DATAFORM II WITH DOS SUPPORT DF2DOSG User's Guide

Version 2

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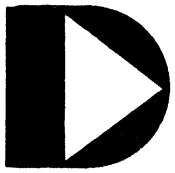
Model Code No. 50052

DATAPOINT CORPORATION



The Leader in Dispersed Data Processing

PREFACE

DATAFORM 2 provides a personalized data entry system for use on DATAPOINT processors. DF2DOSG is intended primarily to support generation and testing of cassette compatible systems, although it is also equally useful as a disk based data entry system.

"Forms" are created for display on the processor's screen, and the data entry operator then simply fills in the form. The data is then recorded, and at any time may be retrieved and revised using the same form to view and edit the recorded data.

Each "form" is custom designed, and editing criteria are assigned to the data fields on the form at the time the form is generated. Programs written in the high level DATAFORM language may also be assigned at this time. Forms and programs are then combined and become a unigue DATAFORM system.

Four stages of development are involved in generating a system: the editor and compiler are used to create field programs; the form generator is used to create forms; the configurator is used to combine the forms into a "system"; and the data entry interpreter is used to control data entry.

Since DATAFORM uses standardized data record formats, further processing of the data can proceed under any DATABUS, BASIC, or RPG program. Additionally, any one of a number of available communications programs or terminal emulators (including DATAPOLL and EM2780) may be used to transmit DATAFORM data files for further processing at remote sites.

Chapter 1 should provide as much information about DF2DOSG as is necessary for those familiar with both the cassette version of DATAFORM and DOS. Chapter 2 provides a more general description of DATAFORM, and continuing chapters describe forms generation and data entry using the forms. The DOS User's Guide, model number 50127, provides more information about the DOS.

DF2DOSG is entirely DOS independent.

Throughout this manual, a field appearing between pointed brackets, as:

<filename>

denotes a required field; whereas, a field appearing between square brackets, as:

[,filename]

denotes an optional field, whose use is explained in subsequent discussion.

To convert DF2DOSG version 1 systems to DF2DOSG version 2 systems, each field program should be re-compiled, and each form should be re-generated.

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CHAPTER 1. A QUICK GUIDE TO THE DISK DATAFORM 2 SYSTEM

1.1 Installing the Disk DATAFORM 2 System

Disk DATAFORM 2 is released on a DMF cassette, listed in the Software Catalog as DF2DOSG. The MIN utility program is required to install the system. Installation is accomplished by entering:

```
MIN ;AO
```

When the cassette has been MIN'd, the following files will have been added to the disk directory:

```
DFEDIT/CMD   DF2DOSG program editor
DFCMP/CMD    DF2DOSG program compiler
DFGEN/CMD    DF2DOSG form generator
DFINT/CMD    DF2DOSG interpreter
DFCON/CMD    DF2DOSG configurator
```

Also included are 15 files labeled DF2DXTND/OVA through /OVO, which are the DF2DOSG extended interpreter overlays.

Thus, 20 files will have been added to the disk.

If the DF2DOSG system is to be used to generate cassette systems, the most current release of DF2 is also required. This must be ordered separately, under model number 20304.

DF2 should be installed using the MIN utility as follows: File zero of tape one should be named DF2CCON/ABS; file one of tape one should be discarded; and file two of tape one should be named DF2CINT/ABS.

Files zero and one of tape two of DF2SYS should be discarded. Files two through sixteen of tape two should be named DF2CXTND/OVA through DF2CXTND/OVO.

When DF2 and DF2DOSG have been installed as outlined above, installation is complete.

1.2 System Names

DF2DOSG utilizes a concept called a "System Name" (which is abbreviated "SYSNAM"). SYSNAM is a one to six character alphabetic name. All forms in a system, i.e. forms that are to be used together, should be assigned the same system name followed by a 2 digit number. Programs to be used with a particular form should be assigned the same system name and number as the form. The program source file (as created by DFEDIT) will have an extension of "TXT", the compiled program object file (as created by DFCMP) will have an extension of "DFP", and the form (as created by DFGEN) will have an extension of "DFF" (SYSNAMnn/DFF). The data file (as created by DFINT) will have the name and extension "SYSNAM/TXT".

The file extensions mentioned above are created and maintained by the particular program being run (DFEDIT, DFCMP, DFGEN, and DFINT). They should not be changed.

1.3 Program Generation

1.3.1 Program Source File Creation

To generate a program enter:

```
DFEDIT <SYSNAMnn>
```

where "SYSNAM" is the name of the system of forms and "nn" is the 2 digit number of the form with which the program(s) will be used. A file named SYSNAMnn/TXT will be created.

When all program statements have been entered, and the DFEDIT has been terminated by use of the ":E" command, the program statements are recorded and the DOS is reloaded. See the chapter on EDIT in the DOS User's Guide for EDIT commands and further EDIT parameterization.

1.3.2 Program Compilation

To compile a program, enter:

```
DFCMP <SYSNAMnn>[,objectfile][;parameters]
```

The compiler identifies itself with the sign-on message:

```
DF2DOSG COMPILER 2.n -- ddmmmyy
```

The compiled object code is placed in the [objectfile]. The default [objectfile] name is the same as the name of the source file. The default [objectfile] extension is "DFP". Parameters may be entered at the time the compiler is executed. The parameters are separated from the [objectfile] name (if a name is present) by a semi-colon. If only a semi-colon is entered, the compiler assumes that no listing is to be printed. If the letter "L" appears after the semicolon, a listing without code will be generated. If the letters "L" and "C" both appear after the semicolon, a listing with code will be generated. If the letter "P" appears after the semicolon, a printer image file will be generated on the disk. If "P" and "C" appear, generated code will be included in the printer image file. The printer image file will be given the name "SYSNAMnn/PRT". This file may be printed or viewed on the screen with the DOS LIST utility. See the chapter on LIST in the DOS User's Guide for LIST parameterization.

If no parameters are entered, and a printer is on line, the messages:

LIST ON LOCAL/SERVO PRINTER?

and

LIST CODE TOO?

must be answered.

1.4 Form Generation

To generate a form enter:

DFGEN <inputform>[,outputform][,objectprogram]

The generator identifies itself with the sign-on message:

DF2DOSG GENERATOR 2.n -- ddmmmyy

The <inputform> name must be in "SYSNAMnn" format. The default [,outputform] name is the same as the <inputform> name. The default [,objectprogram] name is the same as the [outputform] name, but with a default extension of "DFP".

DF2DOSG DFGEN responds to the following commands. Most are the same as the cassette form generator's.

CONSTANT
LINK
NEW
OLD
OS
OUT
PROGRAM
REQUIRE
REVISE
SEMI-CONSTANT
TYPE

When "OUT" is entered, if field programs are assigned, the entire [objectprogram] file will be attached to the [outputform] file. If the [outputform] name is different from the <inputform> name, the [outputform] name should appear on the command line. Thus, when "OLD" is entered, <inputform> will be read; and when "OUT" is entered, the form in memory will be written to [outputform].

Entering "OUT" automatically reloads the DOS if the form generation is successful. The DOS may be reloaded at any time without writing the form by entering "OS".

1.5 Form Testing and Data Entry

To test the completed form, or to perform data entry, enter:

```
DFINT <SYSNAMnn>[,datafile]
```

The interperter identifies itself with the sign-on message:

```
DF2DOSG INTERPRETER 2.n -- ddmmmyy
```

The default extension of the data file is "TXT". If no [datafile] name is entered, the default data file name is "SYSNAM/TXT". Form "SYSNAMnn" is loaded, and the [datafile] is opened.

The commands available in the DF2DOSG interpreter are:

```
ADD
BACKSPACE
CONTINUE
DATA
END
FIND
LOAD
MODIFY
OS
REWIND
START
```

The "START", "ADD", "MODIFY", or "FIND" commands initiate interpreter action. Execution is the same as for the cassette interpreter with the exception that entering "END" both terminates the data file and reloads the DOS.

The "OS" command reloads the DOS without terminating the data file.

1.6 Generating Cassette Systems and Utilities

To generate a cassette system tape enter:

```
DFCON <SYSNAM>
```

The configurator identifies itself with the sign-on message:

```
DF2DOSG CONFIGURATOR 2.n - ddmmmyy
```

NOTE: This is the only time the form number must not be included in the name.

DFCON generates a disk file named "SYSNAM/CAT". The forms to be written to tape must first be cataloged, using the "IN n" command of the configurator. Only forms named "SYSNAMnn/DFF" may be cataloged.

The commands available in the configurator are:

```
CAT
CHOP n
COPY
DEL n
DPRINT
DUP
DUP ALL
FPRINT n
FPRINT ALL
LGO
OS
```

To create a DF2 tape one on the front deck with the forms specified in the catalog enter either:

```
DUP ALL
```

or

```
LGO
```

The replacement of the disk extended interpreters by the cassette extended interpreters is automatic when the LGO or DUP ALL commands are used.

The configurator may be used to print disk data files or forms or to copy cassette data files.

NOTE: Deleting or chopping files from the DF2DOSG catalog does not KILL that file in the disk directory.

1.7 Transferring Cassette Systems to Disk

The DOS MIN utility is required to transfer forms from DF2 tapes onto disk. MIN will display:

```
LGO TAPE FORMAT
LOAD FILE #Ø0 (OBJECT) ?
```

Enter "N" until MIN reaches file #Ø3 (this corresponds to form 1) or greater. After entering "Y", MIN asks:

```
DOS FILE NAME ?
```

Enter the system name, followed by the file number minus 2 (to get the proper form number), followed by "/DFF", as in the following example (where responses to MIN displays are enclosed in quotation

marks):

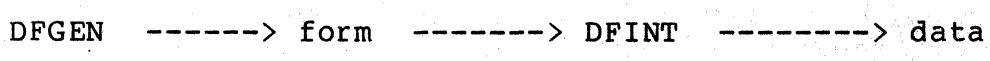
```
LOAD FILE #Ø3 (OBJECT)? "Y"
DOS FILE NAME: "SYSNAMØ1/DFF"
LOAD FILE #11 (OBJECT)? "Y"
DOS FILE NAME: "SYSNAMØ9/DFF"
```

Continue for each of the forms on the tape.

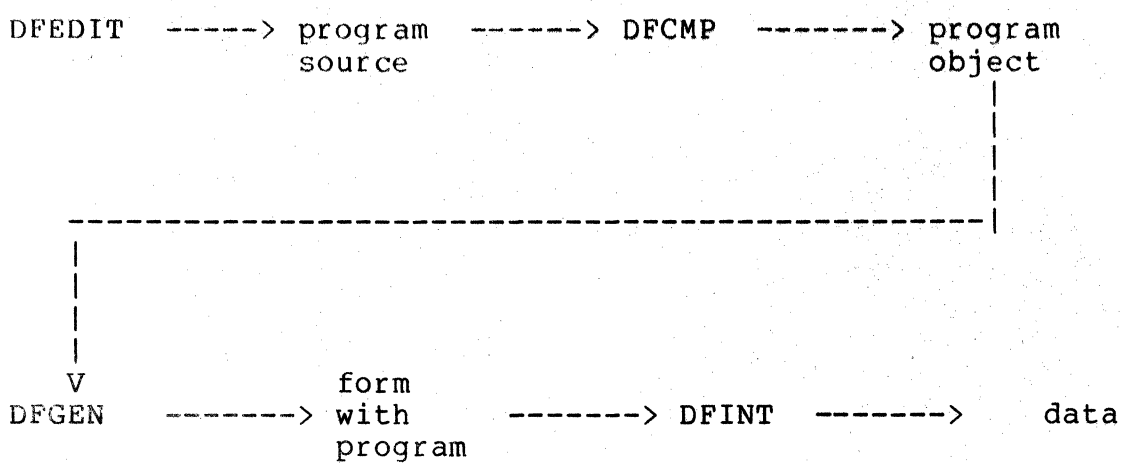
NOTE: the file number displayed by the MIN command is an octal number; the form number used by DF2DOSG is a decimal number. The octal number on the cassette tape should be converted to a decimal number for disk use.

Forms with programs requiring the extended interpreter will have to be re-generated by DFGEN in order to be used by DFINT.

FORM GENERATION AND TEST
without programs



FORM GENERATION AND TEST
with programs



CHAPTER 2. GENERAL DATAFORM TERMS AND CONCEPTS

2.1 What is a FORM?

A "FORM" in this User's Guide refers to the processor's screen image. This screen image is created by the form generator. It contains labeling information, defines the length and positions of "data fields", and reserves space for "keyin only fields".

The amount of data, the number of fields and the amount of constant information in the form image determine exactly how much memory the form requires.

The form generator may also be used to assign edit criteria to the data fields. The criteria are assigned field-by-field in separate passes over the form image.

These criteria include the field type:

- Alphabetic
- Alphanumeric
- Digit
- Numeric left justified/blank filled
- Numeric left justified/zero filled
- Numeric right justified/blank filled
- Numeric right justified/zero filled

entry restrictions:

- Fill controlled
- Program reserved
- Required
- Required/fill controlled
- Required/no keyin

semi-constant data; constant data; and automatic form control (linking to other forms).

In addition, "field programs" may be assigned during form generation. Up to twenty-six unique field programs may be referenced in a single form. The same field program may be assigned to more than one field.

Special function keys, which are discussed in the chapter on the form generator, enable cursor, character, line, and screen manipulation.

The screen image, basic edit criteria and field programs, if any, comprise the "form" which is subsequently interpreted by the DF2DOSG interpreter.

2.2 What is a FIELD PROGRAM?

If extended editing and basic computation are required in a form, a program written and compiled in the DATAFORM 2 language is necessary. This language provides access to the entire data record (on a character or field basis) and definition of working storage variables, tables, messages, etc. COMMON storage is available to pass information between forms. The DATAFORM 2 language provides the following editing capabilities:

Arithmetic
- Add
- Subtract
- * Divide
- * Multiply

Data Manipulation
- Align
- Move
- Set
- * Convert
- * Lookup

Data Entry Control
- Change
- Reset

Data Checking
- In range
- In table
- Not in range
- Not in table
- Null
- Retry

Check Digits
- * Ck1Ø
- * Ck11

Compares

- Equal
- Greater than
- Greater than or equal
- Less than
- Less than or equal
- Not equal

Branching

- Again
- Call
- Change
- Go to
- Next
- Return
- Store

Output

- Beep
- Close
- End
- Formshow
- Message
- Show
- Write

Data Definition

- Common
- Data
- Equ
- Field
- Redefine
- Work

Data Buffers

- Input
- Output

The subroutines to execute these commands are divided into two groups: the interpreter and the extended interpreter. The starred (*) commands in the preceeding list require the extended interpreter, which is discussed in a later section.

The field programs may be assigned to particular fields in a pass of the form generator. When the form is written out, the relocatable program will be converted to "absolute" code and written to the form file.

During data entry, the field program is executed after the operator enters data into the field where the program assignment was made. The program is executed even if the operator bypasses the field.

2.3 User Space and How It's Allocated

When a new form is being created, there are 1550 characters of memory, called "user space", available. This "space", however, encompasses all the following:

Common storage
Extended interpreter (if required)
Field programs (if required)
Form image
Keyin data buffer
Writing data buffer

The form generator indicates the amount of free space as soon as the form image has been defined. The program and, if necessary, the extended interpreter must fit in the remaining free space.

2.4 Some DATA ENTRY Features

In conjunction with the DISPLAY key, the number pad keys can provide the operator with the following functions:

Backspace field
Backspace record
Form data duplication
Form data erase
Load next form
Return to read record
Monitor
Rewind data file
Write record

If semi-constant data is defined in the form it may be accepted or overwritten by the data entry operator. Constant data cannot be over-written, and is placed in the data record as is.

Forms may be loaded in any order under either program or operator control.

Operator correction of previously generated data may be accomplished at any time by either a manual, record-by-record, or an automatic search, with re-writing in-place permitted.

Data may be added to the end of an existing data file (positioning is automatic).

CHAPTER 3. THE FORM GENERATOR

A DATAFORM "form" is an image displayed on the processor's screen which contains form text (explanatory information for the operator, not to be written to the data file), field definitions (special characters which define a field to be filled in by the operator and to be written on the data file) and keyin space (special characters which define a field to be entered [but not stored in the data record]). The processor's screen is 80 characters wide and 12 lines high and any of the 960 positions on the screen may be used in the form.

Each form is contained in a file named "SYSNAMnn/DFF", where "SYSNAM" is the name of a system of forms which may reference each other and "nn" is a two digit number assigned to a particular form. How to load the generator, the filenames required, and default conditions for filenames required is discussed in chapter one.

3.1 Data Field

A data field is part of the form image which starts at a vertical bar (|) and is continued by carets (^) or underscores (_). A field stops at the first non-caret or non-underscore character or the right hand edge of the screen.

Each data field causes a corresponding number of positions to be reserved in the two data areas (one used for entering and one used for writing data), and each field generates a six character set of edit criteria. Each field defined has a "field number" corresponding to its relative position in the form (and pointing to its entry in the edit criteria table). The uppermost, leftmost field is number one. Fields are numbered from left to right, line by line, from the top of the form down.

The construction "|^^^" defines a four character data field; "|" defines a single character field and "|||" defines three adjacent single character fields. The differences between one 3-character field and three 1-character fields are:

1) Only one set of edit criteria applies to the 3-character field whereas each 1-character field may be assigned different edit criteria.

2) Since each set of edit criteria takes 6 characters, the three 1-character fields use more user space than the single 3-character field.

3) Only one field program may be assigned to the 3-character field, whereas each 1-character field may have its own field program.

4) The single 3-character field may be right justified and/or zero filled.

Fields defined by carets will be "space compressed" in the form image (BUT NOT IN THE DATA RECORD!). When the form is displayed, space compressed fields will initially appear blank. As the cursor enters the field, the appropriate number of underscores will be displayed. Space compressed fields allocate less "user space" than non-compressed fields.

Fields defined by underscores are not compressed. The underscore characters are saved as part of the form image.

Constants and semi-constants are stored in the field description area of the form image and therefore can be defined only for fields initially defined by underscores.

The maximum number of characters in a single data field is 80 since the right hand edge of the screen always terminates a field definition.

3.2 Keyin Only Field

A keyin only field, with the exception of the initial character, is defined exactly as is a data field. Keyin only fields begin with a less than character "<" and are continued by carets or underscores. They may appear anywhere in the form. Keyin only fields create a six character set of edit criteria like other fields and thus have a corresponding field number. However, no space is reserved for these fields in the data record. A keyin only field may be used as a verify field, or as a program message field. Nothing in a keyin only field ever gets written to the data file.

3.3 User Space

There is a fixed amount of space available which must contain the form image, the data input/output areas, the edit criteria table and field programs. This fixed area is called "user space". There is no limit (other than the size of the screen) to the amount of text one may include in a form. There is, however, a limit to the number of field definitions (126) and to the number of data characters (245) which can be defined. The total user space available is 1550 characters.

