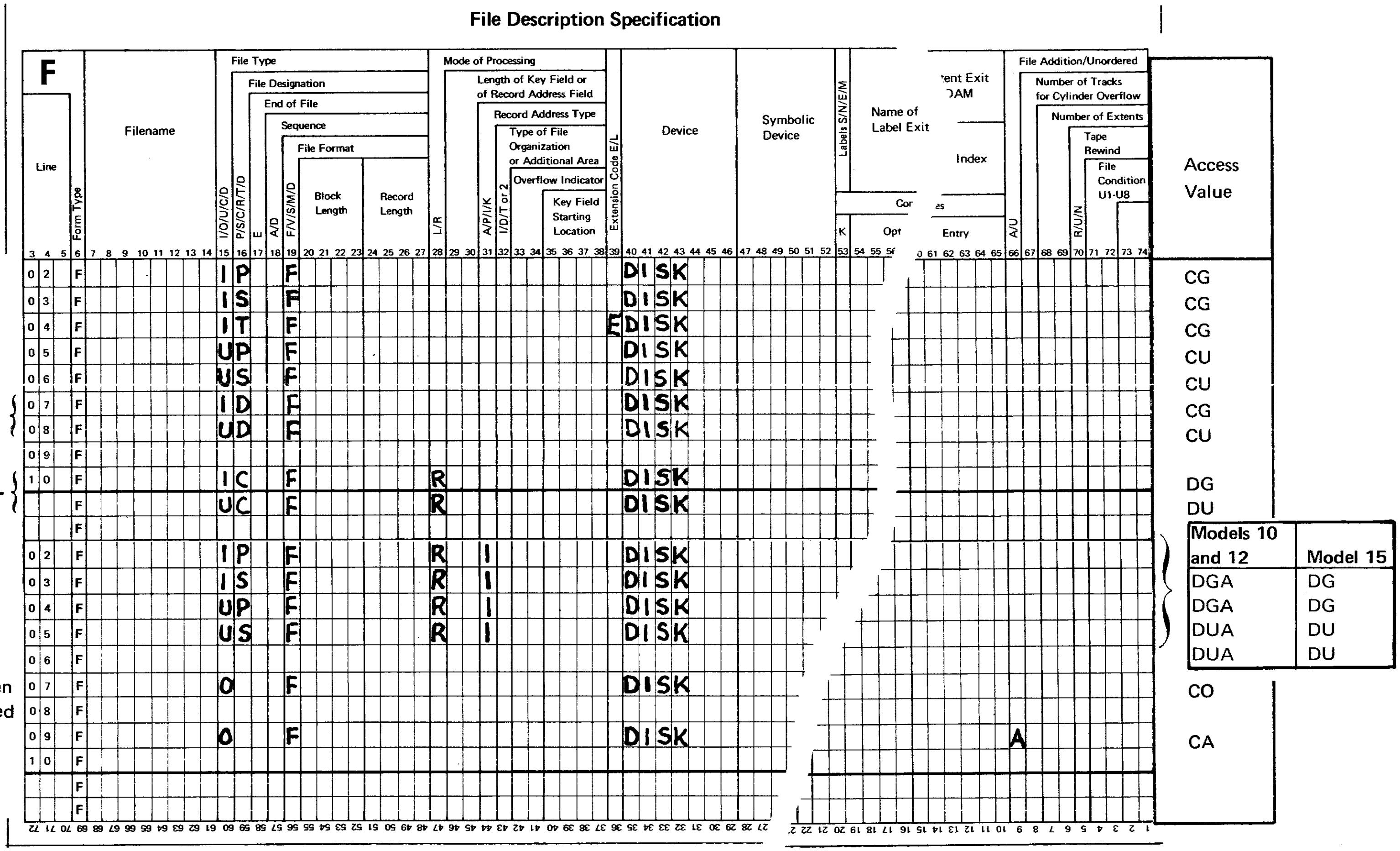
Models 10 and 12	Model 15
DGA	DG
DGA	DG
DUA	DU
DUA	DU

* Sequential processing by key or limits must use the file index, which is always arranged in ascending sequence. When an indexed file is processed record-by-record from beginning to end, the file is processed through the index using the sequential-by-key method.

Notes:

1. DISK, DISK40, or DISK45 can be specified as the device (columns 40-46).
2. If your system has 3340s attached, DISK is not a valid entry in columns 40-46 since index files are not supported on the simulation areas.

Figure 9-10 (Part 1 of 4). Disk Files Access Values for RPG II



Sequential Files

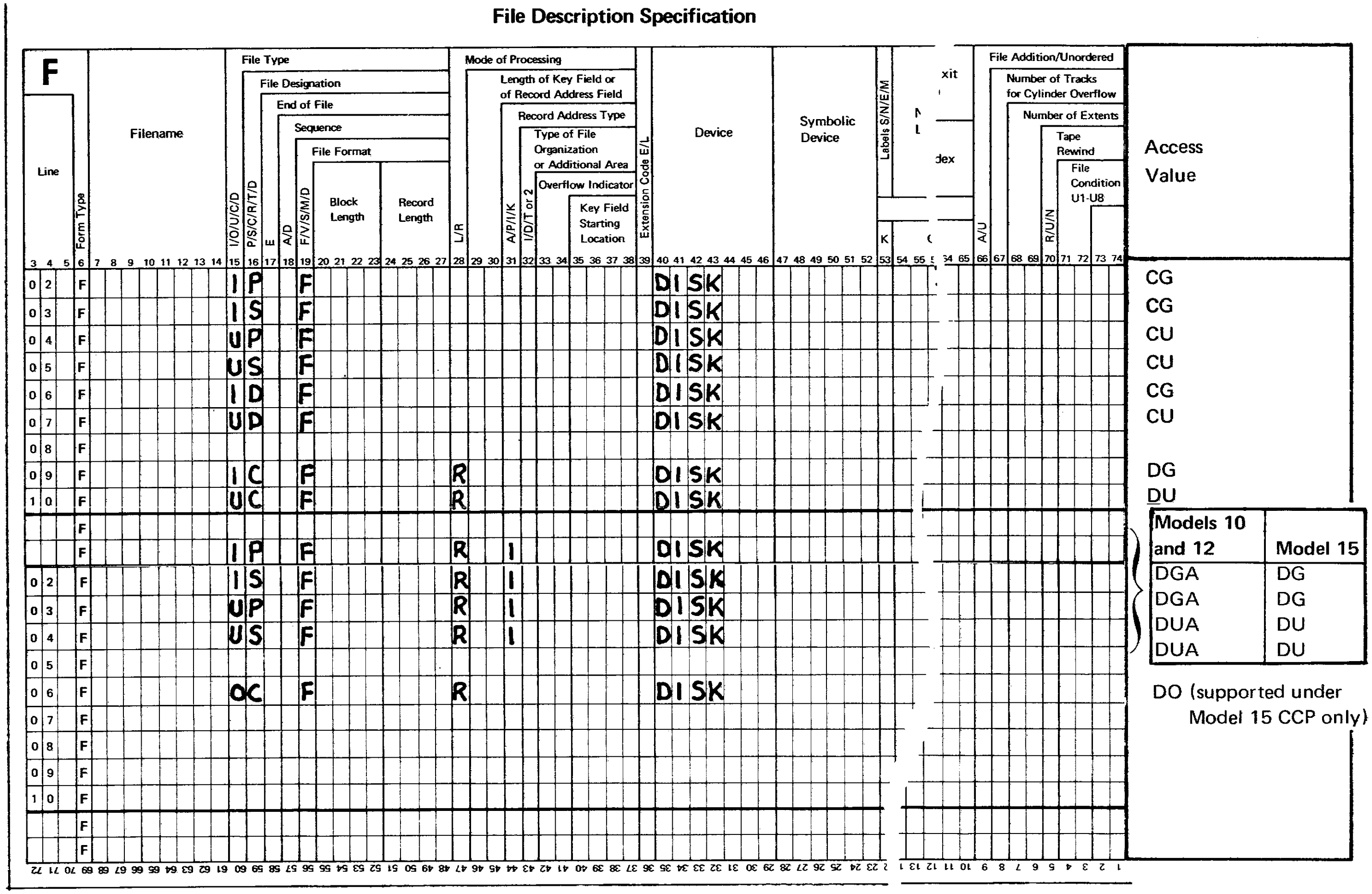
File Description Specification

Type of Processing		Line	Form Type	File Type (15)	File Designation (16)	File Format (19)	L/R (28)	I/D/T or 2 (32)	Extension Code E/L (39)	Device (40-46)	A/U (66)	Access Value
Consecutive (The entire file is read from beginning to end.)		02	F	I	P	F				DISK		CG
		03	F	I	S	F				DISK		CG
		04	F	I	T	F			E	DISK		CG
		05	F	U	P	F				DISK		CU
		06	F	U	S	F				DISK		CU
	by READ	07	F	I	D	F				DISK		CG
	by READ	08	F	U	D	F				DISK		CU
		09	F									
Random	by CHAIN	10	F	I	C	F	R			DISK		DG
	by CHAIN		F	U	C	F	R			DISK		DU
			F									
	by ADDROUT	02	F	I	P	F	R	I		DISK		Models 10 and 12: DGA; Model 15: DG
	by ADDROUT	03	F	I	S	F	R	I		DISK		Models 10 and 12: DGA; Model 15: DG
	by ADDROUT	04	F	U	P	F	R	I		DISK		Models 10 and 12: DUA; Model 15: DU
	by ADDROUT	05	F	U	S	F	R	I		DISK		Models 10 and 12: DUA; Model 15: DU
		06	F									
Load	The file is written on disk as entered	07	F	O		F				DISK		CO
		08	F									
Add records only	ADD only	09	F	O		F				DISK	A	CA
		10	F									
			F									
			F									

Note: DISK, DISK40, or DISK45 can be specified as the device (columns 40-46).

