GC26-3837-2
File No. S370-30

Systems

OS/VS1 Data Management for System Programmers

Release 5

IBM

Third Edition (November 1975)

This edition replaces the previous edition (numbered GC26-3837-1) and its technical newsletter (numbered GN26-0783) and makes them both obsolete.

This edition applies to Release 5 of OS/VS1 and to all subsequent releases of the system unless otherwise indicated in new editions or technical newsletters.

Information on the IBM 3800 Printing Subsystem, IBM 3350 Direct Access Storage, and IBM 3344 Direct Access Storage Device is provided for planning purposes only until the products are available.

Significant system changes are summarized under "Summary of Amendments" following the list of figures. In addition, miscellaneous editorial and technical changes have been made throughout the publication.

Information in this publication is subject to significant change. Any such changes will be published in new editions or technical newsletters. Before using the publication, consult the latest *IBM System/370 Bibliography,* GC20-0001, and the technical newsletters that amend the bibliography, to learn which editions and technical newsletters are applicable and current.

Requests for copies of IBM publications should be made to the IBM branch office that serves you.

Forms for readers' comments are provided at the back of the publication. If the forms have been removed, comments may be addressed to IBM Corporation, General Products Division, Programming Publishing—Department J57, 1501 California Avenue, Palo Alto, California 94304. All comments and suggestions become the property of IBM.

PREFACE

This publication provides information on how to modify and extend the data management capabilities of the OS/VS system control program; the intended audience is system programmers.

Some topics included are:

- Maintaining the OS/VS System Catalog
- Maintaining the Volume Table of Contents
- Executing Your Own Channel Programs
- Using XDAP to Read and Write Data Sets on Direct-Access Devices
- Password Protecting Your Data Sets

The OS/VS system control program provides simpler ways (for example, job control language, utility programs, access method routines) to do each of these things. The information presented in this book (consisting of macro specifications and how-to information) is intended to provide greater flexibility of implementation methods.

Other topics presented are:

- Using System Macro Instructions to Refer to, Validate, and Modify System Control Blocks
- Adding a UCS Image or FCB Image to the System Image Library.

Prerequisite Reading

Readers are expected to understand how to:

- Code programs in assembler language as described in *OS/VS - DOS/VS - VM/370 Assembler Language,* GC33-4010.
- Use the standard linkage conventions as described in *OS/VS1 Supervisor Services and Macro Instructions,* GC24-5103.
- Maintain the catalog and VTOC as described in *OS/VS1 JCL Services,* GC24-5100, *OS/VS Utilities,* GC35-0005, and *OS/VS Data Management Services Guide,* GC26-3783.
- Use the access methods to do input/output using the data management macros as described in *OS/VS Data Management Services Guide,* GC26-3783, and *OS/VS Data Management Macro Instructions,* GC26-3793.
- Protect data sets as described under "IEHPROGM" in *OS/VS Utilities,* GC35-0005.

More specific prerequisite reading is listed at the beginning of each chapter, as it relates to the particular topic.

Related Reading

All of the chapters of this publication make reference to *OS/VS1 System Data Areas*, SY28-0605. This book presents detailed descriptions of system control blocks and common work areas. More specific related reading is listed at the beginning of each chapter, as it relates to the topic under discussion.

Other publications referenced in this manual are:

- *IBM System/370 Principles of Operation,* GA22-7000
- *IBM 2821 Control Unit Component Description,* GA24-3312
- *IBM 3211 Printer, 3216 Interchangeable Train Cartridge, and 3811 Printer Control Unit Component Description and Operator's Guide,* GA24-3543
- *IBM 3800 Printing Subsystem Programmer's Guide,* GC26-3846
- *OS/VS1 Access Method Services,* GC26-3840
- *OS/VS1 Catalog Management Logic,* SY35-0003
- *OS/VS1 DADSM Logic,* SY26-3837
- *OS/VS1 I/O Supervisor Logic,* SY24-5156
- *OS/VS1 JCL Reference,* GC24-5099
- *OS/VS1 Open/Close/EOV Logic,* SY26-3839
- *OS/VS1 Planning and Use Guide,* GC24-5090
- *OS/VS1 System Data Areas,* SY28-0605
- *OS/VS1 System Generation Reference,* GC26-3791
- *OS/VS1 Virtual Storage Access Method (VSAM) Logic,* SY26-3841
- *OS/VS Virtual Storage Access Method (VSAM) Programmer's Guide,* GC26-3838

How to Use This Book

You can use the macro specifications, coding examples, and how-to information in the chapter about catalog maintenance to code your own routines to add, delete, and update entries in the system catalog. This section contains data area layouts for and descriptions of the fields of all the control blocks that can appear in the system catalog.

If you want to read a data set control block, rename a data set, or delete a data set using the system macros, the chapter on maintaining the volume table of contents (VTOC) provides macro specifications, coding examples, and how-to information.

If you want to code your own channel programs to modify the control program or to provide support for unsupported I/O devices, the chapter on using EXCP provides detailed descriptions of which control blocks you must provide and the functions you must perform.

Macro specifications and how-to information are provided for using the XDAP macro instruction to read from and write to direct-access devices without using the access method routines (SAM, ISAM, or BDAM).

If you want to implement data set protection for your facility, the chapter on data set protection:

1. Tells how to build a PASSWORD data set.
2. Describes how the system control program responds to job control language and IEHPROGM utility statements in maintaining the PASSWORD data set.
3. Tells you how to use the PROTECT macro instruction to maintain (add records to, delete records from, changes records in) and read the PASSWORD data set.

The chapter on system macro instructions provides how-to information and macro specifications for:

1. Using system mapping macros to allow you to access system control blocks and work areas using symbolic names.
2. Examining device-type information in unit control blocks (UCBs).
3. Modifying a job file control block (JFCB) before opening a data set.
4. Removing queued requests and restoring requests to queues.
5. Protecting your data sets by verifying data extent blocks.

You can use the coding examples and how-to information in the last chapter to help you add a universal character set (UCS) image or a forms control buffer (FCB) image to the system image library (SYS1.IMAGELIB).

CONTENTS

FIGURES

SUMMARY OF AMENDMENTS

Release 5

New Programming Support

- The IBM 3800 Printing Subsystem is supported with this release. For additional programming information for the 3800 and the IEBIMAGE utility program, see *IBM 3800 Printing Subsystem Programmer's Guide,* GC26-3846. Information on the 3800 is provided for planning purposes only until the product is available.
- The IBM 3350 Direct Access Storage is supported with this release. For additional information on the 3350, see *Introduction to IBM 3350 Direct Access Storage,* GA26-1638. Information on the 3350 is provided for planning purposes only until the product is available.
- The IBM 3344 Direct Access Storage is supported with this release. For additional information on the 3344, see *Reference Manual for IBM 3340 Disk Storage,* GA26-1619. Information on the 3344 is provided for planning purposes only until the product is available.

Other Changes

The descriptions of the EXCPVR and IMGLIB macros, which were previously documented in *OS/VS1 Planning and Use Guide,* GC24-5090, are now documented in this manual.

Release 4

New Devices

- IBM 3850 Mass Storage System: Some restrictions are given for using the RDJFCB macro instruction if the data set resides on MSS virtual volumes. The DEVD code for MSS virtual volumes is provided. The MSS information contained in this publication is only for planning purposes until the product becomes available.

Release 3.1

- This update contains VTAM related changes to the PURG parameter list.

MAINTAINING THE OS/VS SYSTEM CATALOG

This chapter contains detailed information on how to maintain and modify the OS/VS system catalog.

More detailed information about the OS/VS catalog routines is available in *OS/VS1 Catalog Management Logic.*

Before using the information in this chapter, you should be familiar with the information contained in the following publications:

- *OS/VS - DOS/VS - VM/370 Assembler Language,* which contains information you will need in order to code programs in the assembler language.
- *OS/VS Data Management Services Guide,* which contains a general description of the structure of catalog indexes and generation data groups.
- *OS/VS Utilities,* which tells how to use utility programs to maintain the system catalog.
- *OS/VS1 JCL Services,* which tells how to catalog and uncatalog data sets using job control language statements.
- *OS/VS Virtual Storage Access Method (VSAM) Programmer's Guide, OS/VS1 Access Method Services,* and *OS/VS1 Virtual Storage Access Method (VSAM) Logic,* which gives information on VSAM master and user catalogs.

Introduction

The catalog management routines that maintain and modify the catalog are called by the assembler language macro instructions presented in this chapter. These macros are most commonly used by the system control program or the IEHPROGM utility, but you may use them in your own routines.

Catalog management is a component of the OS/VS system control program that is used for keeping track of data sets when a problem program provides only the name of a cataloged data set. The catalog, itself a system data set (DSNAME=SYSCTLG), contains data set names correlated with the volume identification (volume serial number) and device type.

The physical organization of the catalog is the same as that of a partitioned data set directory. It is formatted into 256-byte blocks, containing variable-length entries. Data area layouts and detailed descriptions of the fields of each entry are provided in Figures 1 through 9 at the end of this chapter.

The functions you can perform using the catalog management macro instructions are:

- Reading a block from the catalog.
- Building an index.
- Building a generation index.
- Deleting an index.
- Assigning an alias.
- Deleting an alias.

- Connecting control volumes.
- Disconnecting control volumes.
- Cataloging a data set.
- Removing data set references from the catalog.
- Recataloging a data set.

Specifications for coding the macro instructions are presented with each function to be performed. Accompanying the descriptions are coding examples and programming notes; exceptional-return condition codes follow the coding examples. In the functional descriptions, offsets into data areas are numbered from zero (the first byte is byte zero).

Reading a Block From the Catalog

To read an entry from the catalog, use the LOCATE and CAMLST macro instructions. You may specify the entry you want to read into your work area by using either (1) the fully or partially qualified name of a data set, or (2) the relative block address (TTR) of the block containing the entry. If you specify a fully qualified data set name, a list of volumes on which the data set resides will be read into your work area. This volume list always begins with a 2-byte entry that is the number of volumes in the list. If the data set resides on more than 20 volumes, the address of a volume control block will follow the volume list entries.

If you specify a partially qualified data set name, the first block in the catalog corresponding to the lowest-level index specified will be read into your work area.

If you specify a relative block address (TTR), the block at that relative address in the catalog will be read into your work area.

See Figures 1 through 9 for descriptions of the contents of the volume control block and the other catalog data areas.

Reading a Block by Data Set Name (LOCATE and CAMLST NAME)

When you specify a data set name and the named data set resides on five or fewer volumes, a volume list is built in your work area. A volume list consists of an entry for each volume on which part of the data set; it is preceded by a 2-byte field that contains a count of the number of volumes in the list. The count fields is followed by a variable number of 12-byte entries. Each 12-byte entry consists of a 4-byte device code, a 6-byte volume serial number, and a 2-byte data set sequence number.

If, however, the named data set resides on more than five volumes, a volume control block is read into your work area. A volume control block has essentially the same contents as a volume list, except that it can contain as many as 20 entries and can be linked to another volume control block (see Figure 6). The count field of each volume control block contains the remaining number of volume entries. For example, if a data set resides on 61 volumes, the count field would be decreased by 20 (61, 41, 21, 1) as you read each successive volume control block into your area. The first two bytes of the block contain the number of volume pointers for the data set. Each volume pointer is a 12-byte field that contains a 4-byte device code, a 6-byte volume serial number, and a 2-byte data set sequence number.

Device codes are presented in *OS/VS1 System Data Areas* in the section "The UCBTYP Field in the UCB."

If the named data set is stored on more than 20 volumes, bytes 252-254 of the block contain the relative track address of the next volume control block for the named data set; the last block has binary zeros in bytes 252-254. Byte 255 contains a binary zero.

If the named data set is stored on only one volume, bytes 242-243 of your area contain the relative track address of the DSCB for that data set; otherwise these bytes are zero. Byte 255 contains a binary zero.

The format is:

[*symbol*]	**LOCATE**	*list-addrx*
listname	**CAMLST**	**NAME**
		,*dsname-relexp*
		,[*cvol-relexp*]
		,*area-relexp*

list-addrx
points to the parameter list (labeled *listname*) CAMLST macro instruction.

NAME
this operand must be coded as shown in order to read a block from the catalog by name.

dsname-relexp
specifies the virtual storage location of a fully qualified data set name. The area that contains the name must be 44 bytes long. The name may be defined by a C-type define constant (DC) instruction.

cvol-relexp
specifies the virtual storage location of a 6-byte volume serial number for the volume to be processed. If this parameter is not specified, the system residence volume is processed.

area-relexp
specifies the virtual storage location of your 265-byte work area, which you must define. The work area must begin on a doubleword boundary. The first 256 bytes of the work area will contain a volume list or the volume control block that is read from the catalog, and the last 6 bytes will contain the serial number of the volume on which the block was found. If the data set resides on one volume, bytes 252-254 may contain the relative track address of the DSCB. This address is relative to the beginning of the VTOC.

Example: In the following example, the catalog entry containing a list of the volumes on which data set A.B resides is read into virtual storage. The search for the catalog entry starts on the system residence volume.

```
          LOCATE   INDAB
        Check Exceptional Returns
*                                        READ CATALOG ENTRY FOR
INDAB     CAMLST   NAME,AB,,LOCAREA     DATA SET A.B INTO
AB        DC       CL44'A.B'            VIRTUAL STORAGE AREA
*                                        NAMED LOCAREA.
LOCAREA   DS       0D                   LOCAREA ALSO CONTAINS
          DS       265C                 3-BYTE TTR AND 6-BYTE
*                                        SERIAL NUMBER
```

The LOCATE macro instruction points to the CAMLST macro instruction. NAME, the first operand of CAMLST, specifies that the system is to search the catalog for an entry using the name of a data set. AB, the second operand, specifies the virtual storage location of a 44-byte area into which you have placed the fully qualified name of a data set. LOCAREA, the fourth operand, specifies a 265-byte area you have reserved in virtual storage.

After execution of these macro instructions, the 265-byte area contains: a volume list or a volume control block for the data set A.B and the 6-byte serial number of the volume on which the entry was found (in bytes 259-264). If data set A.B resides on only one volume, bytes 252-254 of your area may contain the relative track address of the DSCB for data set A.B (relative to the beginning of the volume).

If a code of 4 is returned in register 15 indicating that the required control volume (CVOL) was not mounted, bytes 259-264 of the work area will contain the volume serial number of this required volume. If LOCATE finds an old CVOL pointer entry, and the CVOL is not mounted, binary zeros will be returned in bytes 252-255 of the work area. However, if a new CVOL pointer entry is found, the 4-byte device code of the CVOL will be returned in those bytes.

Control will be returned to your program at the next executable instruction after the LOCATE macro instruction. If the block has been successfully read from the catalog, register 15 will contain zeros. Otherwise, register 15 will contain one of the following exceptional return codes:

Code	Interpretation
4	Either the required control volume was not mounted, there is a closed chain of control volume pointers, or the specified volume does not contain a catalog data set (SYSCTLG). The work area contains the volume serial number (in bytes 259-264) and the device code of the volume, if available (in bytes 252-255). Your work area contains the last block that was searched.
8	The last entry found was a control volume pointer or one of the names of the qualified name was not found or an unidentified entry was found. Register 0 contains the number of the last valid name in the qualified name. For example, if the qualified name A.B.C.D were specified, but name C did not exist at the level specified, register 0 would contain the binary number 2. The work area contains the serial number of the volume containing the index (in bytes 259-264).*
12	Either an index or an alias was found when the list of qualified names was exhausted.* If an index pointer entry was found, the work area contains the first block of the specified index.
16	A data set resides at some level of the index other than the lowest index level specified. The work area contains the serial number of the volume containing the index in which a data set was found (in bytes 259-264).*
20	A syntax error exists in the name (for example, nine characters, a double delimiter, blank name field, or a qualified name when a simple name is needed).
24	A permanent I/O error was found when processing the catalog.
28	Relative track address (TTR) supplied to LOCATE is out of the SYSCTLG data set extents.*
32	Invalid work area pointer (for example, not a doubleword boundary).
48	Invalid parameter list. See CAMLSTD DSECT in *OS/VS1 Catalog Management Logic*.

* Register 0 contains the number of index levels that were searched before the failure was encountered.

Reading a Block by Generation Data Set Name (LOCATE and CAMLST NAME)

You specify the name of a generation data set by using the fully qualified generation index name and the relative generation number of the data set. The value of a relative generation number reflects the position of a data set in a generation data group. The following values can be used:

- **Zero**—specifies the latest data set cataloged in a generation data group.
- **Negative number**—specifies a data set cataloged before the latest data set.
- **Positive number**—specifies a data set not yet cataloged in the generation data group.

When you use zero or a negative number as the relative generation number, a volume list or volume control block (depending on whether these are more than five volumes in the data set) is read into virtual storage and the relative generation number is replaced by the absolute generation name.

When you use a positive number as the relative generation number, an absolute generation name is created and replaces the relative generation number. Nothing is read into your work area, because there are no entries in the catalog data sets.

The format is:

[*symbol*] *listname*	**LOCATE** **CAMLST**	*list-addrx* **NAME** *,dsname-relexp* *,[cvol-relexp]* *,area-relexp*

list-addrx
points to the parameter list (labeled *listname)* set up by the CAMLST macro instruction.

NAME
this operand must be coded as shown in order to read a block from the catalog by generation data set name.

dsname-relexp
specifies the virtual storage location of the name of the generation index and the relative generation number. The area that contains these must be 44 bytes long. The name may be defined by a C-type define constant (DC) instruction.

cvol-relexp
specifies the virtual storage location of a 6-byte volume serial number for the volume to be processed. If this parameter is not specified, the system residence volume is processed.

area-relexp
specifies the virtual storage location of your 265-byte work area, which you must define. The work area must begin on a doubleword boundary. The first 256 bytes of the work area will contain a volume list or the volume control block that is read from the catalog, and the last 6 bytes will contain the serial number of the volume on which the block was found. If the data set resides on one volume, bytes 252-254 may contain the relative track address of the DSCB. This address is relative to the beginning of the volume.

Example: In the following example, the list of volumes that contain generation data set A.PAY(-3) is read into virtual storage. The search for the catalog entry starts on the system residence volume.

```
          LOCATE  INDGX                 READ  CATALOG  ENTRY
*                                       FOR
        Check Exceptional Returns
INDGX     CAMLST  NAME,APAY,,LOCAREA    DATA SET APAY(-3) INTO
APAY      DC      CL44'A.PAY(-3)'       YOUR STORAGE AREA
*                                       NAMED LOCAREA.
LOCAREA   DS      0D                    LOCAREA ALSO CONTAINS
          DS      265C                  6-BYTE VOLUME SERIAL
*                                       NUMBER
```

The LOCATE macro instruction points to the CAMLST macro instruction. NAME, the first operand of CAMLST, specifies that the system is to search the catalog for a catalog entry by using the name of a data set. APAY, the second operand, specifies the virtual storage location of a 44-byte area into which you have placed the name of the generation index and the relative generation number of a data set in the generation data group. LOCAREA, the fourth operand, specifies a 265-byte area you have reserved to receive the catalog information.

After execution of these macro instructions, your 265-byte area contains: the catalog entry for generation data set A.PAY(-3) and the 6-byte serial number of the volume on which the block was found (in bytes 259-264). If data set A.PAY(-3) resides on one volume, bytes 252-254 of your area may contain the relative track address of the DSCB for that data set (relative to the beginning of the volume). In addition, the system will have replaced the relative generation number that you specified in your 44-byte area with the data set's absolute generation name. Control will be returned to your program at the next executable instruction after the LOCATE macro instruction. If the index block has been located and read successfully, register 15 will contain zeros. Otherwise, register 15 will contain one of the exceptional return codes described in the previous example.

Reading a Block by Alias (LOCATE and CAMLST NAME)

For each of the preceding functions, you can specify an alias as the first name in the qualified name of an index level, data set, or generation data set. Each function is performed exactly as previously described, with one exception: the alias name specified is replaced by the true name. Be aware, however, that if the true name of the data set is longer than the alias, the fully qualified name may exceed 44 characters.

The format is:

[*symbol*] *listname*	**LOCATE** **CAMLST**	*list-addrx* **NAME** *,dsname-relexp* *,[cvol-relexp]* *,area-relexp*

list-addrx
points to the parameter list (labeled *listname)* set up by the CAMLST macro instruction.

NAME
this operand must be coded as shown in order to read a block from the catalog by name.

dsname-relexp
specifies the virtual storage location of a fully qualified data set name, the first or only name of which is the alias. The area that contains the name must be 44 bytes long. The name may be defined by a C-type define constant (DC) instruction.

cvol-relexp
specifies the virtual storage location of a 6-byte volume serial number for the volume to be processed. If this parameter is not specified, the system residence volume is processed.

area-relexp
specifies the virtual storage location of your 265-byte work area, which you must define. The work area must begin on a doubleword boundary. The first 256 bytes of the work area will contain a volume list or the volume control block that is read from the catalog, and the last 6 bytes will contain the serial number of the volume on which the block was found. If the data set resides on one volume, bytes 252-254 may contain the relative track address of the DSCB. This address is relative to the beginning of the volume.

Example: In the following example, the catalog entry containing a list of the volumes on which data set A.B.C resides is read into virtual storage. (Data set A.B.C, however, is addressed by an alias name—X is an alias for A.) The search for the catalog entry starts on the system residence volume.

```
          LOCATE  INDAB                 READ  CATALOG  ENTRY
*                                       FOR
        Check Exceptional Returns
INDAB     CAMLST  NAME,ABC,,LOCAREA     DATA SET X.B.C INTO
ABC       DC      CL44'X.B.C.'          VIRTUAL STORAGE AREA
*                                       NAMED LOCAREA.
LOCAREA   DS      0C                    LOCAREA ALSO CONTAINS
          DS      265C                  3-BYTE TTR AND 6-BYTE
*                                       SERIAL NUMBER
```

The LOCATE macro instruction points to the CAMLST macro instruction. NAME, the first operand of CAMLST, specifies that the system is to search the catalog for an entry using the name of a data set. ABC, the second operand, specifies the virtual storage location of a 44-byte area into which you have placed the fully qualified name of a data set. (In this case, data set A.B.C is addressed by its alias X.B.C.) LOCAREA, the fourth operand, specifies a 265-byte area you have reserved in virtual storage.

After execution of these macro instructions, the 265-byte area contains: a volume list or a volume control block for the data set A.B.C and the 6-byte serial number of the volume on which the entry was found (in bytes 259-264). If data set A.B.C resides on only one volume, bytes 252-254 of your area may contain the relative track address of the DSCB for data set A.B.C (relative to the beginning of the volume).

If a code of 4 is returned in register 15 indicating that the required control volume (CVOL) was not mounted, bytes 259-264 of the work area will contain the volume serial number of this required volume. If LOCATE finds an old CVOL pointer entry, and the CVOL is not mounted, binary zeros will be returned in bytes 252-255 of the work area. However, if a new CVOL

pointer entry is found, the 4-byte device code of the CVOL will be returned in those bytes.

Reading a Block by Relative Block Address (LOCATE and CAMLST BLOCK)

You can read any block in the catalog by specifying, in the form TTR, the identification of the block and its location relative to the beginning of the catalog. TT is the number of tracks from the beginning of the catalog, R is the record number of the desired block on the track.

The format is:

[*symbol*] *listname*	**LOCATE** **CAMLST**	*list-addrx* **BLOCK** ,*ttr-relexp* ,[*cvol-relexp*] ,*area-relexp*

list-addrx
points to the parameter list (labeled *listname*) set up by the CAMLST macro instruction.

BLOCK
you must code this operand as shown.

ttr-relexp
specifies the virtual storage location of a 3-byte relative block address (TTR). This address indicates the position relative to the beginning of the catalog data set, of the track containing the block (TT), and the block identification (R) on that track.

cvol-relexp
specifies the virtual storage location of a 6-byte volume serial number for the volume to be processed. If this parameter is not specified, the system residence volume is processed.

area-relexp
specifies the virtual storage location of your 265-byte work area, which you must define. The work area must begin on a doubleword boundary. The first 256 bytes of the work area will contain the block that is read from the catalog, and the last 6 bytes will contain the serial number of the volume on which the block was found. If the data set resides on one volume, bytes 252-254 will contain the relative track address of the DSCB.

Example: In the following example, the block at the location indicated by TTR is read into virtual storage. The specified block is in the catalog on the system residence volume.

```
          LOCATE  BLK
        Check Exceptional Returns
BLK       CAMLST  BLOCK,TTR,,LOCAREA READ A BLOCK INTO
*                                   VIRTUAL STORAGE. AREA
*                                   NAMED LOCAREA
TTR       DC      H'5'              RELATIVE TRACK 5
          DC      X'03'             BLOCK 3 ON TRACK
LOCAREA   DS      0D                LOCAREA ALSO CONTAINS
          DS      265C              6-BYTE SERIAL NO.
```

The LOCATE macro instruction points to the CAMLST macro instruction. BLOCK, the first operand of CAMLST, specifies that the system is to search

the catalog for the block indicated by TTR, the second operand. LOCAREA, the fourth operand, specifies a 265-byte area you have reserved in virtual storage.

After execution of these macro instructions, the 265-byte area contains: the 256-byte block and the 6-byte serial number of the volume on which the block was found (in bytes 259-264).

Control will be returned to your program at the next executable instruction following the LOCATE macro instruction. If the index block at the address you specified has been successfully located and read into your work area, register 15 will contain zeros. Otherwise, register 15 will contain one of the exceptional return codes described with the first example in this section.

Building and Deleting Indexes

You handle indexes—build them, delete them, etc.—by using combinations of the INDEX and CAMLST macro instructions.

Building an Index (INDEX and CAMLST BLDX)

To build a new index structure and add it to the catalog, you may create each level of the index separately. (You can also create index levels while you are cataloging a data set onto those index levels. See "Cataloging When Index Levels Exist (CATALOG and CAMLST CAT)" and "Cataloging by Creating Required Index Levels (CATALOG and CAMLST BLDX).") To create each level of the index, use the INDEX and CAMLST macro instructions.

These two macro instructions can also be used to add index levels to existing index structures.

The format is:

[*symbol*] *listname*	**INDEX** **CAMLST**	*list-addrx* **BLDX** ,*namerelexp* ,[*cvol-relexp*]

list-addrx
points to the parameter list (labeled *listname*) set up by the CAMLST macro instruction.

BLDX
this operand must be coded as shown.

namerelexp
specifies the virtual storage location of the fully qualified name of a data set or index level. The name cannot exceed 44 characters. If the name is less than 44 characters, it must be followed by blanks. The name may be defined by a C-type define constant (DC) instruction.

cvol-relexp
specifies the virtual storage location of a 6-byte volume serial number for the volume to be processed. If this parameter is not specified, the system residence volume is processed.

Example: In the following example, index structure A.B.C is built on the control volume whose serial number is 000045.

```
          INDEX    INDEXA           BUILD  INDEX  A
        Check Exceptional Returns
          INDEX    INDEXB           BUILD  INDEX  STRUCTURE
*                                   A.B
        Check Exceptional Returns
          INDEX    INDEXC           BUILD  INDEX  STRUCTURE
*                                   A.B.C
        Check Exceptional Returns
INDEXA    CAMLST   BLDX,ALEVEL,VOLNUM
INDEXB    CAMLST   BLDX,BLEVEL,VOLNUM
INDEXC    CAMLST   BLDX,CLEVEL,VOLNUM
VOLNUM    DC       CL6'000045'      VOLUME SERIAL NUMBER
ALEVEL    DC       CL2'A'           INDEX STRUCTURE NAMES
BLEVEL    DC       CL4'A.B'         FOLLOWED BY A BLANK
CLEVEL    DC       CL6'A.B.C'       WHICH DELIMITS FIELDS
```

Each INDEX macro instruction points to an associated CAMLST macro instruction. BLDX, the first operand of CAMLST, specifies that an index level be built. The second operand specifies the virtual storage location of the area into which you have placed the fully qualified name of an index level. The third operand specifies the virtual storage location of the area into which you have placed the 6-byte serial number of the volume on which the index level is to be built.

Control will be returned to your program at the next executable instruction following the INDEX macro instruction. If the index has been built successfully, register 15 will contain zeros. Otherwise, register 15 will contain one of the following exceptional return codes:

Code	Interpretation
4	Either the required control volume was not mounted, or the specified volume does not contain a catalog data set (SYSCTLG).
8	The existing catalog structure is inconsistent with the operation performed. (Because the INDEX macro instruction uses the search routine of the LOCATE macro instruction, register 1 contains the condition code that would be given by the LOCATE macro instruction, and register 0 contains the number of index levels referred to during the search.)
12	An attempt was made to delete an index or generation index that has an alias or has indexes or data sets cataloged under it. The index is unchanged.
16	The qualified name specified when building an index or generation index implies an index structure that does not exist; the high level index, specified when connecting control volumes, does not exist.
20	Space is not available on the specified control volume.
24	Not used with the INDEX macro instruction.
28	A permanent I/O error was found when processing the catalog.
48	Invalid parameter list. See CAMLSTD DSECT in *OS/VS1 Catalog Management Logic.*
72	The VTOC of a DOS volume could not be converted to OS format.

Building a Generation Index (INDEX and CAMLST BLDG)

You build a generation index by using the INDEX and CAMLST macro instructions. All higher levels of the index must exist. If the higher levels of the index are not in the catalog, you must build them. How to build an index has been explained previously.

The format is:

[*symbol*] *listname*	**INDEX** **CAMLST**	*list-addrx* **BLDG** ,*namerelexp* ,[*cvol-relexp*] ,,**[DELETE]** ,**[EMPTY]** ,*number-absexp*

list-addrx
points to the parameter list (labeled *listname*) set up by the CAMLST macro instruction.

BLDG
this operand must be coded as shown.

namerelexp
specifies the virtual storage location of the fully qualified name of a data set or index level. The name cannot exceed 44 characters. If the name is less, it must be followed | by blanks. The name may be defined by a C-type define constant (DC) instruction.

cvol-relexp
specifies the virtual storage location of a 6-byte volume serial number for the volume to be processed. If this parameter is not specified, the system residence volume is processed.

DELETE
specifies that all data sets on direct-access volumes that are removed from a generation data group are to be deleted, that is, the space allocated to the data set(s) is to be made available for reallocation. A SCRATCH macro instruction will be issued by the catalog management routines to delete the data set, which will be deleted from the volume if there are no conditions preventing deletion (e.g., expiration date not passed, password not verified, volume not mounted, permanent I/O error encountered while trying to delete the data set).

EMPTY
specifies that references to all data sets in a generation data group cataloged in the generation index are to be removed from the index when the number of entries specified is exceeded.

number-absexp
specifies the number of data sets to be included in a generation data group. This number must be specified, and cannot exceed 255.

Example: In this example, generation index D is built on the control volume, serial number 000045. The higher level indexes A.B.C already exist. When the number of generation data sets in the generation index D exceeds four, the oldest data set is uncataloged. When the data set has been successfully uncataloged and the DELETE operand has been specified, the catalog management routines issue a SCRATCH macro (see "Maintaining the Volume Table of Contents") to delete the data set. If there are no conditions preventing the data set from being deleted (for example, the expiration date was not passed, the password could not be verified, or a permanent I/O error was encountered when trying to delete the data set), the data set will be deleted.

```
          INDEX   GENINDX           BUILD  GENERATION  INDEX
        Check Exceptional Returns
GENINDX   CAMLST  BLDG,DLEVEL,VOLNUM,,DELETE,,4
DLEVEL    DC      CL8'A.B.C.D'      ONE BLANK, DELIMITER
VOLNUM    DC      CL6'000045'
```

The INDEX macro instruction points to the CAMLST macro instruction. BLDG, operand of CAMLST, specifies that a generation index be built. DLEVEL specifies the virtual storage location of an area into which you have placed the fully qualified name of a generation index. VOLNUM specifies the virtual storage location of the area into which you have placed the 6-byte serial number of the volume on which the generation index is to be built. DELETE specifies that all data sets dropped from the generation data group are to be deleted. The final operand, 4, specifies the number of data sets that are to be maintained in the generation data group. Control will be returned to your program at the next executable instruction following the INDEX macro instruction. If the generation index was built successfully, register 15 contains zeros. Otherwise, register 15 will contain one of the exceptional return codes described under "Building an Index (INDEX and CAMLST BLDX)."

Deleting an Index (INDEX and CAMLST DLTX)

You can delete any number of index levels from an existing index structure. Each level of the index is deleted separately. Generation indexes are also removed this way. (You can also delete index levels automatically when they are no longer needed. See "Uncataloging a Data Set While Retaining Index Levels (CATALOG and CAMLST UNCAT)" and "Uncataloging a Data Set and Removing Index Levels (CATALOG and CAMLST UCATDX)" in this chapter for details). You delete each level of the index by using the INDEX and CAMLST macro instructions.

If an index level either has an alias, or has other index levels or data sets cataloged under it, it cannot be deleted.

The format is:

[*symbol*] *listname*	**INDEX** **CAMLST**	*list-addrx* **DLTX** ,*namerelexp* ,[*cvol-relexp*]

list-addrx
points to the parameter list (labeled *listname*) set up by the CAMLST macro instruction.

DLTX
this operand must be coded as shown.

namerelexp
specifies the virtual storage location of the fully qualified name of a data set or index level. The name cannot exceed 44 characters. If the name is less than 44 characters, it must be followed by blanks. The name may be defined by a C-type define constant (DC) instruction.

cvol-relexp
specifies the virtual storage location of a 6-byte volume serial number for the volume to be processed. If this parameter is not specified, the system residence volume is processed.