The number of data characters, defined in the form image, reserve two areas: the keyin data area and the writing data area. In addition, each field (whether an actual data field or a keyin only field) defined in the form image requires a six character set of edit criteria. The characters displayed in the form image, both labeling information and field defining characters (excluding carets) reserve user space. Spaces (and carets) in the form image are "compressed", i.e., they are represented by a space compression character followed by the number of spaces compressed at that point. One terminator character is added to each line of the form image; however, lines which are completely blank require no space at all.

The amount of user space reserved for the data record, edit criteria table and form image is subtracted from the total user space and the amount remaining is indicated at the end of the form image generation pass.

In addition to the data record, edit criteria table and form image, user space may be allocated to field programs (which in turn may require an extended interpreter). The length of a field program is indicated on the listing and on the screen at the end of program compilation. The size of the various extended interpreters is listed in an APPENDIX. If an extended interpreter is required, 100 characters of COMMON storage are also required.

When the form is written to the form file, the amount of user space remaining (or the excess allocated, if any) is displayed on the screen. If an excess is allocated, either the form or (if present) the field programs should be revised.

3.4 Form Worksheet

To aid in the design of forms, a "DATAFORM Worksheet" is available. This worksheet provides space for designing the screen image and for recording the various edit criteria, constants, etc. which will have to be assigned at form generation time. The worksheet also serves as a record of the form and as a quick reference for generator commands and function keys.

A printout of completed forms, similar in format to the worksheet, may be obtained using the print utility of the configurator.

3.5 The NEW Command

To generate a new form, enter the:

```
NEW
```

command to clear the screen and enter the image generation mode.

Titles and field definitions may be entered. Pressing the ENTER key places the cursor at the beginning of the next line; pressing the ENTER key without entering text leaves a blank line in the form.

Additional form manipulation is available with the DISPLAY key and the keys on the number pad. When the DISPLAY key is pressed, the keys in the number pad to the right of the keyboard (or the regular number keys) become a set of special function keys enabling: the movement of the cursor up, down, left and right; the insertion and deletion of characters; the deletion of words; the insertion of lines; and the erasure of lines and portions of the screen.

A key becomes a special function key if it is pressed simultaneously with the DISPLAY key. That is, holding down the DISPLAY key while pressing the desired number key turns the number key into a special function key.

The following is a summary of the function keys:

7	Character insert
8	Cursor up
9	Erase to end of screen
4	Cursor left
5	Duplicate character
6	Cursor right
1	Word remove
2	Cursor down
3	Line insert
Ø	Remove character
.	Erase to end of line
CANCEL	Return to monitor

Additionally, the CANCEL key (not the CANCEL function key) will erase an entire line.

3.5.1 Repeat Key (KEYBOARD)

The KEYBOARD key causes a character (and many functions) to be repeated. That is, holding down the KEYBOARD key while pressing a character causes the character to be repeated as long as the KEYBOARD key is held down. Also, holding down the DISPLAY and KEYBOARD keys while pressing a number pad key causes the special function key to be repeated.

3.5.2 Cursor Movement Function Keys (2,4,6,8)

There are four cursor movement function keys which are non-destructive; i.e., they pass over characters on the screen without erasing them. The cursor down function key (2) moves the cursor DOWN, the cursor up function key (8) moves the cursor UP, the cursor right function key (6) moves the cursor RIGHT and the cursor left function key (4) moves the cursor LEFT.

The BACKSPACE key also moves the cursor to the LEFT in a non-destructive manner. Backspacing will wrap around from column 1 of a line to column 80 of the preceding line, except, of course, on the top line.

The SPACE bar is destructive; i.e., it erases the characters it passes over, and moves the cursor to the RIGHT.

All cursor movement function keys may be repeated.

3.5.3 Character Insert Function Key (7)

The character insert function key (7), at the upper left of the number pad, opens a space for character insertion wherever the cursor is positioned on the screen. This function key may be repeated. Characters at the right most edge of the screen are truncated, not wrapped around.

3.5.4 Character Remove Function Key (Ø)

The character remove function key (Ø), at the lower left of the number pad, causes the character at the cursor to be removed and the remaining characters to be concatenated to the left. The line is blank filled on the right. This function key may not be repeated.

3.5.5 Erase Function Keys (1,.,9)

There are several keys available to erase all or part of the screen image. These function keys may not be repeated. The word remove function key (1) causes a word (that is, a group of characters edged by spaces) to be removed. The line is concatenated, and blank filled on the right. The cursor may be placed anywhere in the word when the word remove function key is pressed.

The erase to end of line function key (.) causes the line to be erased from the position of the cursor to the right hand edge of the screen.

The erase to end of screen function key (9) causes all characters to be erased from the cursor to the end of the screen, i.e., through line 12 character 8Ø. This key could be used to clear the entire screen, if the cursor were placed in the upper left corner of the screen.

The CANCEL key (not the CANCEL function key) causes the entire line that the cursor is on to be erased, and places the cursor in the first position of the line.

3.5.6 Line Insert Function Key (3)

The line insert function key (3) causes a blank line to be inserted at the line where the cursor is blinking. The line at the cursor and all lower lines are rolled down the screen one line. The twelfth line will disappear. This function key may not be repeated.

3.5.7 Duplicate Character Function Key (5)

The duplicate character function key (5) causes the character immediately above the cursor to be duplicated in the current cursor position. This function key may be repeated. It has no effect when the cursor is placed on the top line of the screen.

3.5.8 Return To Monitor Function Key (CANCEL)

When the screen has the desired appearance, return to monitor function key (CANCEL) returns control to the generator's monitor. At this point the generator displays the message:

```
nnn DATA

mmm BYTES LEFT
```

indicating the number of characters in the data record and the number of characters remaining in the user space. If the number of characters in the data record is greater than 245, the generator displays the message:

```
MORE THAN 245 DATA
```

The form must immediately be revised to reduce the number of characters. If more than 126 fields are defined, the generator displays the message:

```
MORE THAN 126 FIELDS
```

Again, the form must immediately be revised to reduce the number of fields.

If the combined space required by the form image, data areas and edit criteria table exceeds the available user space, the generator displays the message:

```
nnn BYTES OVER
```

The form should be revised to fit the user space available. Suggestions on saving space are discussed in an APPENDIX.

3.6 Assignment of Edit Criteria

When the form image has been generated, the form is still only in memory and no edit criteria have been assigned.

Edit criteria may be assigned to each field of a form. Different kinds of edit criteria may be assigned in different "passes" over the fields of a form. Each type of edit-defining pass (TYPE, REQUIRED, SEMI-CONSTANT, CONSTANT, PROGRAM, LINK) must be requested separately, and, finally, the form must be written to the form file by use of the OUT command. The edit-defining passes may be requested in any order. Any or all edit-defining passes may be omitted, and passes may be repeated to review or to change the criteria.

During each pass, the form is redisplayed with the cursor at the first field definition (i.e., the first vertical bar (|) or less than (<) sign). Any one of the accepted edit criteria for that pass may be assigned, the field may be bypassed without changing or assigning the edit criteria (by pressing the ENTER key), or the edit criteria may be cleared (by pressing the CANCEL key).

If a pass is re-executed, the current edit criteria will be displayed as each field is reached. If no change is needed, pressing the ENTER key proceeds from field to field.

The backspace field function key (B) may be pressed to position back to the previous field. When the desired edit criteria have been assigned, the return to monitor function key (CANCEL) will return control to the monitor.

To request a pass, enter the name of the pass. Only the first 3 letters of a pass need to be entered to initiate the pass.

3.6.1 The TYPE Pass

The TYPE pass is entered to set restrictions on the characters which may be entered into a field; and, for numeric fields, to indicate whether the entered characters should be left- or right-justified, and blank- or zero-filled within a field. The acceptable types for this pass are discussed below.

If no TYPE edit criteria is assigned to a field, any character is acceptable in any position of that field.

3.6.1.1 Alphabetic (A)

The alphabetic edit criteria for the TYPE pass (A) indicates that characters entered must be uppercase alphabetics (A through Z) or space. Alphabetic fields are left justified and blank filled on the right.

3.6.1.2 Digit (D)

The digit edit criteria for the TYPE pass (D) indicates that characters entered must be strictly numeric (Ø-9). Digit fields are left justified and blank filled on the right.

3.6.1.3 Numeric (N)

The numeric edit criteria for the TYPE pass (N) indicates that characters entered must be of the set of: digits (Ø-9), a decimal point, or a minus sign (plus signs are not allowed). Numeric fields are left justified and blank filled on the right.

During data entry, numeric fields are checked to contain one decimal point at most. If a minus sign is present, it must be the left most character. And, no more than twelve positions are permitted to the left and four to the right of the decimal point.

3.6.1.4 Mixed (M)

The mixed edit criteria for the TYPE pass (M) indicates that characters entered must be of the set of: Alphabetics, space, digits, decimal point, or minus sign. No other special characters are allowed. Mixed fields are blank filled on the right.

3.6.1.5 Left Justify and Zero Fill (L)

The left justify and zero fill edit criteria for the TYPE pass (L) has the same restrictions as the numeric edit criteria; however, the field is left justified and zero filled on the right.

3.6.1.6 Right Justify and Zero Fill (R)

The right justify and zero fill edit criteria for the TYPE pass (R) has the same restrictions as the numeric edit criteria; however,the field is right justified and zero filled on the left.

3.6.1.7 Right Justified and Blank Fill (B)

The right justify and blank fill edit criteria for the TYPE pass (B) has the same restrictions as the numeric edit criteria; however, the field is right justified and blank filled on the left.

3.6.2 The REQUIRE Pass

The REQUIRE pass is entered to establish that a field may not be bypassed (tabbed past without entering data) during data entry, or that all characters must be entered, or that the field is not to be filled by an operator but is to be filled by a field program.

If no REQUIRE edit criteria is assigned to a field, the ENTER key must be pressed somewhere in the field to proceed to the next field.

3.6.2.1 Required (R)

The required edit criteria for the REQUIRE pass (R) indicates that a field is required. This means that during data entry, at least one character must be entered into the field.

3.6.2.2 Fill Controlled (F)

The fill controlled edit criteria for the REQUIRE pass (F) indicates that a field is to be fill controlled. This means that during data entry, the field must be completely filled by the operator.

Fields whose edit criteria for the TYPE pass is R, B, or L should not be fill controlled. For these fields, the interpreter aligns the data after the ENTER key is pressed.

Fill controlled fields may be bypassed, however, if the ENTER key is pressed in the first column of the field. The ENTER key is an unacceptable key elsewhere in the field.

3.6.2.3 Required and Fill Controlled (B)

The required and fill controlled edit criteria for the REQUIRE pass (B) indicates that a field is both required (R) and fill controlled (F). The ENTER key is an unacceptable key.

3.6.2.4 Program Reserved (P)

The program reserved edit criteria for the REQUIRE pass (P) indicates that a field will be filled by a field program. No operator keyin is permitted in this field.

This edit criteria may also be set in a keyin only field to reserve it as an alternate message display area.

3.6.2.5 Required and Program Reserved (S)

The required and program reserved edit criteria for the REQUIRE pass (S) indicates that a field is both program reserved (P) and required (R). This will prevent writing of the data record if data has not been entered into the program reserved field by a field program.

3.6.3 The SEMI-CONSTANT and CONSTANT Passes

The SEMI-CONSTANT or CONSTANT pass is entered to set semi-constants or constants into a field in a form. Semi-constants and constants are characters set into a data field in the form image. During data entry the operator has the option to accept or over-write data set by the SEMI-CONSTANT pass; whereas, data set by the CONSTANT pass automatically becomes part of the data record and cannot be rejected by the operator. Both commands cause the form to be displayed with the cursor in the first field capable of accepting constant or semi-constant information.

Semi-constants and constants may only be set in fields initially defined at image generation time by underscores.

In the CONSTANT pass, the SPACE bar does not set constant spaces into the field but permits movement to the desired position within the data field. If constant spaces are required, the caret key (^) must be used. In addition, neither constant nor semi-constant underscores (_), vertical bars (|) or carets (^) can be set within the field. The CANCEL key will clear any constant field previously set. The BACKSPACE key positions back one character and erases the last character entered.

During the CONSTANT pass, no editing is performed on constants entered. Unacceptable constants will cause the interpreter to hang beeping during data entry. Unacceptable semi-constants will be displayed. This feature may be useful for presenting prompting information to the operator, e.g., a date field may have the unacceptable semi-constant "YYMMDD" set to

guide the operator.

Also, an entire form of constant data should not be prepared; at least one position must be left for the operator - so that the form may be viewed and/or written to the data file. All-constant forms (or forms with no fields) will cause the interpreter to hang clicking at data entry time.

Partial semi-constants at the beginning or in the middle of a field are meaningless since the operator will have to enter data over them to enter the remainder of the field.

Once semi-constants or constants have been set, they will always appear when the form is displayed (e.g., during the TYPE or REQUIRE pass). Semi-constants and constants are not destroyed by assigning edit criteria during other passes.

Semi-constants and constants should be cleared before executing the REVISE command since their presence will change the field definitions.

3.6.4 The PROGRAM Pass

The PROGRAM pass is entered to assign field program names to fields. Field programs are written in the DATAFORM 2 language, which is discussed in a later chapter. Each program is identified by a single alphabetic character (A - Z). A program is assigned to a field by entering the appropriate program letter in any field where a special processing program will be written.

The same field program may be assigned to several fields, e.g., a year and month range check could be used for any date field. Up to twenty-six unique field programs may be assigned in one form.

3.6.5 The LINK Pass

The LINK pass is entered to assign a "link" to another form so that the operator need never be concerned with a form number. Each form in a DATAFORM 2 system may have a pointer, called a "link", to the next form to be used. This pointer must be defined at form generation time. If the data entry system being generated is a cassette system, form links should be planned so that cassette motion is minimized. That is, forms which are linked should be close to each other in the catalog. If the data entry system being generated is a disk based system, form links should be planned carefully so that forms are accessed in a manner most convenient to the operator.

NOTE: LINKed forms must have the same SYSNAM.

A form link may be either of two types: a manual link or an automatic link. The operator must press a special function key to load a manual linked form after the data record has been written. An auto linked form is automatically loaded whenever a data record is written.

When the LINK pass is entered, the message:

NEXT FORM nnn:

will appear (where nnn is the number of the current linked form in octal, initially ØØØ). The current linkage information may be viewed by entering the LINK pass and then simply pressing the ENTER key to leave the value unchanged.

3.6.5.1 Setting a Manual Link

To set a manual link, enter the number of the form (followed by the ENTER key) which is to be displayed when the operator presses the form load function key.

3.6.5.2 Setting an Auto Link

One data entry transaction may require several DATAFORM 2 "forms", e.g. forms 1, 2 and 3 (PAYØ1, PAYØ2 and PAYØ3) may make up one payroll transaction. In order to fill in form 1 once, then form 2 once, then form 3, the operator would have to use the write function (to write out the data) and then the form load function (to load the next form).

To facilitate use of multiple page forms (i.e. sets of forms to be completed in sequence and then reused), the next form links can be set at form generation time to auto-load a new form whenever data is written.

To set an auto-link precede the form number with a minus sign. Thus, when generating form one in the multi-page example above, enter "-2" as the auto link for form 1; enter "-3" as the auto link for form two; and "-1" as the auto link for form 3 (which makes form three wrap around to form one).

3.6.5.3 Clearing a Link

To clear a form link, enter a zero when the "NEXT FORM" message is displayed.

3.7 The OUT Command

During the entire form generation time the form is only in memory. To record the form and its associated edit criteria in the form file, enter the:

OUT

command. If no errors have been detected (e.g. too many fields, too long a data record), the form will be written. If programs have been specified, the proram file (see chapter 1 for a discussion of where the program file name originates) will be opened and searched for all referenced programs. If the file or any of the programs are missing, an error message is displayed and the form is written without field programs.

At the completion of the form writing process, the generator displays either the message:

PROGRAM BASE ADDRESS mmmm

nnn BYTES LEFT

and reloads the DOS or the message:

nnn BYTES OVER

This message means that the form image plus the data record plus the field program is too large to be contained in available user space. Either the form or the field programs must be revised to fit into the user space. All numbers displayed here including the address are decimal.

When the new form has been written, it may be tested by running DFINT specifying the newly created form.

NOTE: To interpret a form using DF2DOSG, the form does not need to be cataloged with the configurator. It only needs to be in the disk directory.

3.8 The REVISE Command

If an error in the form image is discovered after the image has been generated, the:

REVISE

command places the generator in the image generation mode with the current form intact. All edit criteria are cleared which means that all passes have to be re-executed after the form has been revised.

If the form is not in memory, the OLD command must be entered before the REVISE command to load the old form into memory.

NOTE: If constants had already been set into the form, it is best to enter the CONSTANT pass and clear (using the CANCEL key) all constant fields (since constants destroy the field definition characters) before entering the REVISE command.

3.9 The OLD Command

Once a form has been recorded it may be retrieved and modified. The:

OLD

command loads the form into memory. Any pass of the generator may be executed; however, note that the REVISE command will clear all edit criteria.

If the field programs associated with a form have changed, simply enter OLD, to reload the form, and OUT, to attach the new version of the programs. Any time a form is read via the OLD command, all field programs required must be re-attached to the form.

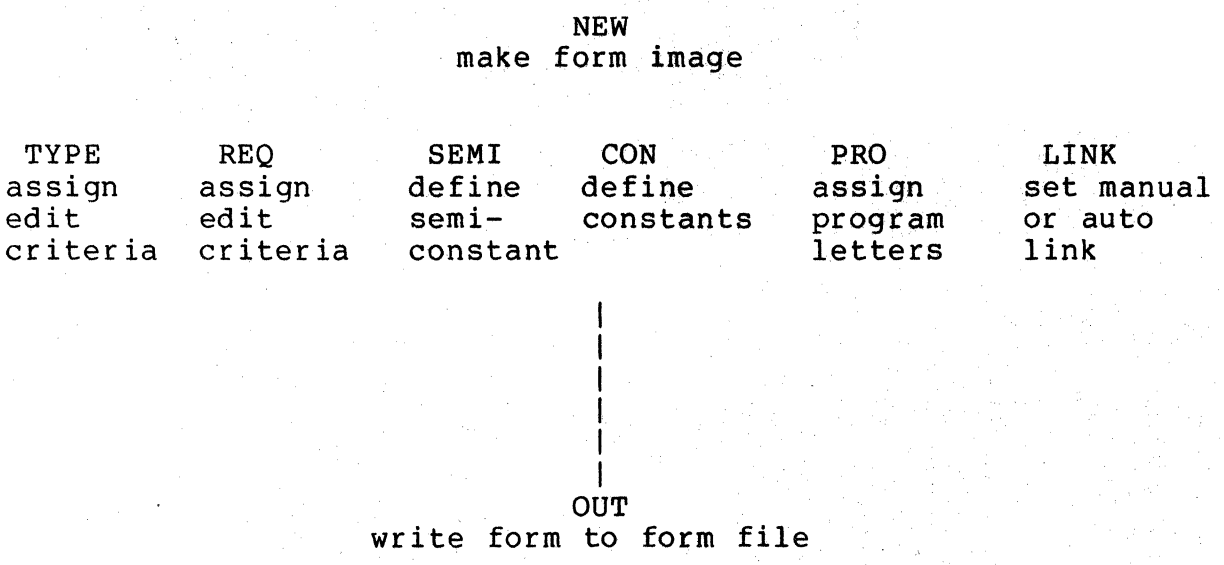
3.10 The OS Command

The:

OS

command reloads the DOS without writing the current form in memory to the form file.