Figure 9-10 (Part 2 of 4). Disk Files Access Values for RPG II

Direct Files



File Description Specification

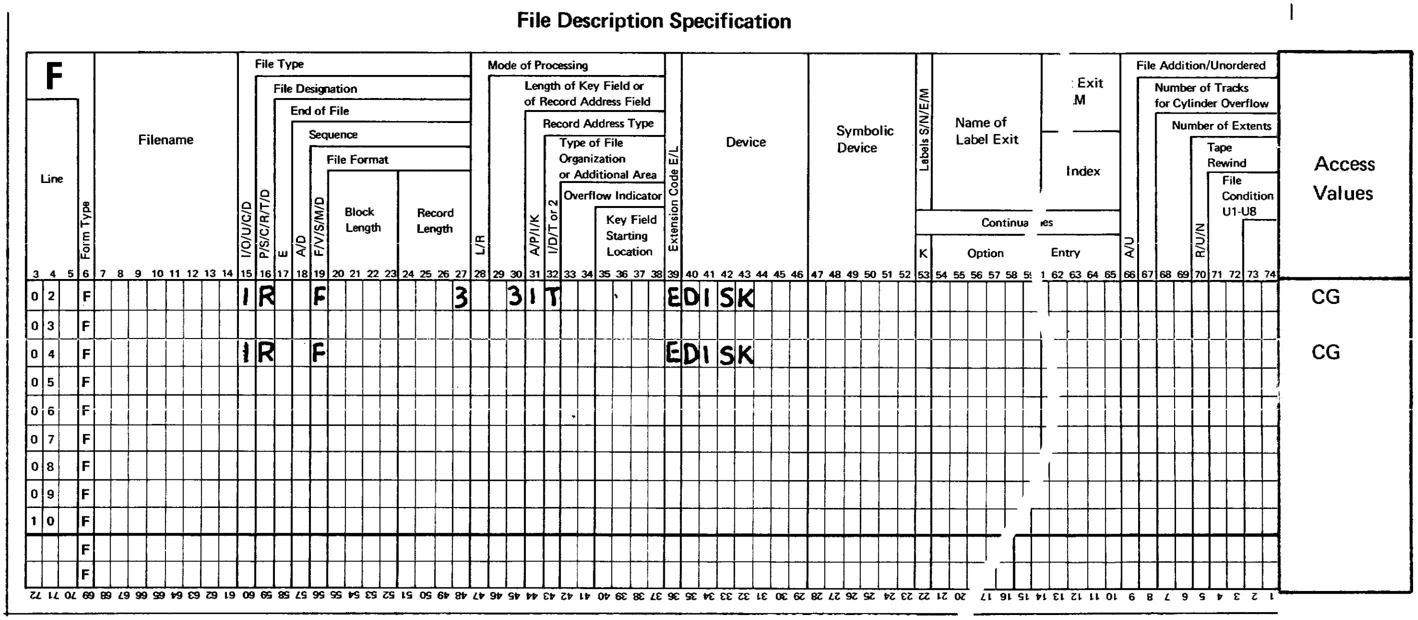
Type of Processing*		Line	Form Type	Filename	File Type	File Designation	File Format	Mode of Processing (L/R)	Record Address Type (A/P/I/K)	Device	Access Value	Models 10 and 12	Model 15
Consecutive (The entire file is read from beginning to end.)	by READ	02	F		I	P	F			DISK	CG		
		03	F		I	S	F			DISK	CG		
		04	F		U	P	F			DISK	CU		
		05	F		U	S	F			DISK	CU		
		06	F		I	D	F			DISK	CG		
		07	F		U	D	F			DISK	CU		
		08	F										
Random	by CHAIN	09	F		I	C	F	R		DISK	DG		
	by CHAIN	10	F		U	C	F	R		DISK	DU		
			F										
	by ADDROUT		F		I	P	F	R	I	DISK		DGA	DG
	by ADDROUT	02	F		I	S	F	R	I	DISK		DGA	DG
	by ADDROUT	03	F		U	P	F	R	I	DISK		DUA	DU
	by ADDROUT	04	F		U	S	F	R	I	DISK		DUA	DU
		05	F										
Load	Disk addresses are developed for each record entered.	06	F		O	C	F	R		DISK	DO (supported under Model 15 CCP only)		
		07	F										
		08	F										
		09	F										
		10	F										
			F										
			F										

* Records are inserted or changed in a direct file by defining the file as an update processed consecutively, or an update file processed randomly by the CHAIN operation code.

Note: DISK, DISK40, or DISK45 can be specified as the device (columns 40-46).

Figure 9-10 (Part 3 of 4). Disk Files Access Values for RPG II

RECORD ADDRESS FILES



1.	ADDROUT Files	0 2	F IR F 3 3IT EDISK	CG
		0 3	F	
2.	Record Key Limits	0 4	F IR F EDISK	CG

Figure 9-10 (Part 4 of 4). Disk Files Access Values for RPG II

* ADDROUT files may be associated with indexed, sequential, or direct disk files.

* Record address files containing record key limits may only be associated with indexed disk files, but may be a disk or MFCU file.

Note: DISK, DISK40, or DISK45 can be specified as the device (columns 40-46).

COBOL LANGUAGE STATEMENTS					Access Value
ASSIGN	ACCESS	KEY	OPEN	I/O Verbs	
DA-544x-S-name	SEQUENTIAL		OUTPUT		CO
UT-544x-S-name	SEQUENTIAL		OUTPUT		
DA-544x-S-name	SEQUENTIAL		INPUT		CG
UT-544x-S-name	SEQUENTIAL		INPUT		
DA-544x-R-name	SEQUENTIAL		INPUT		
DA-544x-S-name-U	SEQUENTIAL		I-O		CU
DA-544x-R-name	RANDOM	ACTUAL	INPUT		DG
DA-544x-R-name-U	RANDOM	ACTUAL	I-O		DU
DA-544x-I-name	SEQUENTIAL	RECORD	INPUT		IS
DA-544x-I-name	SEQUENTIAL	RECORD NOMINAL	INPUT	START . . .	ISL
DA-544x-I-name-U	SEQUENTIAL	RECORD	I-O	REWRITE . . .	ISU
DA-544x-I-name-U	SEQUENTIAL	RECORD NOMINAL	I-O	START . . . REWRITE . . .	ISUL
DA-544x-I-name	RANDOM	RECORD NOMINAL	INPUT		IR
DA-544x-I-name-N	RANDOM	RECORD NOMINAL	I-O	REWRITE	IRU
DA-544-x-I-name-U	RANDOM	RECORD NOMINAL	I-O	WRITE	IRUA
DA-544-x-I-name	SEQUENTIAL	RECORD	OUTPUT		IO

Note: On systems with 3344 disk files, DA-544x can be replaced with DA-3340 for consecutive or direct files; DA-5445 can be replaced with DA-3340 for indexed files.

Figure 9-11. Disk File Access Values for COBOL

FORTRAN IV LANGUAGE STATEMENTS		Access Value
Device Option Statement	Input/Output Statements	
// SEQ40 UNITNO-n, . . .	READ (. . .) . . .	CO*
// SEQ44 UNITNO-n, . . .	WRITE (. . .) . . .	
// SEQ45 UNITNO-n, . . .		
// DAD40 UNITNO-n, . . .	READ (. . .) . . .	DUA
// DAD44 UNITNO-n, . . .	WRITE (. . .) . . .	
// DAD45 UNITNO-n, . . .	DEFINE FILE . . .	
	FIND (. . .)	

*If the program only reads from the file, access value CG may be used. The file could then be sharable.

Figure 9-12. Disk File Access Values for FORTRAN IV

Chapter 10: Program Testing

After you have written a communications program to run under the CCP, you will usually want to test the program before using it in a production environment. If the terminal devices to be used by the program are available, you can test the program according to the following general procedure:

1. Perform the procedures for program preparation described in *Chapter 9. Program Preparation.*
2. Perform the CCP Startup procedures given in the *CCP System Operator's Guide*. Include // FILE statements among the OCL statements at Startup for any test files that were described to the CCP at assignment time.
3. Enter a request for the program from a terminal or from the system operator's console. (See *Program Request* in either the *CCP System Operator's Guide* or the *CCP Terminal Operator's Guide*.)
4. Enter test input data as required by the program.
5. If test files are to be printed using the Disk Copy/Dump utility, the CCP must be shut down prior to using the utility, since the utility can neither be executed under the CCP nor in the opposite level from the CCP in a DPF (dual partition) system, as all test output data may not be available to it. (The Disk Copy/Dump utility program is described in *IBM System/3 Model 10 Disk System Control Programming Reference Manual,* GC21-7512; in *IBM System/3 Model 12 System Control Programming Reference Manual,* GC21-5130; and in *IBM System/3 Model 15 System Control Programming Reference Manual,* GC21-5077, if operating under 5704-SC1, or *IBM System/3 Model 15 System Control Programming Concepts and Reference Manual*, GC21-5162, if operating under 5704-SC2.
6. Evaluate the program by inspecting test files and other output from the program.

Caution: Care should be taken during testing that a malfunction in the test program does not destroy other programs or data in main storage.

Appendix A: CPU to CPU Considerations

The CCP is adaptable to the *concentrator* and *subhost* functions in a teleprocessing environment. A combination of the two functions can be attained through application programming under control of the CCP.

In a concentrator role, the CCP can gather data from a variety of terminals and forward the data to a host system (System/360 or System/370) for further processing. In the reverse direction, the CCP can collect data from the host system and distribute the data to a variety of terminals. In the concentrator role, the CCP supports user-written application programs to handle the message traffic in a *store and forward* manner. (*Store and forward* is defined as the interruption of data flow from the originating terminal to the designated receiver by storing the information enroute and forwarding it at a later time.)

In a subhost role, the CCP can gather data from a variety of terminals, act intelligently on the data, and provide responses in most cases. In those cases where additional data is required, the request can be forwarded to the host system for further processing.

The desirability of the concentrator function lies in reducing line and network costs and in retaining a consistent, common host interface in a changing terminal environment. The subhost function has the same advantages as the concentrator function plus the advantages of distributed processing capability, fast response time, and back-up capability (possibly degraded) in those occasions when the host system is unavailable. In the concentrator and subhost roles, the CCP would most likely be attached to the host as a point-to-point or multipoint tributary station.