Example: In the following example, index level C is deleted from index structure A.B.C. The search for the index level starts on the system residence volume.

```
          INDEX    DELETE                DELETE  INDEX  LEVEL
*                                        C FROM INDEX STRUCTURE
*                                        A.B.C
        Check Exceptional Returns
DELETE    CAMLST   DLTX,LEVELC
LEVELC    DC       CL6'A.B.C'            ONE BLANK FOR
*                                        DELIMITER
```

The INDEX macro instruction points to the CAMLST macro instruction. DLTX, the first operand of CAMLST, specifies that an index level be deleted. LEVELC, the second operand, specifies the virtual storage location of the area into which you have placed the fully qualified name of the index structure whose lowest level is to be deleted. Control will be returned to your program at the next executable instruction following the INDEX macro instruction. If the index level(s) was successfully deleted, register 15 contains zeros. Otherwise, register 15 contains one of the exceptional return codes described in "Building an Index (INDEX and CAMLST BLDX)."

Assigning an Alias for an Index (INDEX and CAMLST BLDA)

You assign an alias to an index level by using the INDEX and CAMLST macro instructions. An alias can be assigned only to a high level index; e.g., index A of index structure A.B.C can have an alias, but index B cannot. Assigning an alias to a high level index effectively provides aliases for all data sets cataloged under that index. An alias cannot be assigned to a generation index with only one level.

The format is:

[*symbol*] *listname*	**INDEX** **CAMLST**	*list-addrx* **BLDA** ,*index namerelexp* ,[*cvol-relexp*] ,*alias namerelexp*

list-addrx
points to the parameter list (labeled *listname*) set up by the CAMLST macro instruction.

BLDA
this operand must be coded as shown.

index namerelexp
specifies the virtual storage location of the name of a high-level index. The area that contains the name must be 8 bytes long. The name may be defined by a C-type define constant (DC) instruction.

cvol-relexp
specifies the virtual storage location of a 6-byte volume serial number for the volume to be processed. If this parameter is not specified, the system residence volume is processed.

alias namerelexp
specifies the virtual storage location of the name that is to be used as an alias for a high-level index. The area that contains the name must be 8 bytes long. The name may be defined by a C-type define constant (DC) instruction.

Example: In the following example, index level A is assigned an alias of X. The search for the index level starts on the system residence volume.

```
          INDEX   ALIAS                 BUILD  AN  ALIAS  FOR
*                                       A HIGH LEVEL INDEX
        Check Exceptional Returns
ALIAS     CAMLST  BLDA,DSNAME,,DSALIAS
DSNAME    DC      CL8'A'                MUST BE 8-BYTE FIELDS
DSALIAS   DC      CL8'X'
```

The INDEX macro instruction points to the CAMLST macro instruction. BLDA, the first operand of CAMLST, specifies that an alias be built. DSNAME, the second operand, specifies the virtual storage location of an 8-byte area into which you have placed the name of the high-level index to be assigned an alias. DSALIAS, the fourth operand, specifies the virtual storage location of an 8-byte area into which you have placed the alias to be assigned.

Control will be returned to your program at the next executable instruction following the INDEX macro instruction. If the alias has been successfully assigned, register 15 will contain zeros. Otherwise, register 15 will contain one of the exceptional return codes described in "Building an Index (INDEX and CAMLST BLDX)."

Deleting an Alias for an Index (INDEX and CAMLST DLTA)

You can delete an alias previously assigned to a high level index by using the INDEX and CAMLST macro instructions.

The format is:

[*symbol*] *listname*	**INDEX** **CAMLST**	*list-addrx* **DLTA** ,*alias namerelexp* ,[*cvol-relexp*]

list-addrx
points to the parameter list (labeled *listname*) set up by the CAMLST macro instruction.

DLTA
this operand must be coded as shown.

alias namerelexp
specifies the virtual storage location of the name that is to be used as an alias for a high-level index. The area that contains the name must be 8 bytes long. The name may be defined by a C-type define constant (DC) instruction.

cvol-relexp
specifies the virtual storage location of a 6-byte volume serial number for the volume to be processed. If this parameter is not specified, the system residence volume is processed.

Example: In the following example, alias X, previously assigned as an alias for index level A, is deleted. The search for the alias starts on the system residence volume.

```
         INDEX   DELALIAS              DELETE AN ALIAS FOR
*                                      A HIGH LEVEL INDEX
      Check Exceptional Returns
DELALIAS CAMLST  DLTA,ALIAS
ALIAS    DC      CL8'X'                MUST BE 8-BYTE FIELD
```

The INDEX macro instruction points to the CAMLST macro instruction. DLTA, the first operand of CAMLST, specifies that an alias be deleted. ALIAS, the second operand, specifies the virtual storage location of the 8-byte area into which you have placed the alias to be deleted.

Connecting and Disconnecting Control Volumes

You connect and disconnect control volumes by using combinations of the INDEX and CAMLST macro instructions.

Connecting Control Volumes (INDEX and CAMLST LNKX)

You connect two control volumes (CVOLs) by using the INDEX AND CAMLST macro instructions. If a control volume is to be connected to the system residence volume, you need supply only the serial number of the volume to be connected and the name of a high level-index associated with the volume to be connected.

If a control volume is to be connected to a control volume other than the system residence volume, you must supply the serial numbers of both volumes and the name of a high-level index associated with the volume to be connected.

The result of connecting control volumes is that the volume serial number of the control volume connected and the name of a high-level index are entered into the volume index of the volume to which it was connected. This entry is called a control volume pointer.

The format is:

[*symbol*] *listname*	**INDEX** **CAMLST**	*list-addrx* **LNKX** ,*index namerelexp* ,[*cvol-relexp*] ,*new cvol-relexp*

list-addrx
points to the parameter list (labeled *listname*) set up by the CAMLST macro instruction.

LNKX
this operand must be coded as shown.

index namerelexp
specifies the virtual storage location of the name of a high-level index. The area that contains the name must be 8 bytes long. The name may be defined by a C-type define constant (DC) instruction.

cvol-relexp
specifies the virtual storage location of a 6-byte volume serial number for the volume to be processed. If this parameter is not specified, the system residence volume is processed.

new cvol-relexp
specifies the virtual storage location of the 4-byte device code and 6-byte volume serial number of the control volume that is to be connected to another control volume.

Example: In the following example, the control volume whose serial number is 001555 is connected to the control volume numbered 000155. The name of the high-level index is HIGHINDX.

```
          INDEX   CONNECT              CONNECT  TWO  CONTROL
*                                      VOLUMES

        Check Exceptional Returns

CONNECT   CAMLST  LNKX,INDXNAME,OLDCVOL
*                                      WHOSE SERIAL NUMBERS
INDXNAME  DC      CL8'HIGHINDX'        ARE 000155 AND 001555.
OLDCVOL   DC      CL6'000155'
NEWCVOL   DC      X'30C02008'          2314 DISK DEVICE CODE
          DC      CL6'001555'
```

The INDEX macro instruction points to the CAMLST macro instruction. LNKX, the first operand of CAMLST, specifies that control volumes be connected. INDXNAME, the second operand, specifies the virtual storage location of the 8-byte area into which you have placed the name of the high-level index of the volume to be connected. OLDCVOL, the third operand, specifies the virtual storage location of a 6-byte area into which you have placed the serial number of the volume to which you are connecting. NEWCVOL, the fourth operand, specifies the virtual storage location of a 10-byte area into which you have placed the 4-byte binary device code of the volume to be connected followed by the 6-byte area to contain the volume serial number of the volume to be connected.

Control will be returned to your program at the next executable instruction following the INDEX macro instruction. If the control volumes have been successfully connected, register 15 will contain zeros. Otherwise, register 15 will contain one of the exceptional return codes described in the section "Building an Index (INDEX and CAMLST BLDX)."

Disconnecting Control Volumes (INDEX and CAMLST DRPX)

You disconnect two control volumes by using the INDEX and CAMLST macro instructions. If a control volume is to be disconnected from the system residence volume, you need supply only the name of the high-level index associated with the volume to be disconnected.

If a control volume is to be disconnected from a control volume other than the system residence volume, you must supply, in addition to the name of the high-level index, the serial number of the control volume from which you want to disconnect.

The result of disconnecting control volumes is that the control volume pointer is removed from the volume index of the volume from which you are disconnecting.

The format is:

[*symbol*] *listname*	**INDEX** **CAMLST**	*list-addrx* **DRPX** ,*index namerelexp* ,[*cvol-relexp*]

list-addrx
points to the parameter list (labeled *listname*) set up by the CAMLST macro instruction.

DRPX
this operand must be coded as shown.

index namerelexp
specifies the virtual storage location of the name of a high-level index. The area that contains the name must be 8 bytes long. The name may be defined by a C-type define constant (DC) instruction.

cvol-relexp
specifies the virtual storage location of a 6-byte volume serial number for the volume to be processed. If this parameter is not specified, the system residence volume is processed.

Example: In the following example, the control volume that contains the high-level index HIGHINDX is disconnected from the system residence volume.

```
         INDEX   DISCNECT              DISCONNECT  TWO
*                                      CONTROL VOLUMES
      Check Exceptional Returns
DISCNECT CAMLST  DRPX,INDXNAME
INDXNAME DC      CL8'HIGHINDX'         MUST BE 8-BYTE FIELD
```

The INDEX macro instruction points to the CAMLST macro instruction. DRPX, the first operand of CAMLST, specifies that control volumes be disconnected. INDEXNAME, the second operand, specifies the virtual storage location of the 8-byte area into which you have placed the name of the high-level index of the control volume to be disconnected.

Control will be returned to your program at the next executable instruction following the INDEX macro instruction. If the control volumes were successfully disconnected, register 15 will contain zeros. Otherwise, register 15 will contain one of the exceptional return codes described in the section "Building an Index (INDEX and CAMLST BLDX)."

Working with Data Set Catalogs

You catalog, uncatalog, and recatalog data sets by using combinations of the CATALOG and CAMLST macro instructions.

When you catalog a data set, the CATALOG macro instruction points to the CAMLST macro instruction; parameters of the CAMLST macro instruction specify the options for cataloging a data set. When the CAT parameter is used, all index levels required to catalog the data set must exist in the catalog. The index structure need not exist when the CATBX parameter is used; any missing index levels are automatically created. CATBX does not apply to generation indexes.

You must build a complete volume list in virtual storage. This volume list consists of an entry for each volume on which the data set is stored. The first two bytes of the list indicate the number of entries in the volume list; the number cannot be zero. Each 12-byte volume list entry consists of a 4-byte device code, a 6-byte volume serial number, and a 2-byte data set sequence number. The sequence number is always zero for direct-access volumes.

Device codes are presented in *OS/VS1 System Data Areas* in the section "The UCBTYP Field in the UCB."

When you uncatalog or recatalog a data set, you use CATALOG and CAMLST in much the same way they are used in cataloging.

Cataloging a Data Set When Index Levels Exist (CATALOG and CAMLST CAT)

When the index levels already exist for a data set, you can use the CAT parameter of the CAMLST macro instruction to catalog the data set. Missing index levels cause an exceptional return code to be set.

The format is:

[*symbol*] *listname*	**CATALOG** **CAMLST**	*list-addrx* **CAT** ,*namerelexp* ,[*cvol-relexp*] ,*vol list-relexp* ,[**DSCBTTR=***dscb ttr-relexp*]

list-addrx
points to the parameter list (labeled *listname*) set up by the CAMLST macro instruction.

CAT
this operand must be coded as shown.

namerelexp
specifies the virtual storage location of the fully qualified name of a data set or index level. The name cannot exceed 44 characters. If the name is less than 44 characters, it must be followed by blanks. The name may be defined by a C-type define constant (DC) instruction.

cvol-relexp
specifies the virtual storage location of a 6-byte volume serial number for the volume to be processed. If this parameter is not specified, the system residence volume is processed.

vol list-relexp
specifies the virtual storage location of an area that contains a volume list. The area must begin on a half-word boundary.

DSCBTTR= *dscb ttr-relexp*
specifies the virtual storage location of the 3-byte relative block address (TTR) of the format-1 data set control block (DSCB) for a data set that resides on only one volume. The address is relative to the beginning of the volume.

Example: In the following example, the data set named A.B.C is cataloged under an existing index structure A.B. The data set is stored on two volumes.

```
          CATALOG   ADDABC         CATALOG DATA SET A.B.C.
*                                  THE INDEX STRUCTURE A.B
*                                  EXISTS
          Check Exceptional Returns
ADDABC    CAMLST    CAT,DSNAME,,VOLUMES
DSNAME    DC        CL6'A.B.C'     ONE BLANK FOR DELIMITER
VOLUMES   DC        H'2'           DATA SET ON TWO VOLUMES
          DC        X'30C02008'    2314 DISK DEVICE CODE
          DC        CL6'000014'    VOLUME SERIAL NUMBER
          DC        H'0'           DATA SET SEQUENCE
*                                  NUMBER
          DC        X'30C02008'    2314 DISK DEVICE CODE
          DC        CL6'000015'    VOLUME SERIAL NUMBER
          DC        H'0'           SEQUENCE NUMBER
```

The CATALOG macro instruction points to the CAMLST macro instruction. CAT, the first operand of CAMLST, specifies that a data set be cataloged. DSNAME, the second operand, specifies the virtual storage location of the area into which you have placed the fully qualified name of the data set to be cataloged. VOLUMES, the fourth operand, specifies the virtual storage location of the volume list you have built.

Control will be returned to your program at the next executable instruction following the CATALOG macro instruction. If your data set has been successfully cataloged, register 15 will contain zeros. Otherwise, register 15 will contain one of the following exceptional return codes.

Code	Interpretation
4	Specifies one of the following: • The required control volume was not mounted. • The specified volume does not contain a catalog data set (SYSCTLG). • An attempt was made to uncatalog a qualified data set name for which there is no index structure.
8	The existing catalog structure is inconsistent with the operation performed or an attempt was made to uncatalog a data set that is not in the catalog. (Because the CATALOG macro instruction uses the SEARCH option of the LOCATE macro instruction, register 1 contains the return code that would be returned by the LOCATE macro instruction. See the exceptional return considered as a result of the execution of a LOCATE macro under "Reading a Block from the Catalog." Register 0 contains the number of the index levels referred to before the exception was noted.)
12	Not used with the CATALOG macro instruction.
16	The index structure necessary to catalog the data set does not exist.
20	Space is not available on the specified control volume.
24	An attempt was made to catalog an improperly named generation data set, or the generation index is full and the named data set is older than any currently in the index.

Code	Interpretation
28	A permanent I/O error was encountered when processing the catalog.
48	Invalid parameter list. See CAMLSTD DSECT in *OS/VS1 Catalog Management Logic.*
72	The VTOC of a DOS volume could not be converted to OS format.

Cataloging a Data Set by Creating Required Index Levels (CATALOG and CAMLST CATBX)

When index levels are missing, you can use the CATBX parameter of the CAMLST macro instruction to automatically create them before cataloging the data set.

The format is:

[*symbol*]	**CATALOG**	*list-addrx*
listname	**CAMLST**	**CATBX**
		,*namerelexp*
		,[*cvol-relexp*]
		,*vol list-relexp*
		,[**DSCBTTR**=*dscb ttr-relexp*]

list-addrx
points to the parameter list (labeled *listname*) set up by the CAMLST macro instruction.

CATBX
this operand must be coded as shown.

namerelexp
specifies the virtual storage location of the fully qualified name of a data set or index level. The name cannot exceed 44 characters. If the name is less than 44 characters, it must be followed by blanks. The name may be defined by a C-type define constant (DC) instruction.

cvol-relexp
specifies the virtual storage location of a 6-byte volume serial number for the volume to be processed. If this parameter is not specified, the system residence volume is processed.

vol list-relexp
specifies the virtual storage location of an area that contains a volume list. The area must begin on a half-word boundary.

DSCBTTR= *dscb ttr-relexp*
specifies the virtual storage location of the 3-byte relative block address (TTR) of the identifier (format-1) DSCB for a data set that resides on only one volume. The block address is relative to the beginning of the volume.

Example: In the following example, the index structure A.B is created and data set A.B.C is cataloged. The data set is stored on one volume.

```
          CATALOG CTBXABC          CATALOG  DATA  SET  A.B.C.
*                                  CREATE NEEDED INDEX
*                                  LEVELS
        Check Exceptional Returns
CTBXABC   CAMLST  CATBX,DSNAME,,VOLUMES,DSCBTTR=TTR
DSNAME    DC      CL6'A.B.C'     ONE BLANK FOR
VOLUMES   DC      H'1'           DELIMITER ONE VOLUME
          DC      X'30C02008'    2314 DISK DEVICE CODE
          DC      CL6'000015'    VOLUME SERIAL NUMBER
          DC      H'0'           DATA SET SEQUENCE
TTR       DC      XL3'000103'    NUMBER TTR OF DSCB
*                                RELATIVE TO BEGINNING
*                                OF VOLUME
```

The CATALOG macro instruction points to the CAMLST macro instruction. CATBX, the first operand of CAMLST, specifies that a data set is to be cataloged and any required higher level indexes are to be created. DSNAME, the second operand, specifies the virtual storage location of an area into which you have placed the fully qualified name of the data set to be cataloged. VOLUMES, the fourth operand, specifies the virtual storage location of the volume list you have built. DSCBTTR=TTR, the fifth operand, specifies the virtual storage location into which you have placed the relative track address of the DSCB for the data set to be cataloged. The DSCBTTR operand is optional and is ignored for data sets residing on more than one volume.

Control will be returned to your program at the next executable instruction following the CATALOG macro instruction. If the index levels have been successfully created, register 15 will contain zeros. Otherwise, register 15 will contain one of the exceptional return codes described in the previous example.

Uncataloging a Data Set While Retaining Index Levels (CATALOG and CAMLST UNCAT)

When the UNCAT operand of the CAMLST macro instruction is used, a data set reference is removed, but all index levels are retained.

The format is:

[*symbol*] *listname*	**CATALOG** **CAMLST**	*list-addrx* **UNCAT** ,*namerelexp* ,[*cvol-relexp*]

list-addrx
points to the parameter list (labeled *listname*) set up by the CAMLST macro instruction.

UNCAT
this operand must be coded as shown.

namerelexp
specifies the virtual storage location of the fully qualified name of a data set or index level. The name cannot exceed 44 characters. If the name is less than 44 characters, it must be followed by blanks. The name may be defined by a C-type define constant (DC) instruction.

cvol-relexp
specifies the virtual storage location of a 6-byte volume serial number for the volume to be processed. If this parameter is not specified, the system residence volume is processed.

In the following example, references to data set A.B.C are removed from the catalog.

```
         CATALOG REMOVE                REMOVE REFERENCES TO
*                                      DATA SET A.B.C FROM
*                                      CATALOG
        Check Exceptional Returns
REMOVE   CAMLST  UNCAT,DSNAME
DSNAME   DC      CL6'A.B.C'            ONE BLANK FOR
*                                      DELIMITER
```

The CATALOG macro instruction points to the CAMLST macro instruction. UNCAT specifies that references to a data set be removed from the catalog. DSNAME specifies the virtual storage location of the area into which you have placed the fully qualified name of the data set whose references are to be removed.

Uncataloging a Data Set and Removing Index Levels (CATALOG and CAMLST UCATDX)

When the UCATDX operand of the CAMLST macro instruction is used, a data set reference and unneeded indexes, with the exception of the highest-level index, are removed from the catalog.

The format is:

[*symbol*] *listname*	**CATALOG** **CAMLST**	*list-addrx* **UCATDX** ,*namerelexp* ,[*cvol-relexp*]

list-addrx
points to the parameter list (labeled *listname*) set up by the CAMLST macro instruction.

UCATDX
this operand must be coded as shown.

namerelexp
specifies the virtual storage location of the fully qualified name of a data set or index level. The name cannot exceed 44 characters. If the name is less than 44 characters, it must be followed by blanks. The name may be defined by a C-type define constant (DC) instruction.

cvol-relexp
specifies the virtual storage location of a 6-byte volume serial number for the volume to be processed. If this parameter is not specified, the system residence volume is processed.

Example: In the following example, references to data set A.B.C are removed from the catalog. Index B is removed unless it contains references to other data sets. Index A remains because it is the highest-level index.

```
          CATALOG RMDSNNDX          REMOVE  REFERENCES TO DATA
*                                   SET A.B.C FROM CATALOG
          Check Exceptional Returns
RMDSNNDX  CAMLST  UCATDX,DSNAME     AND REMOVE UNNEEDED
*                                   INDEXES
DSNAME    DC      CL6'A.B.C'        ONE BLANK FOR
*                                   DELIMITER
```

The CATALOG macro instruction points to the CAMLST macro instruction. UCATDX, the first operand, specifies that references to a data set be removed from the catalog. DSNAME, the second operand, specifies the virtual storage location of the area into which you have placed the fully qualified name of the data set whose references are to be removed.

Control will be returned to your program at the next executable instruction following the CATALOG macro instruction. If the data set has been successfully uncataloged and its related index levels removed, register 15 will contain zeros. Otherwise, register 15 will contain one of the exceptional return codes described in the section titled "Cataloging a Data Set When Index Levels Exist (CATALOG and CAMLST CAT)."

Recataloging a Data Set (CATALOG and CAMLST RECAT)

You recatalog a cataloged data set by using the CATALOG and CAMLST macro instructions. Usually, a data set is recataloged when a new volume is added to the data set.

As in the original cataloging procedure, you must build a complete volume list in virtual storage. This volume list consists of an entry for each volume on which the data set resides. The first 2 bytes of the list indicate the number of entries in the list; the number may not be zero. Each 12-byte volume pointer consists of a 4-byte device code, a 6-byte volume serial number, and a 2-byte data set sequence number. The sequence number is always zero for direct-access volumes.

Device codes are presented in *OS/VS1 System Data Areas* in the section "The UCBTYP Field in the UCB."

The format is:

[*symbol*] *listname*	**CATALOG** **CAMLST**	*list-addrx* **RECAT** ,*namerelexp* ,[*cvol-relexp*] ,*vol list-relexp* ,[**DSCBTTR=** *dscb ttr-relexp*]

list-addrx
points to the parameter list (labeled *listname*) set up by the CAMLST macro instruction.

RECAT
this operand must be coded as shown.

namerelexp
specifies the virtual storage location of the fully qualified name of a data set or index level. The name cannot exceed 44 characters. If the name is less than 44 characters, it must be followed by blanks. The name may be defined by a C-type define constant (DC) instruction.

cvol-relexp
specifies the virtual storage location of a 6-byte volume serial number for the volume to be processed. If this parameter is not specified, the system residence volume is processed.

vol list-relexp
specifies the virtual storage location of an area that contains a volume list. The area must begin on a half-word boundary.

DSCBTTR= *dscb ttr-relexp*
specifies the virtual storage location of the 3-byte relative track address (TTR) of the identifier (format-1) DSCB for a data set that resides on only one volume. The address is relative to the beginning of the volume.

Example: In the following example, the two-volume data set named A.B.C is recataloged to add a third volume. An entry is added to the volume list, which previously contained only two entries.

```
          CATALOG RECATLG              RECATALOG  DATA  SET
*                                      A.B.C ADDING A NEW
*                                      VOLUME

        Check Exceptional Returns

RECATLG   CAMLST  RECAT,DSNAME,,VOLUMES
DSNAME    DC      CL6'A.B.C'           POINTER TO THE VOLUME
*                                      LIST.
VOLUMES   DC      H'3'                 FOR DELIMITER ONE
*                                      BLANK THREE VOLUMES.
          DC      X'30C02008'          2314 DISK DEVICE CODE
          DC      CL6'000014'          VOLUME SERIAL NUMBER
          DC      H'0'                 SEQUENCE NUMBER
          DC      X'30C02008'          2314 DISK DEVICE CODE
          DC      CL6'000015'          VOLUME SERIAL NUMBER
          DC      H'0'                 SEQUENCE NUMBER
          DC      X'30C02008'          2314 DISK DEVICE CODE
          DC      CL6'000016'          VOLUME SERIAL NUMBER
          DC      H'0'                 SEQUENCE NUMBER
```

The CATALOG macro instruction points to the CAMLST macro instruction. RECAT, the first operand of CAMLST, specifies that a data set be recataloged. DSNAME, the second operand, specifies the virtual storage location of an area into which you have placed the fully qualified name of the data set to be recataloged. VOLUMES, the fourth operand, specifies the virtual storage location of the volume list you have built.

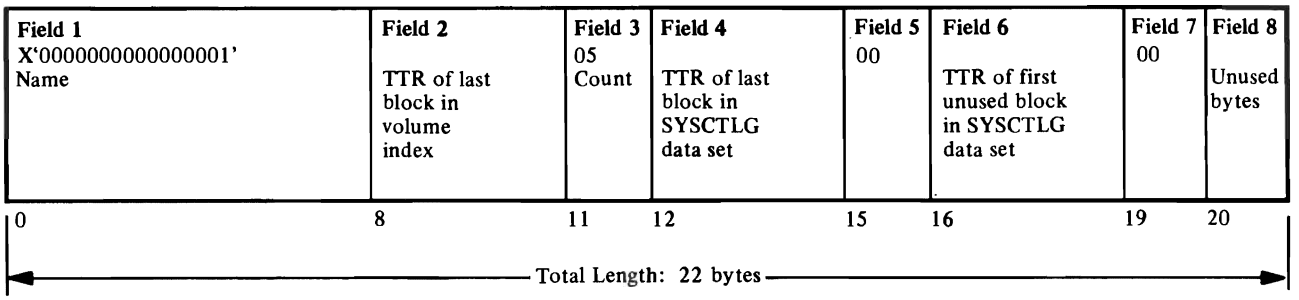
In this example, the entry for the new volume is added to the existing data set pointer entry by replacing the old volume list with the new volume list. If the total number of volumes in the data set had been increased to six or more, the data set pointer entry would have been replaced with a volume control block, which would contain an entry for each volume of the data set.

Control is returned to your program at the next executable instruction following the CATALOG macro instruction. If the data set has been successfully recataloged, register 15 will contain zeros. Otherwise, register 15 will contain one of the exceptional return codes described in the section "Cataloging a Data Set When Index Levels Exist (CATALOG and CAMLST CAT)."

Catalog Block Entries

This section describes the format and contents of each of the entries that may appear in the catalog.

Volume Index Control Entry



The volume index control entry contains information about the entire catalog and the volume index. It is always the first entry in the catalog. It is 22 bytes long and contains eight fields.

Field 1: Name (8 bytes)—contains only a binary one to ensure that this entry is the first entry in the first block of the index.

Field 2: Last-block address (3 bytes)—contains the relative track address (TTR) of the last block in the volume index.

Field 3: Halfword count (1 byte)—contains a binary five to indicate that five halfwords follow.

Field 4: Catalog upper limit (3 bytes)—contains the relative track address (TTR) of the last block in the catalog data set.

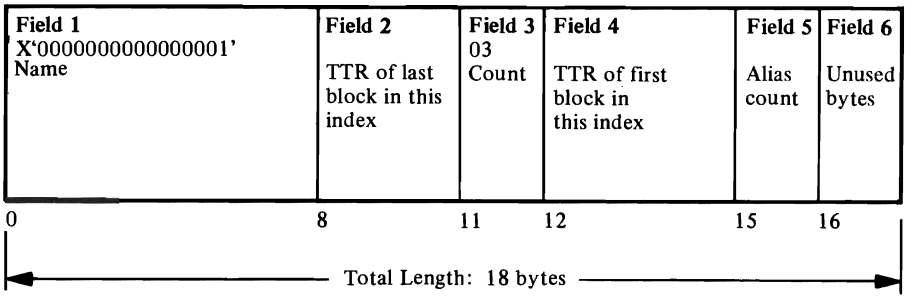
Field 5: Zero field (1 byte)—contains binary zeros.

Field 6: First-available-block address (3 bytes)—contains the relative track address (TTR) of the unused block in the catalog that is closest to the beginning of the catalog data set.

Field 7: Zero field (1 byte)—contains binary zeros.

Field 8: Unused (2 bytes)

Figure 1. The Volume Index Control Entry



This index control entry is quite similar to a volume index control entry, but it only contains information about the index, which it begins. It is 18 bytes long and contains six fields.

Field 1: Name (8 bytes)—contains only a binary one to ensure that this entry, because it has the lowest binary name value, is the first entry in the first block of the index.

Field 2: Last block address (3 bytes)—contains the relative track address (TTR) of the last block assigned to this index.

Field 3: Halfword count (1 byte)—contains a binary three to indicate that 3 halfwords follow.

Field 4: Index lower limit (3 bytes)—contains the relative track address (TTR) of the block in which this entry appears.

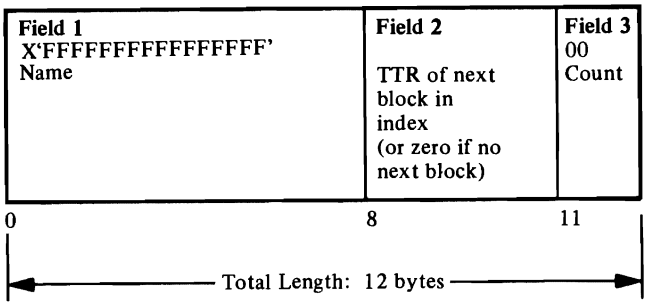
Field 5: Number of aliases (1 byte)—contains the binary count of the number of aliases assigned to the index. If the index is not a high level index, this field is zero.

Field 6: Unused (2 bytes)

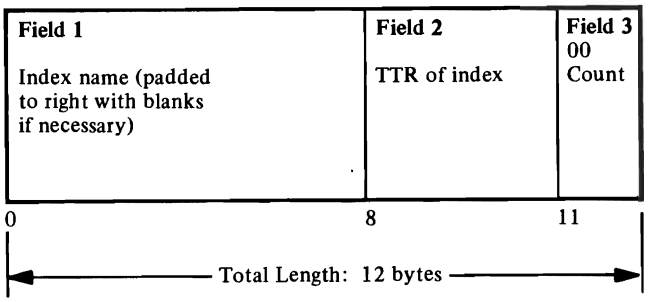
Figure 2. The Index Control Entry

Index Link Entry and Index Pointer Entry

Index Link Entry



Index Pointer Entry



The index link and index pointer entries are quite similar. An index link entry is used to chain several blocks of an index together, and an index pointer entry is used to chain an index to the next lower level index. An index link entry is always the last entry in any index block. These blocks contain three fields and are 12 bytes long.

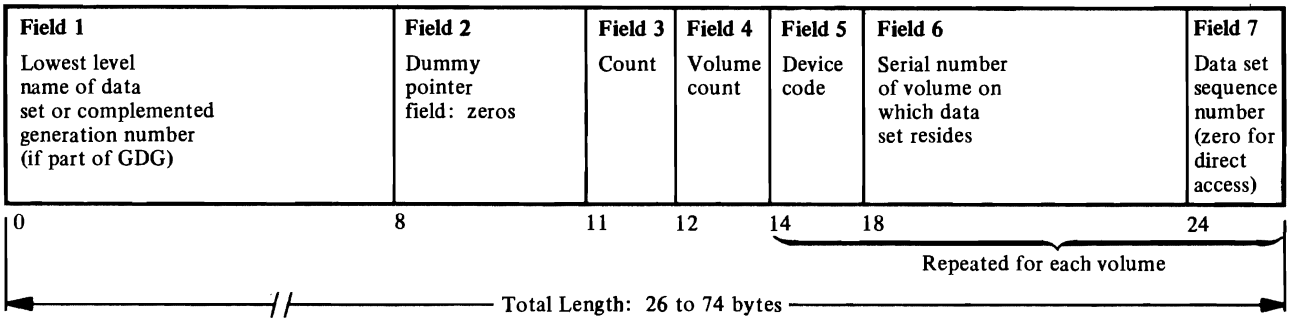
Field 1: Name (8 bytes)—contains the name of the index to which this entry points. If the entry is an index link entry, the name field contains X'FF FF FF FF FF FF FF FF'.

Field 2: Address (3 bytes)—contains either the relative block address (TTR) of th first block of the index if it is an index pointer entry, or the relative block address (TTR) of the next block of the index if it is an index link entry.

Field 3: Halfword count (1 byte)—contains 1 byte of binary zeros to indicate that the entry ends here.

Figure 3. The Index Link and Index Pointer Entries

Data Set Pointer Entry



The data set pointer entry can appear in any index. It contains the simple name of a data set and from one to five 12-byte fields, each of which identifies a volume on which the named data set resides. If the data set resides on more than five volumes, a volume control block pointer entry is substituted for the data set pointer entry. A volume control block pointer entry points to a volume control block or chain of volume control blocks that point to the volumes that contain the data set.

The data set pointer entry varies in length. The length is determined by the formula 14 + 12m, where m is the number of volumes containing the data set. The variable m can be from one to five. The data set pointer entry can appear in any index, and it contains five fields.

Field 1: Name (8 bytes)—contains the simple name of the data set whose volumes are identified in field 5.

Field 2: DSCB TTR (3 bytes)—contains the track address (TTR) of the data set control block if the data set resides on one volume. If the data set resides on more than one volume, this field contains binary zeros.

Field 3: Halfword count (1 byte)—contains the binary count of the number of halfwords that follow. The number is found by the formula 6m + 1, where m is the number of volumes on which the data set resides. The variable m can be from one to five.

Field 4: Volume count (2 bytes)—contains the binary count of the number of volumes identified in field 5 of this entry.

Field 5: Device code (4 bytes)—contains the device code of the device on which the volume with the volume serial number in field 6 can be mounted.

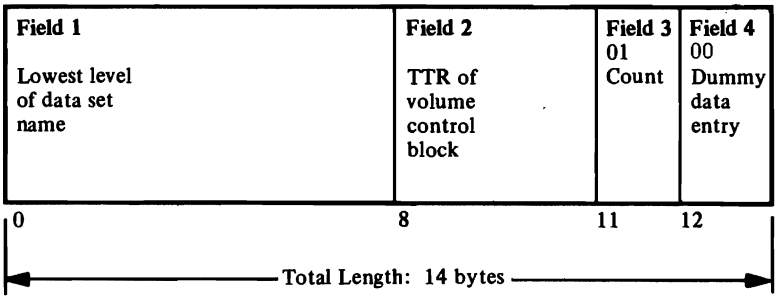
Device codes are presented in *OS/VS1 System Data Areas* in the section "The UCBTYP Field in the UCB."