GENERATING A NEW FORM



CHAPTER 4. THE COMPILER

The DF2DOSG interpreter provides field editing capabilities on a character-for-character basis. Field programs written in the DATAFORM 2 language provide much greater field editing capabilities. The DATAFORM 2 language is a high level programming language, similar in structure to DATABUS and other high level languages. A field program can perform almost any kind of field (and even character) manipulation: check digit, range, and table checks; complete arithmetic processing; inter-form communication; complex data record movement; code-set conversions; etc.

The DATAFORM 2 language is concise, yet powerful. The basic ingredients of the language are, as in any programming language, statements which describe data (called "specification" statements in the DATAFORM 2 language), and statements which manipulate data (called "executable" statements).

4.1 Labels

Any DATAFORM 2 statement may have a label, and some must have a label. A "label" begins in column one and consists of up to eight alphanumeric characters (actually, the label may consist of any number of alphanumeric characters, although all characters after the first eight are ignored).

Labels have three uses: first, to name data items; second, to provide a means for branching and subroutine calls within a DATAFORM 2 program; and third, to name field programs (that is, to associate program code segments to specific fields in the form image).

At most 95 labels may be defined in a DATAFORM compilation.

The following are examples of acceptable labels:

```
A
2765
FIELD17
LABELSTATEMENT      (truncated to LABELSTA)
```

4.2 Field Program Names

The form generator uses a label called a "field program name" to associate a specific starting address of a DATAFORM 2 program segment with a specific field of a form. A field program name is a label which is terminated by a star (or asterisk) "*", and there are no blanks between the label and the star. Since only the first character of a field program name is passed to the form generator, it is pointless (and probably could be confusing) to name field programs with labels which are longer than one character. In addition, the generator requires an alphabetic field program name. It is important to note that the compiler does not check for duplicate field program names; if there are duplicates, it passes both to the generator.

The following are examples of program names:

```
E*
Z*
```

4.3 Spaces

The DATAFORM 2 compiler is a "free-form" compiler -- that is, the space character ( ) is by and large ignored by the compiler. Multiple spaces are treated as a single space, and a single space is ignored except as a field separator. Spaces may be included as desired to improve readability.

4.4 Comments

Comments, too, are ignored by the DATAFORM 2 compiler.

There are two kinds of comments -- comments which appear on a code line after the code; and comments which appear on a line by themselves. Comment lines must begin with a period (.) or a plus (+) in column 1. If a listing is printed, a comment that begins with a plus causes a page to be ejected on the printer and the comment line to be printed on the top line of the next page of the listing.

4.5 Specification Statements

As mentioned earlier, specification statements are statements which describe data. The DATAFORM 2 language contains: the DATA statement (used to access the output data record); the WORK statement (used for data storage within a single form); the COMMON statement (used for data communication between forms); the EQU

statement (used to describe absolute values); the REDEFINE statement (used to associate a label with a previously defined label); and the FIELD statement (used to describe fields of the screen image form).

Every specification statement has associated with it an "item length". The item length is the number of characters which make up an individual item of that statement. The item length of each specification statement below is the length of the entire statement, unless otherwise indicated.

4.5.1 DATA

The DATA statement refers to specific columns of the OUTPUT data record. The general format of the DATA statement is:

```
<label>     DATA <n><,m>
```

where "n" and "m" are decimal numbers in the range 1-245. The number "n" refers to an initial column of the OUTPUT data record, and the number "m" refers to a terminal column of the OUTPUT data record. The item length associated with the DATA statement is: (m-n)+1. The columns defined by the DATA statement do not necessarily correspond to specific fields of the form. Areas may be redefined. The columns defined by a DATA statement may be:

1) Identical to fields on the form.
2) A sub-grouping of a large field into smaller fields.
3) A combination of smaller fields into a larger field.
4) An overlapping of fields on the form.

The following syntax restrictions apply to the DATA statement:

1) "n" and "m" must both be greater than zero but less than 246.
2) "m" must be greater than or equal to "n".
3) The DATA statement must have a label.

Examples of the DATA statement:

```
NAME        DATA 1,29    multiple column field
IDCODE      DATA 30,30   single column field
AMOUNT      DATA 31,39
DOLLARS     DATA 31,37   Sub-group of larger
CENTS       DATA 38,39        field
```

4.5.2 WORK

The WORK statement is used to reserve space within a field program. Space reserved may be uninitialized, or may contain ASCII or octal constants (or tables).

To simply reserve uninitialized space within a field program, the following format of the WORK statement is used:

```
<label>     WORK <n>
```

where <n> is a decimal number in the range 1-245. The area to which <label> refers has an item length of <n>.

Working storage may contain ASCII characters. The characters are enclosed in double quotation marks, as in the following example:

```
WORDS       WORK "PRE-DEFINED CHARACTERS"
```

A special forcing character (#) may be used to "force" the character immediately following it to be included in the string; by using this character, the double quotation mark and the forcing character may themselves appear in the character string:

```
NICKNAME    WORK "I AM #"SHORTY#"."
NUMBER1     WORK "I AM ##1."
```

Each WORK statement that contains constants generates a code segment. Normally, every constant working storage segment is terminated with an additional, special end-of-table character, an octal zero. This character is included in the over-all length of the working storage segment, but is not included in the item length. To conserve memory, it is possible to suppress the special end-of-table character in a constant working storage segment by following the last item of the working storage segment with a semicolon, as in the following examples:

```
WORK1       WORK "DATA"
WORK2       WORK "DATA";
```

The first example will generate the following five octal characters: Ø1Ø4,Ø1Ø1,Ø124,Ø1Ø1,ØØØ. The second will generate the following four octal characters: Ø1Ø4,Ø1Ø1,Ø124,Ø1Ø1. The item length of both statements above is four. Working storage may contain tables as well. The item length of the table is determined by the length of the first item in double quotation marks. Each

item in the WORK statement table must be the same length. Individual items are separated by a comma.

In the following examples:

```
TABLE1      WORK "1","2","3","4","5","6"
TABLE2      WORK "12","34","56"
TABLE3      WORK "123","456"
TABLE4      WORK "123456"
```

all of the working storage tables have the same table length (six characters plus one special end-of-table character for a total table length of seven), but the individual item lengths are respectively 1, 2, 3, and 6.

Working storage items may be continued on more than one line by using a colon, as in this example:

```
CONTINUE    WORK "123456","789012":
                 "345678":
                 "901234"
```

Working storage may contain octal constants. The first octal constant (and only the first) is prefixed by the alphabetic letter "O". Each octal constant generates only one character of working storage. An octal constant may consist of any number of octal digits; however, only the least significant eight bits are placed in the octal character. Octal constants may be separated from one another by a comma, and may be continued from one line to another by use of the colon. Octal constants, like other constants, are terminated with an octal zero; a semicolon after the last constant will suppress the zero. The item length of an octal constant work area is one. Octal constants and ASCII character strings may not be mixed in the same WORK statement; WORK statements are either octal or ASCII.

The following are examples of octal WORK statements:

```
OCTAL1      WORK O15;
OCTAL2      WORK O15,16,17,20
OCTAL3      WORK O15,16,17,20:
                  25,26,27,30:
                  35
OCTAL4      WORK O107
```

The following syntax restrictions apply to the WORK statement:

1) The WORK statement must have a label.
2) If the WORK statement defines a table, all items in the table must be of the same length.
3) A comment may appear on a WORK statement if the comment is preceeded by a period.
4) If the WORK statement merely reserves space (i. e., does not contain any constants), the amount of space reserved must be in the range 1-245.

4.5.3 COMMON

The COMMON statement is used to assign labels and reserve space within the 100 character COMMON block. COMMON statements are identical syntactically to WORK statements. Their main difference is one of function. The COMMON area is used for transferal of information between forms, or for the saving of information used in one form only, although multiple forms are loaded. The format of the COMMON statement is:

```
[label]     COMMON <n>
```

The following example could be used to pass a six character total from one form to another:

```
TOTAL       COMMON 6
```

It is important for every program using information saved through COMMON to have the same relative locations of areas inside the COMMON block. References to COMMON data in second and subsequent form's programs must be in the same order. A dummy COMMON statement, such as:

```
DUMMY       COMMON 6
```

should be used to skip over six unused characters inside the COMMON block. if those characters are not referenced by the current form, but are referenced by another form.

The following syntax restrictions apply to the COMMON statement:

1) A label is not required on a COMMON statement.
2) The maximum total length of the COMMON block is 100 characters.
3) A comment may appear on a COMMON statement if the comment is preceeded by a period.

4.5.4 EQU

The EQU statement is used to associate an octal address value with a label. Following the EQU is a string of octal digits, denoting an absolute octal address. The initial character of the string need not be a zero, although a zero will serve as a reminder that the string is octal rather than decimal.

The minimum memory required for the DF2DOSG interpreter is 12K; the minimum memory required for the DF2SYS interpreter is 8K. If the system has more memory available, this extra memory may contain previously assembled assembly (as distinct from DATAFORM 2) language programs, which may be referenced by using the EQU statement to define a label, and then transferring control to that label (see later sections of this manual for transfer of control statements and for assembly language interfacing).

The following are examples of the EQU statement:

```
8K          EQU 020000
12K         EQU 30000
```

4.5.5 REDEFINE

The REDEFINE statement is used to associate a new label with an elsewhere defined label.

The general format of the REDEFINE statement is:

```
<label2>    REDEFINE <label1><,n><,m>
```

The value "n-1" is added to the previously defined initial value for <label1> and becomes the initial value of <label2>. The item length of <label1> is ignored, and the number "m" becomes the item length for <label2>.

For example, suppose a table is defined as follows:

```
TABLE1      WORK "123456789012"
```

The item length of TABLE1 is 12. Then consider:

```
TABLE2      REDEFINE TABLE1,1,6
TABLE3      REDEFINE TABLE1,1,4
TABLE4      REDEFINE TABLE1,1,3
TABLE5      REDEFINE TABLE1,3,2
TABLE6      REDEFINE TABLE1,7,1
```

The same memory locations are "re-grouped" under different labels, so that the effect is the same as:

```
TABLE2      WORK "123456","789012"
TABLE3      WORK "1234","5678","9012"
TABLE4      WORK "123","456","789","012"
TABLE5      WORK "34","56","78","90","12"
TABLE6      WORK "7","8","9","0","1","2"
```

The REDEFINE statement may redefine WORK and COMMON statements (and the pre-defined label INPUT).

The following syntax restrictions apply to the REDEFINE statement:

1) Both <n> and <m> must be in the range 1-245.
2) The REDEFINE statement must have a label.
3) The field following <m> may be used as a comment field.
4) The REDEFINE statement should immediately follow the label that is being redefined (i.e., <label1> in the general format of the REDEFINE above). The REDEFINE statement is not flagged in error if it appears elsewhere, but erroneous values may be generated if the REDEFINE statement does not immediately follow the label that is being redefined.

4.5.6 FIELD

The FIELD statement is used to reference the OUTPUT fields of the displayed form. The field reference may be absolute or relative to the current field. The absolute field reference is used to reference specific fields of the form.

The format of the absolute FIELD statement is:

```
<label>     FIELD <n>
```

where "n" is a decimal number in the range 1-126.

The relative field reference is used to reference an offset (either positive or negative) of the current field.

The format of the relative field statement is:

```
<label>     FIELD <sign><n>
```

where <sign> is either a "+" or a "-", and "n" is a decimal number in the range 1-126.

The following are examples of the FIELD statement:

```
FIELD7      FIELD 7
NEXTFLD     FIELD +1
LASTFLD     FIELD -1
```

The label appearing on a FIELD statement may be referenced in any type of arithmetic or conditional statement, as in the following example:

```
                    ADD LASTFLD TO INPUT GIVING NEXTFLD
```

4.6 Executable Statements

Executable statements are those statements concerning: 1) transfers of information; 2) arithmetic; 3) comparisons; 4) output; 5) transfers of control; and 6) current field assignment.

4.6.1 Transfers of Information

Data is moved from one location to another using one of five possible statements: ALIGN, CONVERT, LOOKUP, MOVE, or SET.

4.6.1.1 ALIGN

The ALIGN statement format is:

```
[label]     ALIGN <field1> TO <field2>
```

The ALIGN first checks both <field1> and <field2> for the presence of a decimal point. If none exists, it is assumed to be at the rightmost edge of the field. After determining the decimal point, <field1> is moved to <field2>, with decimal points aligned. In <field2>, either truncation or zero-fill or both may occur.

In the following examples, the source field and the destination field (both before and after the ALIGN) are shown:

```
MOVEIT      ALIGN FIELD1 TO FIELD2

FIELD1      FIELD2      FIELD2
            (before)    (after)
10.1        0000.       0010.
10.1        00.00       10.10
10.1        0.000       0.100
1.234       0000.       0001.
1.234       00.00       01.23
12.34       00000       00012
```

NOTE: If <field2> is in the data area, the decimal format may be initialized by setting (during form generation) semi-constant zeros with a decimal point in the appropriate position.

4.6.1.2 CONVERT

The CONVERT statement format is:

```
[label]  CONVERT <field1> BY <table1> AND <table2> GIVING <field2>
```

The CONVERT statement will try to find <field1> in <table1>. The length of <field1> is used for the search. The corresponding entry in <table2> is moved to <field2>.

Given the following specification statements:

```
TABLE1      WORK "MA", "NY","KS","MT","TX"

TABLE2      WORK "BOSTON","ALBANY","TOPEKA":
                 "HELENA","AUSTIN"
```

and the following executable statement:

```
CONVERT FIELD1 BY TABLE1 AND TABLE2 GIVING FIELD2
```

the following will be the contents of FIELD2 if the contents of FIELD1 are as indicated:

```
FIELD1      FIELD2
TX          AUSTIN
MA          BOSTON
KS          TOPEKA
```

The item length of <table2> is used to determine the position

of the corresponding element and the length of the move from <table2> to <field2> (the item length of <field2> is also checked); therefore, each separate item in <table2> should be enclosed in double quotation marks.

If the item is not found in <table1>, no movement of data takes place.

The CONVERT statement should be used when the table has gaps, or is randomly ordered.

NOTE: The CONVERT statement requires a portion of the extended DATAFORM interpreter.

4.6.1.3 LOOKUP

The LOOKUP statement format is:

```
[label]     LOOKUP <field1> IN <table1> GIVING <field2>
```

The LOOKUP statement will use <field1> as an index into <table1>. The item thus selected will be moved to <field2>. If the index value is greater than the length of the table, the value moved into <field2> is indeterminate. The following is an example of the LOOKUP statement:

```
TABLE       WORK "JAN","FEB","MAR","APR","MAY","JUN":
                 "JUL","AUG","SEP","OCT","NOV","DEC"
            LOOKUP NUMBER IN TABLE GIVING NAME
```

The LOOKUP statement should be used when there are no "gaps" in the table from which the data movement takes place. The LOOKUP uses <field1> as an item by item index into the table, and hence will always find a match, even though it may be outside the range of the table (if the index is too large).

NOTE: The LOOKUP statement requires a portion of the extended DATAFORM 2 interpreter.

4.6.1.4 MOVE

The move statement format is:

```
[label]     MOVE <field1> TO <field2>
```

<field1> is moved, left justified, to <field2>. If the length of <field1> is less than the length of <field2>, <field1>'s length is used in the move. Subsequent characters in <field2> are not

changed; their values are as they were before the MOVE. If the length of <field2> is less than the length of <field1>, <field2>'s length is used, meaning that some characters may be truncated (or lost). An example of the MOVE statement is:

```
MOVE TOTAL TO WORK1
```

4.6.1.5 SET

The SET statement format is:

```
[label]     SET <field1> TO <field2>
```

The first character of <field2> is spread throughout <field1> -- as for zeroing out a total, or blank filling a message.

The following example:

```
STAR        WORK "*"
TOTAL       WORK "00000000"
<label>     SET TOTAL TO STAR
```

would set the entire 8 character TOTAL field to stars. The SET statement should not be used to zero a field containing a decimal point which is to be used as a destination for ALIGN or any arithmetic statements, since the decimal, too, will be overstored.

4.6.2 Add, Subtract, Divide, Multiply

The standard arithmetic functions of add, subtract, multiply and divide are provided. These statements must be in the following formats (specifically, the connectives between <label1> and <label2> must not vary):

```
[label]     ADD <label1> TO <label2>
[label]     SUBTRACT <label1> FROM <label2>
            (SUBTRACT may be abbreviated SUB)
[label]     MULTIPLY <label1> BY <label2>
            (MULTIPLY may be abbreviated MUL or MULT
            or MPY)
[label]     DIVIDE <label1> INTO <label2>
            (DIVIDE may be abbreviated DIV)
```

Alternatively, any of the above four may be modified by appending the phrase [GIVING label3] to them. The result of this is that the contents of the first two labels are not affected, but their sum (difference, product, quotient) appears at the third label rather than the second.

NOTE: A comment may appear on an arithmetic statement if the comment is preceeded by a period.

The following are examples of arithmetic statements:

```
ADD INPUT TO SUBTOTAL
SUB DISCOUNT FROM PURCHASE
MULTIPLY PRICE BY QUANTITY
DIVIDE TOTEST INTO TOTSCORE
ADD INPUT TO OLDBAL GIVING NEWBAL
DIV TOTEST INTO SCORE GIVING AVESCORE
```

If GIVING <label3> is appended to the arithmetic statement, an "ALIGN <label2> TO <label3>" is generated prior to the arithmetic statement.

NOTE: Significance may be lost with GIVING <label3> (before computation) if <label3> has fewer places of significance than <label2>.

The result of any arithmetic will be aligned to the decimal point in the result field. Truncation is performed at both ends of the field and leading zeros are supplied in non-sequential leading characters. In a field defined as right justified and blank filled, performing an "ADD NULL TO <field>" will replace the leading blanks by zeros.

NOTE: The MULTIPLY and DIVIDE statements require a portion of the extended DATAFORM interpreter.