The previous paragraphs have described the CCP in an online (nonswitched) connection to a host CPU. The CCP can also function in a switched environment where the CCP acts as a host during certain periods and, when necessary, functions as a subhost, connecting to a host CPU for special transmissions or receptions such as transmission of batched data. The connection can be via a switched line defined as auto or manual call and auto or manual answer. If the host transmissions can be scheduled properly with the normal online terminal operations, an RPQ is available which provides a switching capability between a dial network for remote communications and multipoint control through the EIA local feature (IBM World Trade Corporation EIA/CCITT). If two adapters are used, each can have this RPQ. Use of this RPQ requires separate CCP startups and separate assignment sets for dial and multipoint operation. (See index entry *switched lines* for further information.)

ATTACHMENT CONFIGURATIONS

The CCP can be attached to the following IBM systems that have the indicated hardware and programming support:

System	Communications Adapter	Programming Support	Remote Processor Configurations
System/3 Model 6	BSCA	RPG II Telecommunications Feature (data mode support only)	Point-to-point Switched Multipoint tributary
System/3 Models 4, 10, 12, or 15	BSCA	RPG II Telecommunications Feature (data mode support only)	Point-to-point Switched Multipoint tributary
	BSCA[2]	Multiline/ Multipoint (Features 6030-6031)	Point-to-point Switched Multipoint tributary Control station
	BSCA	CCP	Point-to-point Switched Multipoint tributary Control station
System 7[1]	BSCA (RPQ#S40076)	Programming support for RPQ#S40076 and applications programming support	Point-to-point Switched Multipoint tributary
	MLTA (RPG#S40065)	Programming support for RPQ#S40065 and applications programming support	Point-to-point Switched Multipoint tributary (see Note)
System/360 and System/370	BSCA	BSCA Programming support (BTAM)	Point-to-point Switched Control station

---

[1] System/7 with MLTA functions as a 2740 Model 1 with the following features:
Checking – leased line.
Dial with checking – switched line.
Station control with checking – multipoint tributary.

[2] The Model 4 does not support MLMP.

PROGRAMMING CONSIDERATIONS

This section provides an application-to-application understanding of programming between the CCP and an attached CPU.

The programming of an attached system for linkage to the CCP can differ greatly, depending upon the type of telecommunications support provided by the attached system. On the other hand, a particular application program running under the CCP communicating with a CPU can be easily used with another CPU, with little or no change.

For BSCA attachments, the programmer of the attached CPU should be familiar with the System/3 Model 10 Disk System, System/3 Model 12, or System/3 Model 15 Multiline/Multipoint (MLMP) support for an understanding of the base CCP data management and IOCS. (See the publication *IBM System/3 Multiline/Multipoint Binary Synchronous Communications Reference Manual,* GC21-7573.) For MLTA attachments, the programmer of the attached CPU should be familiar with the MLTA Input/Output Control System for an understanding of the base CCP data management and IOCS. (See the publication *IBM System/3 Multiple Line Terminal Adapter RPQ Program Reference and Component Description Manual,* GC21-7560.)

The CCP application programmer must be aware that the CCP always considers the attached CPU to be a terminal. As such, the attached CPU must be identified as either a command mode or a data mode terminal. The attached CPU should be designated a command mode terminal if it is to initiate CCP application programs without CCP system operator intervention. If program initiation by the attached CPU is not required, it should be designated a data mode terminal. In this case, the CCP system operator or the operator of a CCP command mode terminal initiates the program.

Command Mode

As a command mode terminal, the attached CPU is expected to provide certain commands in order to initiate a CCP application program and can optionally provide other commands to request special CCP control functions. The attaching CPU programming support must support variable length messages in order to handle CCP commands and responses. Messages must be non-transparent, non-ITB, consisting of a single block followed by EOT.

The following commands can be issued by the attached CPU to the CCP:

/ON [password]	(required)
/Q	(optional)
/NOQ	(optional)
/FILE	(dictated by requirements of the CCP application program)
Program Request	(required)
/OFF	(optional)
/MSG	(optional)
/NAME	(optional)
/RUN	(optional)
Data Mode Escape	(optional)
/RELEASE	(optional)

Command	Good	Error
1. /ON	A01, E03	E01, E02, E04, (R01, R02), *E27*
2. /Q	A03	E01, E02, E05, (R01, R02), *E27,* **E29**
3. /NOQ	A04	E01, E02, E05, (R01, R02), *E27,* **E29**
4. /FILE	A06	E01, E02, E17, E18, E19, E20, E21, *E26* (R01, R02), *E27,* **E29**
5. /OFF	A10	E01, E02, E08, E09, E10, (R01, R02), *E27*
6. /NAME	A05	E01, E02, E22, E23, E24, E25, (R01, R02), *E27*
7. /MSG	A02	E01, E02, E06, (R01, R02), *E27*
8. /RELEASE	A08	E01, E02, E07, (R01, R02), *E27*
9. /RUN	A09	E01, E02, E16, (R01, R02), *E27*
10. Program request	User defined	E01, *E02, E11, E12, E13, E14,* E15, (*R01, R02*), R03, R04, R05, *R06,* R07, *R08,* R09, R10, *R11, R12,* R13, R14, *R15,* R16, *R17,* **R19, R20, R21, R23, R24, R25, R26, R27,** *E27,* **E28, E29, E30, E31,**
11. Data mode escape sequence	A07	(R01, R02)

Notes:

1. R02 cannot be received unless R01 has been received.
2. If message or response prefix is in italics, it can be received only under Model 10 and Model 12 CCP. If a prefix is in bold type, it can be received only under Model 15 CCP.
3. Refer to the *IBM System/3 Communications Control Program Terminal Operator's Guide,* GC21-7580, for a complete description of the commands and messages.

Figure A-1. Command Mode Message and Response Prefixes

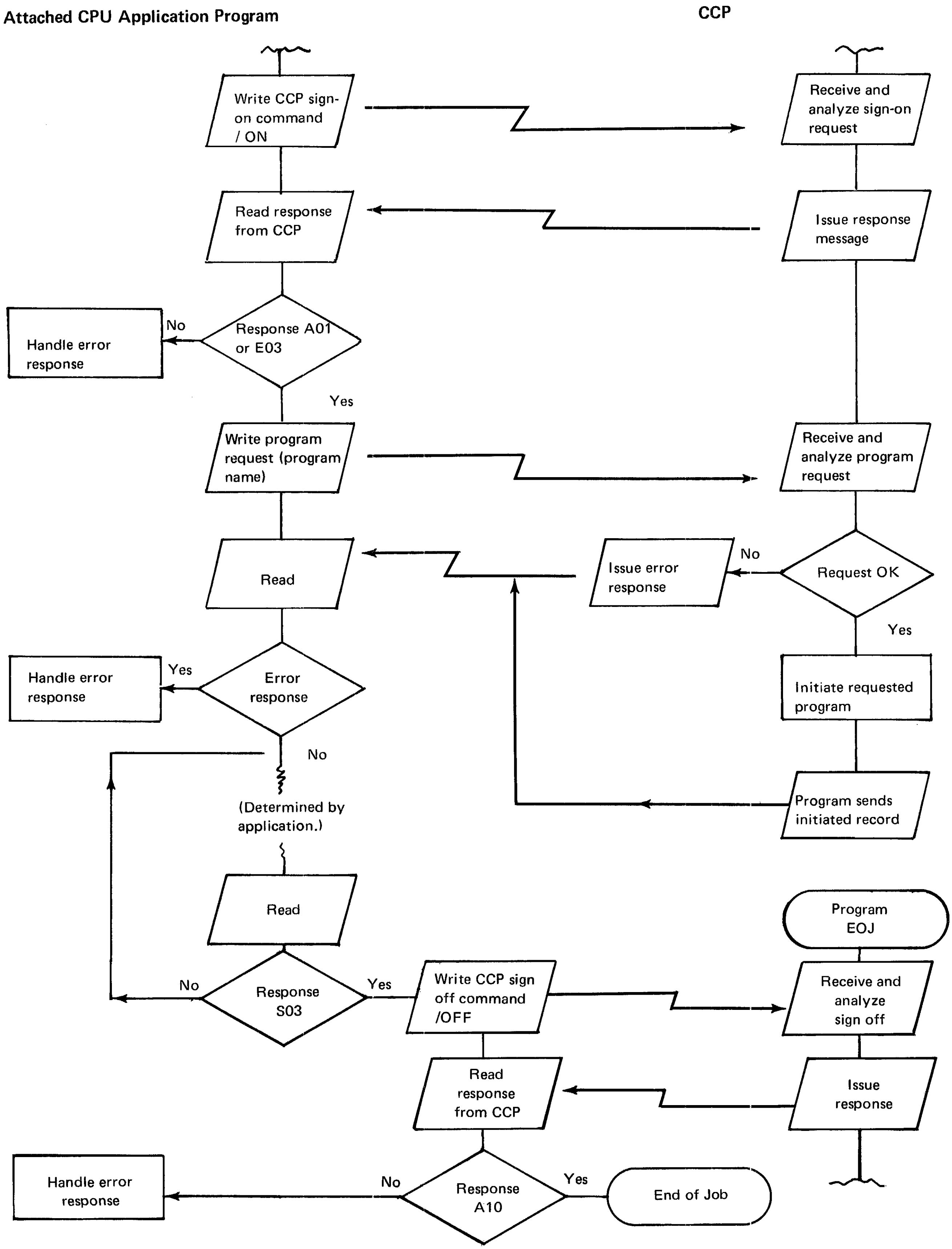


Figure A-2. Procedure for Issuing a Program Request from an Attached Command Mode CPU

Descriptions of the functions of these commands are given in the *CCP Terminal Operator's Guide*, GC21-7580. The *CCP Terminal Operator's Guide* also describes the responses given by the CCP to these commands. The attached CPU application program must analyze these responses and take appropriate action. All messages with an *S* prefix are suppressed by the CCP when communicating with an attached CPU.

Figure A-1 shows the CCP commands and the prefixes of the possible responses to each command. Figure A-2 illustrates the general procedure that should be followed by the attached CPU application program in signing on to the CCP, issuing a program request, and signing off from the CCP.