Field 6: Volume serial number (6 bytes)—contains the volume serial number of one of the volumes of the data set.

Field 7: Volume sequence number (2 bytes)—contains the sequence number of the data set on a magnetic tape volume. It is zero for any other device class.

Figure 4. The Data Set Pointer Entry

Volume Control Block Pointer Entry



The volume control block pointer entry is used instead of a data set pointer entry when the data set resides on more than five volumes. This entry points to a volume control block, which, in turn, describes the data set. The entry is 14 bytes long.

Field 1: Name (8 bytes)—contains the last name of the qualified name of the data set identified by this entry.

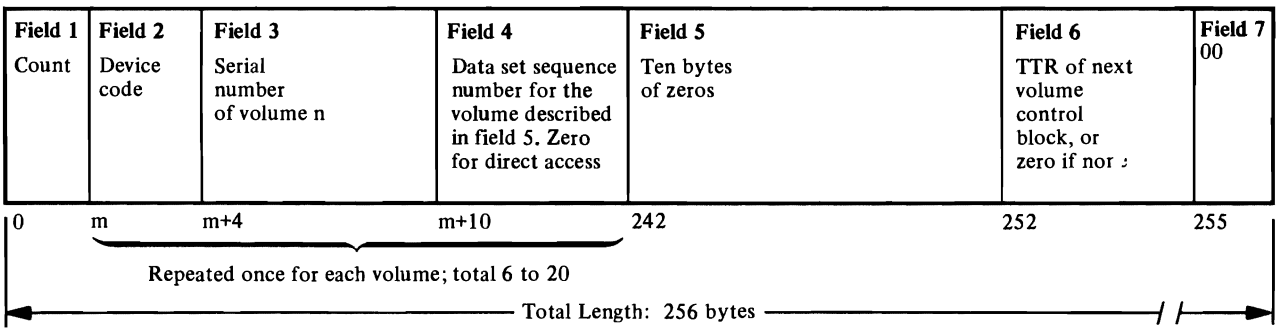
Field 2: Address (3 bytes)—contains the relative block address (TTR) of the volume control block identifying the volumes containing the data set named in field 1.

Field 3: Halfword count (1 byte)—contains a binary one to indicate that one halfword follows.

Field 4: Zero field (2 bytes)—contains binary zeros.

Figure 5. The Volume Control Block Pointer Entry

Volume Control Block



A volume control block contains the description of all the volumes of a data set that resides on more than five volumes. One volume control block can describe as many as 20 volumes. Volume control blocks may be chained together to catalog a data set residing on more than 20 volumes.

The volume control block is always 256 bytes long, regardless of the number of volumes described.

Field 1: Volume count (2 bytes)—the first volume control block contains the binary count of the total number of volumes on which the data set resides. The value of this field is reduced by 20 for each subsequent volume control block. If, for example, the data set resides on 61 volumes, there will be four volume control blocks for the data set. The volume count field of each will contain 61, 41, 21, and 1, respectively.

Fields 2, 3, and 4: Volume identification (12 to 240 bytes)—contains from one to twenty each of which identifies a volume on which the data set resides. Each entry contains a 4-byte device code, a 6-byte volume serial number, and a 2-byte data set sequence number. The data set sequence number is zero for data sets on direct-access volumes.

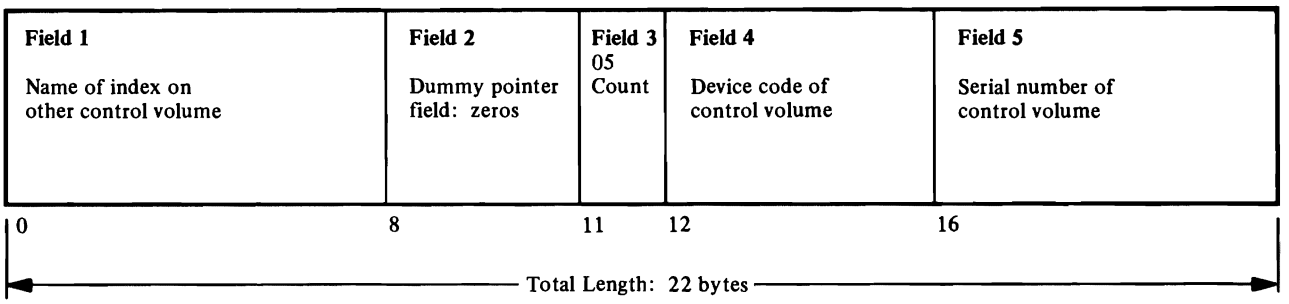
Field 5: Zero field (10 bytes)—contains binary zeros.

Field 6: Chain address (3 bytes)—contains the relative block address (TTR) of the next volume control block, if additional blocks are needed to describe the data set. If this is the last volume control block for the data set, this field will be set to binary zeros.

Field 7: Zero field (1 byte)—contains binary zeros.

Figure 6. The Volume Control Block

Control Volume (CVOL) Pointer Entry



Note: Prior to Release 17, the control volume pointer entry contained a count of 03 and did not have a device code field (field 4).

The CVOL pointer entry is used to indicate that a particular index resides on a volume other than the system residence volume. Control volume pointer entries can exist only in the volume index. They are 22 bytes long.

Field 1: Name (8 bytes)—contains a high-level index name that appears in the volume index of the control volume identified in fields 4 and 5.

Field 2: Address (3 bytes)—contains zeros, because this entry references no other entry in the catalog.

Field 3: Halfword count (1 byte)—contains the number 5 to indicate that five halfwords follow.

Field 4: CVOL device code (4 bytes)—This field contains the device code of the specified control volume.

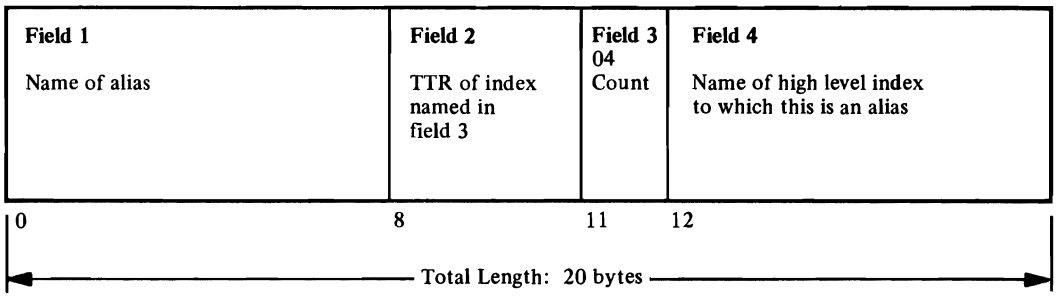
Field 5: CVOL volume serial number (6 bytes)—contains the volume serial number of the control volume which has an entry in its volume index of the same name as this entry.

Figure 7. The Control Volume (CVOL) Pointer Entry

Control Volume Pointer Entry (OLD)

Until Release 17 of OS MFT/MVT, the control volume pointer entry was the same as the present control volume pointer, except that there was no field 4 (device code). The old CVOL pointer entry was 18 bytes long; after Release 17, it is 22 bytes long. Since some control volumes may still contain entries in the old format, and since the catalog management routines still check for it, it is mentioned here.

Alias Entry



The alias entry is used to specify a substitute name for a high-level index. Alias entries only appear in the volume index. They are 20 bytes long.

Field 1: Name (4 bytes)—contains the alias of the high-level index identified in field 2.

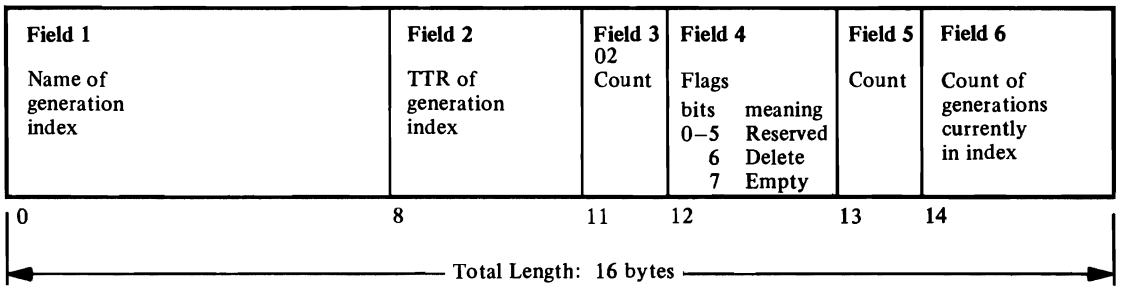
Field 2: Address (3 bytes)—contains the relative block address (TTR) of the first block of the index named in field 4.

Field 3: Halfword count (1 byte)—contains a binary four to indicate that four halfwords follow.

Field 4: True name field (8 bytes)—contains the name of the index whose alias appears in field 1. The address of the index is in field 2.

Figure 8. The Alias Entry

Generation Index Pointer Entry



The generation index pointer entry points to a generation index. It is basically the same as an index pointer entry, except that is includes the flag and count fields. It is 16 bytes long.

Field 1: Name (8 bytes)—contains the lowest level name of the generation data group. That is, a generation data set named WEEKLY.INVNTRY.G0001V00 would have the name INVNTRY in the generation index pointer entry name field.

Field 2: Address field (3 bytes)—contains the relative block address (TTR) of the generation index named in field 1.

Field 3: Halfword count (1 byte)—contains a binary two to indicate that two halfwords follow.

Field 4: Flags (1 byte)—contains flags that govern the uncataloging of data sets as specified by the DELETE and EMPTY options of the INDEX macro instruction. The options and their hexadecimal codes are:

EMPTY = 01, DELETE = 02, and EMPTY and DELETE = 03; if no option was specified this byte is 00.

Field 5: Maximum number of generations allowed (1 byte)—contains the binary count of the maximum number of generations allowed in the index at one time, as specified in the INDEX macro instruction.

Field 6: Current generation count (2 bytes)—contains the binary count of the number of generations cataloged in the index.

Figure 9. The Generation Index Pointer Entry

MAINTAINING THE VOLUME TABLE OF CONTENTS

This chapter contains information on how to read and change the volume table of contents (VTOC) used on direct-access storage device volumes. The information consists of how-to information, macro specifications, and coding examples for the OBTAIN, SCRATCH, and RENAME macro instructions.

More detailed information about how the routines called by these macros work is available in *OS/VS1 DADSM Logic.*

Before using the information in this chapter you should be familiar with the information contained in the following publications:

- *OS/VS - DOS/VS - VM/370 Assembler Language,* which contains information you will need in order to code programs in the assembler language.
- *OS/VS Data Management Services Guide,* contains a general description of direct-access device characteristics and the volume table of contents.
- *OS/VS Utilities,* tells how to use utility programs to maintain the volume table of contents.
- *OS/VS1 System Data Areas,* contains descriptions, (1) of the data set control block (DSCB) formats and (2) the contents of the fields of each DSCB.

Introduction

In the same way that the catalog management routines keep track of cataloged data sets, the direct-access device space management (DADSM) routines maintain the volume table of contents (VTOC) on direct-access storage devices. This chapter tells how to use the OBTAIN, SCRATCH, and RENAME macro instructions. These macros are most commonly used by the system control program and the data set utility programs (IEHMOVE, IEBCOPY, and IEHPROGM), but you may use them in your own routines. The functions you can perform with these macros are:

- Reading a data set control block from the VTOC—OBTAIN
- Deleting a data set—SCRATCH
- Changing the name of a data set—RENAME

You can read a data set control block (DSCB) into virtual storage by using the OBTAIN and CAMLST macro instructions. There are two ways to specify the DSCB that you want to read: by using the name of the data set associated with the DSCB, or by using the absolute track address of the DSCB. You must provide a 148-byte data area in virtual storage, into which the DSCB will be read. When you specify the name of the data set, an identifier (format-1) DSCB is read into virtual storage. To read a DSCB other than a format-1 DSCB, you must specify an absolute track address (see second example). (DSCB formats and field descriptions are contained in *OS/VS1 System Data Areas.*)

You can delete a data set by using the SCRATCH and CAMLST macro instructions. This causes the DSCBs for the data set to be deleted.

You can change a data set name by using the RENAME and CAMLST macro instructions. This causes the data set name in the identifier (format-1) DSCB for the data set to be replaced with a new name.

Accompanying the descriptions of the macro instructions are coding examples, programming notes, and exceptional return code descriptions.

Reading a DSCB by Name (OBTAIN and CAMLST SEARCH)

When a data set name is specified, the 96-byte data portion of the identifier (format-1) DSCB, and the absolute track address of the DSCB are read into virtual storage. The absolute track address is a 5-byte field in the form CCHHR. When the absolute track address of a DSCB is specified, the 44-byte key portion and the 96-byte data portion of the DSCB are read into virtual storage, as shown in the second coding example.

[*symbol*]	**OBTAIN**	*list-addrx*
listname	**CAMLST**	**SEARCH**
		,*dsname-relexp*
		,*vol-relexp*
		,*wkarea-relexp*

list-addrx
points to the parameter list (labeled *listname*) set up by the CAMLST macro instruction.

SEARCH
this operand must be coded as shown.

dsname-relexp
specifies the virtual storage location of a fully qualified data set name. The area that contains the name must be 44 bytes long. If the name is shorter than 44 bytes, it must be followed by blanks.

vol-relexp
specifies the virtual storage location of the 6-byte volume serial number of the volume on which the DSCB is located.

wkarea-relexp
specifies the virtual storage location of a 148-byte work area that you must define. The work area must begin on a doubleword boundary.

Example: In the following example, the identifier (format-1) DSCB for data set A.B.C is read into virtual storage using the SEARCH option. The serial number of the volume containing the DSCB is 770655.

```
         OBTAIN  DSCBABC                READ  DSCB  FOR  DATA
*                                       SET A.B.C INTO DATA
*                                       AREA NAMED WORKAREA
        Check Exceptional Returns
DSCBABC  CAMLST  SEARCH,DSABC,VOLNUM,WORKAREA
DSABC    DC      CL44'A.B.C'           DATA SET NAME
VOLNUM   DC      CL6'770655'           VOLUME SERIAL NUMBER
WORKAREA DS      0D                    148 BYTE WORK AREA
         DS      148C
```

The OBTAIN macro instruction points to the CAMLST macro instruction. SEARCH, the first operand of CAMLST, specifies that a DSCB be read into virtual storage, using the data set name you have supplied at the address indicated in the second operand. DSABC, the second operand, specifies the virtual storage location of a 44-byte area into which you have placed the fully

qualified name of the data set whose format-1 DSCB is to be read. VOLNUM, the third operand, specifies the virtual storage location of a 6-byte area into which you have placed the serial number of the volume containing the required DSCB. The volume must be already mounted on the system. WORKAREA, the fourth operand, specifies the virtual storage location of a 148-byte work area into which the DSCB is to be read.

Control will be returned to your program at the next executable instruction following the OBTAIN macro instruction. If the DSCB has been successfully read into your work area, register 15 will contain zeros. If your system contains VSAM catalogs and the requested format-1 DSCB is not found on the volume's VTOC, the VSAM catalogs open under that job step are searched for the specified data set. If the data set is found in one of the VSAM catalogs, catalog information is used to create a DSCB, which is passed back to OBTAIN's caller. Otherwise, register 15 will contain one of the following exceptional return codes:

Code	Interpretation
4	The required volume was not mounted.
8	The format-1 DSCB was not found in VTOC of specified volume.
12	A permanent I/O error was encountered or an invalid format-1 DSCB was found when processing the specified volume.
16	Invalid work area pointer.

After execution of these macro instructions, the first 96 bytes of the work area contain the data portion of the identifier (format-1) DSCB; the next 5 bytes contain the absolute track address (CCHHR) of the DSCB. These 5 bytes will contain zeros for a VSAM data set.

Reading a DSCB by Actual Device Address (OBTAIN and CAMLST SEEK)

You can read any DSCB from a VTOC using the SEEK option.

The format is:

[*symbol*]	**OBTAIN**	*list-addrx*
listname	**CAMLST**	**SEEK**
		,*cchhr-relexp*
		,*vol-relexp*
		,*wkarea-relexp*

list-addrx
points to the parameter list (labeled *listname*) set up by the CAMLST macro instruction.

SEEK
this operand must be coded as shown.

cchhr-relexp
specifies the virtual storage location of the 5-byte absolute device address (CCHHR) of a DSCB.

vol-relexp
specifies the virtual storage location of the 6-byte volume serial number of the volume on which the DSCB is located.

wkarea-relexp
specifies the virtual storage location of a 148-byte work area that you must define. The work area must begin on a doubleword boundary.

Example: In the following example, the DSCB at actual-device address X'00 00 00 01 07' is read into the virtual storage location READAREA, using the SEEK option. The DSCB resides on the volume with the volume serial number 108745.

```
         OBTAIN  ACTADDR              READ  THE  DSCB  AT
*                                     ACTUAL DEVICE  ADDRESS
*                                     AT LOCATION CCHHR
*                                     INTO STORAGE LOCATION
*                                     NAMED READAREA
```

Check Exceptional Returns

```
ACTADDR  CAMLST  SEEK,CCHHR,VOLSER,READAREA
CCHHR    DC      XL5'0000000107'     ABSOLUTE TRACK ADDRESS
VOLSER   DC      CL6'108745'         VOLUME SERIAL NUMBER
READAREA DS      0D                  148 BYTE WORK AREA
         DS      148C
```

The OBTAIN macro points to the CAMLST macro. SEEK, the first operand of CAMLST, specifies that a DSCB be read into virtual storage. CCHHR, the second operand, specifies the storage location that contains the 5-byte actual-device address of the DSCB. VOLSER, the third operand specifies the storage location that contains the volume serial number of the volume on which the DSCB resides. The fourth operand, READAREA, specifies the storage location into which the 140-byte DSCB is to be read. The last 8 bytes are used by the OBTAIN routine.

Control will be returned to your program at the next executable instruction following the OBTAIN macro instruction. If the DSCB has been successfully read into your work area, register 15 will contain zeros. Otherwise, register 15 will contain one of the following exceptional return codes:

Code	Interpretation
4	The required volume was not mounted.
12	A permanent I/O error was encountered or an invalid format-4 DSCB was found when processing the specified volume.
16	Invalid work area pointer.
20	CCHH not within boundaries of the VTOC extent.

Deleting a Data Set (SCRATCH and CAMLST SCRATCH)

You delete a data set stored on direct-access volumes by using the SCRATCH and CAMLST macro instructions. This causes all data set control blocks (DSCBs) for the data set to be deleted, and all space occupied by the data set to be made available for reallocation. If the data set to be deleted is sharing one or more cylinders with one or more data sets (a split-cylinder data set), the space will not be made available for reallocation until all data sets on the shared cylinders are deleted.

Unless you choose to ignore the expiration date, a data set cannot be deleted if the expiration date in the identifier (format-1) DSCB has not passed. Note that the current date is considered a passed date. You specify that the expiration date is to be ignored by using the OVRD option in the CAMLST macro instruction.

If a data set to be deleted is stored on more than one volume, either a device must be available on which to mount the volumes, or at least one volume must

be mounted. In addition, all other required volumes must be serially mountable.

When deleting a data set, you must build a volume list in virtual storage. This volume list consists of an entry for each volume on which the data set resides. The first two bytes of the list indicate the number of entries in the list. Each 12-byte entry consists of a 4-byte device code, a 6-byte volume serial number, and a 2-byte scratch status code. Device codes are presented in *OS/VS1 System Data Areas.*

If the space to be deleted is a VSAM data space, you must use the DELETE command provided by access method services, the VSAM utility program. For complete information about the DELETE command, see *OS/VS1 Access Method Services.*

Volumes are processed in the order that they appear in the volume list. The volume at the beginning of the list is processed first. If a volume is not mounted, a message is issued to the operator requesting him to mount the volume. This is only done if you indicate the direct-access device on which unmounted volumes are to be mounted by loading register 0 with the address of the UCB associated with the device to be used. If you do not load register 0 with a UCB address, its contents must be zero, and at least one of the volumes in the volume list must be mounted before the SCRATCH macro instruction is issued.

If the operator cannot mount the requested volume, he issues a reply indicating that he cannot fulfill the request. A condition code is then set in the last byte of the volume pointer (the second byte of the scratch status code) for the unavailable volume, and the next volume indicated in the volume list is processed.

If the volume is mounted on a unit that does not belong to your job step, or register 0 contains the address of a UCB that does not belong to your job step, a 130 ABEND may occur in the SCRATCH routines with the possibility of destroying a VTOC. This can be prevented by ensuring that the unit is allocated in a DD statement or by TSO dynamic allocation before using SCRATCH.

The format is:

[*symbol*] *listname*	**SCRATCH** **CAMLST**	*list-addrx* **SCRATCH** *,dsname-relexp* *,,vol list-relexp* **,,[OVRD]**

list-addrx
points to the parameter list (labeled *listname*) set up by the CAMLST macro instruction.

SCRATCH
this operand must be coded as shown.

dsname-relexp
specifies the virtual storage location of a fully qualified data set name. The area that contains the name must be 44 bytes long. If the name is shorter than 44 bytes, it must be followed by blanks.

vol list-relexp
specifies the virtual storage location of an area that contains a volume list. The area must begin on a half-word boundary.

OVRD
when coded as shown, specifies that the expiration date in the DSCB should be ignored.

Example: In the following example, data set A.B.C is deleted from two volumes. The expiration date in the identifier (format-1) DSCB is ignored.

```
          SR      0,0                 SET  REG  0  TO  ZERO
          SCRATCH DELABC              DELETE DATA SET A.B.C.
*                                     FROM TWO VOLUMES
*                                     IGNORING THE
*                                     EXPIRATION DATE IN THE
*                                     DSCB
```

Check Exceptional Returns

```
DELABC    CAMLST  SCRATCH,DSABC,,VOLIST,,OVRD
DSABC     DC      CL44'A.B.C'         DATA SET NAME
VOLIST    DC      H'2'                TWO VOLUMES
          DC      X'30C02008'         2314 DISK DEVICE CODE
          DC      CL6'000017'         VOLUME SERIAL NUMBER
          DC      H'0'                SCRATCH STATUS CODE
          DC      X'30C02008'         2314 DISK DEVICE CODE
          DC      CL6'000018'         VOLUME SERIAL NUMBER
          DC      H'0'                SCRATCH STATUS CODE
```

The SCRATCH macro instruction points to the CAMLST macro instruction. SCRATCH, the first operand of CAMLST, specifies that a data set be deleted. DSABC, the second operand, specifies the virtual storage location of a 44-byte area into which you have placed the fully qualified name of the data set to be deleted. VOLIST, the fourth operand, specifies the virtual storage location of the volume list you have built. OVRD, the sixth operand, specifies that the expiration date in the DSCB of the data set to be deleted be ignored.

When you attempt to delete a password-protected data set, the operating system issues a message (IEC301A) to ask the operator at the console or terminal operator of a remote console to enter the password. The data set will be scratched only if the password supplied is associated with a "WRITE" protection mode indicator. The protection word indicator is described in the chapter titled "Data Set Protection."

Control is returned to your program at the next executable instruction following the SCRATCH macro instruction. If the data set has been successfully deleted, register 15 will contain zeros and the scratch status code in the volume list entry for each volume will be set to zero. Otherwise, register 15 will contain one of the exceptional return codes that follow. To determine whether the data set has been successfully deleted from each volume on which it resides, you must examine the scratch status code, the last byte of each entry in the volume list.

Return Code in Reg. 15	Interpretation
4	No volumes containing any part of the data set were mounted, nor did register 0 contain the address of a unit that was available for mounting a volume of the data set.
8	An unusual condition was encountered on one or more volumes.
12	Invalid volume list (not accompanied by the setting of the last byte of each volume pointer).

After the SCRATCH macro instruction is executed, the last byte of each 12-byte entry in the volume list indicates the following conditions in binary codes:

Scratch Status Code	Interpretation
0	The DSCB for the data set has been deleted from the VTOC on the volume pointed to.
1	The VTOC of this volume does not contain the format-1 DSCB for the data set to be deleted.
2	The macro instruction failed when the correct password was not supplied in the two attempts allowed, or the user tried to scratch a VSAM data set.
3	The data set was not deleted from this volume because either the OVRD option was not specified or the retention cycle has not expired.
4	A permanent I/O error was encountered or an invalid format-1 DSCB was found when processing this volume.
5	It could not be verified that this volume was mounted and a device for mounting this volume was unavailable.
6	The operator was unable to mount this volume.

Renaming a Data Set (RENAME and CAMLST RENAME)

You rename a data set stored on one or more direct-access volumes by using the RENAME and CAMLST macro instructions. This causes the data set name in all identifier (format-1) DSCBs for the data set to be replaced by the new name that you supply.

If a data set to be renamed is stored on more than one volume, either a device must be available on which to mount the volumes, or at least one volume must be mounted. In addition, all other volumes of the data set must be serially mountable.

If the space to be renamed is a VSAM data space, you must use the ALTER command provided by access method services, the VSAM utility program. Note that only unique VSAM data spaces may acquire new names. For complete information about the ALTER command, see *OS/VS1 Access Method Services.*

When renaming a data set, you must build a volume list in virtual storage. This volume list consists of an entry for each volume on which the data set resides. The first two bytes of the list indicate the number of entries in the list. Each 12-byte volume list entry consists of a 4-byte device code, a 6-byte volume serial number, and a 2-byte rename status code. Device codes are presented in *OS/VS1 System Data Areas.* Volumes are processed in the order they appear in the volume list. The first volume on the list is processed first. If a volume is not mounted, a message is issued to the operator requesting him to mount the volume. This is only done if you indicate the

direct-access device on which unmounted volumes are to be mounted by loading register 0 with the address of the UCB associated with the device to be used. If you do not load register 0 with a UCB address, its contents must be zero, and at least one of the volumes in the volume list must be mounted before the RENAME macro instruction is executed.

If the operator cannot mount a volume in the volume list, he issues a reply indicating that he cannot fulfill the request. A condition code is then set in the last byte of the volume list entry (the second byte of the rename status code) for the unavailable volume, and the next volume indicated in the volume list is processed or requested.

If the volume is mounted on a unit that does not belong to your job step, or if register 0 contains the address of a UCB that does not belong to your job step, a 130 ABEND may occur in the RENAME routines with the possibility of destroying the VTOC. This can be prevented by ensuring that the unit is allocated in a DD statement or by TSO dynamic allocation before using RENAME.

The format is:

[*symbol*] *listname*	**RENAME** **CAMLST**	*list-addrx* **RENAME** *,dsname-relexp* *,new namerelexp* *,vol list-relexp*

list-addrx
points to the parameter list (labeled *listname*) set up by the CAMLST macro instruction.

RENAME
this operand must be coded as shown.

dsname-relexp
specifies the virtual storage location of a fully qualified data set name. The area that contains the name must be 44 bytes long. If the name is shorter than 44 bytes, it must be followed by blanks.

new namerelexp
specifies the virtual storage location of a fully qualified data set name that is to be used as the new name. The area that contains the name must be 44 bytes long. If the name is shorter than 44 bytes, it must be followed by blanks.

vol list-relexp
specifies the virtual storage location of an area that contains a volume list. The area must begin on a halfword boundary.

Example: In the following example, data set A.B.C is renamed D.E.F. The data set resides on two volumes.

```
         SR       0,0                    SET  REG  0  TO  ZERO
         RENAME   DSABC                  CHANGE DATA SET
*                                        NAME A.B.C. TO D.E.F
        Check Exceptional Returns
DSABC    CAMLST   RENAME,OLDNAME,NEWNAME,VOLIST
OLDNAME  DC       CL44'A.B.C'
NEWNAME  DC       CL44'D.E.F'
VOLIST   DC       H'2'                   TWO VOLUMES
         DC       X'30C02008'            2314 DISK DEVICE CODE
         DC       CL6'000017'            VOLUME SERIAL NUMBER
         DC       H'0'                   RENAME STATUS CODE
         DC       X'30C02008'            2314 DISK DEVICE CODE
         DC       CL6'000018'            VOLUME SERIAL NUMBER
         DC       H'0'                   RENAME STATUS CODE
```

The RENAME macro instruction points to the CAMLST macro instruction. RENAME, the first operand of CAMLST, specifies that a data set be renamed. OLDNAME, the second operand, specifies the virtual storage location of a 44-byte area into which you have placed the fully qualified name of the data set to be renamed. NEWNAME, the third operand, specifies the virtual storage location of a 44-byte area into which you have placed the new name of the data set. VOLIST, the fourth operand, specifies the virtual storage location of the volume list you have built.

Control is returned to your program at the next executable instruction following the RENAME macro instruction. If the data set has been successfully renamed, register 15 will contain zeros, and the rename status code in the volume list entry for each volume will be set to zero. Otherwise, register 15 will contain one of the exceptional return codes that follow. To determine whether the data set has been successfully renamed on each volume on which it resides, you must examine the rename status code, the last byte of each entry in the volume list.

Return Code in Reg. 15	Interpretation
4	No volumes containing any part of the data set were mounted, nor did register 0 contain the address of a unit that was available for mounting a volume of the data set.
8	An unusual condition was encountered on one or more volumes.
12	Invalid volume list (not accompanied by the setting of the last byte of each volume pointer).

After the RENAME macro instruction is executed, the last byte of each 12-byte entry in the volume list indicates the following conditions in binary code:

Rename Status Code	Interpretation
0	The DSCB for the data set has been renamed in the VTOC on the volume pointed to.
1	The VTOC of this volume does not contain the format-1 DSCB for the data set to be renamed.
2	The macro instruction failed when the correct password was not supplied in the two attempts allowed, or the user tried to rename a VSAM data set.
3	A data set with the new name already exists on this volume.
4	A permanent I/O error was encountered or an invalid format-1 DSCB was found when processing this volume.

Rename Status Code	Interpretation
5	A device for mounting this volume was unavailable or a mount for this volume was not verified.
6	The operator was unable to mount this volume.

When you attempt to rename a password-protected data set, the operating system issues a message (IEC301A) to ask the operator or remote console operator to verify the password. The data set will be renamed only if the password supplied is associated with a "WRITE" protection mode indicator. The chapter titled "Password Protecting Your Data Sets" provides a description of the protection mode indicator.

EXECUTING YOUR OWN CHANNEL PROGRAMS

The execute channel program (EXCP) macro instruction provides you with a device-dependent means of performing the I/O operations. This chapter contains a general description of the function and application of the EXCP macro instruction, accompanied by descriptions of specific control blocks and macro instructions used with EXCP. Factors that affect the operation of EXCP, such as device variations and program modification, are also discussed.

Before reading this chapter, you should be familiar with system functions and with the structure of control blocks, as well as with the operational characteristics of the I/O devices required by your channel programs. Operational characteristics of specific I/O devices are contained in IBM publications for each device.

To understand this chapter, you need to understand the information in these publications:

- *OS/VS Data Management Services Guide,* explains the standard procedures for I/O processing under the operating system.
- *OS/VS - DOS/VS - VM/370 Assembler Language,* contains the information necessary to code programs in the assembler language.
- *OS/VS Data Management Macro Instructions,* describes the system macro instructions that can be used in programs coded in the assembler language.
- *OS/VS1 System Data Areas,* contains format and field descriptions of the system control blocks referred to in this chapter.

The execute channel program (EXCP) macro instruction causes a supervisor-call interruption to pass control to the I/O supervisor. EXCP also provides the I/O supervisor with control information regarding a channel program to be executed. When the IBM standard data access methods are being used, the access method routines are responsible for issuing EXCP. If you are not using the standard access methods, you may issue EXCP in your program. Direct use of EXCP provides you with device dependence in organizing data and controlling I/O devices.

You issue EXCP primarily for I/O programming situations to which the standard access methods do not apply. When you are writing your own data access methods, you must include EXCP for I/O operations. EXCP must also be used for processing nonstandard labels, including reading and writing labels and positioning magnetic tape volumes.

To issue EXCP, you must provide a channel program (a list of channel command words) and several control blocks in your program area. The I/O supervisor then schedules I/O requests for the device you have specified, executes the specified I/O commands, handles I/O interruptions, directs error recovery procedures, and posts the results of the I/O requests.

Executing Channel Programs in System and Problem Programs

This section briefly explains the procedures performed by the system and the programmer when EXCP is issued by the routines of the standard data access methods. The additional procedures that you must perform when issuing EXCP yourself are then described by direct comparison.

System Use of EXCP

When using a standard data access method to perform I/O operations, the programmer is relieved of coding channel programs and of constructing the control blocks necessary for the execution of channel programs. To permit I/O operations to be handled by an access method, the programmer need only issue the following macro instructions:

- A DCB macro instruction that produces a data control block (DCB) for the data set to be retrieved or stored. If appendages are not being used, a short DCB is constructed. Such a DCB does not support reduced error recovery.
- An OPEN macro instruction that initializes the data control block and produces a data extent block (DEB) for the data set.
- A macro instruction (e.g., GET, WRITE) that requests I/O operations.

Access method routines will then:

1. Create a channel program that contains channel commands for the I/O operations on the appropriate device.
2. Construct an input/output block (IOB) that contains information about the channel program.
3. Construct an event control block (ECB) that is later posted with a completion code each time the channel program terminates.
4. Issue an EXCP macro instruction to pass the address of the IOB to the routines that initiate and supervise the I/O operations.