4.6.3 IF

The general format of the IF statement is:

```
[label1]   IF <field1><relation><field2> THEN <label2>
```

If <relation> is true. control is transfered to <label2>, which may be a pre-defined label like STORE. If <relation> is false. the next statement in the program is executed. Three types of relations may be defined:

1) ASCII comparisons (EQ, EQU, EQUAL, GE, GEQ, GREATER, GT, GTR, LE, LEQ, LESS, LESSTHAN, LT, NE, NEQ, NOTEQUAL are all acceptable). The characters in <field1> are compared. from left to right. to the characters in <field2> (using the item length of field1 to terminate the compare). Differing lengths do not cause unequal compares; however. if <field1>

is longer than <field2>, the results are indeterminate.

2) Table lookup (INR, INRANGE, INT, INTABLE, NIR, NOTINRANGE, NIT, NOTINTABLE). <field1> is "looked-up" in the table defined at <field2>. The item length of <field1> is used.

3) Check digit verification. <field1> is tested for correctness of check digit with either a mod 10 (CK10) or a mod 11 (CK11) check performed. using the contents of <field2> as a weighting factor. <field1> should contain the check digit in the least significant position <field2> is assumed to be one character shorter than <field1>.

The following are examples of the usage of the IF statements:

```
AMOUNT      FIELD 1
ACCOUNTNO   DATA 21,27
MONTH       DATA 1,2
DAY         DATA 3,4
DAYTABLE    WORK "Ø1","31"
MONTHTABLE  WORK "Ø1","12"
ZERO        WORK "ØØØØØØ"
WEIGHT1     WORK "212121"
.
. Check field1 for strictly positive
.
A*          IF AMOUNT GREATER ZERO THEN STORE
            AGAIN
.
. Check for null input
.
B*          IF NULL EQ INPUT THEN AGAIN
.
. Check for negative.
.
C*          IF AMOUNT LT ZERO THEN STORE
            AGAIN
.
. Check range using table
.
.
D*          IF DAY NOTINRANGE DAYTABLE THEN AGAIN
            IF MONTH NIR MONTHTABLE THEN AGAIN
            STORE
.
. Perform Mod1Ø check digit validation
.
E*          IF ACCOUNTNO CK1Ø WEIGHT1 THEN STORE
            AGAIN
```

NOTE: The CK1Ø and CK11 forms of the IF statement require a portion of the extended DATAFORM 2 interpreter.

4.6.4 Output Control

The BEEP statement provides an audible tone. The CHAIN statement is used to load another form (in addition to the auto-load and linking-load features of the interpreter) Three statements are provided for displaying information on the processor's screen: FORMSHOW, MESSAGE, and SHOW; and the WRITE statement is provided to write out the data record under program

control.

4.6.4.1 BEEP

When the BEEP statement is executed the processor issues a single BEEP sound. The format of the BEEP statement is:

```
[label]     BEEP
```

4.6.4.2 CHAIN

The CHAIN statement loads a specific form. The format of the CHAIN statement is:

```
[label]     CHAIN <n>
```

where <n> is the decimal number of the form to be loaded (from 1 to 99). A file named "SYSNAMnn/DFF" is loaded. The current data record is not written; however, the flag indicating data present is cleared. The specified form is loaded and control is passed to the interpreter at the first non-constant field of the new form.

A CHAIN to the form currently in memory reloads that form and all its programs.

4.6.4.3 FORMSHOW

The FORMSHOW statement causes the current form to be redisplayed. All data fields on the screen will be cleared. The output record is not affected and the current field index is not changed.

The format of the FORMSHOW statement is:

```
[label]     FORMSHOW
```

In the following example:

```
WRITE
FORMSHOW
```

the last data record written is still in memory; however, it will be erased from the screen and will appear only as each field is reached by the operator.

NOTE: The INPUT field is destroyed when the FORMSHOW statement is executed.

4.6.4.4 MESSAGE

The MESSAGE statement writes the specified messages on the bottom line of the screen.

The format of the MESSAGE statement is:

```
[label1]    MESSAGE <label2>
```

The following is an example of the MESSAGE statement:

```
ERR         WORK "ACCOUNT IS OVERDRAWN"
[label]     MESSAGE ERR
```

The MESSAGE statement always erases the bottom line of the form. However, the message is only temporary and the bottom line of the form will be restored when the operator writes the data record or erases the current record.

NOTE: The INPUT field is destroyed when the MESSAGE statement is executed.

4.6.4.5 SHOW

The SHOW statement displays a message in the current field area of the screen.

The format of the SHOW statement is:

```
[label1]    SHOW [label2]
```

If no [label2] is indicated, the SHOW statement defaults to the contents of the OUTPUT buffer corresponding to the current field.

The following are examples of the SHOW statement:

```
                    SHOW
or                  SHOW TOTAL
```

The SHOW may be used if computations or table lookup conversions were made to change the value of the current field, as in the following example:

```
CRDRTAB     WORK "CREDIT","DEBIT "
LSTFLD      FIELD -1
CD          WORK "C","D"
MSG         WORK "      ";
S*          CONVERT LSTFLD BY CD AND CRDRTAB GIVING MSG
            SHOW MSG
            NEXT
```

Program "S" is assigned to a keyin only field (i.e. a field which reserves no data space) which is set to "program reserved" (to automatically execute the program with no operator intervention). The program tests the preceding field and displays a message corresponding to that value, for operator information.

NOTE: The INPUT field is destroyed when the SHOW statement is executed.

4.6.4.6 WRITE

The WRITE statement writes the data record to the data file. The format for the WRITE statement is:

```
[label]     WRITE
```

Control is returned to the next statement in the field program. The data area in memory is not cleared, and may be used for further computation or for auto-duping selected data.

4.6.5 Transfers of Control

The three transfer of program control statements are the GOTO statement, the CALL statement, and the RETURN statement.

4.6.5.1 GOTO

Control is immediately transferred to the label following the GOTO:

```
GOTO <label1>
```

For the pre-defined labels, the word GOTO is optional. For programmer defined labels, it is mandatory.

The following are examples of the GOTO statement:

```
GOTO OVERDRAWN
GOTO NEXT
NEXT
```

4.6.5.2 CALL and RETURN

A single level of subroutine nesting is provided with the CALL and RETURN statements. A program may contain more than one set of CALL and RETURN statements -- but a CALLed subprogram may not CALL another subprogram.

The statement formats are:

```
[label]     CALL <subprogramname>
            RETURN
```

If a RETURN is executed with no preceeding CALL (in the current field program) a GOTO NEXT is executed.

4.6.6 CHANGE and RESET

The CHANGE statement is used to transfer the input pointer from the current field (i.e., the sequence number of the field as it appears in the form) to another field. The new field number or displacement from the current field number is specified immediately after the CHANGE statement:

```
[label]     CHANGE [sign]<n>
```

For example, after the statement:

```
CHANGE +1
```

is executed, INPUT still contains the entered data; however, the current field number has been incremented by one and OUTPUT now reflects the position in the data record corresponding to the new field. After the statement:

```
CHANGE 1
```

is executed, however, the current field number has been changed to the first field in the form, that is, field 1.

When a field program is entered the number of the current field is saved and may be restored at any time. The:

```
[label]     RESET
```

statement will reset the field pointer to the field current when the program was entered.

4.7 Pre-defined Labels

The nine labels discussed in this section may not be defined in DATAFORM 2 programs. They have specific meaning to the DATAFORM 2 interpreter, and are included automatically in every DATAFORM 2 compilation.

The pre-defined labels INPUT, NULL, OUTPUT, and RETRY refer to locations within the interpreter. These four labels may be used as source or destination operands in data movement and comparison statements. Examples of the use of these labels are given below:

```
MOVE INPUT TO OUTPUT
IF NULL EQ INPUT THEN AGAIN
IF RETRY NE NULL THEN STORE
```

The pre-defined labels AGAIN, CLOSE, END, NEXT and STORE cause a transfer of control from the field program back to the DATAFORM 2 interpreter. These five labels may be used as the destination address of comparison or GOTO instructions, as in the example:

```
B*          IF NULL EQ INPUT THEN AGAIN
            GOTO STORE
```

or may be referenced by name alone, as in:

```
C*          ADD INPUT TO TOTAL
            STORE
D*          NEXT
E*          CLOSE
F*          END
```

AGAIN, CLOSE, END, NEXT and STORE are means of exiting a field program. It is important to note that the interpreter does not place data in the OUTPUT buffer before a field program is called.

It is the responsibility of the field program to do one of three things:

1) MOVE INPUT TO OUTPUT
2) MOVE <somethingelse> TO OUTPUT (where <somethingelse> may or may not be based upon INPUT)
3) Exit the field program through the interpreter label STORE, which will automatically MOVE INPUT TO OUTPUT and position to the next field in the form.

4.7.1 AGAIN

This label returns control to the interpreter at a point which indicates an error to the operator and re-requests the current field. That is, the processor BEEPs and returns the cursor to the first position of the field.

4.7.2 CLOSE

This label returns control to the interpreter at a point which closes the data file; displays the message:

PROGRAM WRITTEN EOF

and reloads the DOS.

4.7.3 END

This label returns control to the interpreter at the point as if the operator had pressed the write data function key.

4.7.4 INPUT

This label designates the contents of the keyin buffer immediately prior to entering the field program. The data in INPUT has not yet been stored in the OUTPUT buffer. It's length is the length of the current field, and it has been validated according to the edit criteria in the form itself prior to executing the field program.

4.7.5 NEXT

This label returns control to the interpreter at the point at which the current field number is incremented. The cursor is moved to the next sequential field. No data is stored.

4.7.6 NULL

This label designates a location in the interpreter which contains a binary zero. It may be used to determine if the interpreter is in normal data entry mode or modify mode; or if data is present in the output record (meaning that this field had been entered before). The item length of NULL is always less than the item length of any variable. Therefore, in comparisons, NULL should be referenced first since the length of the first operand is used for the comparison.

4.7.7 OUTPUT

This label designates the contents of the data output buffer for the current field. If no data has been stored, OUTPUT has the value of binary zero (NULL). The length of OUTPUT is defined at execution time by the length of the current field. OUTPUT is undefined for keyin only fields.

4.7.8 RETRY

This label designates a location in the interpreter which contains a binary flag indicating whether the data file is in modify or data entry mode. It can be checked by a field program by comparing it to NULL. If RETRY equals NULL the data file is in data entry mode.

4.7.9 STORE

This label returns control to the interpreter at the point where the current contents of INPUT is transferred to the OUTPUT buffer. That is, exiting a field program through STORE is equivalent to:

```
MOVE INPUT TO OUTPUT
NEXT
```

4.8 Program Generation

Compilation of a program consists of two processes: using the DATAFORM editor to create a new source program, or edit an existing program; and using the DATAFORM compiler to compile a new, newly edited, or old program.

4.8.1 Editing a Source Program

The DATAFORM editor, DFEDIT, is a special version of the general purpose editor; its command structure is that of the general purpose editor. The commands of the general purpose editor are discussed in the chapter on EDIT in the DOS User's Guide. DFEDIT displays a sign-on message:

```
DOSDF2G EDITOR 2.n -- ddmmmyy
```

The name of the program file to be edited/created is indicated on the initial command line:

```
DFEDIT <program>
```

Field program source file names should be in the "SYSNAMnn" format. The DF2DOSG compiler and form generator all use the "SYSNAMnn" convention, and distinguish among files by their extensions.

4.8.2 Compiling a Source Program

When the source program has been edited, it should be compiled. This is accomplished by entering:

```
DFCMP <sourcefile>[,objectfile][;options]
```

The compiler displays a sign-on message:

```
DF2DOSG COMPILER 2.n - ddmmmyy
```

The compiler makes a first pass through the source file preparing a symbol table. The actual code generation and listing production take place on the second pass over the input file.

At the completion of the compilation, some or all of these messages are displayed on the screen:

```
    STORAGE USED IN DECIMAL: 00000 RELOCATABLE, 00000 COMMON
    EXTENDED INTERPRETER REQUIRED
    FIELD PROGRAMS:
                A       00000
                Z       00000
    END OF COMPILATION:    NO ERRORS.
or  END OF COMPILATION:     n ERRORS.
```

These are descriptions of the program, telling the length of the entire program, whether or not the extended interpreter is required, and listing, in octal, the relocatable starting address of each of the programs defined. The END message lists the number of errors in decimal, if any occurred. After this the DOS is reloaded.

Any error messages are automatically displayed on the screen, with a star indicating the part of the source line in error. The display may be stopped momentarily by pressing either the KEYBOARD or DISPLAY keys.

4.8.3 Printing a Compilation Listing

The first action of the compiler is to test whether a servo or local printer is a part of the compiling system. If either of them are, the message:

```
            LIST ON SERVO PRINTER?
or          LIST ON LOCAL PRINTER?
```

is displayed. A response of "Y" to this message will result in a printed listing of the program, as it is compiled. The listing consists of three parts:

1) The line number.
2) The initial address (either absolute or relocatable) associated with the statement line.
3) The line as it was input.

If a listing is to be printed, the message:

```
            CODE TOO?
```

is displayed. A response of "Y" to this message will place the code generated for each line (eight characters per

printed line, using as many lines as necessary for the amount of code generated) on the listing.

These listing options may be specified in the [;options] field of the DFCMP command line. A semicolon (;) alone indicates that no listing is to be printed; a semicolon followed by: an "L" indicates that a listing is to be printed; a "P" indicates that the printer records are to be placed in a disk printer-image file (whose name is <sourcefile>/PRT) instead of on the printer; and a "C" together with either the "L" or the "P" indicates that generated code is to be included on the listing.

If a listing or print file is requested, a heading line may be entered.

4.8.4 The Program File

When compilation is complete, a file of the name "<sourcefile>/DFP" has been generated which contains the compiled code. The compiled code file consists of a header record and both relocatable and absolute object code records.

The header record contains the number of the extended interpreter required (if any), the length of the relocatable object code, and the names and starting addresses of all field programs in the file.

4.9 Program Execution

4.9.1 Post-process Execution

Field programs are always executed as a "post-process" to data entry; that is, the program is not executed until the data has been entered, edited, and accepted by the interpreter. Thus, alpha-numeric checks, right justification, etc., will already have been performed on the input.

4.9.2 Operator Tabbing

If the operator chooses to bypass a field which is not required, INPUT is NULL (binary zero).

If the cursor enters a field during backward or forward tabbing and no new data is entered, the data currently in the output record (which may or may not be NULL) is passed to the field

program. If, however, new data is entered, the new data is presented to the field program in the INPUT area while previously entered data is still available in the OUTPUT area. If the previously entered data is cancelled by the operator, INPUT is NULL.

4.9.3 Pre-process Execution

To execute a field program as a "pre-process", the pre-process program should be assigned to a preceding field.

4.9.4 Program Reserved Fields

If a field is designated as a "program reserved" field, data for that field is to be assigned by a field program. When the field is entered, the field program is executed immediately and the area designated by INPUT is undefined.

4.9.5 Form Constants

Constants and semi-constants are set into the OUTPUT area prior to data entry. However, fields containing constants will be passed through the basic interpreter as if the constant characters had been entered. They will be edited and passed to the field program in the INPUT area. Unacceptable constants will cause the interpreter to hang BEEPing during data entry.

CHAPTER 5. THE INTERPRETER

Data entry using DF2DOSG involves loading the interpreter, then loading a form, and finally entering data into the fields defined by the form. When the data has been entered on the screen to the operator's satisfaction, and the data record has been written to the data file (by an operator function key or a field program instruction) then the same form is cleared and redisplayed with only constant and semi-constant data appearing.

The format for the DF2DOSG interpreter command line is:

DFINT <SYSNAM[nn]>[,datafile]

where SYSNAM is the name of the system of forms. The default form number value [nn] is Ø1. The default [datafile] name is SYSNAM, and the default [datafile] extension is TXT.

The interpreter displays a sign on message:

DF2DOSG INTERPRETER 2.n - ddmmmyy

The START and ADD commands place the data file in an "OPEN" mode. The data file must be placed in the "CLOSED" mode (e.g., by use of the END command), before another START or ADD command may be entered.

The interpreter will respond to the commands discussed below. A form number (in decimal) is optional in most of these commands; if it is omitted, the current form will be assumed. An error may occur if a form number is required and none is currently in use.

Only the first letter of a command is recognized; for example, "START 2" may also be entered as "S 2".

DATA ENTRY FLOW

DFINT <SYSNAM>

Enter START
Operator Command

Operator
Input

Enter END
Operator Command

SYSNAM/TXT

5.1 The START Command

The:

START [nn]

command causes data fo be placed at the beginning of the data file. If a form number is specified on the command, or if a form is currently in memory, that form is "entered" -- i.e., the form is displayed with the cursor at the first non-constant field. If there is no form in memory, control is returned to the interpreter's monitor.

NOTE:The START command does not check for possibly valid data in the data file; care must be taken so that a possibly valid data file is not overwritten.

5.2 The ADD Command

If the data file already exists, the:

ADD [nn]

command positions to the end of any data already in the file. If a form is already loaded or a form number is specified in the command, the form will be entered at the same time the data file is being positioned. If there is no form in memory, control is returned to the interpreter's monitor.

5.3 The CONTINUE Command

If the data file is open, and the interpreter is positioned in the midst of the file, the:

CONTINUE [nn]

command backspaces the data file one logical record, and reads forward until an end of file mark is found. Other action is identical to the ADD command.

5.4 The LOAD Command

The first form to be loaded may be specified along with the system name on the interpreter command line, as indicated above. If no number is supplied at that time, form number one is assumed (SYSNAMØ1). If any other form is to be loaded (replacing any form currently in memory), the:

LOAD <nn>

command loads form named "SYSNAMnn/DFF" into memory. If a data file has been opened, the form is entered. If no data file has been opened, the message:

FILE CLOSED

is displayed and control is returned to the interpreter's monitor.

New forms may be loaded without disturbing the position of the data file. Each data record contains the form number with which it was created so that subsequent modification or other processing can identify data generated on a particular form.

If the form is not on the disk, the message "BAD FORM" will appear.

5.5 The DATA Command

The:

DATA

command places the data file in the data entry mode initially, or returns to the data entry mode from the interpreter's monitor. If no form is in memory or if the data file is not open, an error message is displayed and control returns to the interpreter's monitor. Data currently in memory will not be disturbed and will be displayed whenever the form is re-entered.

5.6 Revising an Existing Data File

5.6.1 The MODIFY Command

Any data record on a DF2DOSG generated data file can be accessed for review or correction. The:

MOD [nn]

command enables the operator to manually access any data record created by a specified form and to then either bypass or change that record on the data file. The file is searched for the first data record created by the current form. Once a record has been found, the data file is in an "open" mode and may be searched in a forward direction by pressing the read next record function key (9), or, from the monitor mode, by entering another MOD command. To access records already passed over, the rewind function key (7) rewinds the data file (as does the initial MOD command).