If a program running in a command mode CPU on a switched line has sent a /ON command, that program must issue a /OFF command to cause the line to disconnect normally. The /OFF command causes CCP to issue a response message to the program and disconnect the CPU before the line itself is disconnected. The program must be prepared to receive the response. If /OFF is not sent and a disconnection of the line occurs (caused, for example, by end of job on the command mode CPU), CCP attempts to issue a receive to the signed-on CPU on the disconnected line, and the CPU terminal is put into error recovery.

Data Mode

When an attached CPU is defined as a data mode terminal at CCP assignment time, programming of the attached CPU is greatly simplified, since it is not necessary to program for CCP application program requests and the possible CCP responses. In this case, however, the CCP application program must be initiated by the CCP system operator or another CCP command mode terminal. The initiated program can either specify the attached CPU as a required terminal (see PROGRAM assignment statement in *CCP System Reference Manual*) or acquire the CPU during execution.

GENERATION CONSIDERATIONS

The following generation statements must be considered when generating a CCP system that will support an attached CPU:

$EMLA
$EMLD
$EBSC
$EBSD

All CPU-to-CPU support must be specified in the generation stage; a subset of the generated support can be selected in the assignment stage. See *CCP System Reference Manual* for descriptions of the generation and assignment statements.

$EMLA and $EMLD Statements

CCP to System/7 MLTA support must be described in these generation statements. When specifying the $EMLA parameters, you must decide whether or not translation is to be performed on the CPU-to-CPU messages.

When specifying the parameters for the $EMLD statement, you must select one of the following System/7 types:

- SYS7C
- SYS7SC
- SYS7DC

The XMCODE parameter must be specified as PTTCEBCD.

$EBSC and $EBSD Statements

These statements are used to specify CCP to System/3, System/360, System/370, and System/7 BSCA support. When specifying the parameters of the $EBSC statement, consider what the physical attachment of the CPU will be: switched, nonswitched point-to-point, multipoint, or CCP as host (control station).

The parameter for the ITB keyword should be YES if the CPU-to-CCP application program data blocks and data records are of fixed length and transmission checking is desired on each record.

The RECSEP keyword should specify the record separator byte if the CPU-to-CCP application program transmissions are to be of variable block and record length. (*Note:* Block lengths can only be variable up to the maximum block length.)

Either ASCII or EBCDIC code transmission must be specified for the CPU-to-CCP link.

If CS is specified YES (control station) on the $EBSC statement, use of the RESPOL-YES parameter offers considerable performance improvement by making the BSCA polling routines resident.

If the MP-YES parameter is specified (multipoint tributary), the AUTORS-YES parameter offers performance improvement.

The XPRNCY-YES operand should be specified if the full 256-character EBCDIC set is to be used in transmission between the CPU and the CCP application program.

The TYPE operand of the $EBSD statement must specify CPU.

Note: Record formatting for transmission using ITB, RECSEP, and XPRNCY applies only when the CPU is in data mode, communicating with the CCP application program.

ASSIGNMENT CONSIDERATIONS

The following assignment statements must be considered when making assignment selections for a CCP system that will support an attached CPU:

// TERMATTR
// BSCALINE
// BSCATERM
// MLTALINE
// MLTATERM
// PROGRAM

The CCP assignment stage allows the user to select a subset of the generated options. The // TERMATTR statement must be used to specify the attributes of the attaching CPU. The // BSCALINE or // MLTALINE statements must be used to specify the characteristics of the line connection to the attaching CPU. The // BSCATERM or // MLTATERM statement must be used to specify the terminal characteristics of the attaching CPU.

The data transmitted by the CCP application program is formatted for line transmission (block length, record length, etc.) based on information specified in the // TERMATTR statement. Data transmitted to the CCP application program must be formatted in the same manner.

RECOMMENDATIONS AND EXAMPLES

It is generally recommended that, in CPU-to-CCP attachments, the remote CPU be defined as a data mode terminal. This greatly simplifies the attachment interface. In data mode, message synchronization is established by the application programs.

In command mode, it is recommended that the CCP program be designed to send data first. The message length for the remote CPU read operations must be 82 characters minimum to handle command mode message responses.

The examples on the following pages depict System/360/370 BTAM-to-CCP data mode and command mode sequences. The BTAM operations are as follows:

WRITE TI – Write Initial
WRITE TQ – Write Inquiry
WRITE TR – Write Reset
WRITE TT – Write Continue
READ TI – Read Initial
READ TT – Read Continue

Example 1: Multipoint Command Mode

BTAM Operation	BTAM (Control Station)	CCP (Tributary Station)
WRITE TI	Addressing sequence →	
		← ACK
	STX /ON[b̸password] ETX →	
		← ACK
WRITE TR	EOT →	
READ TI	Polling sequence →	
		← STX A01 SIGNED ON – PROCEED ETX
READ TT	ACK →	
		← EOT
WRITE TI	Addressing sequence →	
		← ACK
	STX (program name) ETX →	
		← ACK
WRITE TR	EOT →	
READ TI	Polling sequence →	
		← Program data or CCP error message
READ TT	ACK →	
		← More program data or EOT
READ TT	ACK →	
		← EOT
WRITE TI	Addressing sequence →	
		← ACK
	STX /OFF ETX →	
		← ACK
WRITE TR	EOT →	
READ TI	Polling sequence →	
		← STX A10 SIGNED OFF – [HOLD/DROP] TERMINAL ETX
READ TT	ACK →	
		← EOT

Example 2: Point-to-Point Command Mode

BTAM Operation	BTAM	CCP
WRITE TI	ENQ ——————→ S E T /ON[b̸ password] T ————→ X X	←—— ACK ←—— ACK
WRITE TR	EOT ——————→	
READ TI	ACK ——————→	←—— ENQ S E ←—— T A01 SIGNED ON – PROCEED T X X
READ TT	ACK ——————→	←—— EOT
WRITE TI	ENQ ——————→ S E T (program name) T ————→ X X	←—— ACK ←—— ACK
WRITE TR	EOT ——————→	
READ TI	ACK ——————→	←—— ENQ ←—— Program data or CCP error message
READ TT ⁓ READ TT	ACK ——————→ ⁓ ACK ——————→	←—— More program data or EOT EOT
WRITE TI	ENQ ——————→ S E T /OFF T ————→ X X	←—— ACK ←—— ACK
WRITE TR	EOT ——————→	
READ TI	ACK ——————→	←—— ENQ S ←—— T A10 SIGNED OFF – [HOLD/DROP] X TERMINAL E T X
READ TT	ACK ——————→	←—— EOT

Example 3: Point-To-Point Switched Command Mode

BTAM Operation	BTAM	CCP
WRITE TI	E ID sequence N ——→ Q S E T/ON[b̸password]T ——→ X X	A ←ID sequence C K ←ACK
WRITE TR	EOT ——→	←ENQ
READ TT	ACK ——→	S E ←T A01 SIGNED ON –PROCEED T X X
READ TT	ACK ——→	←EOT
WRITE TQ	ENQ ——→	←ACK
WRITE TT	S E T (program name) T ——→ X X	←ACK
WRITE TR	EOT ——→	←ENQ
READ TT	ACK ——→	←Program data or CCP error message
READ TT ≀ READ TT	ACK ——→ ≀ ACK ——→	←More program data or EOT ≀ ←EOT
WRITE TQ	ENQ ——→	←ACK
WRITE TT ≀	Data to CCP application program ——→ ≀	←ACK ≀
WRITE TR	EOT ——→	←ENQ

Example 3 (continued)

READ TT ⌇ READ TT	ACK ——→ ←—— Program data ⌇ ⌇ ACK ——→ ←—— EOT
WRITE TQ	ENQ ——→ ←—— ACK
WRITE TT	S E T /OFF T ——→ X X ←—— ACK
WRITE TR	EOT ——→ ←—— ENQ
READ TT	ACK ——→ S E ←——T A10 SIGNED OFF – [HOLD/DROP] TERMINAL T X X
READ TT	ACK ——→ ←—— EOT

Example 4: Point-to-Point Data Mode

BTAM Operation	BTAM	CCP	CCP Application Program Operation
WRITE TI	ENQ →		GET
		← ACK	
	(Data) →		
		← ACK	GET
WRITE TT	(Data) →	⋮	⋮
⋮	⋮	← ACK	GET
WRITE TT	(Data →		
		← ACK	GET
WRITE TR	EOT →		
READ TI		← ENQ	PUT
	ACK →		
		← (Data)	
READ TT	ACK →		
⋮	⋮	← (Data)	PUT
		⋮	⋮
READ TT	ACK →		
		← (Data)	PUT MESSAGE
READ TT	ACK →		
		← EOT	
End of Job			End of Job

For definitions of communications and data processing terms that are not included in this glossary, see *IBM Data Processing Glossary,* GC20-1699, or publications listed in *Appendix C: Bibliography.*

$CCPFILE: A CCP control file on a 5444 disk or the 3340 simulation area in which, during CCP assignment stage, the user defines one or more specific operating environments for the CCP. Each operating environment consists of a *set* of terminals, file, and programs that can be used during a particular run of the CCP.

AID character: Attention Identification character.

assignment stage: The special preparatory CCP run during which the user defines one or more *sets* of specific operating environments in which the CCP can run.

Attention Identification (AID) character: A code that is set in a 3270 display station when the operator takes an action that produces an I/O pending condition. The character identifies the action or key that caused the condition to be generated. The AID is set when the display station operator presses a program access key, ENTER key, TEST REQ key, or program function key; when a Selector Pen attention occurs; or when a successful operator identification card read-in occurs. It also identifies device addresses assigned to printers.

attribute (3270): A characteristic of a display field. The attributes of a display field include: protected or unprotected; numeric-only or alphameric input control; displayed, nondisplayed, display intensified; selector-pen-detectable or nondetectable; and modified or not modified.

attribute character (3270): A code that defines the attributes of the display field that follows. An attribute character is the first character in a display field, but it is not a displayable character.

block mode operations: BSCA operations that result in all data from an operation in the program up to ETB being moved into or from the user program's record area.

BSCA: Binary Synchronous Communications Adapter.