The input/output supervisor will then:

5. Construct a request queue element (RQE) for scheduling the request.
6. If the requestor is in pageable partition, fix the pages to be referenced during the I/O operation so that they cannot be paged out; this includes pages for I/O control blocks and appendages.
7. If the requestor is in a pageable partition, translate the requestor's virtual channel program into a real channel program in the System Queue Area and fix the pages to be used as data areas during the I/O operation.
8. Issue a start input/output (SIO) instruction to cause the channel to execute the real channel program.
9. Process I/O interruptions and schedule error recovery procedures when necessary.
10. If the requestor is in a pageable partition, retranslate the "last CCW+8" address in the channel status word (CSW) to the corresponding virtual address.

11. If the requestor is in a pageable partition, free the real storage used for the channel program translation and unfix the pages that were fixed especially for the just completed I/O operation.
12. Post a completion code in the event control block after the channel program has been executed.

Note: If the requestor is in a nonpageable partition, he provides a real channel program, so items 6, 7, 10, and 11 are not performed.

The programmer is not concerned with these procedures and does not know the status of I/O operations until they are completed. Device-dependent operations are limited to those provided by the macro instructions of the particular access method selected.

Use of EXCP in Problem Programs

To issue the EXCP macro instruction directly, you must perform the procedures that the access methods perform, as summarized in items 1 through 4 of the preceding discussion. You must, in addition to constructing and opening the data control block with the DCB and OPEN macro instructions, construct a channel program, an input/output block, and an event control block before you can issue EXCP. The I/O supervisor always handles items 5 through 12.

After issuing EXCP, you should issue a WAIT macro instruction specifying the event control block to determine whether the channel program has terminated. If volume switching is necessary, you must issue an EOV macro instruction. When processing of the data set has been completed, you must issue a CLOSE macro instruction to restore the data control block.

EXCP Operations in a Nonpageable Region

User-constructed channel programs for I/O operations in a nonpageable region are not translated. Because the partition is nonpageable, any CCWs created by the user have correct real data addresses. (Translation would only recreate the user's channel program, so the CCWs are used directly.)

System requests for I/O on behalf of a user, however, do not always operate in the user's nonpageable region. These requests make use of areas with a protection key of 0, which are pageable. Therefore, system requests for I/O on behalf of the user can require translation.

Modification of an active channel program by data read in or by CPU instructions is legitimate in a nonpageable region, but not in a pageable region. Refer to the section "Modification of a Channel Program During Execution."

EXCP Requirements

This section describes the channel program that you must provide in order to issue EXCP. The control blocks that you must either construct directly, or cause to be constructed by use of macro instructions, are also described.

Channel Program

The channel program supplied by you and executed through EXCP is composed of channel command words (CCWs) on doubleword boundaries. Each channel command word specifies a command to be executed and, for commands initiating data transfer, the area to or from which the data is to be transferred. Channel programs to be executed in a pageable partition are restricted to no more than 239 CCWs. The I/O supervisor abnormally terminates an I/O requestor whose translated channel program exceeds that limit. The actual number of CCWs allowed in virtual channel program depends on its structure. If a virtual channel program includes a TIC CCW which causes any other CCW to be translated more than once, the maximum allowable length of the virtual channel program will be less than 240 CCWs.

Channel command word formats used with specific I/O devices can be found in IBM Systems Reference Library publications for each device. All channel command words described in these publications can be used, with the exception of REWIND and UNLOAD (RUN). In addition, both data chaining and command chaining may be used.

Chaining is the successive loading of channel command words into a channel from contiguous doubleword locations in real storage. Data chaining occurs when a new channel command word loaded into the channel defines a new storage area for the original I/O operation. Command chaining occurs when the new channel command word specifies a new I/O operation. For detailed information about chaining, refer to *IBM System/370 Principles of Operation.*

To specify either data chaining or command chaining, you must set appropriate bits in the channel command word, and indicate the type of chaining in the input/output block. Both data and command chaining should not be specified in the same channel command word; if they are, data chaining takes precedence.

When a channel program includes a list of channel command words that chain data for reading operations, no channel command word may alter the contents of another channel command word in the same list. (If such alteration were allowed, specifications could be placed into a channel command word without being checked for validity. If the specifications were incorrect, the error could not be detected until the chain was completed. Data could be read into incorrect locations and the system could not correct the error.)

Control Blocks

When using EXCP, you must be familiar with the function and structure of an input/output block (IOB), an event control block (ECB), a data control block (DCB), and a data extent block (DEB). Brief descriptions of these control blocks follow. Their fields are illustrated in the section "Macro Specifications for Use with EXCP."

Input/Output Block (IOB)

The input/output block is used for communication between the problem program and the system. It provides the addresses of other control blocks, and maintains information about the channel program, such as the type of chaining and the progress of I/O operations. You must define the input/output block and specify its address as the only parameter of the EXCP macro instruction.

Event Control Block (ECB)

The event control block provides you with a completion code that describes whether the channel program was completed with or without error. A WAIT macro instruction for synchronizing I/O operations with the problem program must be directed to the event control block. You must define the event control block and specify its address in the input/output block.

Data Control Block (DCB)

The data control block provides the system with information about the characteristics and processing requirements of a data set to be read or written by the channel program. A data control block must be produced by a DCB macro instruction that includes parameters for EXCP. If appendages are not being used, and OPTCD is not specified, a short DCB is constructed. Such a DCB does not support reduced error recovery. You specify the address of the data control block in the input/output block.

Data Extent Block (DEB)

The data extent block contains one or more extent entries for the associated data set, as well as other control information. An extent defines all or part of the physical boundaries on an I/O device occupied by, or reserved for, a particular data set. Each extent entry contains the address of a unit control block (UCB), which provides information about the type and location of an I/O device. More than one extent entry can contain the same UCB address. (Unit control blocks are set up at system generation time and need not concern you.) For all I/O devices supported by the operating system, the data extent block is produced during execution of the OPEN macro instruction for the data control block. The system places the address of the data extent block into the data control block.

Channel Program Execution

This section explains how the system uses your channel program and control blocks after you issue EXCP.

Initiation of the Channel Program

By issuing EXCP, you request the execution of the channel program specified in the input/output block. The I/O supervisor validates the request by checking certain fields of the control blocks associated with this request. If the I/O supervisor detects invalid information in a control block, it initiates abnormal termination procedures.

The I/O supervisor gets:

- the address of the data control block from the input/output block
- the address of the data extent block from the data control block
- the address of the unit control block from the data extent block

The I/O supervisor places the IOB, TCB, DEB, and UCB addresses and other information about the channel program into an area called a request queue element (RQE). The I/O supervisor uses RQEs to form logical channel queues of scheduled I/O operations. Unless you are providing appendage routines (described in the section "Appendages"), you should not be concerned with the contents of RQEs.

If you are operating in a pageable partition, the I/O supervisor now prepares to translate your virtual channel program into a real channel program. It does this by initializing translation tables and fixing the pages containing the control blocks associated with your request. If you are providing appendages, the I/O supervisor also passes control to your page fix appendage to permit you to specify the pages that must be fixed to prevent page exceptions from occurring during execution of one of your appendages. These pages do not include the appendages themselves as they are automatically fixed by the I/O supervisor. Note that a page exception during appendage execution causes abnormal termination. The I/O supervisor then fixes the pages you specify upon return from your page fix appendage.

Next the I/O supervisor determines whether a channel and the requested I/O device are ready for the channel program. If they are not ready, the RQE is placed in the appropriate logical channel queue, and control is returned to the problem program. Later, when a channel and device are ready, the I/O supervisor resumes control to start the I/O operation.

If you have provided a start I/O (SIO) appendage, the I/O supervisor now passes control to it. The return address from the SIO appendage determines whether the I/O supervisor must:

- execute the I/O operation normally,
- skip the I/O operation, or
- perform extended translation on the channel program before beginning the I/O operation.

See "Appendages" in this chapter for a description of the SIO appendage and its linkage to the I/O supervisor. If you are issuing EXCP from a pageable

partition, the channel program you construct contains virtual addresses. However, because channels cannot use virtual addresses, the I/O supervisor must:

- translate your virtual channel program into one that uses only real addresses, and
- fix in real storage the pages used as I/O areas for the data transfer operations specified in your channel program.

The I/O supervisor builds the translated (real) channel program in a portion of real storage called the System Queue Area. If the I/O device is other than a direct-access device or a magnetic tape device, the I/O supervisor then places the address of the start of the translated channel program into the channel address word (CAW) and issues a start input/output (SIO) instruction.

Before issuing the SIO instruction for a 2314 or 2319 direct-access device, the I/O supervisor issues an initial (or stand-alone) seek, which is overlapped with other operations. You specify the seek address in the input/output block. When the seek has completed, the I/O supervisor constructs a command chain to reissue the seek, sets the file mask specified in the data extent block, and passes control to your real channel program. For all other direct-access devices, the I/O supervisor constructs a command chain to issue a seek, sets the file mask, and passes control to your real channel program. (You cannot issue the initial seek or set the file mask yourself. The file mask is set to prohibit seek cylinder commands, or, if space is allocated by tracks, seek track commands. If the data set is open for INPUT or RDBACK, write commands are also prohibited.)

Before issuing SIO for a magnetic tape device, the I/O supervisor constructs a command chain to set the mode specified in the data extent block and passes control to your real channel program. (You cannot set the mode yourself.)

Modification of a Channel Program During Execution

Any user problem program that modifies an active channel program by data read in by either the I/O operation or by CPU instructions must run in a nonpageable partition. It cannot run in a pageable partition because of the channel program translation performed by the I/O supervisor. (In a pageable partition, an attempt to modify an active channel program affects only the virtual image of the channel program, not the real channel program being executed by the channel.)

A program of this type can be changed to run in a pageable partition by either:

- executing the modified portion of the channel program as a separate I/O operation, or
- using the SIO extend and PCI modify appendage interfaces of the I/O supervisor, described in the section on appendages.

Completion of Execution

The system considers the channel program completed when it receives an indication of a channel end condition in the channel status word (CSW). When channel end occurs, the request element for the channel program is made available, and a completion code is placed into the event control block. The completion code indicates whether errors are associated with channel end. If device end occurs simultaneously with channel end, errors associated with device end (i.e., unit exception or unit check) are also accounted for.

If device end occurs after channel end and an error is associated with device end, the completion code in the event control block does not indicate the error. However, the status of the unit and channel is saved in the unit control block (UCB) for the device, and the UCB is marked as intercepted. The input/output block for the next request directed to the I/O device is also marked as intercepted. The error is assumed to be permanent, and the completion code in the event control block for the intercepted request indicates interception. The IFLGS field of the data control block is also flagged to indicate a permanent error. Note that when a write tape mark or erase long gap CCW is the last (or only) CCW in your channel program, the I/O supervisor will not attempt recovery procedures for device end errors. In these circumstances, command chaining a NOP CCW to your write tape mark or erase long gap CCW ensures initiation of device end error recovery procedures.

To be prepared for device end errors, you should be familiar with device characteristics that can cause such errors. After one of your channel programs has terminated, you should not release buffer space until you have determined that your next request for the device has not been intercepted. You may reissue an intercepted request.

Interruption Handling and Error Recovery Procedures

An I/O interruption allows the CPU to respond to signals from an I/O device which indicate either termination of a phase of I/O operations or external action on the device. A complete explanation of I/O interruptions is contained in *IBM System/370 Principles of Operation.* For descriptions of interruptions by specific devices, refer to IBM publications for each device.

If error conditions are associated with an interruption, the I/O supervisor schedules the appropriate device-dependent error routine. The channel is then restarted with another request that is not related to the channel program in error. (The paragraphs following this one under this topic discuss "related" channel programs.) If the error recovery procedures fail to correct the error, the system places ones in the first two bit positions of the IFLGS field of the data control block. You are informed of the error by an error code that the system places into the event control block.

Related channel programs are requests that are associated with a particular data control block and data extent block in the same job step. They must be executed in a definite order, i.e., the order in which the requests are received by the I/O supervisor. A channel program is not started until all previous requests for related channel programs have been completed. You specify, in the input/output block, whether the channel program is related to others.

If a permanent error occurs in a channel program that is related to other requests, the request elements for all the related channel programs are removed from their queue and made available. This process is called purging.

The addresses of the input/output blocks for the related channel programs are chained together, with the address of the first input/output block in the chain placed into the DEBUSPRG field of the data extent block. The address of the second input/output block is placed into the IOBRESTR field of the first input/output block, and so on. The last input/output block in the chain is indicated by all ones in the last byte of the IOBRESTR field. The chain defines the order in which the request elements for the related channel programs are removed from the request queue.

For all requests related to the channel program in error, the system places completion codes into the event control blocks. The DCBIFLGS field of the data control block is also flagged. Any requests for a data control block with error flags are posted complete without execution. To reissue requests related to the channel program in error, you must reset the first two bits of the DCBIFLGS field of the data control block to zeros. You then issue a RESTORE macro instruction, specifying, as the only parameter, the address of the DEBUSPRG field of the data extent block. This causes execution of all the related channel programs. (The RESTORE macro definition and how to add it to the macro library are in "System macro Instructions.") Alternatively, to restart only particular channel programs rather than all of them, you may reissue EXCP for each channel program desired.

Appendages

This section discusses the appendages that you may optionally code when using EXCP. Before a programmer-written appendage can be executed, it must be included in the SVC library. These procedures are explained first; descriptions of the routines themselves and of their coding specifications follow.

An appendage must be a member of the SVC library. The full member name of an appendage is eight bytes in length, but the first six bytes are required by IBM standards to be the characters IGG019. The last two characters must be provided by you as an identification; they may range in collating sequence from WA to Z9.

The SVC library is a partitioned data set named SYS1.SVCLIB. You can insert an appendage into the SVC library during the system generation process or by link-editing it into the SYS1.SVCLIB.

To enter a routine into the SVC library during system generation, use the SVCLIB macro instruction, which is described in *OS/VS1 System Generation Reference.*

An appendage is a programmer-written routine that provides additional control over I/O operations. By providing appendages, you can examine the status of I/O operations and determine the actions to be taken for various conditions. An appendage may receive control when one of the following occurs:

- Page fixing
- Start I/O
- Program controlled interruption
- End of extent

- Channel end
- Abnormal end

An appendage is executed in supervisor state. An appendage must not issue any SVC instructions or instructions that change the status of the computing or operating system (for example, WTO or LPSW). Because an appendage runs disabled for all types of interrupts except for machine checks, it must not enter loops that test for completion of I/O operations. An appendage must not alter storage that is used by either the supervisor or the I/O supervisor.

The last two characters of an appendage's 8-character name must be specified in the DCB macro instruction, as described in the section "Macro Specification for Use with EXCP." When an OPEN macro instruction for the data control block is issued, any appendages specified in the DCB macro instruction are loaded into the problem program partition. They are loaded into virtual storage if the partition is pageable.

Your appendage routines are made available to the I/O supervisor when the DCB for the data set is opened. The address of each appendage you have provided (and the number of 2K segments of storage each occupies) is placed in a table called the appendage vector table. This table is always constructed by the system when OPEN is issued; if an appendage is not provided, the table contains the address of a branch (BR 14) instruction that immediately returns control to the I/O supervisor. Using the appendage vector table, the I/O supervisor branches and links to each appendage at the appropriate time.

The I/O supervisor uses registers to pass parameters to the appendages as follows:

- *Register 1:* Address of the request queue element (RQE) for the channel program. The RQE consists of 20 bytes formatted as shown in Figure 10.
- *Register 2:* Address of the input/output block (IOB).
- *Register 3:* Address of the data extent block (DEB).
- *Register 4:* Address of the data control block (DCB).
- *Register 7:* Address of the unit control block (UCB).
- *Register 14:* Address of the location in the I/O supervisor to which control is to be returned after execution of the appendage. When returning control to the I/O supervisor, you may use displacements from the return address in register 14. Allowable displacements are summarized in the following table and described later for each appendage.
- *Register 15:* Address of the entry point of the appendage, except in the instance of the page fix appendage. Refer to the following table.

You may not change register 1 in an appendage; this is reserved in case an abnormal condition occurs while the appendage is in control. Register 9, if used, must be set to binary zero before control is returned to the system. All other registers, except those indicated in the descriptions of each appendage, must be saved and restored if they are used. Figure 11 summarizes register conventions.

0(0) TSTLNK – Address of next RQE in this queue	2(2) TSTUCB – Address of UCB
4(4) TSTIDT – TCB identification	5(5) TSTIOB – Address of IOB
8(8) TSTPRI – Requestor's priority	9(9) TSTDEB – Address of DEB
12(0C) TSTKEY – Requestor's protection key	13(0D) TSTTCB – Address of TCB
16(10) Channel program translation flags	17(11) Address of Channel Program Translation Header Block

Figure 10. The Request Queue Element (RQE)

Appendages	Entry Point	Returns		Available Work Reg.*
PGFX	Reg 15 + 4	Reg 14 + 0 Reg 14 + 4	Fix list	Reg. 10, 11, and 13
SIO	Reg 15	Reg 14 + 0 Reg 14 + 4 Reg 14 + 8	Normal Skip Extend	Reg. 10, 11, and 13
PCI	Reg 15	Reg 14 + 0 Reg 14 + 4	Normal Modify	Reg. 10, 11, 12, and 13
EOE	Reg 15	Reg 14 + 0 Reg 14 + 4 Reg 14 + 8	Return Skip Try Again	Reg. 10, 11, 12, and 13
CE	Reg 15	Reg 14 + 0 Reg 14 + 4 Reg 14 + 8 Reg 14 + 12	Normal Skip Re-EXCP By-Pass	Reg. 10, 11, 12, and 13
XCE	Reg 15	Reg 14 + 0 Reg 14 + 4 Reg 14 + 8 Reg 14 + 12	Normal Skip Re-EXCP By-Pass	Reg. 10, 11, 12, and 13

* Certain register conventions for passing parameters from appendages to the I/O supervisor must be followed. These conventions are described in the appendage descriptions.

Figure 11. Entry Points, Returns, and Available Work Registers for the I/O Supervisor Appendages

The types of appendages are listed in the following paragraphs, with explanations of when they are entered, how they return control to the system, and which registers they may use without saving and restoring.

Page Fix (PGFX) and Start I/O (SIO) Appendage

This appendage comprises two essentially independent appendages. The total appendage can be viewed as a re-enterable subroutine having two entry points, one for SIO and one for PGFX.

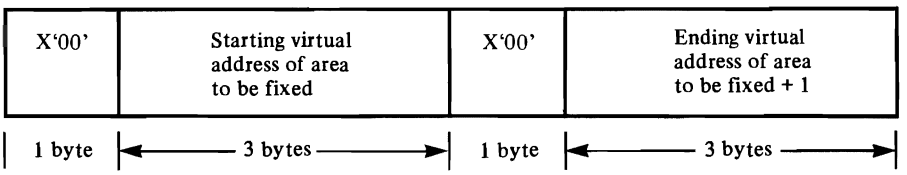
The SIO entry point is offset 0 in the subroutine; it may be a branch to another area of the appendage. The entry point to the PGFX appendage is at offset +4 in the subroutine.

Page Fix (PGFX) Appendage

The purpose of this appendage is to list all of the areas that must be fixed (made nonpageable) to prevent paging exceptions from occurring during the execution of appendages related to the current I/O request. The system may enter this appendage more than once. However, each time it enters the appendage, it must create the same list of areas to be fixed, including the boundary of any items used to create the list. After the first entry to this appendage, any paging exceptions occurring during processing of this or related appendages cause abnormal termination.

Page Fix List Processing

On entry to this appendage, register 10 points to a work area for a list of 10 page fix entries of 8 bytes each. Each page fix entry placed in the list by the appendage must have the following doubleword format:



On return to the I/O supervisor (via the return address provided in register 14), register 10 must point to the first page fix entry in the work area, and register 11 must contain the number of page fix entries in the work area. The I/O supervisor then fixes the pages corresponding to the areas listed by the PGFX appendage. The pages remain fixed until the associated I/O operation is completed.

If your DCB, IOB, or ECB (DECB) exceed the sizes fixed by the I/O supervisor, you must include one or more entries in the fix list that contain these control blocks. The sizes of the control blocks fixed by I/O supervisor follow:

DCB	.....	104 bytes
IOB	.....	80 bytes + a 16-byte prefix, for a total of 96 bytes.
ECB (DECB)	.....	40 bytes

The virtual channel program is also fixed.

Start I/O (SIO) Appendage

Unless an error procedure is in control, the I/O supervisor passes control to the SIO appendage just before the I/O supervisor translates your channel program. You have an opportunity to modify or extend the channel program after you request the I/O operation. However, you should not alter the IOBSTART field of your IOB in the SIO appendage; changing the address in

IOBSTART has no effect on where the I/O supervisor begins CCW translation. If the system does not initiate the I/O activity because of a busy condition and the I/O request has not been translated, this appendage is reentered before the SIO instruction is issued; otherwise, it is not reentered unless bit 2 (DEBRSIOA) in byte 14 (DEBFLGS1) of the DEB is set to 1. You may set this bit prior to issuing an EXCP if you wish to reenter your start I/O appendage each time the SIO instruction is retried due to a busy condition. If the I/O request has already been translated, however, it will not again be translated despite iterated executions of the start I/O appendage. Note that the routine used to set the bit must run in protection key 0.

Optional return vectors give the I/O requester the following choices:

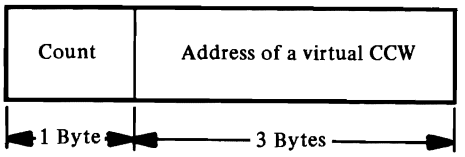
Reg. 14 + 0: Normal return. Normal channel program translation and SIO instruction execution occur.

Reg. 14 + 4: Skip the I/O operation. The channel program is not posted complete, but the request queue element is made available. The I/O requester may post the channel program as follows:

1. Save necessary registers.
2. Place pointer to post entry address from the communications vector table (CVT) in register 15.
3. Place TCB address from the RQE in register 12.
4. Place ECB address from the IOB in register 11.
5. Set the completion code in the high-order byte in register 10.
6. Go to POST using BALR 14,15.

Reg. 14 + 8: Extended channel program translation. This appendage must be included in your program if you modify CCWs with the PCI appendage. In the SIO appendage, you must build an extend parameter list which gives the number of continguous CCWs in each chain and the address of the beginning virtual CCW in that chain (including the CCW chain pointed to by the IOBSTART field of the IOB, the normal starting CCW location). You must also include, in the SIO extend parameter list, the maximum number of indirect address list (IAL) entries required for each CCW that is modified by the PCI appendage (if needed). The number of IAL entries is required by I/O supervisor to reserve space for additional IAL entries needed when translating CCWs at PCI time. See *OS/VS1 I/O Supervisor Logic*, for additional information on the SIO extend parameter list and IAL.

To use the channel program translation, you must provide the address of the SIO extend parameter list in register 10 and the number of entries in the SIO extend parameter list in register 11. The format of an entry in the SIO extend parameter list is as follows:



If an entry is to contain the number of contiguous CCWs in a chain, you must set bit 0 of the count field (called the I bit) to 0. The number of contiguous CCWs in this chain must be placed in bits 1-7 of the count field. If an entry is to contain the maximum number of IAL entries required for a CCW, the I bit

must be set to 1 and the maximum number of IAL entries required must be placed in bits 1-7 of the count field. The maximum number of IAL entries required can be determined by taking the maximum CCW data length to be used divided by 2048. The entry containing the number of contiguous CCWs in a chain must precede the entry that contains the maximum number of IAL entries required for a CCW in that chain. Figure 12 shows an SIO extend parameter list and its relationship to the requestor's virtual CCW chains.

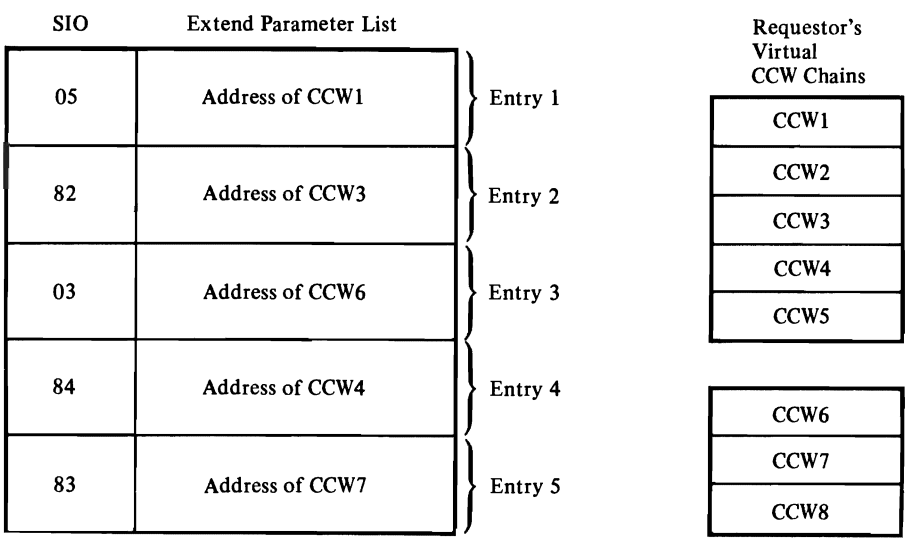


Figure 12. Relationship of SIO Extend Parameter List to Requestor's CCW Chains

Program Controlled Interruption (PCI) Appendage

The system enters this appendage when a program controlled interruption occurs. At the time of the interruption, the contents of the channel status word will not have been placed in the "channel status word" field of the input/output block. The channel status word can be obtained from location 64. The CCW address in the CSW is a virtual address in the virtual channel program.

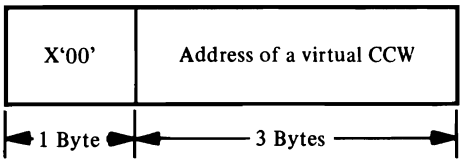
You may use registers 10 through 13 in a PCI appendage without saving and restoring their contents. The system may reenter this appendage for the same channel program if the error recovery procedure is in the process of retrying a CCW with the program controlled interrupt (PCI) bit set on. The IOB error flag is set when the error recovery procedure is in control (IOBFLAG1 = X'20').

Refer to the topic "Block Multiplexor Channel Programming Notes" later in this chapter for special PCI conditions encountered with command retry.

To return control to the I/O supervisor for normal interruption processing, use the return address in register 14. To make use of the PCI modify interface of the I/O supervisor, use register 14 + 4 as the return address.

The PCI modify interface enables you to make changes to translated (real) CCWs in the midst of an I/O operation. In the PCI appendages you can make changes to the virtual image of the channel program whose execution is interrupted. To cause the I/O supervisor to make corresponding changes to the real channel program, you must construct a PCI modify parameter list in a fixed area of storage that you provide. The list must contain the virtual

address of each CCW changed. Each entry in the list consists of four bytes as follows:



On exit from the PCI appendage (via register 14 + 4), register 10 must point to the first entry in the list, and register 11 must contain the number of entries in the list.

The I/O supervisor then finds the real CCW corresponding to each virtual CCW specified in the list, translates the virtual CCW to real, and replaces the real CCW. If the CCW requires an IAL, it must already exist.

Transfer-in-channel (TIC) commands are resolved to previously defined CCW strings only, and cannot be used to expose new CCW strings. Also, new pages to be fixed cannot be exposed now.

Error conditions created by incorrect specifications of PCI modify parameter list entries abnormally terminate the I/O requestor. Examples of such error conditions are:

- The virtual CCW listed exposes a new CCW string or data page.
- A page exception is encountered in accessing an entry in the list.

End-of-Extent Appendage

This appendage is entered when the seek address specified in the input/output block is outside the allocated extent limits indicated in the data extent block.

If you use the return address in register 14 to return control to the system, the abnormal end appendage is entered. An end-of-extent error code (X'42') is placed in the "ECB code" field of the input/output block for subsequent posting in the ECB. You may use the following optional return addresses:

- Contents of register 14 plus 4—The channel program is posted complete; its request element is returned to the available queue.
- Contents of register 14 plus 8—The request is tried again.

You may use registers 10 through 13 in an end-of-extent appendage without saving and restoring their contents.

Note: If an end-of-cylinder or file-protection condition occurs, the I/O supervisor updates the seek address to the next higher cylinder or track address, and re-executes the request. If the new seek address is within the data set's extent, the request is executed; if the new seek address is not within the data set's extent, the end-of-extent appendage is entered. If you wish to try the request in the next extent, you must move the new seek address into the UCB at UCB+48.

If a file-protection condition is caused by a full seek (command code=07) embedded within a channel program, the request is flagged as a permanent error, and the abnormal end appendage is entered.

Channel End (CE) Appendage

This appendage is entered when a channel end (CE), unit exception (UEX) with or without channel end, or channel end with wrong length record (WLR) occurs without any other abnormal end conditions.

If you use the return address in register 14 to return control to the I/O supervisor, the channel program is posted complete, and its request element is made available. In the case of unit exception or wrong length record, the error recovery procedure is performed before the channel program is posted complete, and the IOBEX flag (X'04') in IOBFLAG1 is set on. The condition code may be directly tested by using a BC instruction. A CC=0 means no UEX or WLR accompanied this interruption. The CSW status may be obtained from the IOBCSW field.

If the appendage takes care of the wrong length record and/or unit exception, it may turn off the IOBEX (X'04') flag in IOBFLAG1 and return normally. The event will then be posted complete (completion code X'7F' under normal conditions, taken from the high-order byte of the IOBECBCC field). If the appendage returns normally without resetting the IOBEX flag to zero, the request will be routed to the associated device error routine, and then the abnormal end appendage will be immediately entered with IOBECBCC completion code is set to X'41'.

You may use the following optional return addresses:

- Contents of register 14 plus 4—The channel program is not posted complete, but its request element is made available. You may post the event by using the calling sequence described under the start I/O appendage. This is especially useful if you wish to post an ECB other than the IOBECB.
- Contents of register 14 plus 8—The channel program is not posted complete, and its request element is placed back on the request queue so that the I/O operation can be retried. For correct re-execution of the channel program, you must re-initialize the IOBFLAG1, IOBFLAG2, and IOBFLAG3 fields of the input/output block and set the "error counts" field to zero. As an added precaution, the IOBSENS0, IOBSENS1, and IOBCSW fields should be cleared.
- Contents of register 14 plus 12—The channel program is not posted complete, and its request element is not made available. (The request element is assumed to be used in a subsequent asynchronous exit routine.)

You may use registers 10 through 13 in a channel end appendage without saving and restoring their contents.

Abnormal End (XCE) Appendage

This appendage may be entered on abnormal conditions, such as: unit check, unit exception, wrong length indication, program check, protection check, channel data check, channel control check, interface control check, chaining check, out-of-extent error, and intercept condition (i.e., device end error). It may also be entered when an EXCP is issued for a DCB that has already been purged.

1. When this appendage is entered due to a unit exception and/or wrong length record indication, the IOBECBCC is set to X'41'. For further information on these conditions see "Channel End Appendage."

2. When the appendage is entered due to an out-of-extent error, the IOBECBCC is set to X'42'.
3. When this appendage is entered with the IOBECB code set to X'4B', it is due to:
   a. the tape ERP having been entered after a repositioning for error recovery has been done and, if there was a unit check, a check has been made in the sense byte for load point, or
   b. the tape ERP finding zeros as the IOB CSW command address.

   The ERP exits to the I/O supervisor with a permanent error indication given.
4. When the appendage is first entered due to an intercept condition, the IOBECBCC is set to X'7E'. If it is then determined that the error condition is permanent, the appendage will be entered a second time with the IOBECBCC set to X'44'. The intercept condition signals that an error was detected at device end after channel end on the previous requests.
5. When the appendage is entered due to an EXCP being issued to an already purged DCB, this request will enter the abnormal end appendage with the IOBECBCC set to X'48'. This applies only to related requests.
6. When the appendage is entered with the IOBECBCC set to X'7F', it may be due to a unit check, program check, protection check, channel data check, channel control check, interface control check, or chaining check. When the IOBECBCC is X'7F', it is the first detection of an error in the associated channel program. When the IOBEX flag (bit 5 of the IOBFLAG1) is on, the IOBECBCC field will contain a 41, 42, 48, 4B, or 4F in hexadecimal, indicating a permanent I/O error.

To determine if an error is permanent, you should check the IOBECBCC field of the IOB. To determine the type of error, check the channel status word and the sense information in the IOB. However, when the IOBECBCC is X'42' or X'48', these fields are not applicable. For X'44' the CSW is applicable, but the sense is valid only if the unit check bit is set. If you use the return address in register 14 to return control to the system, the channel program is posted complete, and its request element is made available. (The SYNADAF macro instruction, described in *OS/VS Data Management Macro Instructions*, may be used in an error analysis routine to analyze permanent I/O errors.) You may use the following optional return addresses:

- Contents of register 14 plus 4—The channel program is not posted complete, but its request element is made available.
- Contents of register 14 plus 8—The channel program is not posted complete, and its request element is placed back on the request queue so that the request can be retried. For correct re-execution of the channel program, you must re-initialize the IOBFLAG1, IOBFLAG2, and IOBFLAG3 fields of the input/output block and set the IOBERRCT field to zero. As an added precaution, the IOBSENS0, IOBSENS1, and IOBCSW fields should be cleared.
- Contents of register 14 plus 12—The channel program is not posted complete, and its request element is not made available. (The request element is assumed to be used in a subsequent asynchronous exit.)

You may use registers 10 through 13 in an abnormal end appendage without saving and restoring their contents.

Block Multiplexer Channel Programming Notes

Command retry is a function of the block multiplexer channel supporting the 3330 Disk Storage and the 2305 Fixed Head Storage devices. When the channel receives a retry request, it repeats the execution of the channel command word (CCW) requiring no additional input/output interrupts. For example, a control unit may initiate a retry procedure to recover from a transient error.