If the data file is in the ADD/START mode, the MOD command automatically writes an end of file mark on the data file.

During modification, a new form may be loaded (without disturbing the position of the data file) and that form will subsequently be used for finding data records. Once a record has been found by the MOD command, the contents of all fields will be displayed in the form. Previously recorded data supercedes form constants, thus, the actual data from the file will be displayed, overlaying the form's constants (and changing its display, if different). However, the form's constants will be set into the data record when the field is entered (as they are for new records).

Data in a field may be changed at this time by entering new data in the field. Pressing ENTER in the first column of a field leaves the data unchanged. The edit criteria and field programs associated with the fields are still in effect, and will be re-executed.

5.6.2 The FIND Command

If unique data in the record to be corrected is known, the:

FIND [nn]

command may be used. This command loads the specified form (if different from the current form) and displays the form so the operator may enter characters into any fields to use as a key in searching the file. All edit criteria are applied to fields

(except field programs and required edit criteria) when setting up the match data.

When the data to be matched has been entered, the operator must remember to press the ENTER key after data has been entered in the last field of the search key before pressing the read record function key (9) to start the search. The interpreter will search the data file forward looking for the record generated by the specified form and containing the specified data.

Once the matching data has been found, operation proceeds as in the MOD command.

If a match is not found, the message:

END OF DATA

appears and control is returned to the interpreter's monitor.

The search may be terminated by pressing both the KEYBOARD and DISPLAY keys simultaneously. The operator may want to stop a search if, for example, the wrong system name was specified, the wrong form was specified, or the wrong match data was given for a FIND. Control will be returned to the interpreter's monitor.

5.6.3 Rewriting Existing Records

Data records are rewritten, in both FIND and MODIFY modes, by the use of the write record function key (.). If the record was fetched using the MOD command, the next data record will automatically be read and displayed. If the record was fetched by the FIND command, control is returned to the interpreter's monitor.

If no field needs to be changed, the next record can be fetched by pressing the read next record function key (9); note that any modifications made will be destroyed by the read function. The write record function key (.) must be used to cause updating of the record (unless the write is executed by the field program, in which case the field assigned the program must be entered).

5.7 The BACKSPACE Command

In the ADD/START mode, the

BACKSPACE

command backspaces the data file one logical record after writing an end of file mark on the data file and placing the data file in the MODIFY mode.

In the MODIFY mode, the BACKSPACE command backspaces twice and reads forward once under form number control; that is, if the record being read was not created by the current form, preceding records will be read until a form number match is found.

The backspace record function key (8) also backspaces the data file.

5.8 The REWIND Command

The:

REWIND

command rewinds the data file and positions to the first data record created by the form currently loaded.

If the data file is in the ADD/START mode, the REWIND command automatically writes an end of file mark on the data file.

If, while viewing records during modification, the operator wants to rewind the file in order to view records already passed, the rewind (7) function key may be used.

5.9 The END Command

The:

END

command is used to write an end of file mark on the data file. Switching from START/ADD mode to MODIFY mode automatically writes an end of file mark on the data file. The END command is rejected in the MODIFY mode.

5.10 The OS Command

The:

OS

command is used to terminate execution of DFINT. No file mark is written on the data file. The DOS is reloaded.

5.11 Data Entry Action

In the data entry mode, data set by a CONSTANT command at form generation is displayed and the cursor is placed at the first non-constant position on the form. Data set by the SEMI-CONSTANT command at form generation time is displayed and the cursor is placed in the the first position of the field (over the semi-constant).

If partial constants are set at the right hand end of the field, data must be entered up to the constants; otherwise, the constant data may be omitted in the output record.

During data entry, a CLICK sound is made for each accepted character. If a character fails to pass the TYPE edit criteria for the field (alpha, numeric or mixed) a BEEP is sounded and the cursor does not advance.

When entering data, pressing the ENTER key (or in fill-controlled fields, entering the last character) causes the field to be further edited (right justified, zero filled, checked by program, etc.) and, if no errors are found, the cursor moves to the next field. After the last field of a form is entered, the cursor is placed back at the beginning of the first field awaiting a write function (.) or other commands from the operator.

When the interpreter detects an error in a field, it places the cursor at the beginning of the field just entered and causes the processor to BEEP. The cursor does not advance to the next field. The unacceptable data is not set in the data area in memory, but still appears on the screen. If the operator decides to tab past the field, the last accepted data (blank if none has been entered) is displayed.

5.12 Interpreter Function Keys

The ENTER key is used as a forward tab key and the backspace field function key (3) is used as a backward tab key. Forward tabbing past required fields is not permitted. Note that alpha/numeric editing occurs as data is being entered into the field. When the field is complete, further editing is performed on numeric and right justified fields to insure compliance with format restrictions (e.g., minus sign must be to the left of the field). Field programs are not executed until all other editing has been performed successfully.

5.12.1 The Form Data Duplicate Function Key (Ø)

Once a form has been completed, the data is transferred to the OUTPUT buffer from which it is written to the data file. The OUTPUT buffer is available to the operator for form data duplication by means of the form data duplicate function key (Ø). If no previous record has been written, or if the preceding record was created by a different form, the results of pressing the form data duplication (Ø) function key are undefined.

5.12.2 The Load Next Form Function Key (1)

The next form (specified by the linkage information in the current form) will be brought into memory when the load next form function key (1) is pressed. The current data record must be recorded, either under program control, or by use of the write record function key (.), prior to loading the next form, since pressing the load next form function key (1) does not write the data record, but instead clears any data in memory.

5.12.3 The Backspace Field Function Key (3)

The backspace field function key (3) is used to retreat from a field to the previous field. No indication is given to field programs that the backspace field function has been executed.

5.12.4 The Return to Monitor Function Key (4)

Whenever it becomes necessary to execute one of the interpreter "commands" while entering data into a form, the operator must press the return to monitor function key (4) to return control to the interpreter's monitor. Only then may the command be executed.

5.12.5 The Form Data Erase Function Key (6)

The form data erase function key (6) clears the entire data area (without writing it to the file) and redisplays the cleared form. No indication is given to field programs that the form data erase function has been executed.

5.12.6 The Rewind Data File Function Key (7)

The rewind data file function key (7) rewinds the data file and positions to the first data record created by the currently loaded form. If the data file was in ADD/START mode, an end of file mark is written on the dat file before the data file is rewound; and the file is placed in the MODIFY mode.

5.12.7 The Backspace Record Function Key (8)

If the data file is in ADD/START mode, the backspace record function key (8) causes the interpreter to write an end of file mark on the data file, place the data file in MODIFY mode, and display the next preceding data record written using the current form.

If the data file is in the MODIFY mode, the backspace record function key (8) causes the interpreter to display the next preceding data record written using the current form.

5.12.8 The Read Record Function Key (9)

The read record function key (9) is acceptable only in MODIFY mode. It causes the interpreter to search forward in the data file for the next record that was written by the current form.

5.12.9 The Write Record Function Key (.)

The write record function key (.) is used to write the current data record to the data file. If one or more required fields have not been completed when the write record function key (.) is pressed, the processor BEEPs and the cursor is placed at the first unfilled required field. No data is written to the file. If all required fields are completed, a data record will be written to the data file whenever the write record function key (.) is pressed. The data record is written even if only incomplete data has been entered. If an incomplete data record is written, it will contain ASCII zeros in all fields defined as zero filled (right justified, zero filled and left justified, zero filled) and spaces (or constants, if any) in all other unfilled

fields.

After the current record has been written to the data file, the form will be redisplayed with all data fields cleared to null values (or to the form constants or semi-constants if any) ready for re-entry of data from the beginning. If, however, an auto-link is set when the write record function is executed, the data is written out and the linked form is automatically loaded and displayed.

CHAPTER 6. THE CONFIGURATOR

The system name and form numbers provide an implicit "catalog" of forms available to the DF2DOSG interpreter. However, to generate a cassette system, it is necessary to create a cassette catalog file.

A form number (in decimal) is required by most of the commands discussed in this chapter.

On the disk the order of accessing forms makes no visible difference to the operator; this is not true of the cassette system. Forms are written in form number order; thus the system of forms should be designed carefully to provide both the simplest and fastest operation for data entry. DFCON records and manipulates a DF2DOSG forms catalog.

Enter:

```
DFCON SYSNAM
```

to load the configurator and initialize or load the catalog file. The configurator displays a sign on message:

```
DF2DOSG CONFIGURATOR 2.n - ddmmmyy
```

6.1 The CAT Command

A "catalog" file (SYSNAM/CAT) is maintained on the disk. It identifies each form by a decimal number in the range 1-99 inclusive. The:

```
CAT
```

command is used to display the form numbers which are already assigned in the catalog.

6.2 The IN Command

The:

```
IN <nn>
```

command is used to place the given form number in the forms catalog (a disk file named SYSNAM/CAT). A form named SYSNAMnn/DFF

must already have been created using DFGEN before the IN command can be used.

The catalog file corresponds to the cassette catalog and is referenced by the DUP ALL and LGO commands.

6.3 The DELETE Command

To remove a form from the system catalog, enter:

```
DEL <nn>
```

The file is not KILLed from the disk directory, but is deleted from the SYSNAM/CAT file.

6.4 The CHOP Command

To remove multiple forms from the system catalog, enter:

```
CHOP <nn>
```

The CHOP command deletes the specified form number and all subsequent (higher numbered) forms from the system catalog. Again, the form files are not KILLed from the disk directory, but are deleted from the SYSNAM/CAT catalog.

6.5 Creating a Cassette DF2 System Tape One

For the commands of this section (DUP, DUP ALL, and LGO), the most current version of DF2 must be placed on the disk using the procedure outlined in the section on the disk installation of the cassette DF2 system.

6.5.1 The DUP Command

To generate a DF2 tape one (configurator, blank catalog and interpreter) on the front deck, place a scratch tape in the front deck and enter:

```
DUP
```

The new system tape one will have no forms in its catalog.

6.5.2 The DUP ALL Command

To generate a DF2 tape one complete with forms on the front cassette deck, place a scratch tape in the front deck and enter:

```
DUP ALL
```

The DUP ALL writes the configurator, catalog, interpreter, and all forms indicated in the catalog, onto the tape in the front cassette deck.

6.5.3 The LGO Command

To generate a faster loading version of the interpreter and its forms, place a scratch tape in the front deck and enter:

```
LGO
```

This command omits the configurator and catalog files. No form manipulation (as discussed in the chapter on the configurator of the DF2 user's guide) can be performed on the LGO version of the system. All forms specified in the catalog are written to tape.

6.6 The OS Command

To reload the DOS from the configurator simply enter:

```
OS
```

6.7 Copying Data Files

6.7.1 Copying Disk Data Files

For cassette compatibility, the DF2DOSG maintains a rewrite number in every data record. Since the rewrite number on disk based files is never incremented, there is no real need to have a special copy facility. Disk based data files may be copied via the DOS "SAPP" or "COPY" command; or, they may be renamed, via the "NAME" command so that they will not be overwritten by the next data entry session. (See the DOS User's Guide for a discussion of SAPP, COPY, and NAME.)

6.7.2 The COPY Command

Data tapes may incur tape parity errors or particular data records may reach the rewrite limit by being modified the maximum number of times. To copy a data tape, enter:

```
COPY
```

This command resets the rewrite counter in each record back to zero, and, if tape errors are encountered, provides the option of omitting the record, terminating the copy, or attempting to copy the bad data.

When the COPY command is executed, the message:

```
PLACE DATA TAPE IN FRONT DECK, BLANK TAPE IN REAR DECK
WHEN TAPE IN PLACE, PRESS ENTER
```

will appear. Once the ENTER key is pressed, the tape in the front deck will be copied to the tape in the rear deck. If errors are encounterd on the data tape in the front deck, the following message will appear:

```
PARITY ERROR ON DECK 2
COPY, OMIT OR END?
```

If "O" is entered, the bad record is bypassed and the copy proceeds. If "E" is entered, the copy is terminated with an end of file mark written on the tape in the rear deck. If "C" is entered, the bad record will be written on the tape in the rear deck (the copied record will have no parity error; however, the record will probably be missing data or contain erroneous data) and the copy will continue.

If the end of the tape is reached on the front deck and no end of file mark has been detected, the COPY command will automatically backspace the tape in the rear deck twice and write an end of file mark on it. The tape in the front deck is not disturbed. Note that if this occurs, the final record count is unreliable.

When the copy is completed, the following message is displayed:

```
nnn RECORDS COPIED
```

6.8 The DPRINT Command

To print a data file, enter:

```
DPRINT
```

This command prints each logical each record from the file named SYSNAM/TXT, 80 characters per line, on whichever printer (local or servo) is available. If the data records contain an embedded 015, it is interpreted as a carriage return. If the data record contains an embedded 003, printing of the record terminates prematurely at that point.

6.9 The FPRINT Command

To print a form image, enter:

```
FPRINT [nn]
```

where "nn" is an optional form number. If a number is entered, only that form is printed. If no form number is entered, all cataloged forms are printed in numerical order. Only forms which are in the forms catalog, that is forms which have been IN'ed, may be printed.

Forms will be printed twice; once as the total image would appear to the operator and again, one line at a time, followed by the size of the field and the TYPE, REQUIRED, and PROGRAM edit criteria for each field.

CHAPTER 7. INFORMATION FOR THE PROGRAMMER

7.1 System Structure of the Interpreter

The DF2DOSG interpreter resides within a 12K DATAPOINT processor. The 12K is divided as follows. The first 2.8K (from 0 to 05377) is devoted to the DOS. The next page (from 05400-05777) is for interpreter common area. Interpreter code is divided into two parts -- the first part precedes the user area, and the second part follows the user area. The user area contains the data area, edit tables, form image, and, if necessary, field programs (which, in turn, may required the extended interpreter). The following is a memory map of the interpreter:

DOS drivers	00000-05377
variable data	05400-06027
command handler	06030-11606
instruction interpreter	11607-13222
string arithmetic	13244-14345
form pointers	14524-14740
user space	14741-17777
keyboard I/O	20000-21367
interpreter routines	21370-22370

7.2 The Edit Table

7.2.1 Edit Table Format

For each field defined by a form, a six character set of edit criteria is generated. This entry describes the field in detail, as follows:

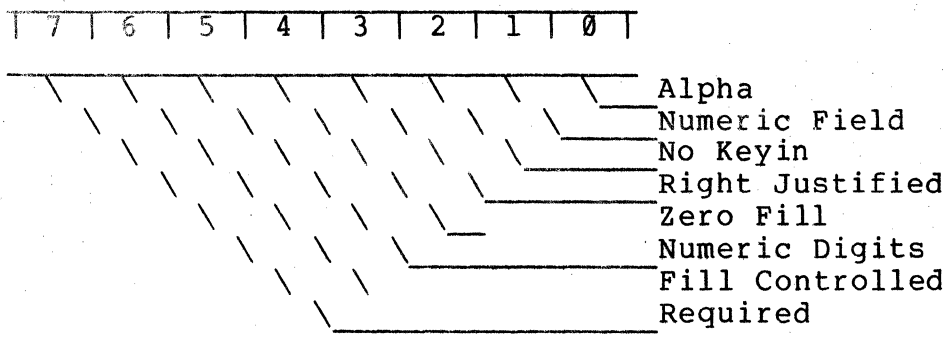
Horizontal position
Vertical positon
Length of field
Position in output record
Edit key
Field program letter

The horizontal position (Ø-79) indicates the starting column of the field in the screen image. The vertical position (Ø-11) indicates the line of the screen image containing the field. The information is used to display the field as well as to access data stored in the form image for the field (i. e., constants).

The length of field is the number of characters the operator may enter -- from 1 to 8Ø. This number is associated at execution time with the labels INPUT, OUTPUT and with field references in field programs.

The position in output record is actually an index (Ø-244) into the OUTPUT buffer. If the field is a "keyin" field, i.e., no data space is reserved, the position's value is Ø377.

The edit key is a combination of bits indicating the edit criteria set in the generator TYPE and REQUIRED passes. The bits in the edit key have the following meanings:



The alpha and numeric digit bits are both set for the "mixed" field type.

The field program letter is set to binary zero if no field

program is assigned; otherwise, the actual ASCII letter is stored in this character. The number of the last field in the screen image (the first is zero) is used to determine the length of the edit table. In addition, there is an Ø377 stored after the last entry in the edit table.

7.2.2 Work Area

During data entry, the six character set of edit criteria for the current field is moved to a work area in the data page for ease of referencing. The variables:

```
COLUMN
LINE
LENGTH
PSN
EDTKEY
USER
```

contain the six character set of edit criteria. The location "SAVFLD" contains the current field number.

7.2.3 Routines to Access the Edit Table

There are several subroutines available to access the set of edit criteria. "EDTPNT" is the most basic subroutine. This subroutine uses the value in the C-register to set the HL registers to the address of the corresponding set of edit criteria.

"MOVEDT" stores the field number at "SAVFLD", and moves the corresponding set of edit criteria to the work area and into the registers. It also positions the cursor to the field.

"NEXT" and "LAST" use the field number at "SAVFLD" to access the next or the preceding field. Both subroutines call "MOVEDT".

7.3 Structure of the Form in Memory

7.3.1 Pointers

The form is defined by a fixed set of pointers:

```
Linked form number
Field program pointers
Maximum field number
```

Edit table pointer
Data-write buffer pointer
Length of data record
Form line pointers

The variable "NEXTF" contains the number of the linked form (ØØØ if no link, linked form number +2 if a link is set), and the variable "PAGE3" is the auto-link flag (Ø or Ø377).

For each possible field program four characters are reserved starting at the label "USERA". The four characters are zero if the corresponding program letter is not present. If a program is present, whether referenced or not, the first pair of characters contains the "base address" to be used for all relative addresses within the field program. The second pair of characters contains the starting address of the program. (Note: All addresses are stored MSB,LSB.) Unresolved program references contain an octal 377 in the first character.

The set of edit criteria is always referenced via the address pointer "SEDIT"; the requested field is always checked against the maximum field number, "EEDIT".

7.3.2 Data Buffers

The OUTPUT buffer is always in a fixed position "DATA" at the end of all form pointers. Its length is defined by the variable "LDATA". The OUTPUT buffer, to which the data is moved prior to writing, is in a variable position. It is set at the end of the data buffer, at a point defined by the length of the data record+8. The address of the OUTPUT buffer is in "SMATCH". The OUTPUT buffer is also used when performing FIND operations. The data contained in the OUTPUT buffer is available to the operator by means of the form data duplicate function key (Ø).

7.3.3 Form Image

The compressed form is stored beyond the two output buffers and it is referenced indirectly through the pointers starting at the label "LINES". If the address in the table of pointers starting at "LINES", corresponding to one of the twelve screen lines, is zero, the corresponding line is to be blank on the screen.