CCC: Copy Control Character.

command interrupt mode: The operating mode of a terminal following data mode escape until the program execution is resumed by a RUN command (the terminal re-enters data mode) or until the program is cancelled by a RELEASE command (terminal enters command mode).

command mode: The operating mode of a command terminal following a successful sign-on, up to and including the program request. Following program termination, a terminal returns to command mode until another program request is made or until sign-off.

command terminal: A terminal that is capable of commanding CCP services related to requesting a program. Terminals are designated as either command terminals or data terminals at assignment time.

communications management: A major function of the CCP that controls terminal input-output.

communications service subroutine: A relocatable subroutine provided by the CCP that is link-edited to user programs written in RPG II, COBOL, or FORTRAN IV. The subroutine is called by the user program whenever the program requires a communications service, enabling programmers to request communications services in these languages. Separate subroutines are provided for COBOL, FORTRAN IV, and RPG II; a macro is provided for Basic Assembler.

control station: The primary or controlling computer in a multipoint telecommunications configuration.

Copy Control Character (CCC): A character used in conjunction with the 3270 Copy command to specify that a particular operation, or combination or operations, is to be performed at a display station or printer in the data that is to be copied.

Copy operation: A 3270 DFF operation that copies the contents of the buffer from one display station or printer to another display station or printer attached to the same control unit.

cursor: A unique symbol (an underscore) that identifies a character position in a 3270 screen display, usually the character position at which the next character to be entered from the keyboard will be displayed.

data entry application: A communications-based system application in which terminals are in relatively prolonged communication with an application program (as opposed to the typical inquiry application), for example, entering data for document preparation (such as invoice preparation), or entering data directly into data files from a terminal.

data mode: The operating mode of a terminal when it is under control of a user program, until the program terminates, the terminal is released by the program, or the data mode escape characters are entered. While in data mode, a terminal is not in direct communication with the CCP.

data mode escape: A special CCP command, consisting of a unique string of six characters entered at a requesting terminal while the terminal is in data mode. The data mode escape command temporarily suspends a terminal's communication with a program and places the terminal in command interrupt mode.

data terminal: A terminal that is not capable of commanding CCP services. A data terminal is always either in standby mode (not polled for input by the CCP) or in data mode (under control of an application program).

dedicated program: A program running under CCP that requires sole use of the CCP user program area. (Applies to Model 10 and Model 12 CCP.)

designator character: A character that immediately follows the attribute character in a 3270 selector-pen-detectable field. The designator character controls whether a detect on the field will or will not cause an attention. For a non-attention-producing field, the designator character also determines whether the modified data tag for the field is to be set or reset as the result of a selector-pen detect.

DFF: 3270 Display Format Facility of the CCP.

disk system management: The group of system programs which control the operation of the IBM System/3 Model 10 Disk System or the IBM System/3 Model 12 and Model 15. Disk system management performs scheduling, input/output control, storage assignment, data management, and related services.

DSM: Disk System Management.

file management: A major function of the CCP that controls the use of data files by programs running under the CCP.

format find: A program (CCPFMT) that will find a newly created or modified format while running under CCP and additionally provides the capability to update the value of the DFFSFDT parameter of the PROGRAM assignment statement.

generation stage: The initial stage of creating the CCP, during which the user specifies the size and range of function he requires in his verson of the CCP, and creates that version on his disk pack.

implied Invite Input: An Invite Input that is not actually issued by the user program, but exists because data is allowed with the program request. Implied Invite Inputs are included in the count of outstanding Invite Inputs in the communications parameter list for certain operations.

initial mode: The operating mode of a command terminal before a sign-on at the terminal has been accepted by the CCP.

inquiry: A communications-based system application in which, typically, a single transaction or request for information is entered from a terminal and a response is returned to the terminal.

inquiry-with-update: A communications-based system application in which records of transactions entered from terminals are used to interrogate and update one or more master files maintained by the system (synonymous with *inquiry and transaction processing).*

interface: In application programming under the CCP, the data areas (parameter list and record area), communications service subroutines, and defined operations by which user programs and the CCP communicate with each other.

line buffer: The internal main storage area associated with a communication line from which data is transmitted to a terminal or into which data is received from a terminal. Data in this area includes device and line control characters inserted or removed by the CCP.

master terminal name: In multicomponent terminals (1050), the symbolic terminal name specified during CCP assignment as referring to the principle input and output component.

MDT: Modified Data Tag.

message mode operations: BSCA operations that result in all blocks of data including the EOT signal being sent or received in a single operation.

MLMP: Multiline/Multipoint BSCA IOCS, the base data management and IOCS included in the CCP for binary synchronous communications.

MLTA: Multiple Line Terminal Adapter RPQ. MLTA IOCS, the System/3 programming support for the MLTA RPQ device, is included in the CCP for asynchronous (start-stop) communications.

Modified Data Tag (MDT): A bit in the attribute character of a 3270 display field which, when set on, causes the field to be read on an input operation. The modified data tag may be set by (1) a keyboard input to the field, (2) a selector-pen detection in the field, (3) a card read-in operation, or (4) program control. The modified data tag may be reset by (1) a selector-pen detection in the field, (2) program control, or (3) ERASE INPUT key.

null character: A hex 00 character on a 3270 that occupies a position in the storage buffer and is displayed as a blank.

MRT program: multiple requesting terminal program.

multicomponent terminal: A class of terminals that can have more than one input and/or output devices attached. The 1050 system is the only terminal supported by the CCP that is considered to be a multicomponent terminal.

multiple requesting terminal (MRT) program: A type of application program under the CCP that can process additional requests for it even though it is still processing an earlier request.

NEP: never-ending program.

never-ending program: A user application program which, after it has been initiated, normally remains in main storage and does not go to end of job until the CCP is shut down.

operation stage: The stage of the CCP during which the CCP is started, supports an online network of terminals, and is shut down.

order entry application: A form of data entry application in which transactions (such as sales orders) are entered into a data file from remote terminals.

output/input field: One of four classes of fields defined under the 3270 Display Format Facility. Output/input fields contain data that has been supplied either during format generation or during execution of the application program; this data can be changed by the terminal operator using the keyboard.

password security option: An optional CCP feature, selected during generation, which requires a terminal operator to enter a predetermined password before the CCP will allow the terminal to enter commands.

physical file: See *symbolic file.*

program management: The major function of the CCP that fetches programs, allocates system resources to programs, manages the concurrent execution of two or more programs, purges programs from main storage, and optionally maintains a count of the number of times each application program is requested.

program request: A command, consisting of a program name entered at a terminal or the system operator's console, that causes the CCP to initiate execution of an application program.

program request count: The optional CCP program management function of maintaining a count of the number of times each application program is requested.

program request under format (PRUF): A method of requesting a program from a display format on a 3277 or 3275. The entire screen can be used to pass data with the program request. The name of the program to be requested appears as the first input field from the 3270 terminal.

program-selected terminal: From the point of view of the application program, a terminal that is selected by an application program for input/output, as opposed to a terminal that requested the program (see *requesting terminal*). Program-selected terminals can be either *required* (must be allocated to the program before the program can run) or *acquired* (allocated dynamically to the program as it is running).

program termination code: A two character code provided by the CCP when an application program has been cancelled by the CCP because of certain coding errors or program logic errors, or because the system operator requested cancellation of the program. This code identifies the reason for the cancellation (refer to the *CCP System Operator's Guide*).

protected field: A 3270 display field for which the display operator cannot use the keyboard or operator identification card reader to enter, modify, or erase data.

record mode operations: Application program input and output operations that result in a single record (for BSCA, a single record of a data block) being moved into or out of the program's record area.

requesting terminal: From the point of view of the application program, a terminal that requested the program, as opposed to a terminal that is selected by the program (see *program-selected terminal*). Requesting terminals are always command terminals.

RVI: A signal from a receiving device to a device that is transmitting to interrupt its transmission as soon as possible (see Get operation).

selector pen detectable (SPD) field: One of four classes of fields defined under the 3270 Display Format Facility. SPD fields allow the terminal operator to enter data by using the selector pen.

Shutdown: The final stage of the CCP operation, during which the CCP allows programs currently executing or scheduled to finish processing, then closes files, adapters, and communication lines.

sign-on: The procedure performed at a terminal while it is in initial mode. This procedure may include entering only the /ON command, or entering the /ON command with a password or other user-specified security data.

single requesting terminal (SRT) program: A type of application program under the CCP that can process a request from only one requesting terminal during its execution.

SPD field: Selector Pen Detectable field.

SRT program: single requesting terminal program.

standby mode: The mode of a data (non-command) terminal when it is not under control of a user program.

startup: The initial phase of the CCP operational stage, during which all necessary initialization occurs, including opening of disk files, adapters, and communication lines, and the completion of various tables and control blocks.

subhost: A telecommunications system which, while directly controlling a group of terminals, is itself a tributary station to another central processor.

symbolic file: A file reference (symbolic name) which allows, on separate executions of a program, reference to different files, known as *physical files.* A symbolic file is related by the terminal operator to a specific physical file by means of a /FILE command.

symbolic subterminal name: Symbolic names assigned to individual components of a multicomponent terminal (1050). See *master terminal name.*

system task: A unit of work for the processing unit from the standpoint of the CCP, consisting of a CCP function (as opposed to a user application, or *user task*) that must be performed by the CCP, such as communications management.

task: See *system task* and *user task.*

task chaining: The process of requesting initiation of a CCP task from within a currently executing CCP task, without requiring system or operator action.

task identification: An identifying character associated with a task which differentiates between that task and other tasks running concurrently under the CCP.

terminal attributes: Characteristics of a terminal from the point of view of the CCP and CCP application programs, including block length, record length, data format, and other information.

terminal reference identifier: A unique two-character identifier, assigned to each terminal during the CCP assignment stage, that is used by the CCP and the system operator to refer to a specific terminal. Any of the 64 graphic EBCDIC characters may be used.

translation: Under the CCP, conversion of the transmission line data code (if not EBCDIC) into EBCDIC or conversion from EBCDIC into transmission line data code.

tributary station: A secondary or non-controlling device in a multipoint telecommunications configuration.

truncation: Loss of excess data when the length of data received from a terminal is greater than the maximum input length specified in the parameter list or when more data is provided in an output operation than the line buffer for the terminal can hold (in BSCA record mode output operations, if the output length exceeds the record length specified in the terminal attributes set).

unit record device: Under the CCP, the MFCU, 1442 Card Read Punch, 5203 and 1403 printers, MFCM, 2501 Card Reader, and 3741 Data Station directly attached.

unprotected field: A 3270 display field for which the terminal operator can manually enter, modify, or erase data.

user task: A unit of work for the processing unit from the standpoint of the CCP, consisting of a user program (as opposed to a system function, or *system task*) that must be executed by the CCP.