A command retry during the execution of a channel program may cause any of the following conditions to be detected by the initiating program:

- Modifying CCWs: A CCW used in a channel program must not be modified before the CCW operation has been successfully completed. Without the command retry function, a command was fetched only once from storage by a channel. Therefore, a program could determine through condition codes or program controlled interruptions (PCI) that a CCW had been fetched and accepted by the channel. This permitted the CCW to be modified before re-execution. With the command retry function, *this* cannot be done, since the channel will fetch the CCW from storage again on a command retry sequence. In the case of data chaining, the channel will command retry starting with the first CCW in the data chain.
- Program Controlled Interrupts: A CCW containing a PCI flag may cause multiple program controlled interruptions to occur. This happens if the PCI-flagged CCW was retried during a command retry procedure, and a PCI could be generated each time the CCW is re-executed.
- Residual Count: If a channel program is prematurely terminated during the retry of a command, the residual count in the channel status word (CSW) will not necessarily indicate how much storage was used. For example, if the control unit detects a "wrong length record" error condition, an erroneous residual count is stored in the CSW until the command retry is successful. When the retry is successful, the residual in the CSW is the correct length of the data transfer. Since the channel will not allow more data to be transferred than is specified in the count field of the CCW, this situation will occur only when reading variable records or unknown record types.
- Command Address: When data chaining with command retry, the CSW may not indicate how many CCWs have been executed at the time of a PCI. For example:

CCW#	Channel Program
1	Read, data chain
2	Read, data chain
3	Read, data chain, PCI
4	Read, command chain

  In this example, assume that the control unit signals command retry on Read #3 and the CPU accepts the PCI after the channel resets the command address to Read #1 because of command retry. The CSW stored for the PCI will contain the command address of Read #1, when actually the channel has progressed to Read #3.
- "Bit Spinning" on Data Read: Any program that tests a data storage location to determine when a CCW has been executed and continues to execute based on this data may get incorrect results if an error is detected and the CCW is retried. An example of this is a PCI appendage in which ones are placed in a buffer area that will be overlaid with zeros when a

record is read. When the PCI appendage is entered, a check for zeros is made and the appendage will continue to loop until the record is read into the buffer (indicated by ones changed to zeros). If the appendage uses the data from this record to modify a channel program, the results will be unpredictable during a command retry sequence, as the CCW has not been correctly executed.

Macro Specifications for Use With EXCP

If you are using the EXCP macro instruction, you must also use DCB, OPEN, CLOSE, and, in some cases, the EOV macro instruction. The parameters of these macro instructions and the EXCP macro instructions are explained here. A diagram of the data control block is included with the description of the DCB macro instruction.

DCB—Define Data Control Block for EXCP

The EXCP form of the DCB macro instruction produces a data control block that can be used with the EXCP macro instruction. You must issue a DCB macro instruction for each data set to be processed by your channel programs. Notation conventions and format illustrations of the DCB macro instruction are given in the *OS/VS Data Management Macro Instructions* publication. DCB parameters that apply to EXCP may be divided into four categories, depending on the following portions of the data control block that are generated when they are specified:

- Foundation block. This portion is required and is always 12 bytes in length. You must specify two of the parameters in this category.
- EXCP interface. This portion is optional. If you specify any parameter in this category, 20 bytes are generated.
- Foundation block extension and common interface. This portion is optional and is always 20 bytes in length. If this portion is generated, the device dependent portion is also generated.
- Device dependent. This portion is optional and is generated only if the foundation block extension and common interface portion is generated. Its size ranges from 4 to 20 bytes, depending on specifications in the DEVD parameter. However, if you do not specify the DEVD parameter (and the foundation extension and common interface portion is generated), the maximum 20 bytes for this portion are generated.

Some of the procedures performed by the system when the data control block is opened and closed (such as writing file marks for output data sets on direct access volumes) require information from optional data control block fields. You should make sure that the data control block is large enough to provide all information necessary for the procedures you want the system to handle.

Figure 13 shows the relative position of each portion of an opened data control block. The fields corresponding to each parameter of the DCB macro instruction are also designated, with the exception of DDNAME, which is not included in a data control block that has been opened. The fields identified in parentheses represent system information that is not associated with parameters of the DCB macro instruction.

Sources of information for data control block fields other than the DCB macro instruction are data definition (DD) statements, data set labels, and data control block modification routines. You may use any of these sources to

specify DCB parameters. However, if a portion of the data control block is not generated by the DCB macro instruction, the system does not accept information intended for that portion from any alternative source.

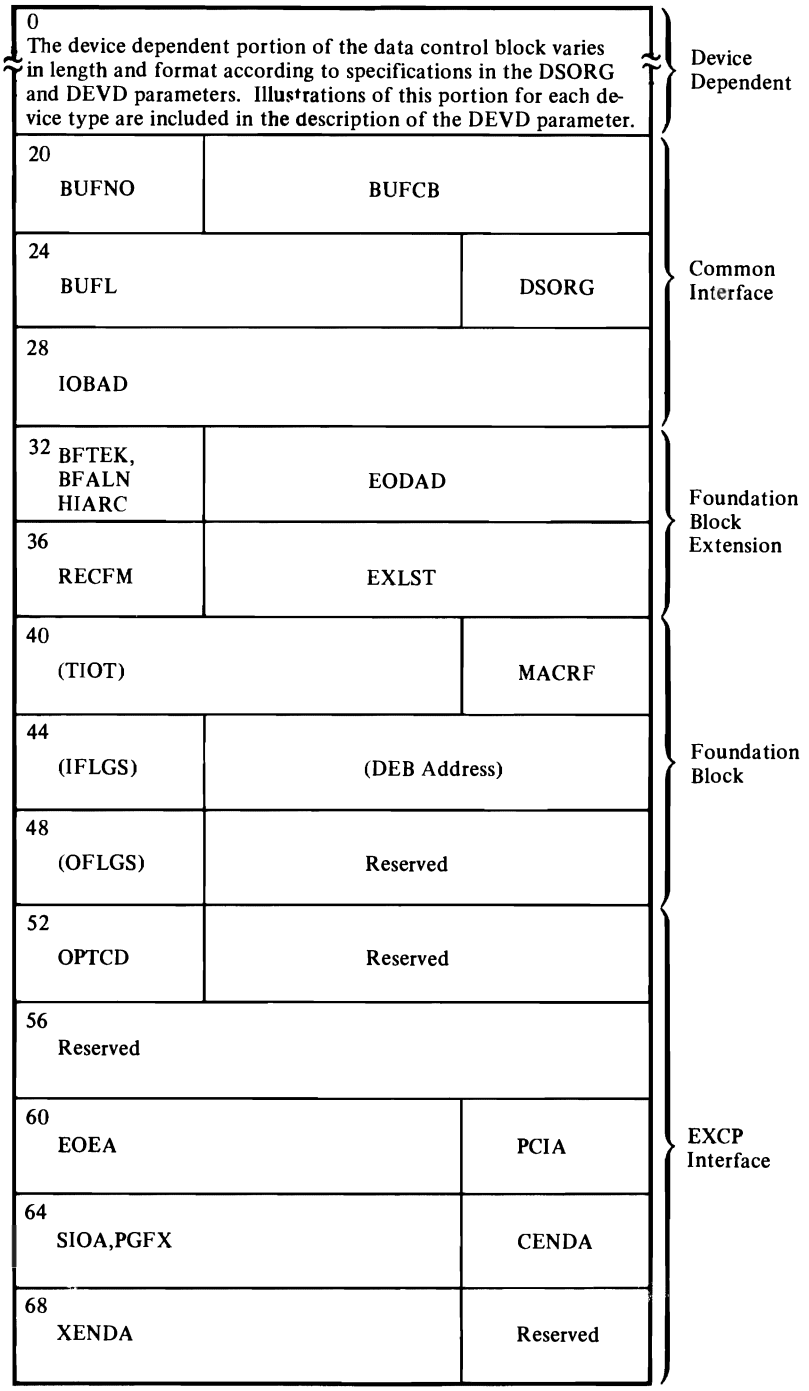


Figure 13. Data Control Block Format for EXCP (After OPEN)

Foundation Block Parameters

DDNAME= *symbol*

The name of the data definition (DD) statement that describes the data set to be processed. This parameter must be given.

MACRF=(E)

The EXCP macro instruction is to be used in processing the data set. This operand must be coded. If, however, you are processing a multivolume, direct data set (DSORG=DA), you should code MACRF=(W) or (R). This results in the operating system's performing automatic parallel volume mounting and causes the Open routines to complete the data extent block (DEB) that represents all volumes of the data set. Note that the user must modify the AVT to ensure that the BDAM appendages are not entered. Do not use BDAM if you want to use your own appendages; they will not be loaded.

REPOS= { Y | N }

Magnetic tape volumes: If your system generation statements include the dynamic device reconfiguration (DDR) entry, then this parameter indicates to the DDR routine whether or not the user is keeping an accurate block count. If the user is keeping an accurate block count, the DDR routine can attempt to swap the volume. (You must maintain the block count in the IOBINCAM field.)

Y—The user is keeping an accurate block count and the DDR routine can attempt to swap the volume.

N—The block count is unreliable and the DDR routine cannot and will not attempt to swap the volume.

If the operand is omitted, **N** is assumed.

EXCP Interface Parameters

EOEA= *symbol*

2-byte identification of an end-of-extent appendage that you have entered into the SVC library. (See Note A.)

PCIA= *symbol*

2-byte identification of a program controlled interruption (PCI) appendage that you have entered into the SVC library. (See Note A.)

SIOA= *symbol*

2-byte identification of a start I/O (SIO) appendage that you have entered into the SVC library. (See Note A.)

CENDA= *symbol*

2-byte identification of a channel end appendage that you have entered into the SVC library. (See Note A.)

XENDA= *symbol*

2-byte identification of an abnormal end appendage that you have entered into the SVC library. (See Note A.)

Note A: The full name of an appendage is 8 bytes in length, but the first six bytes are required by IBM standards to be the characters IGG019. You provide the last two characters as the identification; they may range in collating sequence from WA to Z9.

PGFX={ Y | N }

A yes response indicates the existence of a user page fix appendage. If you specify PGFX=yes, also specify SIOA=XX. If this operand is omitted, 'NO' is assumed.

OPTCD=Z
indicates that for magnetic tape (input only) a reduced error recovery procedure (5 reads only) will occur when a data check is encountered. It should be specified only when the tape is known to contain errors and the application does not require that all records be processed. Its proper use would include error frequency analysis in the SYNAD routine. Specification of this parameter will also cause generation of a foundation block extension. This parameter is ignored unless it was selected at system generation.

IMSK= *value*
Any specification indicates that the system will not use IBM-supplied error routines.

Foundation Block Extension and Common Interface Parameters

EXLST= *address*
the address of an exit list that you have written for exceptional conditions. The format of this exit list is given in *OS/VS Data Management Services Guide.*

EODAD= *address*
the address of your end-of-data set routine for input data sets. If this routine is not available when it is required, the task is abnormally terminated.

DSORG= { PS | PO | DA | IS }
the data set organization (one of the following codes). Each code indicates that the format of the device-dependent portion of the data control block is to be similar to that generated for a particular access method:

Code	DCB Format for
PS	QSAM or BSAM
PO	BPAM
DA	BDAM
IS	QISAM or BISAM

Note: For direct-access devices, if you specify either PS or PO, you must maintain the following fields of the device-dependent portion of the data control block so that the system can write a file mark for output data sets:

- The track balance (DCBTRBAL) field, which contains a 2-byte binary number that indicates the remaining number of bytes on the current track.
- The full disk address (DCBFDAD) field, which indicates the location of the current record. The address is in the form MBBCCHHR.

These fields are written into the format-1 DSCB and are used by Open routines for staging MSS data sets. Staging is done only up to the last cylinder specified by these fields if the data set is re-opened for OUTPUT, INOUT, or OUTIN.

If you specify PO for a direct-access device, the DCBDIRCT field will not be updated. Therefore, you should be careful when using EXCP with the STOW macro.

IOBAD= *address*
the address of an input/output block (IOB). If a pointer to the current IOB is not required, you may use this field for any purpose.

The following parameters are not used by the EXCP routines, but they provide cataloging information about the data set. This information can be used later by access method routines that read or update the data set.

RECFM= *code*
the record format of the data set. Record format codes are given in *OS/VS Data Management Macro Instructions.* When writing a data set to be read later using one of the access method routines, the RECFM, LRECL, KEYLEN, and BLKSIZE should be specified to identify the data set attributes. LRECL and BLKSIZE can only be specified in a job file control block (JFCB) created by a DD statement, since these fields do not exist in a DCB used by EXCP.

BFTEK={ S | E }
the buffer technique, either simple or exchange.

BFALN= { F | D }
the word boundary alignment of each buffer, either fullword or doubleword.

BUFL= *length*
the length in bytes of each buffer; the maximum length is 32,767.

BUFNO= *number*
the number of buffers assigned to the associated data set; the maximum number is 255.

BUFCB= *address*
the address of a buffer pool control block, i.e., the 8-byte field preceding the buffers in a buffer pool.

Device-Dependent Parameters

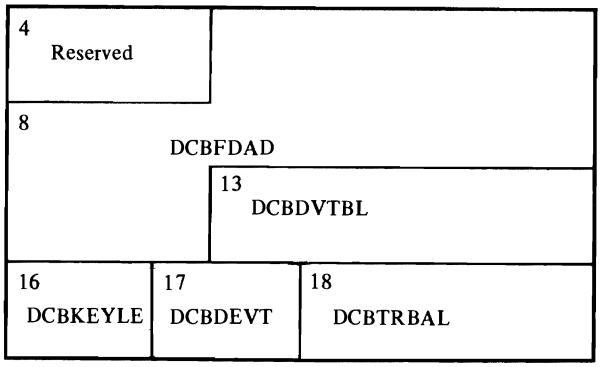
DEVD= *code*
the device on which the data set may reside. The codes are listed in order of descending space requirements for the data control block:

Code	Device
DA	Direct access
TA	Magnetic tape
PT	Paper tape
PR	Printer
PC	Card punch
RD	Card reader

Note: If you do not wish to select a specific device until job set-up time, you should specify the device type requiring the largest area. For MSS virtual volumes, DA should be used.

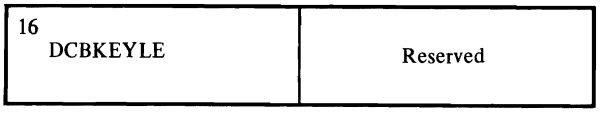
The following diagrams illustrate the device-dependent portion of the data control block for each device type specified in the DEVD parameter, and for each data set organization specified in the DSORG parameter. Fields that correspond to device-dependent parameters in addition to DEVD are indicated by the parameter name. For special services, you may have to maintain the fields shown in parentheses. The special services are explained in the note that follows the diagram.

Device-dependent portion of data control block when DEVD=DA and DSORG=PS or PO:

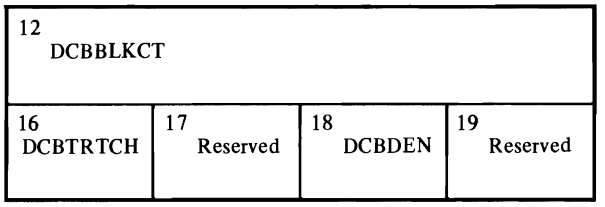


Note: For output data sets, the system uses the contents of the full disk address (DCBFDAD) field plus one to write a file mark when the data control block is closed, provided the track balance (DCBTRBAL) field indicates that space is available. You must maintain the contents of these two fields yourself if the system is to write a file mark. OPEN will initialize DCBDVTBL and DCBDEVT.

Device-dependent portion of data control block when DEVD=DA and DSORG=IS or DA:



Device-dependent portion of data control block when DEVD=TA and DSORG=PS:



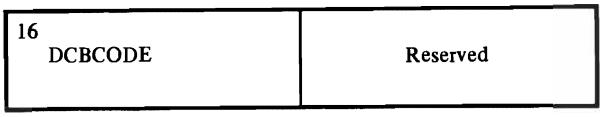
Note: For output data sets, the system control program uses the contents of the block count (DCBBLKCT) field to write the block count in trailer labels when the data control block is closed or when the EOV macro instruction is issued.

The IOS tape trapcode routine updates this field by adding the value in IOBINCAM to DCBBLKCT.

When using EXCP to process a tape data set open at a checkpoint, you must be careful to maintain the correct value in IOCINCAM; otherwise, the system may position the data set incorrectly when restart occurs.

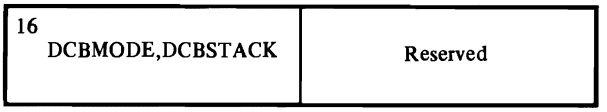
If your system generation statements include the dynamic device reconfiguration entry, IOBINCAM must be maintained by you for repositioning. Also, your DCB macro instruction must include the REPOS=Y entry.

Device-dependent portion of data control block when DEVD=PT and DSORG=PS:



Device-dependent portion of data control block when DEVD=PR and DSORG=PS:

Device-dependent portion of data control block when DEVD=PC or RD and DSORG=PS:



The following DCB operands pertain to specific devices and may be specified only when the DEVD parameter is specified.

KEYLEN= *length*
for direct-access devices, the length in bytes of the key of a physical record, with a maximum value of 255. When a block is read or written, the number of bytes transmitted is the key length plus the record length.

CODE= *value*
for paper tape, the code in which records are punched:

Value	Code
I	IBM BCD
F	Friden
B	Burroughs
C	National Cash Register
A	ASCII
T	Teletype[1]
N	no conversion (format-F records only)

If this parameter is omitted, N is assumed.

[1] Trademark of Teletype Corporation

DEN=*value*
for magnetic tape, the tape recording density in bits per inch:

Value	Density 7-Track Tape	9-Track Tape
0	200	—
1	556	—
2	800	800 (NRZI)
3	—	1600 (PE)
4	—	6250 (GCR)

NRZI—Non-return-to-zero-inverse mode
PE—Phase encoded mode
GCR—Group coded recording mode

If this parameter is omitted, the highest density on the device is assumed.

TRTCH= *value*
for 7-track magnetic tape, the tape recording technique:

Value	Tape Recording Technique
C	Data conversion feature is available.
E	Even parity is used. (If omitted, odd parity is assumed.)
T	BCDIC to EBCDIC translation is required.

MODE= *value*
for a card reader or punch, the mode of operation. Either C (column binary mode) or E (EBCDIC code) may be specified.

STACK= *value*
for a card punch or card reader, the stacker bin to receive cards, either 1 or 2.

PRTSP= *value*
for a printer, the line spacing, either 0, 1, 2, or 3.

OPEN—Initialize Data Control Block

The OPEN macro instruction initializes one or more data control blocks so that their associated data sets can be processed. You must issue OPEN for all data control blocks that are to be used by your channel programs. (A dummy data set may not be opened for EXCP.) Some of the procedures performed when OPEN is executed are:

- Construction of data extent block (DEB).
- Transfer of information from DD statements and data set labels to DCB.
- Verification or creation of standard labels.
- Tape positioning.
- Loading of your appendage routines.

The three parameters of the OPEN macro instruction are:

[*symbol*]	**OPEN**	(*dcb address*,*[*(*options*)*]*,...)

dcb address —A-type Address or (2-12)
the address of the data control block to be initialized. (More than one data control block may be specified.)

option $_1$
the intended method of I/O processing of the data set. You may specify this parameter as either INPUT, RDBACK, OUTPUT, INOUT, OUTIN, or UPDAT.

If this parameter is omitted, INPUT is assumed.

option $_2$
the volume disposition that is to be provided when tape volume switching occurs. The operand values and meanings are as follows:

REREAD
Reposition the volume to process the data set again.

LEAVE
No additional positioning is performed at end-of-volume processing.

DISP
The disposition indicated on the DD statement is tested and appropriate positioning provided. This service is assumed if this operand is omitted and volume positioning is applicable. If there is no disposition specified in the DD statement when this operand is specified, LEAVE is assumed.

When you code MACRF=(E) in the DCB macro instruction, indicating that your program uses the EXCP macro instruction, the Open routines process your data control block as if it represents a single-volume, physical-sequential data set, except that the DCB fields are merged (from and to the DSCB and JFCB for the data set) according to the DSORG you specify in the DCB macro instruction.

However, if you are concatenating partitioned data sets, mount messages will be issued, volume verification will be performed, and a DEB will be built that represents all the extents and volumes of the concatenated data sets.

You should recognize that if you are opening multiple-volume direct or index-sequential data sets, only the first volume of the data set is verified to be mounted by the operating system, and the DEB built by the Open routines for the data set will represent only the first volume.

The list and execute forms of the OPEN macro instruction are described in *OS/VS Data Management Macro Instructions.*

EXCP—Execute Channel Program

The EXCP macro instruction requests the initiation of the I/O operations of a channel program. You must issue EXCP whenever you want to execute one of your channel programs. The only parameter of the EXCP macro instruction is:

[*symbol*]	**EXCP**	*iob-address*

iob-address—A-type address, (2-12), or (1)
the address of the input/output block of the channel program to be executed.

ATLAS—Assigning an Alternate Track and Copying Data from the Defective Track

A program that uses the EXCP macro instruction for input and output may use the ATLAS macro instruction, during the execution of the program, to obtain an alternate track and to copy a defective track onto the alternate track. With the use of ATLAS, the program can recover from permanent (hard) errors encountered in the execution of the following types of I/O commands:

- Search ID.
- Write. (The error condition must be confirmed during the execution of the channel program by a CCW that checks the data written.)
- Read count. Errors in the CCHHR part of the count area can be recovered from unless the record is the home address or record zero. Errors in the KDD part of the count area cannot be recovered from unless the user has identified the defective record.

Note: ATLAS cannot be used with MSS virtual devices (3330V).

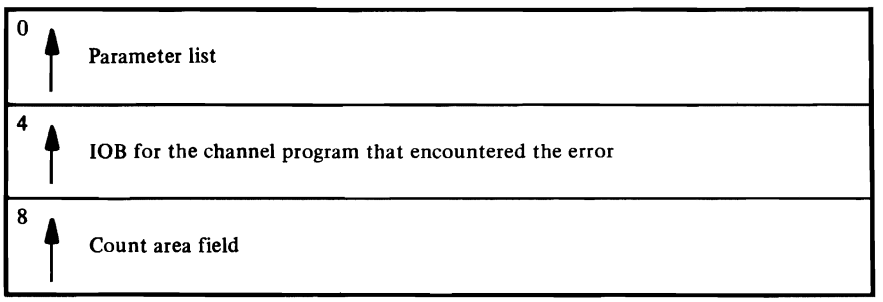
Your DCB must include the DCBRECFM field and the field must show whether the data set is in the track overflow format. If it is, recovery from errors in last records on tracks depends on your identifying the track overflow record segments.

Recovery takes the form of obtaining an alternate good track and copying the defective track onto the good alternate one. Unless a re-execution of the channel program by ATLAS can correct the defect, the user should examine, and if necessary replace, defective records in a subsequent job if the data set is to be processed again.

The format is:

[*symbol*]	**ATLAS**	**PARMADR=**{*address*} **[,CHANPRG=**{**R** | **NR**}**]** **[,CNTPTR=**{**P** | **F**}**]** **[,WRITS=**{**YES** | **NO**}**]**

PARMADR
Address of a parameter address list of the following format:



The count area field contains the CCHHRKDD of a defective record or the CCHH of a track that is to be copied.

address-(2-12) or (1)
Address is given as the symbolic label of the address list or as the number of a general register that contains the address of the list.

CHANPRG={ R | NR }
specifies whether the channel program that encountered the error can be executed again.

R
Channel program may be executed again by ATLAS. Before permitting re-execution of the channel program by ATLAS, you must reset the error indications of the previous execution fields in the DCBIFLGS. (See the example of the use of ATLAS below.)

NR
Channel program may not be executed again.

If this parameter is omitted, R is assumed.

CNTPTR= { P | F }
specifies whether the count area field contains a full count area (CCHHRKDD) or a partial count area (CCHH).

P
Part of the count area (the CCHH address of the track to be copied).

F
Full count area (CCHHRKDD count of the record that was found defective).

If this parameter is omitted, P is assumed.

WRITS= { YES | NO }
track overflow segment identification.

If your data set is in the track overflow format, this identification determines recovery from errors in last records on tracks.

YES
If this is the last record on the track, it is a segment other than the last of a track overflow record.

NO
If this is the last record on the track it is the last or only segment of a track overflow record.

If this parameter is omitted, it is assumed that it cannot be established whether a last record is a segment of an overflow record.

Using ATLAS

If a channel program encounters a unit check condition (shown in the CSW) in its execution, the I/O supervisor program will place the sense bytes in the IOB. ATLAS can be used to recover from sense conditions shown by the following bit settings:

Setting	Meaning
IOBSENS0 X'08'	Data check (except in the count area)
IOBSENS1 X'80'	Data check in the count area
IOBSENS1 X'02'	Missing address marker (see the following for combinations of this bit setting which ATLAS cannot handle.)

However, defects in the home address record or the record zero record cannot be recovered from through the use of ATLAS. These conditions are shown by:

IOBSENS1 X'02' *and* IOBSENS0 X'01'—home address defect.

IOBSENS1 X'0A'—record zero defect, or, home address cannot be located.

Also, before using ATLAS, you must reset the DCBIFLGS error indications as follows:

```
NI  DCBIFLGS,X'3F'
```

The ATLAS program will attempt to find a good alternate track and will attempt to copy the defective track onto the good track, including all error conditions in either key or data areas. The error conditions may be rectified by re-executing the channel program or through the use of the IEHATLAS utility program in a subsequent step.

Example: the following illustrates the use of the ATLAS macro instruction.

```
        EXCP     MYIOB
        WAIT     ECB=MYECB
        TM       MYECB,X'20'        TEST FOR I/O ERROR
        BO       NEXT               NO, SUCCESSFUL, GO TO
*                                   ANOTHER ROUTINE
        TM       IOBCSW+3,X'02'     UNIT CHECK
        BZ       OTHER              NO, DO OTHER ERROR
*                                   PROCESSING
        TM       IOBSENS0,X'08'     DATA CHECK
        BO       ATLASGO            YES, VALID ERROR
        TM       IOBSENS1,X'80'     DATA CHECK IN COUNT
        BO       ATLASGO            YES, VALID ERROR
        TM       IOBSENS1,X'0A'     MISSING ADDRESS MARKER
*                                   AND NO RECORD FOUND
*                                   YES, ATLAS CANNOT HANDLE
        BO       OTHER              ERROR; DO OTHER ERROR
ATLASGO EQU      *                  PROCESSING NO, MISSING
*                                   ADDRESS MARKER ONLY
        NI       DCBIFLGS,X'3F'     RESET ERROR INDICATORS
        ATLAS    PARMADR=THERE,CHANPRG=R
```

Operation of the ATLAS Program

The ATLAS program (SVC 86):

- Establishes the availability and address of the next alternate track from the format-4 DSCB of the VTOC.
- Brings all count fields from the defective track into storage to establish the description of the track.
- Initializes the alternate track. (Write home address, write record zero.)
- Brings the key and data areas of each record into storage, one at a time, and combines them with their new count area to write the complete record onto the alternate track.
- When the copying is finished, chains the alternate to the defective track and updates the VTOC.

Control is returned to your program at the next executable instruction following the ATLAS macro instruction. The success of the ATLAS macro instruction can be determined by examining the contents of register 15, which

will contain one of the return codes described below. If register 15 contains 0, 36, 40, or 44, the contents of register 0 may be significant.

Decimal Return Code	Interpretation
0	Successful completion. Key and data areas have been copied from the defective track onto a good alternate one. The only error encountered was in the record identified by the user's CCHHRKDD value. If the channel program is re-executable, it has been successfully re-executed.
4	This device type does not have alternate tracks that can be assigned by programming.
8	All alternate tracks for the device have been assigned.
12	A request for storage (GETMAIN macro instruction) could not be satisfied.
16	All attempts to initialize and transfer data to an alternate track failed. The number of attempts made is equal to 10% of the assigned alternates for the device.
20	The type of error shown by the sense byte cannot be handled through the use of the ATLAS macro instruction. The condition is other than a data check (in the count or data areas) or a missing address marker.
24	The format-4 DSCB of the VTOC cannot be read, therefore alternate track information is not available to ATLAS.
28	The record specified by the user was the format-4 DSCB and it could not be read.
32	An error found in count area of last record on the track cannot be handled because last-record-on-track identification is not supplied.
36	An error was encountered when reading or writing the home address record or record zero. No error recovery has taken place. If register 0 contains X'01 00 00 00', the defect is in record zero.
40	Successful completion. Key and data areas have been copied from the defective track onto a good alternate one. However, the alternate track may have records with defective key or data areas. Register 0 identifies the first three found defective as follows: n R R R n—Number of record numbers that follow (0, 1, 2, or 3). R—The number of the record found defective but copied anyhow. If the channel program is re-executable, it has been successfully re-executed.
44	Error(s) encountered and no alternate track has been assigned. The return parameter register (register 0) will contain the R of a maximum of three error records. Error conditions that return this code are: • ATLAS received an error indication for a record with a data length in the count field of zero. Recovery was not possible because a distinction cannot be made between an EOF record and an invalid data length. • An error occurred while reading the count field of a record and the KDD (key length-data length) was found to be defective. • More than three records on the specified track contained errors in their count fields.
48	No errors found on the track, no alternate assigned. ATLAS will not assign an alternate unless a track has at least one defective record.
52	I/O error in re-executing user's channel program. A good alternate is chained to the defective track and data has been transferred. The user's control blocks will give indication of the error condition causing failure in re-execution of his channel program.

Decimal Return Code	Interpretation
56	The DCB reflects a track overflow data set, but the UCB device type shows that the device does not support track overflow.
60	The CCHH of the user-specified count area is not within the extents of his data set.
64	The device is an MSS virtual device, which is not supported.

Figures 14 and 15 summarize the return codes that reflect track error conditions by error location.

Record in Error	Area in Error			
	Count Area		Key Area	Data Area
	CCHHR	KDD		
Record r (r≠0)				
Not last on track	0	44	40	40
Last on track				
WRITS=YES	0	44	40	40
WRITS=NO	0	44	40	40
Omitted*	32	44	40	40
Record zero	36	36	36	36
Home address	36			

*Omitted and the data set is in the track overflow format

Figure 14. Error Locations and Return Codes if CCHH is in the Count Area Field

Record in error	Area in error			
	Count Area		Key Area	Data Area
	CCHHR	KDD		
Record n (n=R in CCHHRKDD)				
Not last on track	0	0	0	0
Last on track				
WRITS=YES	0	0	0	0
WRITS=NO	0	0	0	0
Omitted*	32	32	0	0
Record m (m≠R in CCHHRKDD)				
Not last on track	0	44	40	40
Last on track				
WRITS=YES	0	44	40	40
WRITS=NO	0	44	40	40
Omitted*	32	44	40	40
Record zero	36	36	36	36
Home address	36			

*Omitted and the data set is the track overflow format.

Figure 15. Error Locations and Return Codes if CCHHRKDD is in the Count Area Field

EOV—End of Volume

The EOV macro instruction identifies end-of-volume and end-of-data set conditions. For an end-of-volume condition, EOV causes switching of volumes and verification or creation of standard labels. For an end-of-data set condition, EOV causes your end-of-data set routine to be entered. Before processing trailer labels on a tape input data set, you must decrement the DCBBLKCT field. You issue EOV if switching of magnetic tape or direct-access volumes is necessary, or if secondary allocation is to be performed for a direct-access data set opened for output.

For magnetic tape, you must issue EOV when either a tapemark is read or a reflective spot is written over. In these cases, bit settings in the 1-byte DCBOFLGS field of the data control block determine the action to be taken when EOV is executed. Before issuing EOV for magnetic tape, you must make sure that appropriate bits are set in DCBOFLGS. Bit positions 2,3,6, and 7 of DCBOFLGS are used only by the system; you are concerned with bit positions 0,1,4, and 5. The use of these DCBOFLGS bit positions is as follows:

Bit 0:
set to 1 indicates that a write command was executed and that a tape mark is to be written.

Bit 1:
indicates that a backward read was the last I/O operation.

Bit 4:
indicates that data sets of unlike attributes are to be concatenated.

Bit 5:
indicates that a tape mark has been read.

If bits 0 and 5 of DCBOFLGS are both off when EOV is executed, the tape is spaced past a tapemark, and standard labels, if present, are verified on both the old and new volumes. The direction of spacing depends on bit 1. If bit 1 is off, the tape is spaced forward; if bit 1 is on, the tape is backspaced.

If bit 0 is on when EOV is executed, a tapemark is written immediately following the last data record of the data set. Standard labels, if specified, are created on the old and the new volume.

When issuing EOV for sequentially organized output data sets on direct-access volumes, you can determine whether additional space has been obtained on the same or a different volume. You do this by checking the volume serial number in the unit control block (UCB) both before and after issuing EOV.

The only parameter of the EOV macro instruction is:

[*symbol*]	**EOV**	*dcb address*

dcb address—A-type address, (2-12), or (1)
the address of the data control block that is opened for the data set. If this parameter is specified as (1), register 1 must contain this address.

CLOSE—Restore Data Control Block

The CLOSE macro instruction restores one or more data control blocks so that processing of their associated data sets can be terminated. You must issue CLOSE for all data control blocks that were used by your channel programs. Some of the procedures performed when CLOSE is executed are:

- Release of data extent block (DEB)
- Removal of information transferred to data control block fields when OPEN was executed
- Verification or creation of standard labels
- Volume disposition
- Release of programmer-written appendage routines

[*symbol*]	**CLOSE**	(*dcb address* ,[*option*],...)

dcb address—A-type address or (2-12)
the address of the data control block to be restored. More than one data control block may be specified.

option
the type of volume disposition intended for the data set. You may specify this parameter as LEAVE, REREAD, REWIND, or DISP. The corresponding volume disposition when CLOSE is executed is as follows:

LEAVE
Volume is positioned at logical end of data set.