7.3.4 Edit Criteria Table

The edit criteria table is generated beyond the compressed form. The character immediately after the edit table terminator (Ø377) is available for field programs.

7.3.5 Field Programs

When programs are attached to the form, blocks starting at relocatable addresses are given absolute addresses based at the first available space after the form edit table (the program base address). Non-relocatable records from the field program (e.g. COMMON), are simply passed through to the form file.

7.3.6 Extended Interpreter

There are fifteen extended interpreters which contain all possible combinations of four extended interpreter commands (CONVERT and LOOKUP are combined as one command, as are CKlØ and CKll). Thus, extended interpreter 1 contains only check digits; 2 contains the multiply subroutine; 3 contains both check digits and multiply; 4 contains divide; 5 contains divide and check digit; 6 contains multiply and divide; 7 contains multiply, divide and check digits; 8 contains conversions; 9 contains conversions and check digits; lØ contains conversions and multiply; ll contains conversions, multiply and check digits; 12 contains conversions and divide; 13 contains conversions, divide and check digits; 14 contains conversions, multiply and divide; and 15 contains all extended functions.

The extended interpreters are all assembled so that they end at an address lØØ characters (plus 3 to 18 characters for jump instructions) from the end of memory; thus leaving a maximum amount of user space. Three to eighteen of the characters are reserved for a jump table into the extended interpreter itself, since the starting addresses of the subroutines change for each of the fifteen levels of interpreter.

7.4 Subroutines Available in the Interpreter

7.4.1 DOS Facilities Available

The DOS interrupt handler and disk I/O routines are available. INCHL, DECHL and BLKTFR are also present. See the DOS User's Guide for descriptions and locations of the various routines.

7.4.2 Keyboard Input Routine

The interpreter contains its own keyboard input routine which has two entry points. When the routine is entered at "KEYIN", the edit type and length for the current field are applied to the input. In addition, it is assumed that the corresponding area of the form image is in the HL registers. This area is checked for constants. If entered at "KEYIN$", parameters are provided to permit keyin of twenty characters with no edit restrictions. The input is always stored in TEMP.

7.4.3 Display Routine

The display routine also has two entry points, "DSPLY$" and "DSPLY". If the display routine is entered at "DSPLY", the cursor position will be set to the bottom line of the screen and the screen will be rolled up after the message is displayed. The message must be terminated by an Ø15. If the display routine is entered at "DSPLY$", the contents of DE will be used to position the cursor and no rollup will take place at the end of the display.

There are two special characters permitted in the display input message: Ø23, which may appear only at the beginning of the message (causing the screen to rollup one line); and Ø11 followed by a count, which may appear anywhere in the message (indicating space compression). In addition, binary zeros are converted to underscores and spaces are not displayed at all (i. e., the cursor is simply positioned to the right). The message being displayed is always expanded into TEMP.

The routine called "REWRT" redisplays the form (with no data).

7.4.4 Form and Data Access Routines

The routine "GETADR" uses the contents of the variables "HP" and "VP" to locate to positions in the form image corresponding to the current field (this is where constants and semi-constants are stored).

"GETDAT" sets HL to the address in the data buffer corresponding to the current field. The B-register contains the length of the field.

"MOVEDT" uses the value in the C-register to access the edit table entry corresponding to that field and moves the six character entry to a work area for easy referencing. It also saves the field number in the variable "SAVFLD".

7.4.5 String Arithmetic Package

The string arithmetic package used in DATAFORM requires the following parameters:

```
HL = destination and field operated on
DE = operator (i.e., divisor)
the length of HL is in BLEN
the length of DE is in ALEN
```

Only the add and subtract functions are available in the basic interpreter. The addresses of multiply and divide change depending on the particular level of extended interpreter being used.

The entry point for add is ADD$ and for subtract is SUB$.

7.5 Assembly Language Interfacing and Overlays

7.5.1 Program Base Address

When the form generator outputs a form, it displays a message:

PROGRAM BASE ADDRESS mmmm

The value, mmmm, is the decimal starting address of the form's programs. This information is of particular interest if assembly language programs are to be included with the form. The technique

for utilizing this information is:

1. Generate a form and record the program base address.
2. Generate and assemble the assembly language program set at the program base address.
3. Compute the length (in decimal) of the assembly language program.
4. Generate and compile the DATAFORM 2 program with a labeled WORK statement the same size as the assembly language program. (It may be necessary to use two WORK statements since the maximum reservable amount is 245 characters.)
5. Rerun the form generator. Enter OLD to retrieve the form and OUT to write the form with the DATAFORM 2 program attached.
6. Use the DOS "APP" command to attach the assembly language program to the form:

   APP <assembly>,<form>,<newform>

This form may now be used by the interpreter.

NOTE: The assembly program and DATAFORM form should always be appended in this order, since, during conversion to cassette systems, the extended interpreter and all subsequent code are replaced by the cassette extended interpreter.

7.5.2 External References

Facilities are provided in the DATAFORM 2 language to reference points outside the program, locations which may be either in the interpreter itself or in a separately assembled assembly language program.

The EQU instruction assigns an address to a label which may then be referenced by any of the branching statements in DATAFORM 2 (GOTO, CALL, etc.). If this facility is used, the assembler return instruction "RET" will return control to either the statement after a CALL or to the NEXT point in the interpreter.

7.5.3 Returning to the Interpreter

A table of interpreter entry points is provided so that these address may be accessed at the same point in future versions:

```
NEXT$     EQU   Ø5563
AGAIN$    EQU   Ø5566
STORE$    EQU   Ø5571
END$      EQU   Ø5574
WEOF$     EQU   Ø5577
```

To return to a field program after being called, the assembly language should simply return, "RET". Otherwise, a jump to the appropriate exit routine will return control to the interpreter.

7.5.4 Interpreter Data Areas

Various interpreter data areas may be needed by the assembly language programs. The variable TEMP is the single item keyin buffer and it is this area which is accessed when "INPUT" is referenced in a field program. References to "INPUT" are compiled as an address of Ø1ØØØ and a length of zero. At execution time, the length of the current field is substituted and the address is converted to the DF2DOSG address Ø54ØØ. OUTPUT, compiled as address zero and length zero, is resolved at execution time. It is converted to the length and address in the data buffer of the current field.

Labels defined in FIELD statements are compiled with lengths of one and a special code in the MSB portion of the address. If the MSB is Ø37Ø, the LSB represents an index to the field table (i.e. the field number supplied by the programmer, minus one). If the MSB is Ø375, the LSB represents a displacement which, at execution time, is added to the current field number in order to resolve the length and address information.

NOTE: Referencing a field other than the current field does not change the number of the current field.

Several variables in the interpreter may be useful to the DATAFORM 2 program. To access external data, i.e., data in the interpreter or created by an assembly language routine, first EQU a label, then REDEFINE the label, assigning it the proper length. For example, the current field number (in binary, starting at zero), is at location Ø1141 (remember cassette values are converted automatically by the interpreter for DATAFORM 2 programs, but not assembly language programs). For example, to

test for field 5:

```
CURFLD EQU 1141
CURENT REDEFINE CURFLD,1,1
FLD5   WORK 04
TEST   IF CURENT EQUAL FLD5 THEN XXXX
```

When the operator presses the ENTER key in the first position of a field, the current data is at INPUT and is then passed to the field program. The variable at location 01140, SAVNUM, contains a flag which is 0 if no data was entered, and is non-0 if data was entered.

7.5.5 Loading the Assembly Language Program

Since the format of a form and that of assembly code is the same, an assembly language overlay may be loaded by assigning it a name of SYSNAMnn/DFF and then entering "LOAD nn".

Once the form and program have been tested, there are several ways to put the system together:

1) The assembly program may be cataloged as a separate form and be loaded by either the operator or by a field program.

2) The form and the assembly language program may be appended together using the facilities of the DOS.

7.5.6 DF2DOSG - DF2 Address Compatibility

The DF2DOSG interpreter performs a translation of addresses in field programs. Since the base page of the cassette version is 01000 and that of the disk version is 05400, all absolute references on the base page, e.g., INPUT, are translated to the correct value by adding 04400. The addresses for processing points in the interpreter, e.g., NEXT, END, STORE, etc., are also translated via a new jump table.

Assembly language programs which reference absolute locations in the disk version of the interpreter will not work when a cassette system is created. To test the programs, the following procedure is recommended. A label called "base" should be EQU'd to 05400. All interpreter data page labels should be referenced as <label>+BASE. When the program is debugged, BASE should be changed to 01000 and the program should be re-assembled and re-attached to the form for use with the cassette system.

APPENDIX A. SAMPLE PROGRAMS

```
             <_______   |_____ |
SIZE         7          6      1
TYPE         R
REQUIRED                P      P
PROGRAM      S
```

SAMPLE PROGRAM - MOVE SIGN FROM LEFT END TO RIGHT END

```
INSIGN      REDEFINE      INPUT,1,1
INREST      REDEFINE      INPUT,2,6
NXTFLD      FIELD         +1
SIGN        FIELD         +2
SPACE       WORK          " ";
MINUS       WORK          "-";
.
.
. INPUT TO KEYIN ONLY FIELD; MOVE
. SIGN AND STORE IN NEXT FIELD
.
.
S*          IF            NULL NE INPUT THEN MOVE1
            IF            NULL EQ NXTFLD THEN AGAIN
            NEXT
MOVE1       MOVE          INREST TO NXTFLD
            MOVE          INSIGN TO SIGN
            IF            MINUS EQ INSIGN THEN NEXT
            MOVE          SPACE TO SIGN
            NEXT
```

```
            |_____ |   |   |_____   |  =  |_____   |
SIZE        6      1   1   6        1     6        1
TYPE        R              R
REQUIRED                                  P        P
PROGRAM                           K
```

SAMPLE PROGRAM - ARITHMETIC OPERATIONS ON FIELDS WITH SIGN ON RIGHT

```
LFT         WORK        7;
LFTSIGN     REDEFINE    LFT,1,1
LFTVALU     REDEFINE    LFT,2,6
MID         WORK        7;
MIDSIGN     REDEFINE    MID,1,1
MIDVALU     REDEFINE    MID,2,6
SUM         WORK        7;
SUMSIGN     REDEFINE    SUM,1,1
SUMVALU     REDEFINE    SUM,2,6
ADD         WORK        "+";
SUB         WORK        "-";
MPY         WORK        "*";
DIV         WORK        "/";
SPACE       WORK        " ";
ZED         WORK        "Ø";
VALU1       FIELD       1
SIGN1       FIELD       2
OP          FIELD       3
VALU2       FIELD       4
VALU3       FIELD       6
SIGN3       FIELD       7
.
.
K*          MOVE        INPUT TO OUTPUT
            MOVE        VALU1 TO LFTVALU
            MOVE        SIGN1 TO LFTSIGN
            MOVE        VALU2 TO MIDVALU
            MOVE        INPUT TO MIDSIGN
            IF          OP EQ ADD THEN ADD1
            IF          OP EQ SUB THEN SUB1
            IF          OP EQ MPY THEN MPY1
            IF          OP EQ DIV THEN DIV1
            CHANGE      3
            AGAIN
ADD1        ADD         MID TO LFT GIVING SUM
            GOTO        DONE
SUB1        SUB         MID FROM LFT GIVING SUM
```

```
            GOTO        DONE
MPY1        MPY         MID BY LFT GIVING SUM
            GOTO        DONE
DIV1        DIV         MID INTO LFT GIVING SUM
DONE        MOVE        SUMVALU TO VALU3
            IF          SUMSIGN EQ ZED THEN BLANK
            MOVE        SUMSIGN TO SIGN3
            NEXT
BLANK       MOVE        SPACE TO SIGN3
            NEXT
```

```
            <_____    |_______
SIZE        6_____    7_______
TYPE        D
REQUIRED                P
PROGRAM     C
```

SAMPLE PROGRAM TO COMPUTE CHECK DIGIT (MOD 10)

```
COMBO       WORK          "0000000";
CKWORK      REDEFINE      COMBO,1,6
CKDIG       REDEFINE      COMBO,7,1
NXTFLD      FIELD         +1
ONE         WORK          "1";
WEIGHT      WORK          "121212";
.
.
C*          MOVE          INPUT TO CKWORK
            SUB           CKDIG FROM CKDIG
C1          IF            COMBO CK10 WEIGHT THEN C2
            ADD           ONE TO CKDIG
            GOTO          C1
C2          MOVE          COMBO TO NXTFLD
            STORE
```

```
            MM   DD   YY        JULIAN
            |_   |_   |_        |_  |__
SIZE        2    2    2         2   3
TYPE        R    R    R
REQUIRED                        P   P
PROGRAM     G    H    J
```

SAMPLE PROGRAM TO CONVERT TO JULIAN DATE

```
ADDER       WORK        "000","031","059","090","120","151":
                        "181","212","243","273","304","334"
LEAPYR      WORK        "76","80","84","88","92","96"
MONTH       WORK        "01","12"
DAY         WORK        "01","31"
HOLD        WORK        "000";
K1          WORK        "1";
K02         WORK        "02";
INDAY       FIELD       -1
INMO        FIELD       -2
JYR         FIELD       +1
JDAY        FIELD       +2
.
.
G*          IF          INPUT NIR MONTH THEN AGAIN
            STORE
.
.
H*          IF          INPUT NIR DAY THEN AGAIN
            STORE
.
.
J*          ALIGN       INMO TO HOLD
            LOOKUP      HOLD IN ADDER GIVING JDAY
            ADD         INDAY TO JDAY
            MOVE        INPUT TO JYR
            IF          INPUT NIT LEAPYR THEN STORE
            IF          INMO LE K02 THEN STORE
            ADD         K1 TO JDAY
            STORE
```

```
          <_______   |_____   |
SIZE      7          5        1
TYPE      R
REQUIRED             P        P
PROGRAM   M
```

SAMPLE PROGRAM TO CREATE MINUS OVERPUNCH TYPE CHARACTER

```
SIGN      REDEFINE   INPUT,1,1
VALU      REDEFINE   INPUT,2,5
LAST      REDEFINE   INPUT,7,1
NXTFLD    FIELD      +1
PUNCH     FIELD      +2
ZERO      WORK       "Ø";
MINUS     WORK       "-";
ZED       WORK       "{";
TABLE     WORK       "J","K","L","M","N":
                     "O","P","Q","R"
.
M*        MOVE       VALU TO NXTFLD
          MOVE       LAST TO PUNCH
          IF         SIGN NEQ MINUS THEN NEXT
          IF         LAST EQ ZERO THEN PUNT
          LOOKUP     LAST IN TABLE GIVING PUNCH
          NEXT
PUNT      MOVE       ZED TO PUNCH
          NEXT
```

```
                |_____________________________
SIZE            30
TYPE            M
REQUIRED
PROGRAM         C
```

SAMPLE PROGRAM ILLUSTRATING CHARACTER CONVERSION

```
IN1         REDEFINE    INPUT,1,1
INMOVE      REDEFINE    INPUT,2,29
ALLOUT      DATA        1,30
WK1         REDEFINE    ALLOUT,30,1
WKMOVE      REDEFINE    ALLOUT,2,29
ASCII       WORK        "ABCDEFGHIJKL":
                        "MNOPQRSTUVWX":
                        "YZ0123456789"
EBCDIC      WORK        O301,302,303,304,305,306:
                        307,310,311,321,322,323:
                        324,325,326,327,330,331:
                        342,343,344,345,346,347:
                        350,351,360,361,362,363:
                        364,365,366,367,370,371
SINGLE      REDEFINE    EBCDIC,1,1
K29         WORK        "29";
COUNT       WORK        "00";
K00         WORK        "00";
K1          WORK        "1";
.
.
C*          MOVE        K29 TO COUNT
C1          CONVERT     IN1 BY ASCII AND SINGLE GIVING WK1
            MOVE        INMOVE TO INPUT
            MOVE        WKMOVE TO ALLOUT
            SUB         K1 FROM COUNT
            IF          K00 NE COUNT THEN C1
            NEXT
```

```
                SHIPPED TO  |_____________      SHIPPED FROM  |_____________
SIZE                        15                                15
TYPE
REQUIRED
PROGRAM                     A                                 A

                  ADDRESS   |_____________%        ADDRESS   |_____________
SIZE                        15                                15
TYPE
REQUIRED
PROGRAM                     A                                 B

                     DATE   |__|__|__                  DATE   |__|__|__
SIZE                        2  2  2                           2  2  2
TYPE                        R  R  R                           R  R  R
REQUIRED
PROGRAM                        C
```

SAMPLE PROGRAM ILLUSTRATING ENTERING FIELDS "OUT OF ORDER"

```
.
.
A*          CALL          SAVE
            CHANGE        +1
            NEXT
.
.
B*          CALL          SAVE
            CHANGE        7
            NEXT
.
.
C*          CALL          SAVE
            CHANGE        1
            NEXT
.
.
SAVE        MOVE          INPUT TO OUTPUT
            RETURN
```

```
                THIS IS THE FIELD
                |_______________
SIZE            15
TYPE
REQUIRED
PROGRAM         V


SAMPLE PROGRAM TO ILLUSTRATE MODIFY MODE VERFICATION

ONE             WORK            "1";
THREE           WORK            "3";
HOLD            WORK            "                ";
COUNT           WORK            "Ø";
.
.
V*              IF              RETRY EQ NULL THEN STORE
                IF              INPUT EQ OUTPUT THEN OK
                ADD             ONE TO COUNT
                IF              COUNT EQ THREE THEN TRY
                MOVE            INPUT TO HOLD
                AGAIN
TRY             IF              INPUT NE HOLD THEN ATTEMPT
                MOVE            INPUT TO OUTPUT
OK              SUB             COUNT FROM COUNT
                NEXT
ATTEMPT         SUB             COUNT FROM COUNT
                AGAIN
```

```
                |_______
SIZE            7
TYPE            R
REQUIRED
PROGRAM         A

                |_______
SIZE            7
TYPE            R
REQUIRED
PROGRAM         A

                |_______
SIZE            7
TYPE            R
REQUIRED
PROGRAM         A

                |_______
SIZE            7
TYPE            R
REQUIRED
PROGRAM         A

                |_______
SIZE            7
TYPE            R
REQUIRED
PROGRAM         A

                0000.00
SIZE            7
TYPE
REQUIRED        P
PROGRAM
```

SAMPLE PROGRAM - TOTAL ACCUMULATION (FIRST STYLE)

```
TOTAL       FIELD         6
.
.
A*          SUB           OUTPUT FROM TOTAL
            ADD           INPUT TO TOTAL
            STORE
```

```
                |_______
SIZE            7
TYPE            R
REQUIRED
PROGRAM         F

                |_______
SIZE            7
TYPE            R
REQUIRED
PROGRAM         F

                |_______
SIZE            7
TYPE            R
REQUIRED
PROGRAM         F

                |_______
SIZE            7
TYPE            R
REQUIRED
PROGRAM         F

                0000.00
SIZE            7
TYPE
REQUIRED        P
PROGRAM
```