WCC: Write Control Character.

Write Control Character (WCC): A character used in conjunction with 3270 write operations to specify that a particular operation, or combination of operations, is to be performed at a display station or printer.

Appendix C: Bibliography

The following publications contain information that readers may require to gain more detailed knowledge of System/3, teleprocessing, telecommunications equipment, and programming languages that can be used with System/3 and the CCP:

CCP

- *IBM System/3 Communications Control Program General Information Manual*, GC21-7578
- *IBM System/3 Communications Control Program Terminal Operator's Guide,* GC21-7580
- *IBM System/3 Models 10 and 12 Communications Control Program System Operator's Guide,* GC21-7581
- *IBM System/3 Model 15 Communications Control Program System Operator's Guide,* GC21-7619
- *IBM System/3 Models 10 and 12 Communications Control Program System Reference Manual,* GC21-7588
- *IBM System/3 Model 15 Communications Control Program System Reference Manual,* GC21-7620
- *IBM System/3 Communications Control Program Messages Manual*, GC21-5170

General System/3

- *IBM System/3 Models 8, 10, 12, and 15 Components Reference Manual*, GA21-9136

MLTA and MLTA Terminals

- *IBM System/3 Multiple Line Terminal Adapter RPQ Program Reference and Component Description Manual*, GC21-7560
- *IBM 2740 Communications Terminal Models 1 and 2 Component Description,* GA24-2403
- *IBM 2741 Communication Terminal,* GA24-3415
- *IBM 1050 Data Communication System Principles of Operation,* GA24-3474
- *IBM 3767 Models 1 and 2 Communications Terminal Component Description Manual,* GA27-3096

BSC and BSCA Terminals/Systems

- *IBM System/3 Models 8, 10, 12, and 15 Components Reference Manual*, GA21-9136
- *General Information: Binary Synchronous Communications*, GA27-3004
- *IBM 3270 Information Display System Component Description*, GA27-2749
- *IBM System/3 3735 Support Program Coding Manual*, GC21-5096
- *IBM 3735 Programmer's Guide*, GC30-3001
- *IBM 3740 Data Entry Systems Programmers Guide*, GC21-5071
- *IBM 3741 Data Station Reference Manual*, GA21-9183
- *IBM System/7 RPQ Binary Synchronous Communications Module Programming Guide and Reference Manual*, SC34-1510
- *IBM System/7 System Summary,* GA34-0002
- *IBM System/3 Multiline/Multipoint Binary Synchronous Communications Reference Manual*, GC21-7573

Programming Language Manuals

- *IBM System/3 RPG II Reference Manual*, SC21-7504
- *IBM System/3 Subset American National Standard COBOL*, GC28-6452
- *IBM System/3 Subset American National Standard COBOL Compiler and Library Programmer's Guide*, SC28-6459
- *IBM System/3 FORTRAN IV Reference Manual*, SC28-6874
- *IBM System/3 Basic Assembler Reference Manual*, SC21-7509
- *IBM System/3 Overlay Linkage Editor Reference Manual*, GC21-7561
- *IBM System/3 Models 10 and 12 Control Programming Macros Reference Manual*, GC21-7562
- *IBM System/3 Model 15 System Control Programming Macros Reference Manual*, GC21-7608

General Telecommunications

- *IBM Data Communications Primer*, C20-1668
- *IBM System/360 Introduction to Teleprocessing*, C30-2007

Appendix D: Operation Codes

Table D-1 shows the decimal and hexadecimal values and RPG II codes that represent CCP communications operations. The following symbols are used in the table to represent operations:

Operation Symbols

ACC	Accept Input
ACQ	Acquire Terminal
CPY	Copy (3270 DDF only)
EAU	Erase All Unprotected (3270 DFF only)
EOF	Force End-of-File (RPG II only)
GET	Get
GTA	Get Terminal Attributes
INV	Invite Input
PNW	Put-No-Wait
PTG	Put-Then-Get
PUT	Put
REL	Release Terminal
SHQ	Shutdown Inquiry
SPI	Stop Invite Input
TCH	Chain Task Request (5704-SC2 only)
WAT	Wait Operation (Model 15 only)

Operation Modifier Symbols

CMD	Command-mode Terminal
BLK	Block – send end-of-block (EOB)
KPL	Keep line
MSG	Message – end end-of-transmission (EOT)
NEL	Not End New Line
NNL	Not Start New Line
OVR	Override (3270 DFF only)
PRF	Program Request under Format (PRUF)
RVI	Send reverse interrupt (RVI)
STA	Set terminal attributes

Operation	Value		RPG II Code
	Dec	Hex	
ACC	4	0004	ƀƀƀD
ACQ	9	0009	ƀƀƀI
ACQ,CMD	41	0029	ƀƀBI
ACQ,STA	25	0019	ƀƀAI
CPY	66	0042	ƀƀDB
EAU	82	0052	ƀƀEB
EOF	–	–	ƀƀGA
GET	1	0001	ƀƀƀA
GET,RVI	17	0011	ƀƀAA
GTA	8	0008	ƀƀƀH
INV	5	0005	ƀƀƀE
PNW	6	0006	ƀƀƀF
PNW,NEL	262	0106	ƀAƀF
PNW,NNL	518	0206	ƀBƀF
PNW,NNL,NEL	774	0306	ƀCƀF
PNW,BLK	38	0026	ƀƀBF
PNW,BLK,NEL	294	0126	ƀABF

Table D-1 (Part 1 of 3). CCP Operation Codes

Operation	Value		RPG II Code
	Dec	Hex	
PNW,BLK,NNL	550	0226	ƀBBF
PNW,BLK,NNL,NEL	806	0326	ƀCBF
PNW,MSG	54	0036	ƀƀCF
PNW,MSG,INV	–	–	ƀƀƀW
PNW,MSG,INV,OVR	–	–	ƀHƀW
PNW,MSG,NEL	310	0136	ƀACF
PNW,MSG,NNL	566	0236	ƀBCF
PNW,MSG,NNL,NEL	822	0336	ƀCCF
PNW,MSG,OVR	2102	0836	ƀHCF
PNW,MSG,OVR,PRF	2166	0876	ƀHGF
PNW,MSG,PRF	118	0076	ƀƀGF
PTG	3	0003	ƀƀƀC
PTG,NEL	259	0103	ƀAƀC
PTG,NNL	515	0203	ƀBƀC
PTG,NNL,NEL	771	0303	ƀCƀC
PTG,MSG	51	0033	'ƀƀCC'
PUT	2	0002	ƀƀƀB
PUT,NEL	258	0102	ƀAƀB
PUT,NNL	514	0202	ƀBƀB
PUT,NNL,NEL	770	0302	ƀCƀB

Table D-1 (Part 2 of 3). CCP Operation Codes

Operation	Value		RPG II Code
	Dec	Hex	
PUT,BLK	34	0022	ƀƀBB
PUT,BLK,PRF	98	0062	ƀƀFB
PUT,BLK,NEL	290	0122	ƀABB
PUT,BLK,NNL	546	0222	ƀBBB
PUT,BLK,NNL,NEL	802	0322	ƀCBB
PUT,MSG	50	0032	ƀƀCB
PUT,MSG,INV	–	–	ƀƀCS
PUT,MSG,INV,OVR	–	–	ƀHCS
PUT,MSG,NEL	306	0132	ƀACB
PUT,MSG,NNL	562	0232	ƀBCB
PUT,MSG,NNL,NEL	818	0332	ƀCCB
PUT,MSG,OVR	2098	0832	ƀHCB
PUT,MSG,PRF	114	0072	ƀƀGB
PUT,MSG,PRF,OVR	2162	0872	ƀHGB
REL	10	000A	ƀƀƀK
REL,KPL	26	001A	ƀƀAK
SHQ	0	0000	ƀƀ00
SPI	1025	0401	ƀDƀA
TCH	42	002A	ƀƀBK
WAT	20	0014	ƀƀAD

Table D-1 (Part 3 of 3). CCP Operation Codes

Appendix E: Return Codes

This appendix contains summary tables of return codes issued to application programs by the CCP following telecommunications operations. (See index entry *return codes* for references to additional information.) The following summary tables are provided:

Table E-1	Success/Exception Conditions Return Codes
Table E-2	Common I/O Error Return Codes
Tables E-3, E-4, and E-5	Unique 3270, 3735, and 3741 BSCA I/O Error Return Codes
Table E-6	Success/Exception Return Codes Per Operation Type
Table E-7	Common I/O Error Return Codes Per Operation Type
Tables E-8, E-9, and E-10	3270, 3735, and 3741 I/O Error Return Codes Per Operation Type
Table E-11	Contents of Effective Input Length Field and Record Area Per Operation Type and Return Code

Tables 1-3 include a suggested program action for each CCP return code. The recommended actions are as follows:

Code	Recommended Program Actions
A1	Continue normal processing
A2	Attempt to determine the cause of the error and retry the operation if appropriate; otherwise go to the next logical operation *Note*: If the failure that caused the error condition is not corrected before the retry, the same error may occur on the retry.
A3	Do not reissue the operation to this terminal
A4	Go to End-of-Job as soon as logically possible
A5	Process according to the requirements of the application
A6	Process data until EOT on the terminal for which data is pending
A7	Issue a Get operation or go to End-of-Job

On data transfer operations, input and/or output data accompanies the following return codes, and no others:

0, 1, 2, 3, 6

Negative Return Codes

In most cases, when the CCP encounters an error condition, it stops processing the operation and returns a negative return code. Therefore, if concurrent error conditions occur, the CCP returns a code for only the first error condition detected.

The results of the data transfer for any operation yielding a negative return code are unpredictable, except that a translation error on an output operation always indicates the data has not been transmitted.