REREAD
Volume is positioned at logical beginning of data set.

REWIND
Volume is positioned at load point

DISP
The disposition indicated on the DD statement is tested, and appropriate positioning is provided. This service is assumed if this operand is omitted and volume positioning is applicable. If there is no disposition specified in the DD statement when this operand is specified, LEAVE is assumed.

This parameter is ignored if specified for volumes other than magnetic tape or direct access.

Note: When CLOSE is issued for data sets on magnetic tape volumes, labels are processed according to bit settings in the DCBOFLGS field of the data control block. Before issuing CLOSE for magnetic tape, you must set the appropriate bits in DCBOFLGS. The DCBOFLGS bit positions that you are concerned with are listed in the EOV macro instruction description. The list and execute forms of the CLOSE macro instruction are described in *OS/VS Data Management Macro Instructions.*

Control Block Fields

The fields of the input/output block, event control block, and data extent block are illustrated and explained here; the data control block fields have been described with the parameters of the DCB macro instruction in the section "EXCP Programming Specifications."

Input/Output Block Fields

The input/output block (IOB) is not automatically constructed by a macro instruction; it must be defined as a series of constants and must be on a fullword boundary. For unit record and tape devices, the IOB is 32 bytes in length. For direct access, teleprocessing, and graphic devices, 8 additional bytes must be provided.

In Figure 16, the shaded areas indicate fields in which you must specify information. The other fields are used by the system and must be defined as all zeros. You may not place information into these fields, but you may examine them.

IOBFLAG1 (1 byte): the type of channel program. You must set bit positions 0, 1, and 6. One bits in positions 0 and 1 indicate data chaining and command chaining, respectively. (If both data chaining and command chaining are specified, the system does not use error recovery routines except for the 2671, 1052, 2150, and the direct access devices.) A one bit in position 6 indicates that the channel program is not related to any other channel program. Bit positions 2, 3, 4, 5, and 7 are used only by the system.

IOBFLAG2 (1 byte): is used only by the system.

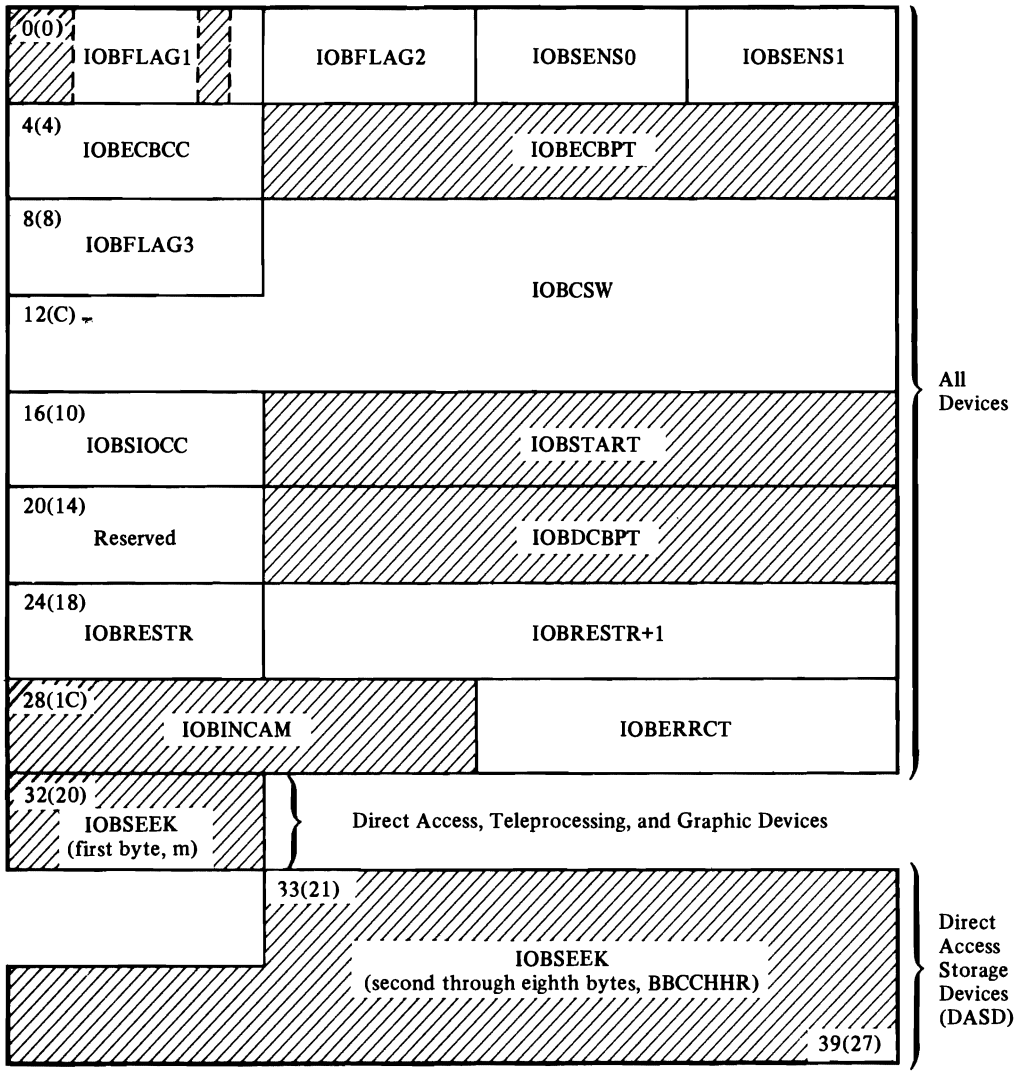


Figure 16. Input/Output Block Format

IOBSENS0 and IOBSENS1 (2 bytes): are placed into the input/output block by the system when a unit check occurs. If the two sense bytes are X'10FE', the supervisor received unit checks while attempting to issue a sense command to reset a unit check.

IOBECBCC (1 byte): the first byte of the completion code for the channel program. The system places this code in the high-order byte of the event control block when the channel program is posted complete. The completion codes and their meanings are listed under "Event Control Block Fields."

IOBECBPT (3 bytes): the address of the 4-byte event control block that you have provided.

IOBFLAG3 (1 byte): is used only by the system.

IOBCSW (7 bytes): the low-order seven bytes of the channel status word, which are placed into this field each time a channel end occurs.

IOBSIOCC (1 byte): in bits 0 and 1, the instruction-length code; in bits 2 and 3, the start I/O (SIO) condition code for the SIO instruction the system issues to start the channel program; and in bits 4 through 7, the program mask.

IOBSTART (3 bytes): the starting address of the channel program to be executed.

Reserved (1 byte): used only by the system.

IOBDCBPT (3 bytes): the address of the data control block of the data set to be read or written by the channel program.

IOBRESTR (1 byte): used by the system for volume repositioning in error recovery procedures.

IOBRESTR+1 (3 bytes): used by the system to indicate the starting address of a channel program that performs special functions for error recovery procedures. The system also uses this field in procedures for making request elements available, as explained under "Error Recovery Procedures for Related Channel Programs."

IOBINCAM (2 bytes): for magnetic tape, the amount by which the block count (DCBBLKCT) field in the device-dependent portion of the data control block is to be incremented. You may alter these bytes at any time. For forward operations, these bytes should contain a binary positive integer (usually +1); for backward operations, they should contain a binary negative integer. When these bytes are not used, all zeros must be specified.

IOBERRCT (2 bytes): the number of retries attempted during error recovery procedures.

IOBSEEK (first byte, M): direct-access devices: Extent entry in the data extent block that is associated with the channel program (0 indicates the first extent; 1 indicates the second, etc.). Teleprocessing and graphic devices: The UCB index.

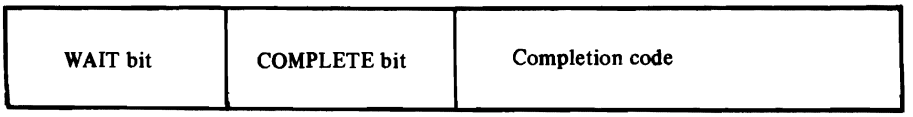
IOBSEEK (last 7 bytes, BBCCHHR): for direct-access devices, the seek address for your channel program.

Event Control Block Fields

You must define an event control block (ECB) as a 4-byte area on a fullword boundary. When the channel program has been completed, the input/output supervisor places a completion code containing status information into the ECB (Figure 17). Before examining this information, you must test for the setting of the complete bit. If the complete bit is not on, and your problem program cannot perform other useful operations, you should issue a WAIT macro instruction that specifies the event control block. Under no circumstances may you construct a program loop that tests for the complete bit.

Data Extent Block Fields

The data extent block (DEB) is constructed by the system when an OPEN macro instruction is issued for the data control block. You may not modify the fields of the DEB, but you may examine them. The DEB format and field description are contained in *OS/VS1 System Data Areas.*



WAIT bit
A one bit in this position indicates that the WAIT macro instruction has been issued, but that the channel program has not been completed.

COMPLETE bit
A one bit in this position indicates that the channel program has been completed; If it has not been completed, a zero bit is in this position.

Completion Code
This code, which includes the wait and complete bits, may be one of the following 4-byte hexadecimal expressions:

Code	Interpretation
7F000000	Channel program has terminated without error.
41000000	Channel program has terminated with permanent error.
42000000	Channel program has terminated because a direct-access extent address has been violated.
43000000	I/O ABEND condition occurred for the task loading a transient error routine. (CSW contents do not apply.)
44000000	Channel program has been intercepted because of permanent error associated with device end for previous request. You may reissue the intercepted request. (CSW contents do not apply.)
48000000	Request element for channel program has been made available after it has been purged. (CSW contents do not apply.)
4B000000	One of the following errors occurred during tape error recovery processing. • The CSW command address in the IOB is zeros. • An unexpected load point was encountered.
4F000000	Error recovery routines have been entered because of direct-access error but are unable to read home address or record 0. (CSW contents do not apply.)

Figure 17. Event Control Block After Posting of Completion Code (EXCP)

EXCPVR—Execute Channel Program, Virtual Request (Fixed)

The EXCPVR macro instruction requests the initiation of the I/O operations of a channel program. The format of the EXCPVR macro instruction is:

[*symbol*]	**EXCPVR**	*iob-address*

iob-address—A-type address, (2-12)
the address of the IOB of the channel program to be executed.

The EXCPVR macro instruction provides you with the same functions as the EXCP macro instruction (that is, a device-dependent means of performing I/O operations.) Also, it allows your program to improve the efficiency of I/O operations in a paging environment by translating its own virtual channel programs to real channel programs. That is, authorized programs can execute in a pageable area while your program provides the I/O supervisor with real

channel programs. This eliminates the translation of channel programs by the I/O supervisor and minimizes the amount of real storage that must be fixed to execute a channel program.

Problem programs are authorized to use the EXCPVR macro under the authorized program facility (APF). A description of how to authorize a program can be found in *OS/VS1 Planning and Use Guide.*

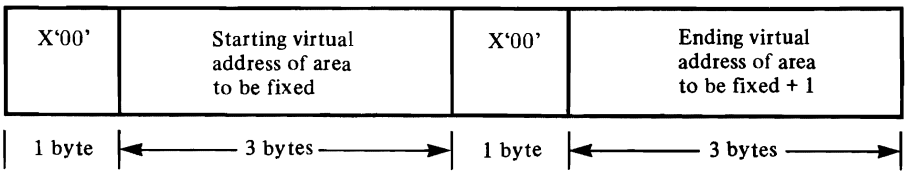
To use EXCPVR, you must do all the things you would do for EXCP; you must also:

1. Fix in real storage the data areas containing your channel programs, appendages, and control blocks. To fix your data areas, build a fix list in your page-fix appendage. For information about which data areas must be fixed and how to build a fix list, see "Page Fix (PGFX) and Start I/O (SIO) Appendage."
2. Determine whether the data areas in virtual storage, specified in the address fields of your CCWs, cross page boundaries. If they do, you must build an indirect address list (IAL) and put a pointer to the IAL in the affected CCW.
3. Translate the addresses in your CCWs from virtual to real addresses.

You must do items 2 and 3 in your start I/O (SIO) appendage.

EXCPVR Fix List

The EXCPVR interface in the I/O supervisor expects a variable-length list of data areas to be fixed. As with the EXCP macro instruction, you must pass the address of the list in register 10 and a count of the number of entries in the list in register 11. The contents of each entry in the fix list is the same as with the list used with EXCP, except that it can contain as many entries as you need:



Consider fixing these data areas in real storage:

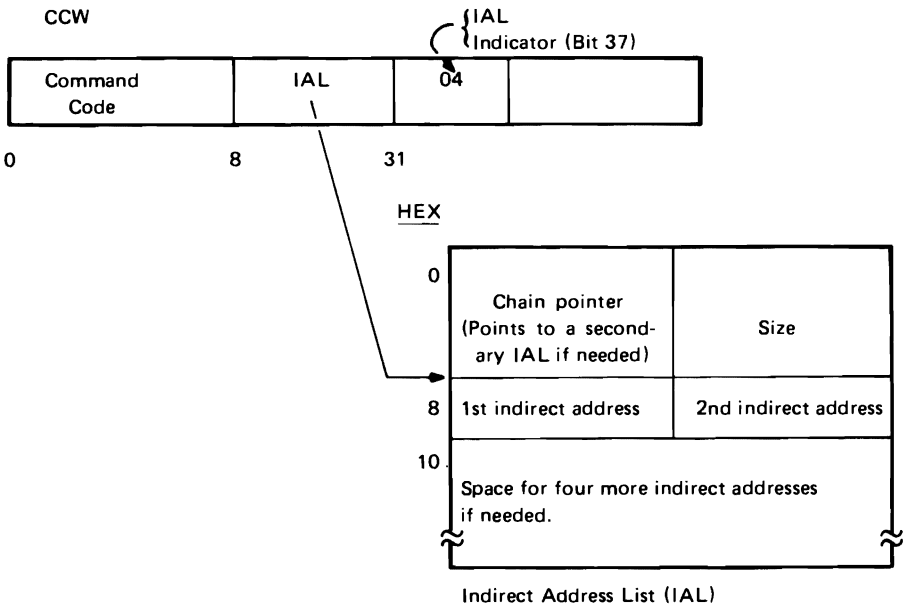
1. The fix list itself. If needed, this must be the first entry in the list.
2. The channel program.
3. The appendages.
4. Data areas from which your channel program will be writing and to which your channel program will be reading.
5. Control blocks—IOB, ECB, and DCB.
6. Any other control blocks referred to in your SIO appendage (the DEB, for example).

Address Translation—Indirect Address List (IAL)

If you are using EXCPVR to execute your channel program, translate the virtual addresses in your channel program to real addresses, build the IAL (if required) in your SIO appendage, and turn on the IAL indicator in the CCW.

You can use the load real address (LRA) instruction to convert the virtual addresses in the channel program to real addresses. Also, you must check the data areas starting at the addresses (bits 8-31) of your CCWs to determine whether the data areas cross page boundaries. If they do, you must provide an entry in the IAL for each page boundary crossed. The I/O supervisor uses the IAL to identify the address to which the channel will continue reading to, or writing from, when it crosses the page boundary. You can use the LRA instruction to translate the virtual address of each entry in the IAL to a real address, then add it to the indirect address list. The address of the IAL must be put in the data address field of the CCW.

Figure 18 shows the relationship of the CCW to the indirect address list.



Note 1: Put one entry in this list for each page boundary your data area crosses.

Note 2: If the CCW has an IAL rather than a data address, bit 37 must be on to signal this to the channel.

Figure 18. Relationship of CCW to Indirect Address List

USING XDAP TO READ AND WRITE TO DIRECT-ACCESS DEVICES

The execute direct-access program (XDAP) macro instruction provides you with a means of reading, verifying, or updating blocks on direct-access volumes without using an access method and without writing your own channel program. This chapter explains what the XDAP macro instruction does and how you can use it. The control block generated when XDAP is issued and the macro instruction used with XDAP are also discussed.

Since most of the specifications for XDAP are similar to those for the execute channel program (EXCP) macro instruction, you should be familiar with the "Executing Your Own Channel Programs (EXCP)" chapter of this publication, as well as with the information contained in *OS/VS Data Management Services Guide,* which provides how-to information for using the access method routines of the system control program.

Introduction

Execute direct-access program (XDAP) is a macro instruction that you may use to read, verify, or update a block on a direct-access volume. If you are not using the standard IBM data access methods, you can, by issuing XDAP, generate the control information and channel program necessary for reading or updating the records of a data set.

You cannot use XDAP to add blocks to a data set, but you can use it to change the keys of existing blocks. Any block configuration and any data set organization can be read or updated.

Although the use of XDAP requires much less storage than do the standard access methods, it does not provide many of the control program services that are included in the access methods. For example, when XDAP is issued, the system does not block or deblock records and does not verify block length.

To issue XDAP, you must provide the actual device address of the track containing the block to be processed. You must also provide either the block identification or the key of the block, and specify which of these is to be used to locate the block. If a block is located by identification, both the key and data portions of the block may be read or updated. If a block is located by key, only the data portion can be processed.

For additional control over I/O operations, you may write appendages, which must be entered into the SVC library. Descriptions of these routines and their coding specifications are contained in the "Executing Your Own Channel Programs (EXCP)" section of this publication.

XDAP Requirements

Before issuing the XDAP macro instruction, you must issue a DCB macro instruction, which produces a data control block (DCB) for the data set to be read or updated. You must also issue an OPEN macro instruction, which initializes the data control block and produces a data extent block (DEB).

When the XDAP macro instruction is issued, another control block, containing both control information and executable code, is generated. This control block may be logically divided into three sections:

- An event control block (ECB), which is supplied with a completion code each time the direct-access channel program is terminated.
- An input/output block (IOB), which contains information about the direct-access channel program.
- A direct-access channel program, which consists of three or four channel command words (CCWs). The type of channel program generated depends on specifications in the parameters of the XDAP macro instruction.

After this XDAP control block is constructed, the direct-access channel program is executed. A block is located by either its actual address or its key, and is either read or updated.

When the channel program has terminated, a completion code is placed into the event control block. After issuing XDAP, you should therefore issue a WAIT macro instruction specifying the event control block to determine whether the direct-access program has terminated. If volume switching is necessary, you must issue an EOV macro instruction. When processing of the data set has been completed, you must issue a CLOSE macro instruction to restore the data control block.

Macro Specifications for Use With XDAP

When you are using the XDAP macro instruction, you must also issue DCB, OPEN, CLOSE, and, in some cases, the EOV macro instructions. The parameters of the XDAP macro instruction are listed and described here. For the other required macro instructions, special requirements or options are explained, but you should refer to "Macro Specifications for Use with EXCP" for listings of their parameters.

DCB—Define Data Control Block

The EXCP form of the DCB macro instruction produces a data control block that can be used with the XDAP macro instruction. You must issue a DCB macro instruction for each data set to be read or updated by the direct-access channel program. The section "DCB—Define Data Control Block for EXCP" contains a diagram of the data control block, as well as a listing of the parameters of the DCB macro instruction.

OPEN—Initialize Data Control Block

The OPEN macro instruction initializes one or more data control blocks so that their associated data sets can be processed. You must issue OPEN for all data control blocks that are to be used by the direct-access program. Some of the procedures performed when OPEN is executed are:

- Construction of data extent block (DEB).
- Transfer of information from DD statements and data set labels to the data control block.
- Verification or creation of standard labels.
- Loading of programmer-written appendage routines.

The two parameters of the OPEN macro instruction are the address(es) of the data control block(s) to be initialized, and the intended method of I/O processing of the data set. The method of processing may be specified as either INPUT, OUTPUT, INOUT, OUTIN, or UPDAT; however, if nothing is specified, INPUT is assumed.

XDAP—Execute Direct-Access Program

The XDAP macro instruction produces the XDAP control block (i.e., the ECB, IOB, and channel program) and executes the direct-access channel program. The format of the XDAP macro instruction is:

[*symbol*]	**XDAP**	*ecb-symbol* ,*type* ,*dcb-addr* ,*area-addr* ,*length-value* ,[*(key-addr*,*keylength-value)*] ,*blkref-addr* ,[*sector-addr*] ,[**MF=** {**L** | **E**}]

ecb-symbol—symbol or (2-12)
the symbolic name to be assigned to the XDAP control block. Registers can be used only with MF=E or MF=L.

type — {**RI** | **RK** | **WI** | **WK** | **VI** | **VK** }

the type of I/O operation intended for the data set and the method by which blocks of the data set are to be located. Two values must be coded in this field. The following combinations are valid: RI, RK, WI, WK, VI, and VK.

The codes and their meanings are:

R
Read a block.

W
Write a block.

V
Verify contents of a block but do not transfer data.

I
Locate a block by identification. (The key portion, if present, and the data portion of the block are read or written.)

K
Locate a block by key. (Only the data portion of the block is read or written.) If you code this value, you must code the *key-addr* and *key-length-value* operands.

dcb-addr—A-type address or (2-12)
the address of the data control block of the data set.

area-addr—A-type address or (2-12)
the address of an input or output area for a block of the data set.

length-value—absexp or (2-12)
the number of bytes to be transferred to or from the input or output area. If blocks are to be located by identification and the data set contains keys, the value must include the length of the key. The maximum number of bytes transferred is 32,767.

key-addr—RX-type address or (2-12)
when blocks are to be located by key, the address of a virtual storage field that contains the key of the block to be read or overwritten.

keylength-value—absexp or (2-12)
when blocks are to be located by key, the length of the key. The maximum length is 255 bytes.

blkref-addr—RX-type address or (2-12)
the address of a field in virtual storage containing the actual device address of the track containing the block to be located. The actual address of a block is in the form MBBCCHHR, where M indicates which extent entry in the data extent block is associated with the direct-access program; BB is not used but must be zero; CC indicates the cylinder address; HH indicates the actual track address; and R indicates the block identification. R is not used when blocks are to be located by key. (See "Conversion of Relative Block Address to Actual Device Address" later in this chapter for more detailed information.)

sector-addr—RX-type address or (2-12)
the address of a 1-byte field containing a sector value. The sector-address parameter is used for rotational position sensing (RPS) devices only. The parameter is optional, but its use will improve channel performance. When the parameter is coded, a set-sector CCW (using the sector value indicated by the data address field) precedes the search-ID-equal command in the channel program. The sector-address parameter is ignored if the type parameter is coded as RK, WK, or VK. If a sector-address is specified in the list form of the macro, then a sector-address, not necessarily the same, must be specified in the execute form.

Note: No validity check is made on either the address or the sector value when the XDAP macro is issued. However, a unit check interrupt will occur during the channel program execution if the sector value is larger than the maximum for the device or if the sector-addr operand is used when accessing a device without RPS. (See "Obtaining Sector Number of a Block or a Device with the RPS Feature" later in this chapter for more detailed information.)

MF=
you may use the L-form of the XDAP macro instruction for a macro expansion consisting of only a parameter list, or the E-form for a macro expansion consisting of only executable instructions.

MF=L
The first two operands *(ecb-symbol* and *type)* are required and must be coded as symbols. All other operands are optional except *blkref-addr*, which is ignored if coded. The last five operands must be coded as A-type addresses.

MF=E

The first operand *(ecb-symbol)* is required and may be coded as a symbol or supplied in register 2-12. The *type, dcb-addr, area-addr,* and *length-value* operands may be supplied in either the L- or E-form. The *blkref-addr* operand may be supplied in the E-form or moved into the IOB by you. The *sector-addr* is optional; it may be coded either in both the L- and E-form or in neither.

The *dcb-addr, area-addr, blkref-addr,* and *sector-value* operands may be coded as RX-type addresses or supplied in register 2-12. The *length-value* and *keylength-value* operands can be specified as a decimal digit or supplied in register 2-12.

EOV—End of Volume

The EOV macro instruction identifies end-of-volume and end-of-data set conditions. For an end-of-volume condition, EOV causes switching of volumes and verification or creation of standard labels. For an end-of-data set condition, EOV causes your end-of-data set routine to be entered. When using XDAP, you issue EOV if switching of direct-access volumes is necessary, or if secondary allocation is to be performed for a direct-access data set opened for output.

The only parameter of the EOV macro instruction is the address of the data control block of the data set.

CLOSE—Restore Data Control Block

The CLOSE macro instruction restores one or more data control blocks so that processing of their associated data sets can be terminated. You must issue CLOSE for all data sets that were used by the direct-access channel program. Some of the procedures performed when CLOSE is executed are:

- Release of data extent block (DEB)
- Removal of information transferred to data control block fields when OPEN was executed
- Verification or creation of standard labels
- Release of programmer-written appendage routines

The only parameter of the CLOSE macro instruction is the address of the data control block to be restored. (More than one data control block may be specified.)

Control Blocks Used with XDAP

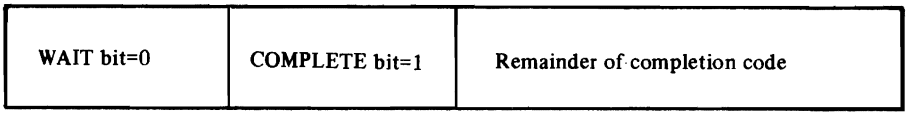
The three control blocks generated during execution of the XDAP macro instruction are described here.

Event Control Block

The event control block (ECB) begins on a fullword boundary and occupies the first 4 bytes of the XDAP control block. Each time the direct-access channel program terminates, the input/output supervisor places a completion code containing status information into the event control block (Figure 19). Before examining this information, you must test for the setting of the complete bit by issuing a WAIT macro instruction specifying the event control block.

Input/Output Block

The input/output block (IOB) is 40 bytes in length and immediately follows the event control block. The "Control Block Guide" section in the EXCP section of this publication contains a diagram of the input/output block. The only fields with which the user of XDAP is concerned are the IOBSENS0, IOBSENS1, and IOBCSW fields. You may wish to examine these fields when a unit check condition or an I/O interruption occurs.



WAIT Bit
A one bit in this position indicates that the direct-access channel program has not been completed.

COMPLETE Bit
A one bit in this position indicates that the channel program has been completed; if it has not been completed, a zero bit is in this position.

Completion Code
This code, which includes the WAIT and COMPLETE bits, may be one of the following 4-byte hexadecimal expressions:

Code	Interpretation
7F000000	Direct-access program has terminated without error.
41000000	Direct-access program has terminated with permanent error.
42000000	Direct-access program has terminated because a direct-access extent address has been violated.
43000000	I/O ABEND condition occurred for the task loading a transient error routine. (CSW contents do not apply.)
44000000	Channel program has been intercepted because of permanent error associated with device end for previous request. You may reissue the intercepted request.
48000000	Request element for channel program has been made available after it has been purged.
4F000000	Error recovery routines have been entered because of direct-access error but are unable to read home address or record 0.

Figure 19. Event Control Block After Posting of Completion Code (XDAP)

Direct-Access Channel Program

The direct-access channel program is 24 bytes long (except when set sector is used for RPS devices) and immediately follows the input/output block. Depending on the type of I/O operation specified in the XDAP macro instruction, one of four channel programs may be generated. The three channel command words for each of the four possible channel programs appear in Figure 20.

Type of I/O Operation	CCW	Command Code
Read by identification	1	Search ID Equal
	2	Transfer in Channel
Verify by identification[1]	3	Read Key and Data
Read by key	1	Search Key Equal
	2	Transfer in Channel
Verify by key[1]	3	Read Data
Write by identification	1	Search ID Equal
	2	Transfer in Channel
	3	Write Key and Data
Write by key	1	Search Key Equal
	2	Transfer in Channel
	3	Write Data

[1]For verifying operations, the third CCW is flagged to suppress the transfer of information to virtual storage.

Figure 20. The XDAP Channel Programs

When you specify a sector address with an RI, VI, or WI operation, the channel program is 32 bytes long. Each of the channel programs in Figure 20 would be, in this case, preceded by a set sector command.

Conversion of Relative Block Address to Actual Device Address

To issue XDAP, you must provide the actual device address of the track containing the block to be processed. If you know only the relative block address, you can convert it to the actual address by using a resident system routine. The entry point to this conversion routine is labeled IECPCNVT. The address of the entry point (CVTPCNVT) is in the communication vector table (CVT). The address of the CVT is in location 16. (For the displacements and descriptions of the CVT fields, see *OS/VS1 System Data Areas).*

The conversion routine does all its work in general registers. You must load registers 0, 1, 2, 14, and 15 with input to the routine. Register usage is as follows:

Register	Use
0	Must be loaded with a 4-byte value of the form TTRN, where TT is the number of the track relative to the beginning of the data set, R is the identification of the block on that track, and N is the concatenation number of the data set. (0 indicates the first or only data set in the concatenation, 1 indicates the second, etc.)
1	Must be loaded with the address of the data extent block (DEB) of the data set.
2	Must be loaded with the address of an 8-byte area that is to receive the actual address of the block to be processed. The converted address is of the form MBBCCHHR, where M indicates which extent entry in the data extent block is associated with the direct-access program (0 indicates the first extent, 1 indicates the second, etc.); BB indicates the bin number of the direct-access volume; CC indicates the cylinder address; HH indicates the actual track address; and R indicates the block identification.
3-8	Are not used by the conversion routine.
9-13	Are used by the conversion routine and are not restored.
14	Must be loaded with the address to which control is to be returned after execution of the conversion routine.
15	Is used by the conversion routine as a base register and must be loaded with the address at which the conversion routine is to receive control. If the converted address is outside the limits of the data set, the conversion routine places a return code of X'04' in the register and returns control to the user. A return code of X'00' indicates that the converted address is within the limits of the data set.

When control is returned to your program, register 15 will contain one of the following return codes:

Code	Meaning
0	Successful conversion.
4	The relative block address converts to an actual device address outside the extents defined in the DEB.

Conversion of Actual Device Address to Relative Track Address

To get the relative track address when you know the actual device address, you can use the conversion routine labeled IECPRLTV. The address of the entry point (CVTPRLTV) is in the communication vector table (CVT). The address of the CVT is in location 16.

The conversion routine does all its work in general registers. You must load the register, 1, 2, 14, and 15 with input to the routine. Register usage is as follows:

Register	Use
0	Will be loaded with the resulting TTR0 to be passed back to the caller.
1	Must be loaded with the address of the data extent block (DEB) of the data set.
2	Must be loaded with the address of an 8-byte area containing the actual address to be converted to a TTR. The actual address is of the form MBBCCHHR.
3-8	Are not used by the conversion routine.
9-13	Are used by the conversion routine and are not restored.
14	Must be loaded with the address to which control is to be returned after execution of the conversion routine.
15	Is used by the conversion routine as a base register and must be loaded with the address at which the conversion routine is to receive control.

Obtaining Sector Number of a Block on a Device with the RPS Feature

To obtain the performance improvement given by rotational position sensing, you should specify the *sector-addr* parameter on the XDAP macro. For programs which may be used for both RPS and non-RPS devices, the UCBTYP field can be checked to determine whether or not the device has the rotational position sensing feature.

The *sector-addr* parameter on the XDAP macro specifies the address of a one byte field in your region. You must store the sector number of the block to be located in this field. You can obtain the sector number of the block by using a resident conversion routine, IEC0SCR1. The address of this routine is in field CVT0SCR1 of the CVT, and the address of the CVT is in location 16. The routine should be invoked via a BALR 14, 15 instruction.

For RPS devices, the conversion routine does all its work in general registers. You must load registers 0, 2, 14, and 15 with input to the routine. Register usage is as follows:

Register	Use
0	For fixed-length records, register 0 must be loaded with a 4-byte value in the form DDKR, where DD is a 2-byte field containing the physical block size, K is a 1-byte field containing the key length, and R is a 1-byte field containing the number of the record for which a sector value is desired. The high-order bit of register 0 must be turned off (set to 0) to indicate fixed-length records. For variable-length records, register 0 must be loaded with a 4-byte value in the form BBIR, where BB is the total number of key and data bytes up to, but not including, the target record; I is a 1-byte key indicator (1 for keyed records, 0 for records without keys); and R is a 1-byte field containing the number of the record for which a sector value is desired. The high-order bit of register 0 must be turned on (set to 1) to indicate variable-length records.
1	Not used by the sector convert routine.
2	Must be loaded with a 4-byte field in which the first byte is the UCB device type code for the device (obtainable from UCB+19), and the remaining three bytes are the address of a 1-byte area that is to receive the sector value.
3-8,12,13	Not used.
9-11	Used by the convert routine and are not saved or restored.
14	Must be loaded with the address to which control is to be returned after execution of the sector conversion routine.
15	Used by the conversion routine as a base register and must be loaded with the address of the entry point to the conversion routine.

PASSWORD PROTECTING YOUR DATA SETS

OS/VS password protection does not apply to VSAM data sets. Information about VSAM data set protection is in *OS/VS Virtual Storage Access Method (VSAM) Programmer's Guide* and *OS/VS1 Access Method Services*. To use the data set protection feature of the operating system, you must create and maintain a PASSWORD data set consisting of records that associate the names of the protected data sets with the password assigned to each data set. There are three ways to maintain the PASSWORD data set:

- You can write your own routines.
- You can use the PROTECT macro instruction.
- You can use the utility control statements of the IEHPROGM utility program.

This chapter discusses only the first two of the three ways—it provides technical detail about the PASSWORD data set that is necessary for writing your own routines, and it describes how to use the PROTECT macro instruction.