SAMPLE PROGRAM - TOTAL ACCUMULATION (SECOND STYLE)

```
BLANK       WORK          "           ";
SUM         FIELD         5
.
.
F*          SUB           OUTPUT FROM SUM
            ADD           INPUT TO SUM
            MOVE          INPUT TO OUTPUT
            MESSAGE       BLANK
            MESSAGE       SUM
            NEXT
```

```
                |_______
SIZE            7
TYPE            R
REQUIRED
PROGRAM         Z

                |_______
SIZE            7
TYPE            R
REQUIRED
PROGRAM         Y

                |_______
SIZE            7
TYPE            R
REQUIRED
PROGRAM         X

                |_______
SIZE            7
TYPE            R
REQUIRED
PROGRAM         W

                0000.00
SIZE            7
TYPE
REQUIRED        P
PROGRAM
```

SAMPLE PROGRAM - TOTAL ACCUMULATION (THIRD STYLE)

```
ONE             FIELD           1
TWO             FIELD           2
THREE           FIELD           3
FOUR            FIELD           4
FIVE            FIELD           5
.
.
Z*              ADD             INPUT TO TWO GIVING FIVE
                GOTO            EXIT1
Y*              ADD             ONE TO INPUT GIVING FIVE
EXIT1           ADD             THREE TO FIVE
                GOTO            EXIT2
X*              ADD             ONE TO TWO GIVING FIVE
```

```
            ADD             INPUT TO FIVE
EXIT2       ADD             FOUR TO FIVE
            STORE
W*          ADD             ONE TO TWO GIVING FIVE
            ADD             THREE TO FIVE
            ADD             INPUT TO FIVE
            STORE
```

```
                |_______
SIZE            7
TYPE            R
REQUIRED
PROGRAM         P

                |_______
SIZE            7
TYPE            R
REQUIRED
PROGRAM         Q

                |_______
SIZE            7
TYPE            R
REQUIRED
PROGRAM         R

                |_______
SIZE            7
TYPE            R
REQUIRED
PROGRAM         S

                0000.00
SIZE            7
TYPE
REQUIRED        P
PROGRAM
```

SAMPLE PROGRAM TOTAL ACCUMULATION (FOURTH STYLE)

```
ONE             FIELD           1
TWO             FIELD           2
THREE           FIELD           3
FOUR            FIELD           4
FIVE            FIELD           5
BLANK           WORK            "         ";
.
.
P*              ADD             INPUT TO TWO GIVING FIVE
                GOTO            EXIT1
Q*              ADD             ONE TO INPUT GIVING FIVE
EXIT1           ADD             THREE TO FIVE
```

```
            GOTO        EXIT2
R*          ADD         ONE TO TWO GIVING FIVE
            ADD         INPUT TO FIVE
EXIT2       ADD         FOUR TO FIVE
            GOTO        EXIT3
S*          ADD         ONE TO TWO GIVING FIVE
            ADD         THREE TO FIVE
            ADD         INPUT TO FIVE
EXIT3       MOVE        INPUT TO OUTPUT
            MESSAGE     BLANK
            MESSAGE     FIVE
            NEXT
```

```
            0000.00
SIZE        7
TYPE        R
REQUIRED
PROGRAM

            0000.00
SIZE        7
TYPE        R
REQUIRED
PROGRAM

            0000.00
SIZE        7
TYPE        R
REQUIRED
PROGRAM

            0000.00
SIZE        7
TYPE        R
REQUIRED
PROGRAM

            0000.00
SIZE        7
TYPE        R
REQUIRED    R
PROGRAM     T
```

SAMPLE PROGRAM - TOTAL ACCUMULATION, CHECKING AGAINST KEYED IN TOTAL

```
FIRST       FIELD       1
SECOND      FIELD       2
THIRD       FIELD       3
FOURTH      FIELD       4
TEMP        WORK        "0000.00";
SILVER      WORK        "CORRECT";
GOLD        WORK        "NOT CORRECT; 0000.00 IS CORRECT"
SHINE       REDEFINE    GOLD,14,7
.
.
T*          ADD         FIRST TO SECOND GIVING TEMP
```

```
            ADD         THIRD TO TEMP
            ADD         FOURTH TO TEMP
            IF          TEMP EQ INPUT THEN GREEN
            MOVE        TEMP TO SHINE
            MESSAGE     GOLD
            AGAIN
GREEN       MOVE        INPUT TO OUTPUT
            MESSAGE     SILVER
            NEXT
```

APPENDIX B. COMMANDS

CONFIGURATOR	SECTION	ACTION
CATALOG	6.1	display the forms in the catalog
CHOP	6.4	delete specified form and all subsequent forms
COPY	6.7.2	copy a data tape and reset rewrite counters to zero.
DELETE	6.3	delete the specified form
DPRINT	6.8	print data file
DUP	6.5.1	duplicate the main system with a blank catalog
DUP ALL	6.5.2	duplicate the entire system including forms
FPRINT	6.9	print form
IN	6.2	input a form assigning the specified form number
LGO	6.5.3	write faster loading interpreter
OS	6.6	reload the DOS
GENERATOR:		
CONSTANT	3.6.3	set constants into the form
LINK	3.6.5	define next form linkage
NEW	3.5	clear the work area for a new form
OLD	3.9	load old form from front deck
OS	3.10	reload the DOS
OUT	3.7	write the current form to disk
PROGRAM	3.6.4	assign program letters to fields
REQUIRE	3.6.2	set required, fill controlled, or program reserved edit criteria
REVISE	3.8	revise the current form
SEMI-CONSTANT	3.6.3	set semi-constant data into the form
TYPE	3.6.1	set alphabetic or numeric edit criteria
INTERPRETER:		
ADD	5.2	add to the end of a data file
BACKSPACE	5.7	backspace the data file one record
CONTINUE	5.3	add to the end of a data file if the file is already open
DATA	5.5	switch to data entry mode
END	5.9	write an end of file on the data file
FIND	5.6.2	search for matching data record
LOAD	5.4	load the specified form
MODIFY	5.6.1	modify data records

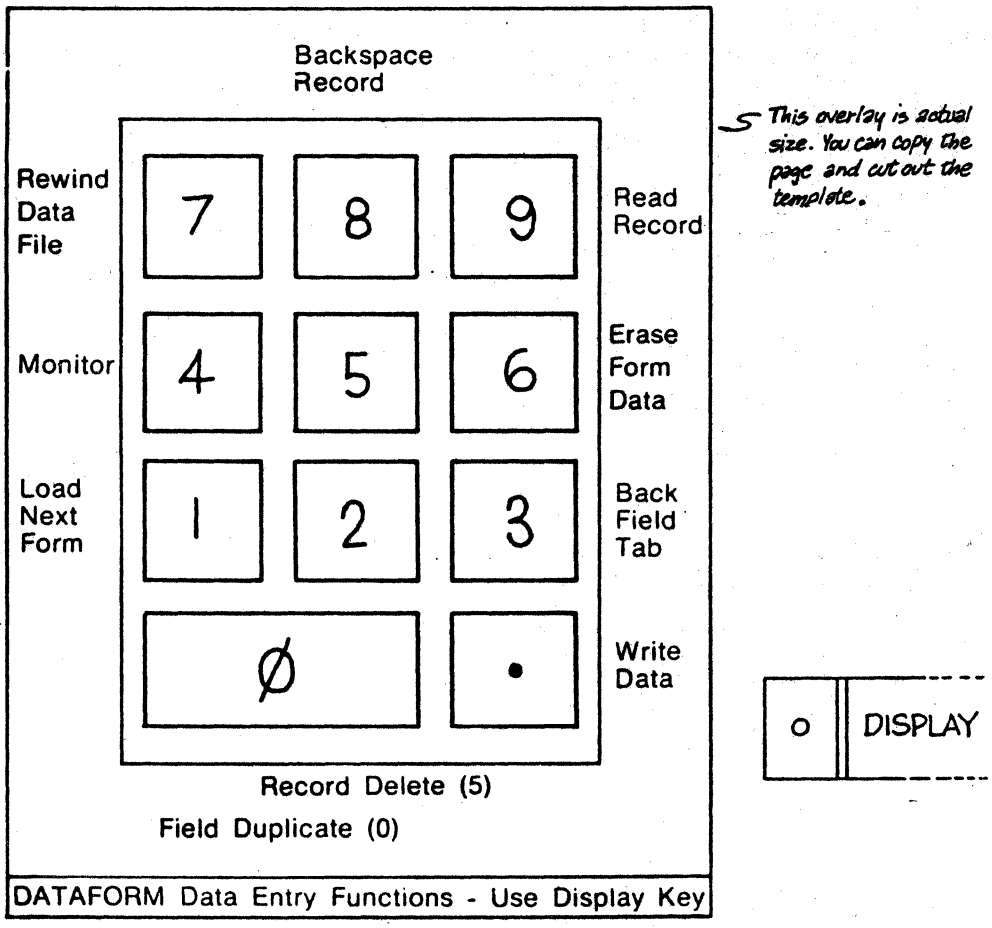
OS	5.1Ø	reload the DOS
REWIND	5.8	rewind data file
START	5.1	initialize a data file

APPENDIX C. INTERPRETER FUNCTION KEYS

The interpreter has a set of special function keys available in data entry and modify modes. When the DISPLAY key is pressed simultaneously write a number pad key, the number pad key becomes a special function key. The following functions are available:

Mode	Key Entered	Function
All Data Entry	.	write record
	0	form data duplicate
	1	load next form
	3	backspace field
	4	return to monitor
	6	form data erase
Modify and Find Only	7	rewind data file
	8	backspace record
	9	read record

NUMBER PAD OVERLAY



DATA ENTRY COMMANDS VIA NUMERIC KEYBOARD

APPENDIX D. FORM GENERATOR FUNCTION KEYS

The form generator has a set of special functions available in the image generation mode only. When the DISPLAY key is pressed, the number pad characters become function keys. The following functions are available:

7 - character insert
8 - cursor up
9 - erase to end of screen
4 - cursor left
5 - character duplicate
6 - cursor right
1 - word remove
2 - cursor down
3 - form expand (downward)
Ø - character remove
. - erase to end of line
CANCEL - return to monitor

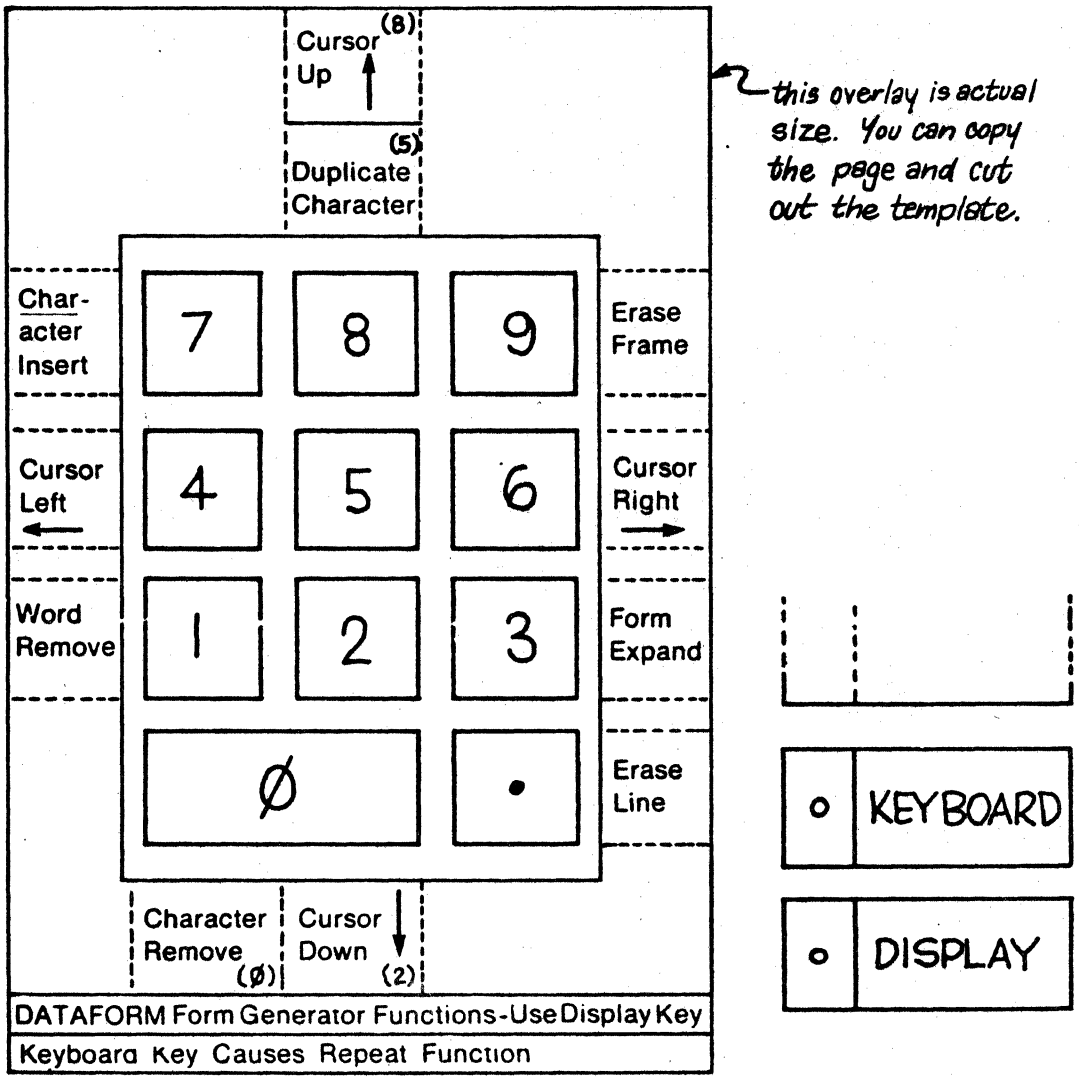
The BACKSPACE key and cursor left function key have the same function. Backspacing from column 1 back to column 8Ø is permitted. All cursor movement with the special function keys is non-destructive.

The CANCEL key erases the entire line the cursor is on and places the cursor at the beginning of the line.

The KEYBOARD key acts as a REPEAT key for all characters and for most function keys.

The CANCEL function key returns to the form generator's monitor. The ENTER key places the cursor at the beginning of the next lower line.

NUMBER PAD OVERLAY



FORM GENERATOR COMMANDS VIA NUMERIC KEYBOARD

APPENDIX E. FORM GENERATOR TYPE AND REQUIRE EDIT CRITERIA

TYPE	MEANING
A	Alpha (A - Z and space)
D	Digit (Ø - 9)
N	Numeric (Ø - 9, decimal point and leading minus)
M	Mixed alpha and numeric
L	Numeric, left justified/zero filled
R	Numeric, right justified/zero filled
B	Numeric, right justified/blank filled
CANCEL	Clears edit criteria

Right justified fields are filled with leading zeros (R) or blanks (B). During data entry, the field is justified and re-displayed after the ENTER key is pressed. Numeric fields are limited to 12 places of significance to the left and 4 places to the right of the decimal point.

REQUIRE	MEANING
R	Required (1 character necessary)
F	Fill controlled (all characters necessary) (ENTER key allowed only to bypass field)
B	Both fill controlled and required
P	Program reserved (no keyin)
S	Required and program reserved (field is checked prior to write)

APPENDIX F. ALPHABETICAL LISTING OF STATEMENT TYPES

NAME	SECTION
ADD	4.6.2
AGAIN	4.7.1
ALIGN	4.6.1.1
BEEP	4.6.4.1
CALL	4.6.5.2
CHAIN	4.6.4.2
CHANGE	4.6.6
CLOSE	4.7.2
COMMON	4.5.3
CONVERT	4.6.1.2
DATA	4.5.1
DIVIDE	4.6.2
END	4.7.3
EQU	4.5.4
FORMSHOW	4.6.4.3
FIELD	4.5.6
GOTO	4.6.5.1
IF CK10	4.6.3
IF CK11	4.6.3
IF INT	4.6.3
IF NIT	4.6.3
IF INR	4.6.3
IF NIR	4.6.3
IF EQ	4.6.3
IF NE	4.6.3
IF GE	4.6.3
IF LE	4.6.3
IF GREATER	4.6.3
IF LESS	4.6.3
INPUT	4.7.4
LOOKUP	4.6.1.3
MESSAGE	4.6.4.4
MOVE	4.6.1.4
MULTIPLY	4.6.2
NEXT	4.7.5
NULL	4.7.6
OUTPUT	4.7.7
REDEFINE	4.5.5
RESET	4.6.6
RETRY	4.7.8

RETURN	4.6.5.2
SET	4.6.1.5
SHOW	4.6.4.5
STORE	4.7.9
SUBTRACT	4.6.2
WORK	4.5.2
WRITE	4.6.4.6

APPENDIX G. STATEMENTS REQUIRING THE EXTENDED INTERPRETER

ROUTINE	DECIMAL SIZE
MULTIPLY	83*
DIVIDE	183*
CONVERT & LOOKUP	83
CK1Ø & CK11	161
*MUL/DIV OVERHEAD	56
EXTENDED INTERPRETER OVERHEAD	18
COMMON (REQUIRED WITH EXTENDED INTERPRETER)	1ØØ

APPENDIX H. INTERPRETER FLAG ADDRESSES

LABEL	LOCATION	DESCRIPTION
TEMP	Ø1ØØØ	'INPUT' buffer
COLUMN	Ø113Ø	edit entry - horizontal position
LINE	Ø1131	vertical position
LENGTH	Ø1132	field length
PSN	Ø1133	position in OUTPUT
EDTKEY	Ø1134	edit criteria
USER	Ø1135	program letter
SAVNUM	Ø114Ø	number of characters entered (Ø if ENTER pressed)
NEWOLD	Ø1143	I/O mode/status word
FORMNO	Ø1146	current form number +4 (in binary)
CURI	Ø12Ø1	address of next DATAFORM instruction
NEXTF	Ø14524	linked form number +4 (in binary)
PAGE3	Ø14525	Auto link flag
BASE	Ø1177	program base address
NEXT$	Ø1147	transfer to NEXT
AGAIN$	Ø1152	transfer to AGAIN
STORE$	Ø1155	transfer to STORE
END$	Ø116Ø	transfer to END
WEOF$	Ø1163	transfer to CLOSE
ERASE$	Ø1166	erase function key

APPENDIX I. ERROR MESSAGES

COMPILER MESSAGES:

NAME REQUIRED

The name of the program source file must be on the initial command line.

BAD LABEL INITIATOR

A character that was neither a decimal point nor a plus nor a space nor alphanumeric appeared in column 1 of the input line.