For BSCA, a negative return code always terminates the current transmission with the terminal, except for a translation error on a Put operation. If a translation error occurs when data is being sent to a terminal, the line is still connected to the terminal. Except for the translation error, a Put Message should not be issued if you are transmitting when a negative return code occurs and another Get should not be issued unless you wish to re-establish communication with the terminal.

See *Put-Then-Get* operation under *Operations* in Chapter 2 for information about the meaning of negative return codes for that operation. See also index entry *return codes, negative (DFF).*

Use of Data Truncated Return Code in 3270 DFF

The data truncated (hex 01) return code has a special meaning in programs using the 3270 Display Format Facility. If this return code is received from a Get or Accept Input operation, it indicates that the maximum input length given in the parameter list for the operation was less than the total length of all the fields the program should have expected, as defined by the last Put Message or Put Overrides (with select input fields) operation.

The data truncated return code does not necessarily mean that more data was entered from the terminal than was received by the program. A situation could exist where only a few fields were entered from the terminal, the sum of which was less than the length the program should expect and less than the value given as maximum input length for the operation. The fact that the length given by the program is less than should have been given causes the data truncated return code to be returned from the operation.

Under the DFF, the data truncated return code can be an indication that the program is expecting a record in a different structure than the one it is receiving.

CCP RETURN CODES				
Dec	Hex	RPG II	Description	Program Action
0	0000	00	Successful operation	A1
1	0001	01	DATA TRUNCATED: Data was truncated; for input operations, the length of the data was greater than the input length specified in the parameter list; for output operations, the length of the data was greater than the length of the teleprocessing line buffer.	A2
2	0002	02	EOT: Input operation was successful (EOT was received), or non-PRUF program request data was returned to a PRUF program at program request time.	A1
3	0003	03	DATA TRUNCATION AND EOT: Data truncation occurred on this operation and EOT was received.	A2
4	0004	04	SHUTDOWN REQUESTED: The system operator has requested CCP shutdown. The requested operation has not been performed.	A4
5	0005	05	DATA PENDING: The operation was issued to a terminal on a BSCA line which is currently controlled by another terminal in use by your program (line awaiting EOT). An Invite Input was issued to a terminal which is currently awaiting an EOT. A Put or Get of a record or block was issued to another terminal on the same line. Put or Get operations with the previous terminal must be continued until EOT is transmitted on the line.	A6
6	0006	06	TERMINAL INTERRUPT/RVI: A terminal interrupt (MLTA) or RVI (BSCA) has been received from the remote station. The operation was successful. For BSCA terminals, this return code indicates that the RVI was received after the initial positive response to addressing. An RVI to addressing will result in -14 for CPU, -40 for 3735, or -20 to -28 for 3270.	A5
7	0007	07	3270 CLEAR: The terminal operator at 3270 pressed the CLEAR key (see *3270 Component Description*, GA27-2749).	A5
8	0008	08	TERMINAL NO LONGER AVAILABLE: Command interrupt mode was entered and the terminal operator released (/RELEASE command) the terminal. The terminal is no longer available to this program.	A3

Table E-1 (Part 1 of 2). Success/Exception Condition Return Codes

CCP RETURN CODES			Description	Program Action
Dec	Hex	RPG II		
9	0009	09	TERMINAL OFFLINE: The requested terminal has been varied offline and is not available to this program.	A3
10	000A	10	STOP INVITE INPUT SUCCESSFUL: The request to stop Invite Input was successful; the Invite input has been cancelled.	A1
11	000B	11	ACQUIRE TERMINAL FAILED: The attempt to acquire a terminal for this program has failed.	A1
12	000C	12	CHAIN TASK QUEUE FULL: The maximum number of chain task requests are already queued; this chain task request cannot be accepted.	A2
13	000D	13	INSUFFICIENT TP BUFFER: Insufficient TP is available to queue this request.	A2
14	000E	14	CHAIN REQUEST DATA ACCEPTED SUCCESSFULLY: An operation to accept the data from a chain task request was successful.	A1
15	000F	15	CHAIN REQUEST DATA TRUNCATED: The data associated with a chain task request was truncated.	A2

Table E-1 (Part 2 of 2). Success/Exception Condition Return Codes

CCP Return Codes				
Dec	**Hex**	**RPG II**	**Description**	**Program Action**
-1	FFFF	0J	DATA CHECK: Data was received incorrectly, checking error condition detected.	A2
-2	FFFE	0K	INVALID CHARACTER: (1) During translation of data, an invalid character was found. (2) An invalid ASCII character has been detected by BSCA.	A2
-3	FFFD	0L	LOST DATA: Data received was lost because it exceeded the size of the input buffer.	A2
-4	FFFC	0M	PERMANENT BSCA ERROR: Operation failed because a permanent error condition was detected.	A2
-5	FFFB	0N	ABNORMAL RESPONSE: An invalid response was received from the remote station.	A2
-6	FFFA	0O	TRANSMIT/RECEIVE ABORT: Data transfer failed and the teleprocessing line has been closed. CCP has varied offline all terminals on this line.	A3
-7	FFF9	0P	NO RESPONSE TO POLLING/ADDRESSING: The selected terminal does not respond to polling or addressing.	A2
-8	FFF8	0Q	TEXT TIME OUT: The terminal does not respond to attempted data transfer.	A2
-9	FFF7	0R	WAIT TIME EXCEEDED: Data not sent or received before EOT within a specified time frame. *Note:* If using 3270, retry (program action A2) is not allowed. Go to End-of-Job as soon as logically possible.	A2
-10	FFF6	1}	NO CONNECTION: Unable to establish a connection with the remote station.	A2
-11	FFF5	1J	INVALID ID'S: The ID exchange with the remote station failed.	A2
-12	FFF4	1K	ABORT, DISCONNECT: The switched line connection to the remote station has been lost.	A2
-13	FFF3	1L	ADAPTER CHECK: A hardware check occurred on the teleprocessing line adapter.	A2
-14	FFF2	1M	NEGATIVE RESPONSE TO ADDRESSING: The remote terminal has an error condition which prevents it from successfully receiving data. For the 3284, 3286 and 3288 printer components of the 3270 system, this return code indicates the printer is busy.	A2
-91	FFA3	9J	OPERATION NOT PERFORMED (RPG II SPECIAL): The operation was not performed because indicator 91 was set on by a previous operation and was not set off.	A2

Table E-2. Common I/O Error Return Codes

CCP RETURN CODES			Description	Program Action
Dec	Hex	RPG II		
-20	FFEC	2}	Device unavailable or not ready.	A2
-21	FFEB	2J	Not used. This return code is not returned to the user. If CCP detects this condition, an operations message is displayed followed by a 2F termination code.	
-22	FFEA	2K	Equipment check; device end.	A2
-23	FFE9	2L	3270 detected a BSCA error.	A2
-24	FFE8	2M	Control check; data check.	A2
-25	FFE7	2N	Data check on copy command.	A2
-26	FFE6	2O	Operation check—copy command.	A2
-27	FFE5	2P	Device busy with copy command.	A2
-28	FFE4	2Q	Control check, operation check, data check during copy command.	A2
-29	FFE3	2R	Invalid data from 3270 using DFF. This return code is caused by the terminal operator pressing the TEST REQ key on the 3270 keyboard.	A2

Table E-3. Unique 3270 BSCA I/O Error Return Codes

CCP RETURN CODES				
Dec	Hex	RPG II	Description	Program Action
-40	FFD8	4}	Attempted send before receive.	A7
-41	FFD7	4J	Invalid character.	A2
-42	FFD6	4K	Buffer overflow.	A2
-43	FFD5	4L	Disk full.	A5
-44	FFD4	4M	Directory full.	A5
-45	FFD3	4N	Undefined header.	A2
-46	FFD2	4O	3735 disk error.	A2

Table E-4. Unique 3735 BSCA I/O Error Return Codes

CCP RETURN CODES				
Dec	Hex	RPG II	Description	Program Action
-50	FFCE	5}	Transparency error occurred.	A2
-51	FFCD	5J	No activity in 20 seconds.	A2
-52	FFCC	5K	Data check.	A2
-53	FFCB	5L	Received line bid error.	A2
-54	FFCA	5M	Wrong length error.	A2
-55	FFC9	5N	Reset was pressed on 3741.	A5
-56	FFC8	5O	Security check.	A5
-57	FFC7	5P	Disk overflow.	A5
-58	FFC6	5Q	Bad extent error.	A2
-59	FFC5	5R	Both stations transmit.	A7
-60	FFC4	6}	Length error.	A2
-61	FFC3	6J	No record found on disk.	A2
-62	FFC2	6K	Seek error.	A2
-63	FFC1	6L	Read error.	A2
-64	FFC0	6M	Write error.	A2
-65	FFBF	6N	Not ready.	A2
-66	FFBE	6O	Diskette write protected.	A2

Table E-5. Unique 3741 BSCA I/O Error Return Codes

Table E-6. Success/Exception Return Codes Per Operation Type

Return Code Value			Description	Operation (Abbreviations are explained under *Operation Codes* in Appendix D)															
Dec	Hex	RPG II		ACC	ACQ	CPY	EAU	EOF	GET	GTA	INV	PNW	PTG	PUT	REL	SHQ	SPI	TCH	WAT
0	0000	00	Successful operation	X	X	X	X		X	X	X	X	X	X	X^2	X^3	X^1	X	X
1	0001	01	Data truncated	X					X	X			X	X			X		
2	0002	02	EOT/non-PRUF data	X^4					X				X	X			X		
3	0003	03	Data truncation and EOT	X					X				X	X			X		
4	0004	04	Shutdown requested	X						X									
5	0005	05	Data pending						X			X	X	X					
6	0006	06	Terminal interrupt/RVI										X	X					
7	0007	07	3270 clear	X					X				X				X		
8	0008	08	Terminal no longer available	X^2					X^2				X^2				X^2		
9	0009	09	Terminal offline	X		X	X		X		X	X	X	X					
10	000A	10	Stop invite input successful														X		
11	000B	11	Acquire terminal failed		X														
12	000C	12	Chain task queue full															X	
13	000D	13	Insufficient TP buffer															X	
14	000E	14	Chain request data accepted	X															
15	000F	15	Chain request data truncated	X															

---

[1] This specifies that the Get operation was successful while the Stop Invite Input failed.