Before using the information in this chapter, you should be familiar with information in several related publications. The following publications are recommended:

- *OS/VS Data Management Services Guide,* contains a general description of the data set protection feature.
- *OS/VS Message Library: VS1 System Messages,* contains a description of the operator messages and replies associated with the data set protection feature.
- *OS/VS1 JCL Reference,* contains a description of the data definition (DD) statement parameter used to indicate that a data set is to be password protected.
- *OS/VS1 DADSM Logic,* contains a description of the PASSWORD data set record format.
- *OS/VS Utilities,* contains a description of how to maintain the PASSWORD data set using the utility control statements of the IEHPROGM utility program.

Introduction

In addition to the usual label protection that prevents opening of a data set without the correct data set name, the operating system provides data set security options that prevent unauthorized access to confidential data. Password protection prevents access to data sets, until a correct password is entered by the system operator.

The following are the types of access allowed to password protected data sets:

- PWREAD/PWWRITE—A password is required to read or writer.
- PWREAD/NOWRITE—A password is required to read. Writing is not allowed.
- NOPWREAD/PWWRITE—Reading is allowed without a password. A password is required to write.

To prepare for use of the data set protection feature of the operating system, you place a sequential data set, named PASSWORD, on the system residence volume. This data set must contain at least one record for each data set placed under protection. In turn, each record contains a data set name, a password for that data set, a counter field, a protection mode indicator, and a field for recording any information you desire to log. On the system residence volume, these records are formatted as a "key area" (data set name and password) and a "data area" (counter field, protection mode indicator, and logging field). The data set is searched on the "key area."

You can write routines to create and maintain the PASSWORD data set. If you use the PROTECT macro instruction to maintain the PASSWORD data set, see the section in this chapter called "Using the Macro Instruction to Maintain the PASSWORD Data Set." If you use the IEHPROGM utility program to maintain the PASSWORD data set, see *OS/VS Utilities.* These routines may be placed in your own library or the system library, SYS1.LINKLIB. You may use a data management access method or EXCP programming to read from and write to the PASSWORD data set.

If a data set is to be placed under protection, it must have a protection indicator set in its label (format-1 DSCB or header 1 tape label). This is done by the operating system when the data set is created, by the IEHPROGM utility program, or, by the PROTECT macro when creating or adding the control password. The protection indicator is set in response to a value in the LABEL= operand of the DD statement associated with the data set being placed under protection. *OS/VS1 JCL Reference* describes the LABEL operand.

Note: Data sets on magnetic tape are protected only when standard labels are used.

Password-protected data sets can only be accessed by programs that can supply the correct password. When the system control program receives a request to open a protected data set, it issues a message that requests that the password be given. The message goes to the operator console. If you want the password supplied by another method in your installation, you can modify the READPSWD source module or code a new routine to replace READPSWD in SYS1.SVCLIB.

PASSWORD Data Set Characteristics

The PASSWORD data set must reside on the same volume as your operating system. The space you allocate to the PASSWORD data set must be contiguous, i.e., its DSCB must indicate only one extent. The amount of space you allocate depends on the number of data sets your installation wants to protect. Each entry in the PASSWORD data set requires 132 bytes of space. The organization of the PASSWORD data set is physical sequential, the record format is unblocked, fixed-length records (RECFM=F). These records are 80 bytes long (LRECL=80,BLKSIZE=80) and form the data area of the PASSWORD data set records on direct-access storage. In these direct-access storage records, the data area is preceded by a key area of 52 bytes (KEYLEN=52). The key area contains the fully qualified data set name of up to 44 bytes and a password of one to eight bytes, left justified with blanks added to fill the areas. The password assigned may be from one to eight alphameric characters in length. *OS/VS1 DADSM Logic*, describes the PASSWORD data set record format.

You can protect the PASSWORD data set itself by creating a password record for it when your program initially builds the data set. Thereafter, the PASSWORD data set cannot be opened (except by the operating system routines that scan the data set) unless the operator enters the password.

Note: If a problem occurs on a password-protected system data set, maintenance personnel must be provided with the password in order to access the data set and resolve the problem.

Creating Protected Data Sets

A data definition (DD) statement parameter (LABEL=) is used to indicate that a data set is to be placed under protection. Operating procedures at your installation must ensure that password records for all data sets currently under protection are entered in the PASSWORD data set. You may, for example, create a data set and set the protection indicator in its label, without entering a password record for it in the PASSWORD data set. However, once the data set is closed, any subsequent attempt to open results in termination of the program attempting to open the data set, unless the password record is available and the operator can honor the request for the password. (Note that if the protection mode is NOPWREAD and the request is to open the data set for input, no password will be required.)

Protection Feature Operating Characteristics

The topics that follow provide information concerning actions of the protection feature in relation to termination of processing, volume switching, data set concatenation, SCRATCH and RENAME functions, and counter maintenance.

Termination of Processing

Processing is terminated when:

- The operator cannot supply the correct password for the protected data set being opened after two tries.
- A password record does not exist in the PASSWORD data set for the protected data set being opened.
- The protection mode indicator in the password record, and the method of I/O processing specified in the Open routine do not agree, e.g., OUTPUT specified against a read-only protection mode indicator.
- There is a mismatch in data set names for a data set involved in a volume switching operation. This is discussed in the next topic.

Volume Switching

The operating system end-of-volume routine does not normally request a password for a data set involved in a volume switch. Continuity of protection is handled in the following ways:

Input Data Sets—Tape and Direct-Access Devices: Processing continues if the data set name in the tape label or DSCB on the volume switched to matches the name of the data set opened with the password. If they do not match, processing is terminated.

If the protection mode on the new volume is PASSWORD and no previous volumes of the same data set had a protection mode of PASSWORD, then a password is requested.

Output Data Sets—Tape Devices: The protection indicator in the tape label for the first data set on the volume switched to is tested:

- If the protection indicator is set ON and the data set name in the label and the name of the data set opened with the password match, processing continues. An unequal comparison results in a call for another volume.
- If the protection indicator is OFF, processing continues, and a new label is written with the protection indicator set ON.
- If only a volume label exists on the volume switched to, processing continues, and a new label is written with the protection indicator set ON.

Output Data Sets—Direct-Access Devices: For existing data sets, if the data set name in a DSCB on the volume switched to and the name of the data set opened with the password match, processing continues. For new output data sets, the volume switching mechanism ensures continuity of protection: the DSCB created on the volume switched to will indicate protection.

Data Set Concatenation

A password is requested for *every* protected data set that is involved in a concatenation of data sets, regardless of whether the other data sets involved are protected or not.

SCRATCH and RENAME Functions

Each attempt to delete or rename a protected data set results in a request for the password via the IEC301A message. The password supplied in response to this message must be associated with a "WRITE" protection mode indicator.

Counter Maintenance

Other than incrementing the count, the operating system does not maintain the counter in the password record and no overflow indication will be given (overflow after 65,535 openings). You may provide a counter maintenance routine to check and, if necessary, reset this counter.

Using the PROTECT Macro Instruction to Maintain the PASSWORD Data Set

To use the PROTECT macro instruction, your PASSWORD data set must be on the system residence volume. The PROTECT macro can be used to:

- Add an entry to the PASSWORD data set.
- Replace an entry in the PASSWORD data set.
- Delete an entry from the PASSWORD data set.
- Provide a list of information about an entry in the PASSWORD data set; this list will contain the security counter, access type, and the 77 bytes of security information in the "data area" of the entry.

In addition, the PROTECT macro, updates the DSCB of a protected direct-access data set to reflect its protection status; this feature eliminates the need for you to use job control language whenever you protect a data set.

PASSWORD Data Set Characteristics and Record Format When You Use the PROTECT Macro Instruction

When you use the PROTECT macro, the record format and characteristics of the PASSWORD data set are no different from the record format and characteristics that apply when you use your own routines to maintain it.

Number of Records for Each Protected Data Set

When you use the PROTECT macro, the PASSWORD data set must contain at least one record for each protected data set. The password (the last 8 bytes of the "key area") that you assign when you protect the data set for the first time is called the *control password.* In addition, you may create as many secondary records for the same protected data set as you need. The passwords assigned to these additional records are called *secondary passwords.* This feature is helpful if you want several users to have access to the same protected data set, but you also want to control the manner in which they can use it. For example: one user could be assigned a password that allowed the data set to be read and written, and another user could be assigned a password that allowed the data set to be read only.

Note: The PROTECT macro will update the protection mode indicator in the format-1 DSCB in the protected data set only when you issue it for adding, replacing, or deleting a control password.

Protection Mode Indicator

You can set the protection mode indicator in the password record to four different values:

- X'00' to indicate that the password is a secondary password and the protected data set may only be read (PWREAD).
- X'80' to indicate that the password is the control password and the protected data set may only be read (PWREAD).
- X'01' to indicate that the password is a secondary password and the protected data set may be read and written (PWREAD/PWWRITE).
- X'81' to indicate that the password is the control password and the protected data set may be read and written (PWREAD/PWRITE).

Because the DSCB of the protected data set is updated only when the control password is changed, you may request protection attributes for secondary passwords that conflict with the protection attributes of the control password.

Because of the sequence in which the protection status of a data set is checked, the following defaults will occur:

If control password is:	Secondary password must be:
PWREAD/PWRITE or PWREAD/NOWRITE	PWREAD/PWWRITE or PWREAD/NOWRITE
NOPWREAD/PWWRITE	NOPWREAD/PWWRITE

If the control password is set to either of the settings in item 1 above, the secondary password will be set to PWREAD/PWRITE if you try to set it to NOPWREAD/PWWRITE.

If the control password is changed from either of the settings in item 1 to the setting in item 2 above, the secondary password will automatically become NOPWREAD/PWWRITE.

If the control password is changed from the setting in item 2 to either of the settings in item 1 above, the secondary password is set by the system to PWREAD/PWWRITE.

PROTECT Macro Specification

The format is:

[*symbol*]	**PROTECT**	*parameter list address*

parameter list address—A-type address, (2-12), or (1)
indicates the location of the parameter list. The parameter list must be set up before the PROTECT macro is issued. The address of the parameter list may be passed in register 1, in registers 2 through 12, or as an A-type address. The first byte of the parameter list must be used to identify the function (add, replace, delete, or list) you want to perform. See Figures 21 through 24 for the parameter lists and codes used to identify the functions.

0 X'01'	1 00 00 00
4 Length of data set name	5 Pointer to data set name
8 00	9 00 00 00
12 00	13 Pointer to control password
16 Number of volumes	17 Pointer to volume list
20 Protection code	21 Pointer to new password
24 String length	25 Pointer to string

0 X'01'
Entry code indicating ADD function.

13 Pointer to control password.
The control password is the password assigned when the data set was placed under protection for the first time. The pointer can be 3 bytes of binary zeros if the new password is the control password.

16 Number of volumes.
If the data set is not cataloged and you want to have it flagged as protected, you have to specify the number of volumes in this field. A zero indicates that the catalog information should be used.

17 Pointer to volume list.
If the data set is not cataloged and you want to have it flagged as protected, you provide the address of a list of volume serial numbers in this field. Zeros indicate that the catalog information should be used.

20 Protection code.
A one-byte number indicating the type of protection: X'00' indicates default protection (for the ADD function; the default protection is the type of protection specified in the control password record of the data set); X'01' indicates that the data set is to be read and written; X'02' indicates that the data set is to be read only; and X'03' indicates that the data set can be read without a password, but a password is needed to write into it. The PROTECT macro will use the protection code value, specified in the parameter list, to set the protection mode indicator in the password record.

21 Pointer to new password.
If the data set is being placed under protection for the first time, the new password becomes the control password. If you are adding a secondary entry, the new password is different from the control password.

24 String length.
The length of the character string (maximum 77 bytes) that you want to place in the optional information field of the password record. If you don't want to add information, set this field to zero.

25 Pointer to string.
The address of the character string that is going to be put in the optional information field. If you don't want to add additional information, set this field to zero.

Figure 21. Parameter List for ADD Function

0 X'02'	1 00 00 00
4 Length of data set name	5 Pointer to data set name
8 00	9 Pointer to current password
12 00	13 Pointer to control password
16 Number of volumes	17 Pointer to volume list
20 Protection code	21 Pointer to new password
24 String Length	25 Pointer to string

0 X'02'
Entry code indicating REPLACE function.

9 Pointer to current password.
The address of the password that is going to be replaced.

13 Pointer to control password.
The address of the password assigned to the data set when it was first placed under protection. The pointer can be set to 3 bytes of binary zero if the current password is the control password.

16 Number of volumes.
If the data set is not cataloged and you want to have it flagged as protected, you have to specify the number of volumes in this field. A zero indicates that the catalog information should be used.

17 Pointer to volume list.
If the data set is not cataloged and you want to have it flagged as protected, you have to provide the address of a list of volume serial numbers in this field. If this field is zero, the catalog information will be used.

20 Protection code.
A one-byte number indicating the type of protection: X'00' indicates that the protection is default protection (for the REPLACE function the default protection is the protection specified in the current password record of the data set); X'01' indicates that the data set is to be read and written; X'02' indicates that the data set is to be read only; and X'03' indicates that the data set can be read without a password, but a password is needed to write into the data set.

21 Pointer to new password.
The address of the password that you want to replace the current password.

24 String length.
The length of the character string (maximum 77 bytes) that you want to place in the optional information field of the password record. Set this field to zero if you don't want to add additional information.

25 Pointer to string.
The address of the character string that is going to be put in the optional information field of the password record. Set the address to zero if you don't want to add additional information.

Figure 22. Parameter List for REPLACE Function

0 X'03'	1 00 00 00
4 Length of data set name	5 Pointer to data set name
8 00	9 Pointer to current password
12 00	13 Pointer to current password
16 Number of volumes	17 Pointer to volume list

0 X'03'.
Entry code indicating DELETE function.

9 Pointer to current password.
The address of the password that you want to delete. You can delete either a control entry or a secondary entry.

13 Pointer to control password.
The address of the password assigned to the data set when it was placed under protection for the first time. The pointer can be 2 bytes of binary zero if the current password is also the control password.

16 Number of volumes.
If the data set is not cataloged and you want to have it flagged as protected, you have to specify the number of volumes in this field. A zero indicates that the catalog information should be used.

17 Pointer to volume list.
If the data set is not cataloged and you want to have it flagged as protected, you have to provide the address of a list of volume serial numbers in this field. If this field is zero, the catalog information will be used.

Figure 23. Parameter List for DELETE Function

0 X'04'	1 Pointer to 80 byte buffer
4 Length of data set name	5 Pointer to data set name
8 00	9 Pointer to control password

0 X'04'.
Entry code indicating LIST function.

1 Address of 80-byte buffer.
The address of a buffer where the list of information can be returned to your program by the macro instruction.

9 Pointer to current password.
The address of the password of the record that you want listed.

Figure 24. Parameter List for LIST Function

Return Codes From the PROTECT Macro

When the PROTECT macro finishes processing, register 15 contains a return code that indicates what happened during the processing. Figure 25 contains the return codes and their interpretation.

Register 15	Interpretation
0	The updating of the PASSWORD data set was successfully completed.
4	The PASSWORD of the data set name was already in the password data set.
8	The password of the data set name was not in the PASSWORD data set.
12	A control password is required or the one supplied is incorrect.
16	The supplied parameter list was incomplete or incorrect.
20	There was an I/O error in the PASSWORD data set.
[2]24	The PASSWORD data set was full.
28	The validity check of the buffer address failed.
[1]32	The LOCATE macro failed. LOCATE's return code is in register 1, and the number of indexes searched is in register 0.
[1]36	The OBTAIN macro failed. OBTAIN's return code is is in register 1.
[1]40	The DSCB could not be updated.
44	The PASSWORD data set does not exist.
[1]48	Tape data set cannot be protected.
[1]52	Data set in use.

[1] For these return codes, the PASSWORD data set has been updated, but the DSCB has not been flagged to indicate the protected status of the data set.

[2] For this return code, a message is written to the console indicating that the PASSWORD data set is full.

Figure 25. Return Codes from the PROTECT Macro Instruction

SYSTEM MACRO INSTRUCTIONS

This chapter describes miscellaneous macro instructions that allow you either to modify control blocks or to obtain information from control blocks and system tables.

Before reading this chapter, you should be familiar with the information in the following publications:

- *OS/VS - DOS/VS - VM/370 Assembler Language,* contains the information necessary to code programs in the assembler language.
- *OS/VS1 System Data Areas,* contains format and field descriptions of the system control blocks referred to in this chapter.

Introduction

The system macro instructions are described in these functional groupings:

- Mapping (IEFUCBOB, IEFJFCBN, and CVT)
- Obtaining device characteristics (DEVTYPE)
- Manipulating the JFCB (RDJFCB)
- Data security (DEBCHK)
- Manipulating queues (PURGE and RESTORE)

Mapping System Data Areas

The IEFUCBOB, IEFJFCBN, and CVT macro instructions are used as DSECT expansions that define the symbolic names of fields within the unit control block (UCB), job file control block (JFCB), and communication vector table (CVT), respectively. When coding these instructions, you must precede each with a DSECT statement.

The IEFUCBOB, IEFJFCBN, and CVT macro definitions are in a system generation library (SYS1.AMODGEN) and must be copied (using IEBCOPY) into SYS1.AMACLIB, or SYS1.AMODGEN may be concatenated to the macro library before reference can be made to it.

The fields in these blocks are shown and described in *OS/VS1 System Data Areas.*

IEFUCBOB—Mapping the UCB

This macro instruction defines the symbolic names of all fields in the unit control block (UCB). Code this macro instruction with blank name and operand fields, and precede it with a DSECT statement.

The format is:

[*symbol*]	**DSECT** **IEFUCBOB**	

IEFJFCBN—Mapping the JFCB

This macro instruction defines the symbolic names of all fields in the job file control block (JFCB). Code this macro instruction with blank name and operand fields, and precede it with a DSECT statement.

The format is:

[*symbol*]	**DSECT** **IEFJFCBN**	

CVT—Mapping the CVT

This macro instruction defines the symbolic names of all fields in the communication vector table (CVT). Code this macro instruction with blank name and operand fields, and precede it with a DSECT statement.

The format is:

[*symbol*]	**DSECT** **CVT**	

Obtaining I/O Device Characteristics

Use the DEVTYPE macro instruction to request information relating to the characteristics of an I/O device, and to cause this information to be placed into a specified area. (The results of a DEVTYPE macro instruction executed before a checkpoint is taken should not be considered valid after a checkpoint/restart occurs.)

The topics that follow discuss the macro itself, device characteristics, and particular output for particular devices.

DEVTYPE Macro Specification

The format is:

[*symbol*]	**DEVTYPE**	*ddloc-addrx* *,area-addrx* **[,DEVTAB]** **[,RPS]**

ddloc-addrx
the address of an 8-byte field that contains the symbolic name of the DD statement to which the device is assigned. The name must be left justified in the 8-byte field, and must be followed by blanks if the name is less than eight characters. The doubleword need not be on a doubleword boundary.

area-addrx
the address of an area into which the device information is to be placed. The area can be one, two, five, or six fullwords, depending on whether or not the DEVTAB and RPS operands are specified. The area must be on a fullword boundary.

DEVTAB

This operand is only required for direct-access devices. If DEVTAB is specified, the following number of words of information is placed in your area:

- For direct-access devices — 5 words
- For non-direct-access devices — 2 words

If you do not code DEVTAB, one word of information is placed in your area if the reference is to a graphics or teleprocessing devices; for any other type of device, two words of information are placed in your area.

RPS

If RPS is specified, DEVTAB must also be specified. The RPS parameter causes one additional full word of RPS information to be included with the DEVTAB information.

Note: Any reference for a DUMMY data set in the DEVTYPE macro instruction will cause eight bytes of zeros to be placed in the output area. Any reference to a SYSIN or SYSOUT data set causes X'00000102' to be placed in word 0 and 32,760 (X'00007FF8') to be placed in word 1 in the output area.

Device Characteristics Information

The following information is placed into your area as a result of issuing a DEVTYPE macro:

Word 0

Describes the device as defined in the UCBTYP field of the UCB. For a complete description of this field, refer to *OS/VS1 System Data Areas.*

Word 1

Maximum blocksize. For direct-access devices, this value is the maximum size of an unkeyed block; for magnetic or paper tape devices, this value is the maximum blocksize allowed by the operating system. For all other devices, this value is the maximum blocksize accepted by the device.

If DEVTAB is specified, the next three fullwords contain the following information about direct-access devices:

Word 2

Bytes 0-1	The number of physical cylinders on the device.
Bytes 2-3	The number of tracks per cylinder.

Word 3

Bytes 0-1	Maximum track length. Note that for the 2305, 3330, 3330-1, 3340/3344, and 3350 direct-access devices, this value is not equal to the value in word one (maximum blocksize) as it is for other IBM direct-access devices.
Byte 2	Block overhead, keyed block—the number of bytes required for gaps and check bits for each keyed block other than the last block on a track.
Byte 3	Block overhead—the number of bytes required for gaps and check bits for a keyed block that is the last block on a track. **Note:** Before using bytes 2 and 3, please read the description of word 4.

Word 4

Byte 0 — Block overhead, block without key—the number of bytes to be subtracted if a block is not keyed.

Byte 1
- bit 0 — If 1, indicates that the number of cylinders indicated in word 2, bytes 0-1, are invalid. This bit will be set to 1 only for 3340 devices with no volume currently mounted on the unit.
- bits 1-3 — Reserved.
- bit 4 — If 1, bytes 2 and 3 of word 3 contain a halfword giving the block overhead for any block on a track, including the last block.
- bits 5-6 — Reserved.
- bit 7 — If 1, a tolerance factor must be applied to all blocks except the last block on the track.

Bytes 2-3 — Tolerance factor—this factor is used to calculate the effective length of a block. The calculation should be performed as follows:

- Step 1 - add the block's key length to the block's data length.
- Step 2 - test bit 7 of byte 1 of word 4. If bit 7 is 0, perform step 3. If bit 7 is 1, multiply the sum computed in step 1 by the tolerance factor. Shift the result of the multiplication nine bits to the right.
- Step 3 - add the appropriate block overhead to the value obtained above.

If DEVTAB and RPS are specified and the device supports the RPS feature, the next fullword contains the following information:

Word 5

Bytes 0-1 — R0 overhead for sector calculations

Byte 2 — Number of sectors for the device

Byte 3 — Number of data sectors for the device

Figure 26 shows the actual output for each device type as a result of issuing the DEVTYPE macro.

Control is returned to your program at the next executable instruction following the DEVTYPE macro instruction. If the information concerning the DDNAME you specified has been successfully moved to your work area, register 15 will contain zeros. Otherwise, register 15 will contain one of the following exception return codes.

Code	Meaning
04	DDname not found.
08	Invalid area address. The address of the output area either violates protection, or it is out of the range of virtual storage.

Device[1]	Maximum Record Size (Word 1, In Decimal)	DEVTAB (Words 2, 3, and 4, In Hexadecimal)	RPS (Word 5, (In Hexadecimal)
2540 Reader	80	Not Applicable	Not Applicable
2540 Reader w/CI	80	Not Applicable	Not Applicable
2540 Punch	80	Not Applicable	Not Applicable
2540 Punch w/CI	80	Not Applicable	Not Applicable
1442 Reader-Punch	80	Not Applicable	Not Applicable
1442 Reader-Punch w/CI	80	Not Applicable	Not Applicable
1442 Serial Punch	80	Not Applicable	Not Applicable
1442 Serial Punch w/CI	80	Not Applicable	Not Applicable
2501 Reader	80	Not Applicable	Not Applicable
2501 Reader w/CI	80	Not Applicable	Not Applicable
2520 Reader-Punch	80	Not Applicable	Not Applicable
2520 Reader-Punch w/CI	80	Not Applicable	Not Applicable
2520 B2-B3	80	Not Applicable	Not Applicable
2520 B2-B3 w/CI	80	Not Applicable	Not Applicable
1287 Optical Reader	0	Not Applicable	Not Applicable
1288 Optical Reader	0	Not Applicable	Not Applicable
1419/1275 Reader/Sorter	0	Not Applicable	Not Applicable
3505 Reader	80	Not Applicable	Not Applicable
3505 Reader w/CI	80	Not Applicable	Not Applicable
3525 Punch	80	Not Applicable	Not Applicable
3525 Punch w/CI	80	Not Applicable	Not Applicable
3886 Optical Reader	0	Not Applicable	Not Applicable
3890 Reader Sorter	0	Not Applicable	Not Applicable
1403 Printer	120[2]	Not Applicable	Not Applicable
1403 w/UCS	120[2]	Not Applicable	Not Applicable
1404 Printer	120[2]	Not Applicable	Not Applicable
1443 Printer	120[2]	Not Applicable	Not Applicable
3211 Printer	132[2]	Not Applicable	Not Applicable
3800 Printing Subsystem	136[3]	Not Applicable	Not Applicable
2671 Paper Tape Reader	32760	Not Applicable	Not Applicable
1052 Printer-Keyboard	130	Not Applicable	Not Applicable
1053 Printer		Not Applicable	Not Applicable
3210 Printer-Keyboard	130	Not Applicable	Not Applicable
3215 Printer-Keyboard	130	Not Applicable	Not Applicable
2400 (9-track)	32760	Not Applicable	Not Applicable
2400 (9-track, p.e.)	32760	Not Applicable	Not Applicable
2400 (9-track, d.d.)	32760	Not Applicable	Not Applicable
2400 (7-track)	32760	Not Applicable	Not Applicable
2400 (7-track, d.c.)	32760	Not Applicable	Not Applicable
2495 Tape Cartridge Reader	0	Not Applicable	Not Applicable
3400 (9-track, p.e.)	32760	Not Applicable	Not Applicable
3400 (9-track, d.d.)	32760	Not Applicable	Not Applicable
3400 (7 track)	32760	Not Applicable	Not Applicable

Legend

CI-card image feature, d.c.-data conversion, d.d.-dual density, p.e.-phase encoding, UCS-universal character set, w/-with

[1] UCB Type Field (Word 0) — Device codes are presented in *OS/VS1 System Data Areas,* "The UCBTYP Field of the UCB."

[2] Although certain models can have a larger line size, the minimum line size is assumed.

[3] The 3800 Printing Subsystem can print 136 characters per line at 10-pitch, 163 characters per line at 12-pitch, and 204 characters per line at 15-pitch. The machine default is 136 characters per line at 10-pitch.

Figure 26 (Part 1 of 2). Output Obtained from Issuing DEVTYPE Macro

Device[1]	Maximum Record Size (Word 1, In Decimal)	DEVTAB (Words 2, 3, and 4, In Hexadecimal)	RPS (Word 5, (In Hexadecimal)
2314/2319 DAS Facility	7294	00CB00141C7E922D2D010216	Not Applicable
2305-1 Fixed-Head Storage	14136	0030000838E80278CA080200	02985A57
2305-2 Fixed-Head Storage	14660	006008083A0A01215B080200	0140B4B1
3330 (or 3333 Model 1) Disk Storage	13030	019B0013336DBFBF38000200	00ED807C
3330V MSS Virtual Volume	13030	019B0013336DBFBF38000200	00ED807C
3330-1 (or 3333 Model 11) Disk Storage	13030	032F0013336DBFBF38000200	00ED807C
3340 Disk Storage (35-megabyte)	8368	015D000C2157F2F24B000200	0125403D
3340/3344 Disk Storage (70-megabyte)	8368	02BA000C2157F2F24E000200	0125403D
3350 Direct Access Storage	19069	0230001E4BBA010952080200	0181807C
2250-1 Display Unit		Not Applicable	Not Applicable
2250-2 Display Unit		Not Applicable	Not Applicable
2253-3 Display Unit		Not Applicable	Not Applicable

Legend

CI-card image feature, d.c.-data conversion, d.d-dual density, p.e.-phase encoding, UCS-universal character set, w/-with

[1] UCB Type Field (Word 0) — Device codes are presented in *OS/VS1 System Data Areas,* "The UCBTYP Field of the UCB."

Communication Equipment	Record Size
1030,1050,83B3, TWX,2250, S360	Not Applicable
1060,115A,1130	Not Applicable
2780	Not Applicable
2740	Not Applicable

Figure 26 (Part 2 of 2). Output obtained from Issuing DEVTYPE Macro

Reading and Modifying a Job File Control Block

To accomplish the functions that are performed as a result of an OPEN macro instruction, the Open routine requires access to information that you have supplied in a data definition (DD) statement. This information is stored by the system in a job file control block (JFCB).

Usually, the programmer is not concerned with the JFCB itself. In special applications, however, you may find it necessary to modify the contents of a JFCB before issuing an OPEN macro instruction. To assist you, the system provides the RDJFCB macro instruction. This macro instruction causes a specified JFCB to be read into virtual storage from the job queue (SYS1.SYSJOBQE) or system work area data set in which it has been stored. The format and field descriptions of the JFCB are contained in *OS/VS1 System Data Areas.*

When subsequently issuing the OPEN macro instruction, you must indicate, by specifying the TYPE=J option, that you have supplied a modified JFCB to be used during the initialization process.

The JFCB is returned to SYS1.SYSJOBQE or the system work area data set by the Open routine or the OPENJ routine, if any of the modifications in the following list occur. These modifications can occur only if the information is not in the JFCB when the OPEN macro instruction is issued.

- Expiration date field and creation date field merged into the JFCB from the DSCB.
- Secondary quantity field merged into the JFCB from the DSCB.
- DCB fields merged into the JFCB from the DSCB.
- DCB fields merged into the JFCB from the DCB.
- Volume serial number fields added to the JFCB.
- Data set sequence number field added to the JFCB.
- Number of volumes field added to the JFCB.

Note: Care must be taken in using RDJFCB if the data set resides on MSS (Mass Storage System) virtual volumes such that:

- The expiration date added does not conflict with other volumes within the specified MSVGP (mass storage volume group).
- The secondary allocation quantity should be in cylinder increments.
- Any volume serial numbers added to the JFCB should exist in the MSVGP.
- The number of volumes must not exceed the number available in the specific MSVGP.

If you make these, or any other modifications, and you want the JFCB returned to the job queue or system work area data set, you must set the high-order bit of field JFCBMASK+4 to one. This field is in the JFCB. Setting the high-order bit of field JFCBMASK+4 to zero does not necessarily suppress the return of the JFCB to the job queue or system work area data set. If the Open or OPENJ routines have made any of the above modifications, the JFCB is returned to the job queue or system work area data set. To inhibit writing the JFCB back to the job queue or system work area data set during an OPENJ, the field JFCBTSDM should be set to X'08' prior to issuing the OPEN macro.

OPEN—Initialize Data Control Block for Processing the JFCB

The OPEN macro instruction initializes one or more data control blocks so that their associated data sets can be processed.

A full explanation of the operands of the OPEN macro instruction, except for the TYPE=J option, is contained in *OS/VS Data Management Macro Instructions*. The TYPE=J option, because it is used in conjunction with modifying a JFCB, should be used only by the system programmer or only under his supervision.

[*symbol*]	**OPEN**	*dcb-addr* **,**[(*options*)],...] **[,TYPE=J]**

TYPE=J

specifies that for each data control block referred to, you have supplied a job file control block (JFCB) to be used during initialization. A JFCB is an internal representation of information in a DD control statement.

During initialization of a data control block, its associated JFCB may be modified with information from the data control block or an existing data set label or with system control information.

The system always creates a job file control block for each DD control statement. The job file control block is placed in a job queue on direct-access storage. Its position, in relation to other JFCBs created for the same job step, is noted in a table in virtual storage.

When this operand is specified, you must also supply a DD control statement. However, the amount of information given in the DD statement is at your discretion, because you can ignore the system-created job file control block. If you specify DUMMY on your DD statement, the Open routine will ignore the JFCB DSNAME and open the data set as Dummy. (See the examples of the RDJFCB macro instruction for a technique for modification of a system-created JFCB.)

Note: The DD statement must specify at least:

- Device allocation (refer to *OS/VS1 JCL Reference* for methods of preventing share status).
- A ddname corresponding to the associated data control block DCBDDNAM field.

RDJFCB—Read a Job File Control Block

The RDJFCB macro instruction causes a job file control block (JFCB) to be read from the job queue or system work area data set into virtual storage for each data control block specified.

[*symbol*]	**RDJFCB**	(*dcb-address* ,[(*options*)] ,...)

dcb-address,(options)

(same as dcb, option$_1$, and option$_2$ operands in OPEN macro instruction)

Although the option operands are not meaningful during the execution of the RDJFCB macro instruction, these operands can appear in the L-form of either the RDJFCB or OPEN macro instruction to generate identical parameter lists, which can be referred to with the E-form of either macro instruction.

To accomplish the functions that are performed as a result of an OPEN macro instruction, the Open routine requires access to information that you have supplied in a DD statement. This information is stored by the system in a JFCB.

Usually, the programmer is not concerned with the JFCB itself. In special applications, however, you may find it necessary to modify the contents of a JFCB before issuing an OPEN macro instruction. To assist you, the system provides the RDJFCB macro instruction. This macro instruction causes a specified JFCB to be read into real storage from the job queue in which it has

been stored. Format and field descriptions of the JFCB are contained in *OS/VS1 System Data Areas.*

When subsequently issuing the OPEN macro instruction, you must indicate, by specifying the TYPE=J option, that you have supplied a modified JFCB to be used during the initialization process.

The JFCB is returned to the job queue by the Open routine or the OPENJ routine, if any of the modifications in the following list occur:

- Expiration date field and creation date field merged into the JFCB from the DSCB.
- Secondary quantity field merged into the JFCB from the DSCB.
- DCB fields merged into the JFCB from the DSCB.
- DCB fields merged into the JFCB from the DCB.
- Volume serial number fields added to the JFCB.
- Data set sequence number field added to the JFCB.
- Number of volumes field added to the JFCB.

These modifications can occur only if the information is not originally in the JFCB.