INVALID OCTAL

The character string pointed to by the star contains a character which is not in the set Ø-7.

ILLEGAL OPERATOR

Something other than the accepted statement types was the first nonblank symbol after column 1 (or after the label, if one exists).

NUMBER FROM 1-245 EXPECTED

The indicated symbol is non-numeric, or if numeric, not in the specified range.

COMMA EXPECTED

The symbol after the first number in a DATA statement was not a comma.

FIELD2 IS LESS THAN FIELD1

In a DATA statement, the second field is less than the first.

LABEL REQUIRED

The DATA, REDEFINE and WORK statements all require a label.

DOUBLE QUOTE ASSUMED

A pre-defined constant (either in WORK or COMMON statements) should be terminated by a double quotation mark. If the double quotation mark is not there, it is assumed.

ILLEGAL LITERAL

In a table, every item enclosed in double quotation marks must be of equal length. Those that are of different length than the first item are in error.

IMPROPER CONTINUATION

If a COMMON or WORK table is continued from one line to another, the following line must have a blank in column one, and the first symbol on the line must be a double quotation mark. If either of these is not the case, the continuation is an improper one.

UNDEFINED LABEL

A label is referenced which is neither one of the nine pre-defined labels, nor defined elsewhere in the program.

MISSPELLED WORD

A specific reserved word -- for example, the TO in an ADD statement -- has been misspelled. The misspelled word is assumed to be the one expected, and the next symbol is expected to be a legal label.

ILLEGAL CONDITION

The connective in an IF statement is not acceptable.

DUPLICATE LABEL

The label which begins the line listed is defined elsewhere in the program (or it is one of the nine pre-defined labels). The second (and any subsequent) definitions of the label are ignored.

MAXIMUM LABELS REACHED

The maximum number of labels allowed by the compiler is fixed at 95, excluding the pre-defined labels. All labels after this maximum is reached are ignored.

COMMON LIMIT EXCEEDED

The COMMON block may not exceed 100 characters. Anything defined as COMMON after this length will not be accepted.

PROGRAM COUNTER ERROR

The program counter at the end of pass two does not equal the program counter at the end of pass one. This is an internal compiler error message.

COMMON SYSTEM ERRORS

FILE MISSING or FORM MISSING
: The form number specified is not present as SYSNAMnn/DFF.

  In the interpreter, this message may mean that the next form specified (in the current form's link) is not present, or that a command assumes that there is a form in memory (e.g. DATA) and none is loaded.

NAME REQUIRED
: The initial command line did not include the system name or form name required by the program.

ILLEGAL DEVICE SPECIFICATION
: The initial command line included a disk drive specification which was improperly formatted.

BAD NUMBER
: The form number may have been omitted, out of range (1-99), non-numeric, or, the form specified is not in the disk directory as SYSNAMnn/DFF. Note that if the form number is omitted in a command which optionally accepts form numbers (e.g. START [n]) the command line cannot end with a space.

CONFIGURATOR ERRORS

BAD SYSTEM NAME
: Name specified in the command line cannot possibly be a system name since it is greater than 6 characters.

ILLEGAL SYSTEM NAME
: During a DUP, DUP ALL or LGO command one of the DATAFORM 2 cassette program files was not found.

VERIFY FAILURE
: During a DUP, DUP ALL or LGO command, while re-reading the tape to verify it, a tape error was encountered.

PARITY ERROR ON DECK y

COPY, OMIT or END?

A parity error was encountered on a tape being copied on deck y. Entering a "C" will copy the erroneous record; entering an "O" will omit the erroneous record; and entering an "E" will end the copy at that point by writing an end of file mark on the new tape.

INTERNAL ERROR x ON DECK y

This message indicates a tape or tape deck failure. The "x" is replaced by a letter indicating the error condition:

D - parity error
E - end of tape
F - end of file
G - unfindable file
Z - write failure

Generally these errors occur only if something is severly wrong with the cassette. One cause of error Z is trying to write on a cassette whose write protect tab has been punched; another cause of error Z is a cassette which is improperly inserted in the deck. If error Z occurs, and the cause is not apparent, a hardware failure should be suspected.

The letter "y" in the message is replaced by the number of the tape deck on which the error occured (deck 1 is the rear deck, deck 2 is the front).

END OF FILE MISSING

End of tape reached during COPY - an end of file mark is automatically written.

NUMBER IN USE

The form number specified for an IN command has already been assigned.

NO PRINTER

A DPRINT or FPRINT command was attempted with no printer connected or turned on.

GENERATOR ERRO..S

BAD FORM NAME
The form name specified in the command line must end with a two digit number.

BAD FORM
The form in memory cannot be written out, or have any pass except REVISE executed, because of some error condition.

NO FIELDS DEFINED
Every created form must have at least one field (which may be a keyin only field).

NO ROOM FOR CONSTANTS
Constants and semi constants can only be assigned to fields of a form which were initially defined using the underscore (as opposed to the caret). This messare is

MORE THAN 126 FIELDS
During image generation more than 126 data fields were defined. The form must be revised before it may be written out.

MORE THAN 245 DATA
During image generation more than 245 data characters were defined. The form must be revised before it may be written out.

XXX DATA
YYY BYTES LEFT
The messages appear immediately after the image generation phase of form generation. They are for information only.

YYY BYTES OVER
If this message appears after image generation, the form image, data area and edit table have combined to overflow the user space. Something must be reduced.

EXTENDED INTERPRETER MISSING
The extended interpreters must be cataloged exactly DF2DXTND/OVA through /OVO. If the file is not present and an extended interpreter is required, the message will appear.

PROGRAM x MISSING
A program specified in the program pass is not contained in the program file (or there is no program file at all).

INTERPRETER ERRORS

Continuous Beeping during data entry
: An illegal constant has been defined at form generation time. The constant must be reset to conform with the edit criteria before data entry may proceed.

Continuous Clicking during data entry
: An all constant form with no keyin field has been loaded. The form must be corrected before data entry may proceed.

SELECT DATA MODE
: No START, ADD, MOD or FIND command has been executed.

END OF DATA
: End of file has been reached on the data file.

DATA FILE OPEN
: An open type operation was attempted with the data file already open.

DATA FILE CLOSED
: A close type operation was attempted with the data file already closed.

NO FIELDS
: A form with no fields has been generated.

NO LINK SET
: The operator attempted to load a linked form and no link was set.

BAD OP
: An unacceptable op code was encountered during the execution of a field program.

APPENDIX J. USER SPACE REDUCTION TECHNIQUES

1. Use carets (^) in field definitions (remember they are compressed in the form image (but not the data record) while underscores (_) are not).

2. Use COMMON instead of WORK if any extended interpreter is used (100 characters of COMMON are reserved whether they are used or not). If COMMON is used, it should be specified all at the same time to prevent multiple short records from being written in the form (this considerably slows down form loading).

3. Place semi-colons at the end of all non-table, non-range variables to suppress the end-of-table character.

4. Use REDEFINE to create constants or tables which are subsets of other constants or tables. This technique may also be used for computation or hold areas if the redefined variables are not needed at the same time.

5. Use subroutines to perform repeated operations.

6. Use field displacement referencing to generalize programs used with line-items (i.e., where the same set of fields is entered several times within one form).

7. Use INPUT, OUTPUT and RESET to generalize programs and thus avoid duplication of code.

8. Keep constants in the form itself (by defining them at form generation time) instead of using a field program to set them.

9. Combine several fields into one wherever possible (each field requires 6 additional characters of edit table).

10. Avoid extended interpreter functions when possible (by coding multiplies using adds, etc.).

11. Use LOOKUP instead of CONVERT to save one of the tables.

12. Use data areas as work areas whenever possible, thus saving intermediate hold areas.

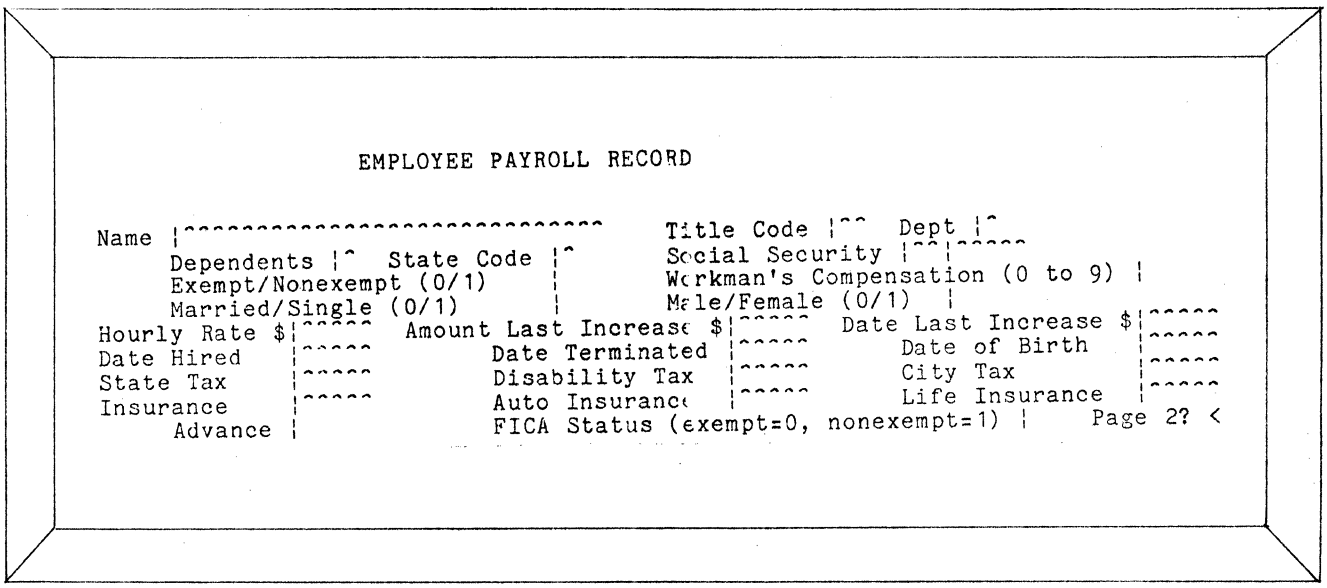
13. Execute all programs on last field if possible, to save NEXT and STORE instructions.

14. Avoid CHANGE/SHOW/CHANGE as a series of instructions. Keep in mind that fields declared "program reserved" will show up on the screen in their sequence although the operator cannot keyin to them.

APPENDIX K. SAMPLE FORM GENERATION

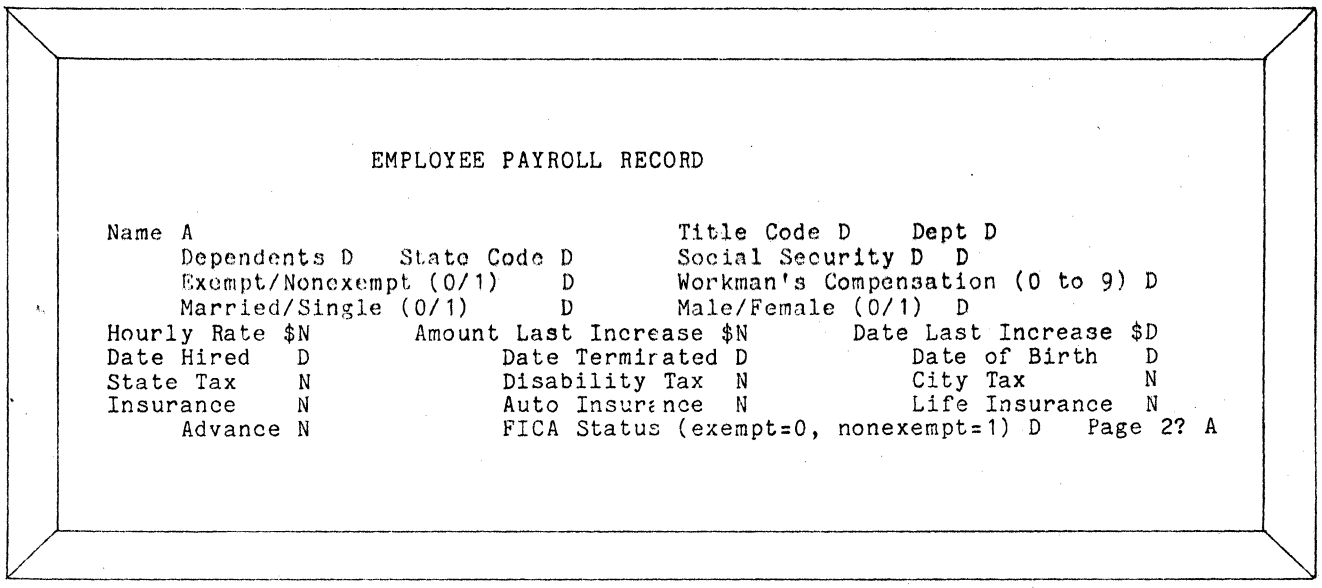
Sample Form -- During NEW or REVISE Pass

[artist rer Form text, data, and keyin only field definitions are set in either the NEW or REVISE pass. If no constants or semi-constants are added, this is the way the form text will look during data entry except that the carets will be replaced by spaces.



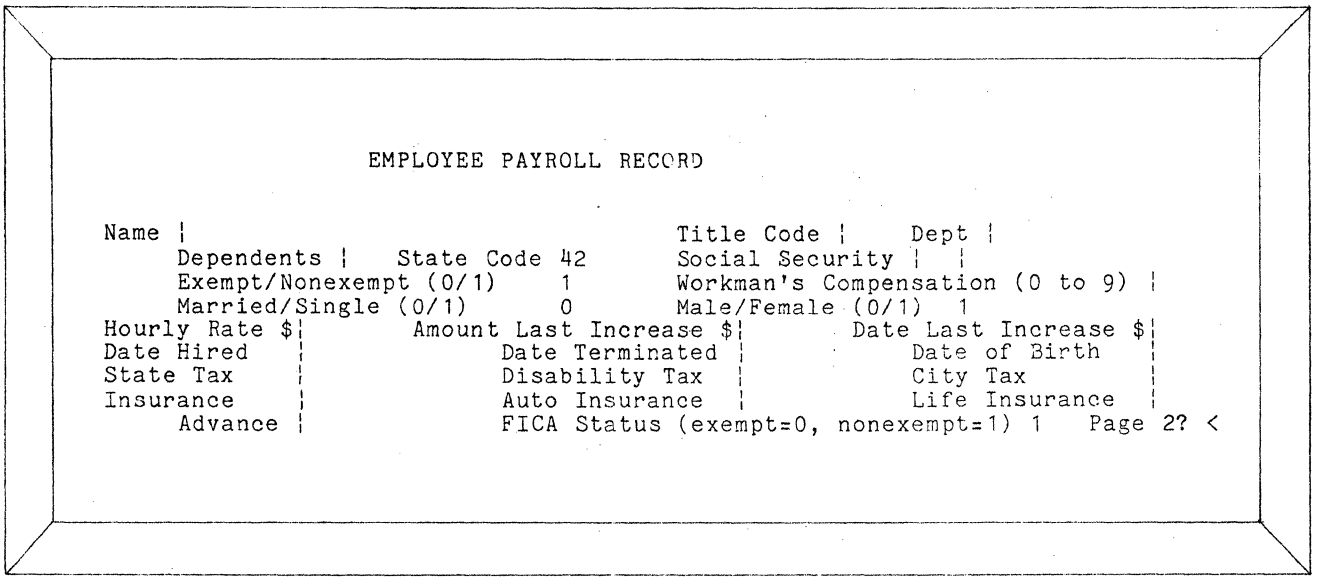
Sample Form -- During TYPE Pass

The field type edit criteria are set in the TYPE pass. Edit criteria will not be displayed during data entry.



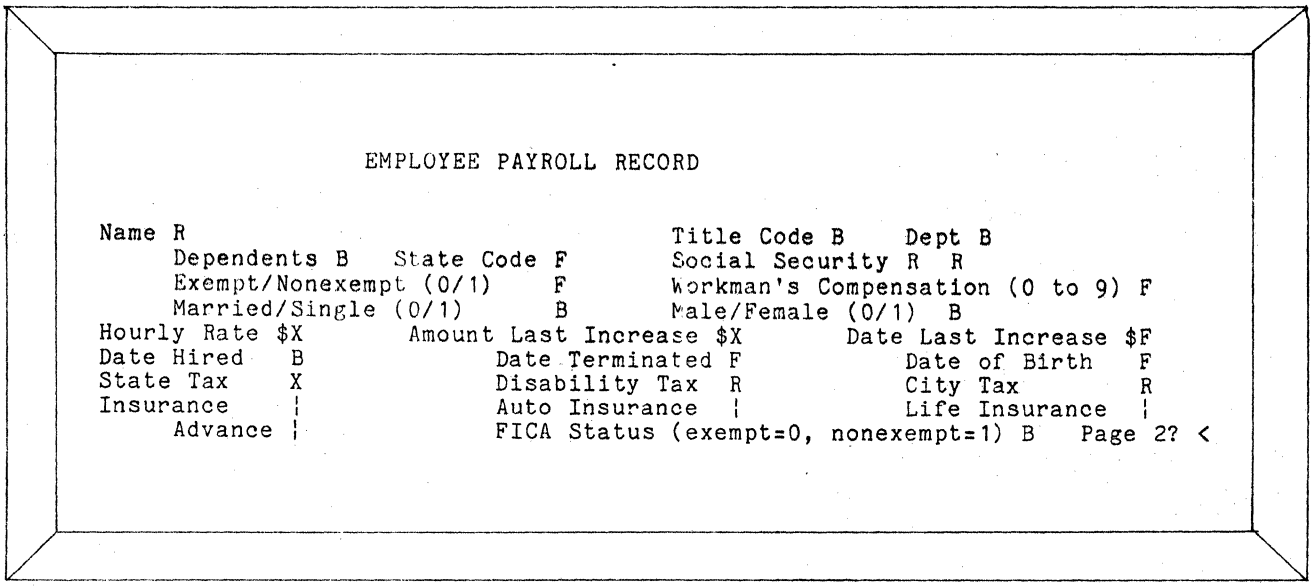
Sample Form -- During SEMI-CONSTANT Pass

Several fields are preset to commonly entered values in the SEMI-CONSTANT pass. These may be accepted or rejected by the operator during data entry. The CONSTANT pass looks the same; however, constants may not be rejected during data entry.



Sample Form -- During REQUIRED Pass

Required, fill controlled, and program reserved edit criteria are set in the REQUIRED pass. Edit criteria will not be displayed during data entry.



Sample Form -- During PROGRAM Pass

Field program names are set in the PROGRAM pass. Program "A" checks range 0-1; "B" checks range 0-9; "D" checks for valid dates; and "X" checks for a "Y" or "N" to determine if another form should be loaded. Program names will not be displayed during data entry.