[2] The count of Invite Input operations outstanding for this user program is returned in the effective input length field of the parameter list.

[3] Indicates shutdown not requested.

[4] If a PRUF program, indicates that non-PRUF data was received.

Table E-7. Common I/O Error Return Codes Per Operation Type

Return Code Value			Description	Operation (Abbreviations are explained under *Operation Codes* Appendix D)															
Dec	Hex	RPG II		ACC	ACQ	CPY	EAU	EOF	GET	GTA	INV	PNW	PTG	PUT	REL	SHQ	SPI	TCH	WAT
-1	FFFF	0J	Data check	X		X	X		X				X[1]	X[1]			X		
-2	FFFE	0K	Invalid character	X		X	X		X				X	X			X		
-3	FFFD	0L	Lost data	X		X	X		X				X				X		
-4	FFFC	0M	Permanent BSCA error	X		X	X		X				X	X			X		
-5	FFFB	0N	Abnormal response	X		X	X		X				X	X			X		
-6	FFFA	0O	Transmit/receive abort	X		X	X		X				X	X			X		
-7	FFF9	0P	No response to polling/addressing	X		X	X		X				X	X			X		
-8	FFF8	0Q	Text time out	X		X	X		X				X	X			X		
-9	FFF7	0R	Wait time exceeded	X		X	X		X				X	X			X		
-10	FFF6	1 }	No connection	X		X	X		X				X	X			X		
-11	FFF5	1J	Invalid IDs	X		X	X		X				X	X			X		
-12	FFF4	1K	Abort, disconnect	X		X	X		X				X	X			X		
-13	FFF3	1L	Adapter check	X		X	X		X				X	X			X		
-14	FFF2	1M	Negative response to addressing										X	X					
-91		9J	Operation not performed[2]																

---

[1] Data check cannot occur on a Put for BSCA EBCDIC.

[2] RPG II SPECIAL only.

Table E-8. 3270 I/O Error Return Codes Per Operation Type

Return Code Value			Description	Operation (Abbreviations are explained under *Operation Codes* in Appendix D)															
Dec	Hex	RPG II		ACC	ACQ	CPY	EAU	EOF	GET	GTA	INV	PNW	PTG	PUT	REL	SHQ	SPI	TCH	WAT
-20	FFEC	2}	Device unavailable or not ready			X	X						X	X					
-20	FFEB	2J	Not used																
-22	FFEA	2K	Equipment check; device end			X	X						X	X					
-23	FFE9	2L	3270 detected BSCA error			X	X						X	X					
-24	FFE8	2M	Control check; data check			X	X						X	X					
-25	FFE7	2N	Data check on copy command			X							X	X					
-26	FFE6	2O	Operation check-copy command			X							X	X					
-27	FFE5	2P	Device busy with copy command			X							X	X					
-28	FFE4	2Q	Control, operation, or data check on copy command			X							X	X					
-29	FFE3	2R	Invalid data from 3270 using DFF	X					X								X		

Table E-9. 3735 I/O Error Return Codes Per Operation Type

Return Code Value			Description	Operation (Abbreviations are explained under *Operation Codes* in Appendix D)															
Dec	Hex	RPG II		ACC	ACQ	CPY	EAU	EOF	GET	GTA	INV	PNW	PTG	PUT	REL	SHQ	SPI	TCH	WAT
-40	FFD8	4}	Attempted send before receive										X	X					
-41	FFD7	4J	Invalid character										X	X					
-42	FFD6	4K	Buffer overflow										X	X					
-43	FFD5	4L	Disk full										X	X					
-44	FFD4	4M	Directory full										X	X					
-45	FFD3	4N	Undefined header										X	X					
-46	FFD2	4O	3735 disk error	X					X				X				X		

Table E-10. 3741 I/O Error Return Codes Per Operation Type

Return Code Value			Description	Operation (Abbreviations are explained under *Operation Codes* in Appendix D)															
Dec	Hex	RPG II		ACC	ACQ	CPY	EAU	EOF	GET	GTA	INV	PNW	PTG	PUT	REL	SHQ	SPI	TCH	WAT
-50	FFCE	5}	Transparency error occurred	X					X				X						
-51	FFCD	5K	No activity in 20 seconds	X					X			X	X	X			X		
-52	FFCC	5K	Data check	X					X				X						
-53	FFCB	5L	Received line bid error	X					X			X	X	X			X		
-54	FFCA	5M	Wrong length error	X					X			X	X	X			X		
-55	FFC9	5N	Reset was pressed on 3741	X					X			X	X	X			X		
-56	FFC8	5O	Security check	X					X			X	X	X			X		
-57	FFC7	5P	Disk overflow	X					X			X	X	X			X		
-58	FFC6	5Q	Bad extent error	X					X				X						
-59	FFC5	5R	Both stations transmit	X					X				X						
-60	FFC4	6}	Length error	X					X			X	X	X			X		
-61	FFC3	6J	No record found on disk	X					X			X	X	X			X		
-62	FFC2	6K	Seek error	X					X			X	X	X			X		
-63	FFC1	6L	Read error	X					X			X	X	X			X		
-64	FFC0	6M	Write error	X					X			X	X	X			X		
-65	FFBF	6N	Not ready									X	X	X					
-66	FFBE	6O	Diskette write protected									X	X	X					

	Operation															
	ACC[1]		ACQ		CPY		EAU		EOF		GET[1]		GTA		INV	
Return Code	EFFL	RECA	EFFL	RECA	EFFL	RECA	EFFL	RECA	EFFL	RECA	EFFL	RECA	EFFL	RECA	EFFL	RECA
0	LIN	DATA	ATRID	NC	NC	NC	NC	NC			LIN	DATA	LIN	ATTRS	NC	NC
1 – Truncated	LIN* LIN**	DATA* DATA**									LIN* LIN**	DATA* DATA**	LIN*	DATA*		
2 – EOT/non-PRUF data	LIN	DATA									LIN	DATA				
3 – Truncated–EOT[2]	LIN*	DATA*									LIN*	DATA*				
4 – Shutdown	NC ZERO	NC BLANK														
5 – Data pending											NC ZERO	NC BLANK				
6 – RVI																
7 – CLEAR key	ZERO	NC BLANK									ZERO	NC BLANK				
8 – Released	#INV	NC BLANK									#INV	NC BLANK				
9 – Terminal offline	NC	NC			NC	NC	NC	NC			NC ZERO	NC BLANK			NC	NC
10 – Stop Invite Input											ZERO	BLANK				
11 – Acquire failed			NC	NC												
12 – Chain queue full																
13 – Insufficient TP buffer																
14 – Chain data accepted	LIN	DATA														
15 – Chain data truncated	LIN*	DATA*														
-n – All negative return codes	ZERO	BLANK			NC	NC	NC	NC			ZERO	BLANK				

Legend:

EFFL
LIN = Actual length of input data received in the record area.
LIN* = Data was truncated – the value shown is the maximum input length.
LIN** = Data was truncated – the value shown is the actual length of data received in the record area.
#INV = Count of outstanding Invite Inputs.
NC = No change.
ZERO = Set to zero by the CCP.
ATRID = Attributes Identifier.

RECA
DATA = Data received from terminal.
DATA* – Data received from terminal up to maximum input length.
DATA** = Data received from the terminal, up to the last field that would fit in the record area.
BLANK = Set to blanks (X'40') by the CCP.
ATTRS = Terminal attributes information (21 positions).

---

[1] The top symbol is for non-DFF programs; the bottom symbol is for DFF programs.
[2] Not applicable for DFF.

Table E-11 (Part 1 of 2). Contents of Effective Input Length Field and Record Area Per Operation Type and Return Code

	Operation															
	PNW		PTG[2,3]		PUT		REL		SHQ		SPI[1]		TCH		WAT	
Return Code	EFFL	RECA	EFFL	RECA	EFFL	RECA	EFFL	RECA	EFFL	RECA	EFFL	RECA	EFFL	RECA	EFFL	RECA
0	NC	NC	NC LIN	NC DATA	NC	NC	#INV	NC	NC	NC	LIN	DATA	NC	NC		
1 – Truncated			NC LIN*	NO DATA*	NC	NC					LIN*	DATA*				
2 – EOT/Non-PRUF data			 LIN	 DATA							LIN	DATA				
3 – Truncated–EOT[3]			 LIN*	 DATA*							LIN*	DATA*				
4 – Shutdown									NC	NC						
5 – Data pending	NC	NC	NC NC	NC NC	NC	NC										
6 – RVI			 NC	 NC	NC	NC										
7 – CLEAR key			 ZERO	 NC							ZERO	NC BLANK				
8 – Released			 #INV	 NC							#INV	NC BLANK				
9 – Terminal offline	NC	NC	NC NC	NC NC	NC	NC					NC ZERO	NC BLANK				
10 – Stop Invite Input											NC BLANK	NC BLANK				
11 – Acquire failed																
12 – Chain queue full													NC	NC		
13 – Insufficient TP buffer													NC	NC		
14 – Chain data accepted																
15 – Chain data truncated																
-n – All negative return codes			NC ZERO	NC BLANK	NC	NC					ZERO	BLANK				

Legend:

EFFL
LIN = Actual length of input data received in the record area.
LIN* = Data was truncated – the value shown is the maximum input length.
LIN** = Data was truncated – the value shown is the actual length of data received in the record area.
#INV = Count of outstanding Invite Inputs.
NC = No change.
ZERO = Set to zero by the CCP.
ATRID = Attributes Identifier.

RECA
DATA = Data received from terminal.
DATA* = Data received from terminal up to maximum input length.
DATA** = Data received from the terminal, up to the last field that would fit in the record area.
BLANK = Set to blanks (X'40') by the CCP.
ATTRS = Terminal attributes information (21 positions).

---

[1] The top symbol is for non-DFF programs; the bottom symbol is for DFF programs.
[2] The top symbol is for the Put portion of the operation; the bottom symbol is for the Get portion of the operation.
[3] Not applicable for DFF.

Table E-11 (Part 2 of 2). Contents of Effective Input Length Field and Record Area Per Operation Type and Return Code

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