If you made these or any other modifications and you want the JFCB returned to the job queue, you must set the high-order bit of field JFCBMASK+4 to 1. This field is in the JFCB. Setting the high-order bit of field JFCBMASK+4 to 0 does not necessarily suppress the return of the JFCB to the job queue. If the Open or OPENJ routines have made any of the preceding modifications, the JFCB is returned to the job queue. To inhibit writing the JFCB back to the job queue during an OPENJ, the field JFCBTSDM should be set to X'08' prior to issuing the OPEN macro.

Examples: In Figure 27, the macro instruction at EX1 creates a parameter list for two data control blocks: INVEN and MASTER. In creating the list, both data control blocks are assumed to be opened for input; $option_2$ for both blocks is assumed to be DISP. The macro instruction at EX2 reads the system-created JFCBs for INVEN and MASTER from the job queue into virtual storage, thus making the JFCBs available to the problem program for modification. The macro instruction at EX3 modifies the parameter list entry for the data control block named INVEN and indicates, through the TYPE=J operand, that the problem program is supplying the JFCBs for system use.

```
                .
                .
                .
EX1             RDJFCB (INVEN,,MASTER), MF=L
                .
                .
                .
EX2             RDJFCB MF=(E,EX1)
                .
                .
                .
EX3             OPEN (,(RDBACK,LEAVE)),TYPE=J,MF=(E,EX1)
                .
                .
                .
INVEN           DCB       EXLST=LSTA,...
MASTER          DCB       EXLST=LSTB,...
LSTA            DS        0F
                DC        X'07'
                DC        AL3(JFCBAREA)
                .
                .
                .
JFCBAREA        DS        0F,176C
                .
                .
                .
LSTB            DS        0F
                .
                .
                .
```

Figure 27. Sample Code Using RDJFCB Macro

Any number of data control block addresses and associated options may be specified in the RDJFCB macro instruction. This facility makes it possible to read job file control blocks in parallel.

An exit list address must be provided in each data control block specified by an RDJFCB macro instruction. Each exit list must contain an active entry that specifies the virtual storage address of the area into which a JFCB is to be placed. A full discussion of the exit list and its use is contained in *OS/VS Data Management Services Guide*. The format of the job file control block exit list entry is as follows:

Type of Exit List Entry	Hexadecimal Code (high-order byte)	Contents of Exit List Entry (the low-order bytes)
Job file control block	07	Address of a 176-byte area to be provided if the RDJFCB or OPEN (TYPE=J) macro instruction is used. This area must begin on a fullword boundary and must be located within the user's region.

The virtual storage area into which the JFCB is read must be at least 176 bytes long.

The data control block may be open or closed when this macro instruction is executed.

If the JFCB is read successfully for all DCBs in the parameter list, a return code of zero is placed in register 15. If the JFCB is not read for any of the DCBs because the DDNAME is blank or a DD statement is not provided, then a return code of 4 is placed in register 15.

Cautions: The following errors cause the results indicated:

Error	Result
A DD control statement has not been provided.	A return code of 4 is placed in register 15.
DDNAME field in DCB is blank.	A write-to-programmer is issued, the request for this DCB is ignored, and a return code of 4 is placed in register 15.
A virtual storage address has not been provided.	Abnormal termination of task.

Note that if you want to open a VTOC data set to change its contents (that is, open it for OUTPUT, OUTIN, INOUT, or UPDAT), your program must be authorized under the Authorized Program Facility (APF). APF provides security and integrity for your data sets and programs. Details on how you authorize your program are provided in the *OS/VS1 Planning and Use Guide.*

Ensuring Data Security by Validating the Data Extent Block

Protecting one user's data from inadvertent or malicious access by an unauthorized user depends on protection of the data extent block (DEB). The DEB is a critical control block because it contains information about the device a data set is mounted on and describes the location of data sets on direct-access device storage volumes. The DEB also contains the address of the appendage vector table (AVT). Using the AVT, a user with malicious intent can modify the AVT to give control to his own routine in supervisor state to read from and write to data sets to which he would otherwise be denied access.

To guarantee protection of the DEB, the DEBCHK macro instruction is provided. The DEBCHK macro is issued by several components of the system control program. For example:

- The Open access method executors issue the macro to add the address of a DEB they have built to a list of valid addresses called the *DEB table.* The DEB validity checking routine builds and maintains a DEB table for each job step.
- The I/O supervisor uses the macro to verify that the DEB passed with each EXCP request is in the DEB table.
- The Close component issues the macro to remove a DEB from the DEB table.

If you code a routine that builds a DEB, you must add the address of the DEB you built to the DEB table. If you code a routine that depends on the validity of a DEB that is passed to your routine, you should verify that the DEB passed to your routine has a valid entry in the DEB table. Use the TYPE=ADD and the TYPE=VERIFY operands of the macro, respectively.

Additional details about the functions provided by the DEB validity checking routine and about the contents of the DEB table are available in *OS/VS1 Open/Close/EOV Logic.*

The DEBCHK macro instruction provides four functions:

- Adds the address of a DEB to the DEB table, which is located in protected storage. The DEB table contains the address of every user DEB associated with a given job step. Every system control program component that builds a user DEB must add the address of that DEB to a DEB table.
- Verifies that the DEB table associated with a given job step contains the address of a valid DEB. Any system control program component or problem program can use this function to verify that a DEB is valid.
- Deletes the address of a DEB from the DEB table. Any program that deletes a user DEB must, before it deletes the DEB, issue a DEBCHK macro with a TYPE=DELETE operand to delete the address of the DEB from the DEB table. If the DEB validity checking routine encounters an error while deleting the address from the DEB table, the job step is abnormally terminated.
- Deletes the address of a DEB from the DEB table in the same way as the preceding function, except that, instead of terminating the job step, this function merely returns an error code in register 15:

Return Code in Register 15	Interpretation
4	The indicated DEB pointer is not in the DEB table.
8	Invalid TYPE is specified.
12	The caller is in problem state and TYPE≠VERIFY.
16	DEBDCBAD does not point to the DCB.
20	Access method value does not equal DEBAMTYP value.
24	DEB not on TCB chain for TYPE=ADD.
28	DEBAMTYP or DEBTBLOF≠0 for TYPE=ADD.
32	DEB table contains 32,760 bytes for TYPE=ADD.

This function is provided to prevent recurring abnormal termination. The format of the DEBCHK and a description of the operands follow.

If the DEBCHK routine is completed successfully, register 15 will be set to 0 and register 1 will contain the address of the DEB when control is returned to your program.

DEBCHK—Macro Specification

[*symbol*]	**DEBCHK**	*cbaddr* **[,TYPE={VERIFY | ADD | DELETE | PURGE}]** **[,AM={***amtype* **|(***amaddr* **) | (***amreg* **)}]**

cbaddr — RX-Type Address, (2-12), or (1)
a control block address passed to the DEBCHK routine. This operand is ignored if MF=L is coded. For verify, add, and delete requests, cbaddr is the address of a data control block (DCB) that points to the DEB whose address is either verified to be in the DEB table, added to the DEB table, or deleted from the DEB table. For the purge function, cbaddr is the address of the DEB whose pointer is to be purged from the table: no reference is made to the DCB.

TYPE={ VERIFY | ADD | DELETE | PURGE }
indicates the function to be performed. If MF=L is coded, TYPE is ignored. The functions are:

VERIFY This function is assumed if the **TYPE** operand is not coded. The control program checks the DEB table to determine whether the DEB pointer is in the table at the location indicated by the DEBTBLOF field of the DEB; the DEBAMTYP field in the DEB is compared to the AM operand value, if given. The two must be equal. TYPE=VERIFY can be issued in either supervisor or problem state.

ADD
Before the DEB pointer can be added to the table, the DEB must be queued on the current TCB DEB chain (the TCBDEB field contains the address of the first DEB in the chain). The DEB address is added to the DEB table at some offset into the table. That offset value is placed in the DEBTBLOF field of the DEB, and the access method type is inserted into the DEBAMTYP field of the DEB. A zero is placed in the DEBAMTYP field if the AM operand is not coded. TYPE=ADD can be issued only in supervisor state.

DELETE
The DEB and the DCB must point to each other before the DEB address can be deleted from the DEB table. TYPE=DELETE can be issued only in supervisor state.

PURGE
The DEB pointer is removed from the DEB table without checking the DCB. TYPE=PURGE can be issued only in supervisor state.

AM= { *amtype* | (*amaddr*) | (*amreg*) }
specifies an access method value. Each value corresponds to a particular access method type (note that BPAM and SAM have the same values):

Type	Value
ISAM	X'80'
BDAM	X'40'
SAM	X'20'
BPAM	X'20'
TAM	X'10'
GAM	X'08'
TCAM	X'04'
EXCP	X'02'
VSAM	X'01'
NONE	X'00'

The operand can be coded in one of the following three ways, only the first of which is valid for the list form (**MF=L**) of the instruction.

amtype
refers to the actual access method type: ISAM, BDAM, SAM, BPAM, TAM, GAM, TCAM, or EXCP.

amaddr
is the RS-type address of the access method value. This format may not be coded when MF=L is used.

amreg
is one of the general registers 1-14 that contains the access method value in its low-order byte (bit positions 24-31). The high-order bytes are not inspected. This form may not be used when MF=L is coded.

The use of *amaddr* and *amreg* should be restricted to those cases where the access method value has been generated previously by the MF=L form of DEBCHK. If MF=L is not coded, the significance of the AM operand depends upon the TYPE.

If TYPE is ADD and AM is specified, the access method value is inserted in the DEBAMTYP field of the DEB, and all subsequent DEBCHK macros referring to this DEB must either specify the same AM or omit the operand. When the AM operand is omitted for TYPE=ADD, a null value (0) is placed in the DEB and all subsequent DEBCHK macros must omit the AM operand.

If AM is specified when the TYPE is PURGE, DELETE, or VERIFY, the access method value is compared to the value in the DEBAMTYP field of the DEB. If AM is omitted, no comparison is made.

MF
indicates the list form of the DEBCHK macro instruction. When MF=L is coded, a parameter list is built consisting of the access method value that corresponds to the AM keyword. This value may be referenced by name in another DEBCHK macro by coding AM= *(amaddr),* or it may be inserted into the low-order byte of a register before issuing another DEBCHK macro by coding AM= *((amreg)).*

Removing Queued Requests and Restoring the Requests

You can stop the processing of I/O requests for a specific task or against a particular data set, using the PURGE macro instruction. The function of the Purge macro instruction is to call the Purge routine which removes request queue elements (RQEs) from queues and frees RQEs. You can subsequently requeue the requests by issuing the RESTORE macro. The PURGE and RESTORE macros give control to routines documented in *OS/VS1 I/O Supervisor Logic.* The logic of the routines and additional details are available in that publication.

You can give control to the Purge and Restore routines in two ways: (1) by loading register 1 with the address of your parameter list and issuing the assembler language SVC instructions or (2) by issuing the PURGE and RESTORE macro instructions. If your installation requires the use of macro instructions, you must add the macro definitions to the macro library (SYS1.MACLIB) or place them in a partitioned data set and concatenate this data set to the macro library. The macro definitions, JCL, and utility statements needed to add the macros to your macro library are presented in Figures 28 and 29. Whether you issue the macro instructions or the SVC instructions, you must first build a parameter list. The SVC instructions are SVC 16 for PURGE and SVC 17 for RESTORE.

```
PURGE Macro Definition
         MACRO
&NAME    PURGE     &LIST
         AIF       ('&LIST'EQ'').E1
&NAME    IHBINNRA  &LIST            LOAD REG 1
         SVC       16
         MEXIT
.E1      IHBERMAC  01,147           LIST ADDR MISSING
         MEND
```

Control Statements Required

```
//jobname     JOB       { parameter }
//stepname    EXEC      PGM=IEBUPDTE,PARM=NEW
//SYSPRINT    DD        SYSOUT=A
//SYSUT2      DD        DSNAME=SYS1.MACLIB,DISP=OLD
//SYSIN       DD        *
./  ADD       NAME=PURGE,LIST=ALL
                .
                .
                .
              PURGE macro definition
                .
                .
                .
./  ENDUP
/*
```

Figure 28. Macro Definition, JCL, and Utility Statements for Adding the PURGE Macro to Your Macro Library

```
RESTORE Macro Definition
         MACRO
&NAME    RESTORE   &LIST
         AIF       ('&LIST' EQ '').E1
&NAME    IHBINNRA  &LIST            LOAD REG 1
         SVC       17              ISSUE SVC FOR RESTORE
         MEXIT
.E1      IHBERMAC  01,150          LIST ADDR MISSING
         MEND
```

Control Statements Required

```
//jobname     JOB       { parameters }
//stepname    EXEC      PGM=IEBUPDTE,PARM=NEW
//SYSPRINT    DD        SYSOUT=A
//SYSUT2      DD        DSNAME=SYS1.MACLIB,DISP=OLD
//SYSIN       DD        DATA
./  ADD       NAME=RESTORE,LIST=ALL
                .
                .
                .
              RESTORE macro definition
                .
                .
                .
./  ENDUP
/*
```

Figure 29. Macro Definition, JCL, and Utility Statements for Adding the RESTORE Macro to Your Macro Library

PURGE—Remove an RQE From a Queue

The Purge routine stops the processing of I/O requests by removing RQEs from queues. The queues from which RQEs can be removed are:

- a logical channel queue
- the task supervisor request block queues
- the task supervisor asynchronous exit queue

- the dynamic device reconfiguration (DDR) WAIT queue

The macro instruction used to call the Purge routine is coded as follows:

[*symbol*]	**PURGE**	*parameter-list address*

parameter list address — RX-type address, (2-12) or (1)
specifies the address of a parameter list you have built on a fullword boundary in your region. The parameter list address can be specified as an RX-type constant or in registers 2-12 or 1. You specify which queues you want altered by bit setting in the first field (PRGOPT) of the parameter list. You also can choose to either halt any currently active I/O operation (requests cannot be restored) or allow the operation to quiesce (requests can be restored), again by using a bit setting in the PRGOPT field of the parameter list (see Figure 30).

Note that you can bypass the purge of the request blocks chained to a TCB (or to be chained to a TCB) by setting bit 5 of the PRGOPT field to 1.

0(0) PRGOPT – Purge options	1(1) PRGDEB – Address of data extent block
4(4) PRGCOD – Complete code	5(5) PRGTCB – Address of task control block
8(8) PRGCTR – Quiesce count	9(9) PRGCHN – Address of first link in chain
12(C) PRGVTM – Purge AIO| status	14(E) PRGCSW – CSW status

Figure 30. PURGE Parameter List

Offset	Bytes and Alignment	Field Name	Description
0 (0)	1	PRGOPT	Purge options.
		0...	Purge request queue elements for all entries in the data extent block (DEB) chain, starting with the DEB whose address is in PRGDEB.
		1...	Purge only the request queue element for the DEB whose address is in PRGDEB.
		.0..	Do not post the event control blocks for the purged request queue elements.
		.1..	Post the event control blocks for the purged request queue elements. (A X'48' completion code is used.)
		..0.	Allow the activity to quiesce.
		..1.	Halt the I/O activity. (The effect of the halt I/O instruction is simulated if the operation is a seek.)
		...0	Purge all requests.
		...1	Purge only related requests.
		.... 0...	Normal purge.
		.... 1...	Used only for TSO tasks.
		.... .0..	Purge the asynchronous exit queue, the request block queue, the logical channel queue, and the DDR wait queue.

Offset	Bytes and Alignment	Field Name	Description
		.... .1..	Purge the logical channel queue, the asynchronous exit queue (removing only RQEs for requests in error), and the DDR wait queue. Bypass the request blocks.
		.... ..0.	Purge by data extent block.
		.... ..1.	Purge by task control block. When this bit is on, the setting of bit 0 is ignored.
		1	Return status of HIO to VTAM.
		0	Do not use VTAM/TOLTEP/PURGE/HIO interface.
1 (1)	. 3	PRGDEB	Address of data extent block. If you are purging by TCB, not required.
4 (4)	1	PRGCOD	Purge routine completion code X'7F' posted here by purge routines.
5 (5)	.3	PRGTCB	Address of task control block from which I/O is to be purged.
			If zero, the current TCB is used. When not purging by TCB address, this field must be zero.
8 (8)	1	PRGCTR	Quiesce count. The number of active request queue elements for which I/O activity has not yet been completed.
9 (9)	. 3	PRGCHN	Address of the first link in the chain of IOBs which are purged. The first link can be located in the user's area, or in the DEBUSPRG field of the DEB. It will point to the first IOB in the chain. The last IOB in the chain will contain ones in the low-order byte of the restart address (IOBR) field. A diagram of the purge chain is shown in Figure 30.
12(C)	1	PRGVTM	Status after Purge.
		1...	HIO issued by Purge.
		.1..	Interrupt is pending, condition code equals 0 or 2. Condition code is 1 with CSW status of 0. CSW status is saved only on condition code 1.
		..xx	Condition code (set by HIO).
		.... 1...	Channel logout occurred.
		xxx	Reserved
13(D)	.1		Reserved
14(E)	..2	PRGCSW	CSW status when HIO issued (condition code equals 1).

If you are purging all the I/O requests currently in a queue for a given data set using the quiesce option, a chain of IOBs will be built whose addresses represent RQEs that have been removed from a queue. When control is returned to your program, the address of a pointer to the first IOB that was dequeued will be in the PRGCHN field of your parameter list. This address is used to restore the requests to queues. For the contents of word four of the parameter list to be useful, you must specify the purge by data set option for only one request at a time.

RESTORE — Return Purged IOBs to Queues

You can restore I/O requests to the queues from which they were purged by issuing the RESTORE macro instruction, which can be coded as follows:

[*symbol*]	**RESTORE**	*purge chain-address*

purge chain-address — RX-type address, (2-12) or (1)
specifies the address of the first of one or more IOBs you want restored to queues. The purge chain address may be specified as either an RX-type constant or loaded into registers 2-12 or 1. This field can be either (1) the address of the DEBUSPRG field (offset 17 (X'11')) in a DEB or (2) a fullword in your region. The IOBRESTR field (offset 24 (X'18')) of the IOB is used to chain IOBs. The last three bytes of the IOBRESTR field of the last IOB in the chain are set to X'FF' (see Figure 31).

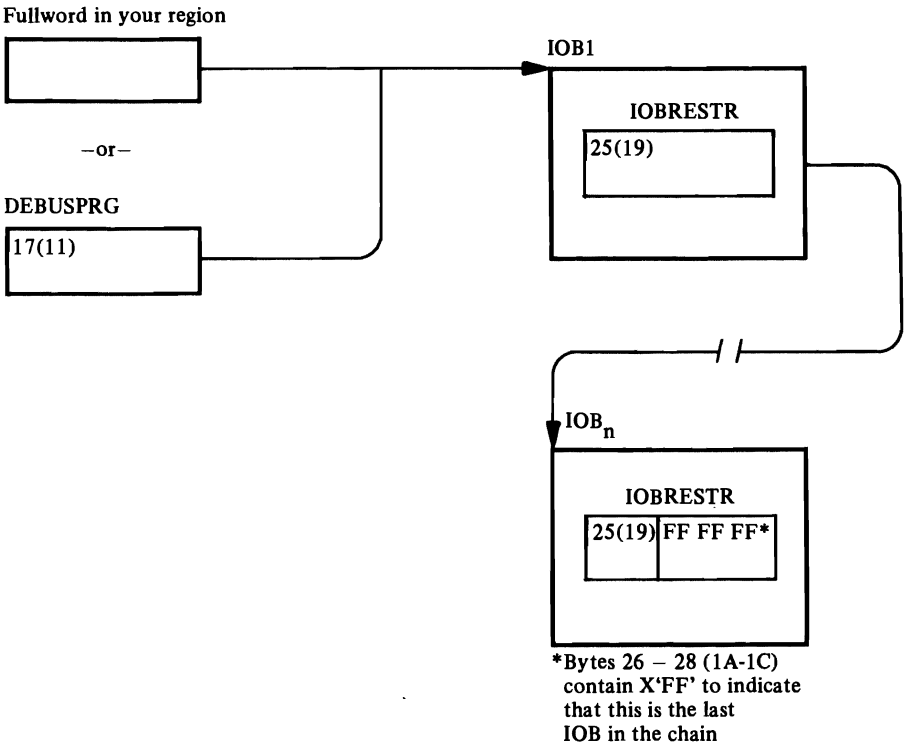


Figure 31. Purge Chain for Restoring IOBs

ADDING A UCS IMAGE OR FCB IMAGE TO THE SYSTEM IMAGE LIBRARY

This chapter provides a detailed description of how to add either an IBM UCS (universal character set) image or an IBM FCB (forms control buffer) image to SYS1.IMAGELIB. It also describes a procedure that can be used to read an FCB image into virtual storage for the purpose of modifying it before loading it into the forms control buffer.

For the 3800 Printing Subsystem a utility, IEBIMAGE, has been provided to build the 3800 control modules (character arrangement table modules, forms control buffer modules, graphic character modification modules, and copy modification modules) and store them in SYS1.IMAGELIB. For additional information, see *IBM 3800 Printing Subsystem Programmer's Guide.*

Before reading this section, you should be familiar with the information in these publications:

- *IBM 2821 Control Unit Component Description* contains the information necessary to create a user-designed chain/train for the 1403 Printer.
- *OS/VS Data Management Macro Instructions* describes the SETPRT macro instruction that loads a UCS image and an FCB image into their respective buffers.
- *OS/VS1 JCL Reference* describes the UCB and FCB parameters that can be specified in a DD statement to load the UCS and FCB buffers when they are opened.
- *IBM 3211 Printer, 3216 Interchangeable Train Cartridge, and 3811 Control Unit Component Description and Operator's Guide* contains the information necessary to create a user-designed train for the 3211 Printer.

Introduction

Unlike most other chapters in this publication, this chapter does not explain macro instructions. Rather, it shows how you can use the assembler and linkage editor to place an image in the library; no executable code is generated—the assembler prepares DCs and the linkage editor puts them in the library.

The remainder of this chapter discusses, first, UCS images, and, then, FCB images.

Adding a UCS Image to the Image Library

The IBM standard character set images listed in the following table may be included in SYS1.IMAGELIB at system generation by using the UCS macro instruction. You code a member name for an image in the image library by prefixing a character set code shown in the table with UCS1 or UCS2. UCS1 denotes a 1403 printer image and UCS2 denotes a 3211 printer image (for example, UCS1AN or UCS2A11).

Printer	Image
1403	AN, HN, PCAN, PCHN, PN, QNC, QN, RN, SN, TN, XN, YN
3211	A11, G11, H11, P11, T11

You may add a user-designed character image to the image library or make an existing image a default image by following these rules:

1. The member name must be either the four characters UCS1 for the 1403 or UCS2 for the 3211 printer. The member name must be followed by a unique character set code that is one to four characters long. This character set code can be any valid combination of letters and numbers according to the rules for assembler language symbols. The single letters U or C should not be used as a character set code since they are symbols for special conditions recognized by the system. The assigned character set code must be specified on the DD statement or SETPRT macro instruction to load the image into the UCS buffer.
2. The first byte in the load module of a character set image specifies whether or not the image is a default. A default image is indicated by X'80', and is used when the UCS parameter is not coded in the DD statement. X'00' specifies that the image is not to be used as a default.
3. The second byte of the load module indicates the number of lines (n) to be printed for image verification.
4. Each byte of the next n bytes indicates the number of characters to be printed on each verification line. (**Note:** For the 3211 printer, the maximum number of characters printed per line is 48; the associative bytes are not printed during verification.)
5. A 240-byte 1403 UCS image or a 512-byte 3211 UCS image must follow the previously described fields. (A 3211 UCS image has 432 characters, followed by 15 bytes of X'00', 64 bytes of associative bits, and a reserved byte (byte 512) of X'00'.) Because of assembler language syntax, two apostrophes or two ampersands must be coded to represent a single apostrophe or a single ampersand, respectively, which is a part of a character set image.

Figure 32 is an example of adding a 1403 UCS image, YN, to the image library.

```
//ADDYN         JOB MSGLEVEL=1
//STEP          EXEC  PROC=ASMFCL,PARM.ASM='NODECK,LOAD',
//     PARM.LKED='LIST,OL,REFR,RENT,XREF'(See note)
//ASM.SYSIN     DD  *
UCS1YN          CSECT
                DC  X'80'         (THIS IS A DEFAULT IMAGE)
                DC  AL1(6)        (NUMBER OF LINES TO BE PRINTED)
                DC  AL1(39)       (39 CHARACTERS PRINTED ON 1ST LINE)
                DC  AL1(42)       (42 CHARACTERS PRINTED ON 2ND LINE)
                DC  AL1(39)       (39 CHARACTERS PRINTED ON 3RD LINE)
                DC  AL1(39)       (39 CHARACTERS PRINTED ON 4TH LINE)
                DC  AL1(42)       (42 CHARACTERS PRINTED ON 5TH LINE)
                DC  AL1(39)       (39 CHARACTERS PRINTED ON 6TH LINE)
                DC  C'1234567890STABCDEFGHIJKLMNOPQRSTUVWXYZ*,.'
                DC  C'1234567890STABCDEFGHIJKLMNOPQRSTUVWXYZ*,.#-$'
                DC  C'1234567890STABCDEFGHIJKLMNOPQRSTUVWXYZ*,.'
                DC  C'1234567890STABCDEFGHIJKLMNOPQRSTUVWXYZ*,.'
                DC  C'1234567890STABCDEFGHIJKLMNOPQRSTUVWXYZ*,.#-$'
                DC  C'1234567890STABCDEFGHIJKLMNOPQRSTUVWXYZ*,.'
                END
/*
//LKED.SYSLMOD DD DSNAME=SYS1.IMAGELIB(UCS1YN),DISP=OLD
```

Note: The RENT and REFR linkage editor attributes are used for performance considerations in a paging environment and may be omitted.

Figure 32. Sample Code to Add a 1403 UCS Image to SYS1.IMAGELIB

Figure 33 shows the code used to add a 3211 UCS image (A11) to the image library. A 3211 UCS image has 432 characters, followed by 15 bytes of X'00', 64 bytes of associative bits, and a reserved byte (byte 512) of X'00'. Two ampersands must be coded to represent a single ampersand that is part of the character set image.

The 64 bytes of associative bits must be coded to avoid data checks. To determine how to code these bits for a particular chain, see *IBM 3211 Printer, 3216 Interchangeable Train Cartridge, and 3811 Printer Control Unit Component Description and Operator's Guide.*

```
//ADDA11        JOB MSGLEVEL=1
//STEP          EXEC  PROC=ASMFCL,PARM.ASM='NODECK,LOAD',
//    PARM.LKED='LIST,OL,REFR,RENT,XREF'(See note)
//ASM.SYSIN     DD  *
UCS2A11         CSECT
                DC  X'80'          (THIS IS A DEFAULT IMAGE)
                DC  AL1(9)         (NUMBER OF LINES TO BE PRINTED)
                DC  AL1(48)        (48 CHARACTERS PRINTED ON 1ST LINE)
                DC  AL1(48)        (48 CHARACTERS PRINTED ON 2ND LINE)
                DC  AL1(48)        (48 CHARACTERS PRINTED ON 3RD LINE)
                DC  AL1(48)        (48 CHARACTERS PRINTED ON 4TH LINE)
                DC  AL1(48)        (48 CHARACTERS PRINTED ON 5TH LINE)
                DC  AL1(48)        (48 CHARACTERS PRINTED ON 6TH LINE)
                DC  AL1(48)        (48 CHARACTERS PRINTED ON 7TH LINE)
                DC  AL1(48)        (48 CHARACTERS PRINTED ON 8TH LINE)
                DC  AL1(48)        (48 CHARACTERS PRINTED ON 9TH LINE)
*                                   THE FOLLOWING NINE LINES REPRESENT
*                                   THE TRAIN IMAGE
                DC  C'1<.+IHGFEDCBA*$-RQPONMLKJ%,&&ZYXWVUTS/@#098765432 '
                DC  C'1< +IHGFEDCBA*$-RQPONMLKJ%,&&ZYXWVUTS/@#098765432 '
                DC  C'1<.+IHGFEDCBA*$-RQPONMLKJ%,&&ZYXWVUTS/@#098765432 '
                DC  C'1<.+IHGFEDCBA*$-RQPONMLKJ%,&&ZYXWVUTS/@#098765432 '
                DC  C'1<.+IHGFEDCBA*$-RQPONMLKJ%,&&ZYXWVUTS/@#098765432 '
                DC  C'1<.+IHGFEDCBA*$-RQPONMLKJ%,&&ZYXWVUTS/@#098765432 '
                DC  C'1<.+IHGFEDCBA*$-RQPONMLKJ%,&&ZYXWVUTS/@#098765432 '
                DC  C'1<.+IHGFEDCBA*$-RQPONMLKJ%,&&ZYXWVUTS/@#098765432 '
                DC  C'1<.+IHGFEDCBA*$-RQPONMLKJ%,&&ZYXWVUTS/@#098765432 '
                DC  15X'00'        RESERVED FIELD, BITS 433-447
*  THE FOLLOWING FOUR DC INSTRUCTIONS DEFINE THE ASSOCIATIVE BITS,
*  UCSB BYTE POSITIONS 448-511
                DC  X'C0101010101010101000404042400040 10'
                DC  X'10101010101010101000404100004040 1010'
                DC  X'10101010101000404000000010101010 1010'
                DC  X'10101010004040444800'
                DC  X'00'      RESERVED FIELD, BYTE 512
                END
/*
//LKED.SYSLMOD     DD     DSNAME=SYS1.IMAGELIB(UCS2A11),DISP=OLD
```

Note: The RENT and REFR linkage editor attributes are used for performance considerations in a paging environment and may be omitted.

Figure 33. Sample Code to Add a 3211 UCS Image to SYS1.IMAGELIB

Note: Executing the ASMFCL procedure does not actually generate executable code. The assembler/linkage editor is used as a vehicle to load the UCS image into the image library.

Adding an FCB Image to the Image Library

Two standard FCB images, STD1 and STD2, can be included in SYS1.IMAGELIB during system generation for a 3211 printer. STD1 prints six lines per inch on a 8 1/2 inch form. STD2 prints six lines per inch on an eleven inch form. Channels for both images are evenly spaced with channel one on the fourth line and channel nine on the last line.

In addition to the IBM-supplied images, user images can be defined. Each user image is added to the image library as part of a load module. To add an FCB image to the image library, follow these rules:

- The member name cannot exceed eight bytes. The first four characters of this member name must be FCB2. The characters that follow FCB2 identify the FCB image and are referred to as the image identifier. Any combination of characters that are valid in assembler language can be used with the exception of a single "S"or a single "U" as an image identifier. The image identifier must be specified in a DD statement or in the SETPRT macro instruction to load the image in the FCB buffer.

- The first byte of the load module of a forms control image specifies whether or not the image is a default. A default image is indicated by X'80' and is used for all jobs that do not have the FCB parameter coded on the DD statement; X'00' indicates that the image is not to be used as a default.
- The second byte of the load module indicates the number of bytes to be transferred to the control unit to load the FCB image. This count includes the byte, if used, for the print position indexing feature.
- The third byte of the load module (the first byte of the FCB image) is either the print position indexing byte or the lines per inch byte. The print position indexing byte is optional and, when used, precedes the lines per inch byte. A description of the print position indexing feature and its use may be found in *IBM 3211 Printer, 3216 Interchangeable Train Cartridge, and 3811 Printer Control Unit Component Description and Operator's Guide.*

  The form image begins with lines per inch byte and must be as long as the form. For example, if you are printing six lines per inch on an eleven inch form, the form image must be 66 bytes long. The lines per inch byte defines the number of lines per inch and a channel:

  - X'1n' means eight lines are printed per inch.
  - X'0n' means six lines are printed per inch.

  All remaining bytes (lines) must contain X'0n' except the last byte. The last byte must be X'1n'. The letter n can be a hexadecimal value from 1 to C, representing a channel (one to twelve); or it can be zero (0), which means no channel is indicated.

In Figure 34, an FCB load module is assembled and added to SYS1.IMAGELIB. The image defines a print density of eight lines per inch on an eleven inch form with a right shift of 15 line character positions (1 1/2 inches).

```
//ADDFCB       JOB   MSGLEVEL=1
//STEP         EXEC  PROC=ASMFCL,PARM.ASM='NODECK,LOAD',
//    PARM.LKED='LIST,OL,REFR,RENT,XREF'  (See note)
//ASM.SYSIN    DD    *
FCB2ID1        CSECT
*THIS EXAMPLE IS FOR A FORM LENGTH OF 11 INCHES
*WITH 8 LINES OF PRINT PER INCH (88 LINES)
               DC    X'80'    THIS IS A DEFAULT IMAGE
               DC    AL1(89)  LENGTH OF FCB IMAGE
               DC    X'8F'    OFFSET PRINT LINE 15
*CHARACTER POSITIONS TO THE RIGHT
               DC    X'10'    8 LINES PER INCH-NO CHANNEL FOR POSITION 1
               DC    XL4'0'   4 LINES NO CHANNEL
               DC    X'01'    CHANNEL 1 IN POSITION 6
               DC    XL6'0'   6 LINES NO CHANNEL
               DC    X'02'    CHANNEL 2 IN POSITION 13
               DC    XL6'0'
               DC    X'03'
               DC    XL6'0'
               DC    X'04'
               DC    XL6'0'
               DC    X'05'
               DC    XL6'0'
               DC    X'06'
               DC    XL6'0'
               DC    X'07'
               DC    XL6'0'
               DC    X'08'
               DC    XL6'0'
               DC    X'09'
               DC    XL6'0'
               DC    X'0A'
               DC    XL6'0'
               DC    X'0B'
               DC    XL6'0'
               DC    X'0C'    CHANNEL 12 IN POSITION 83
               DC    XL4'0'   4 LINES NO CHANNEL
               DC    X'10'    POSITION 88 LAST LINE IN IMAGE
               END
/*
//LKED.SYSLMOD       DD  DSNAME=SYS1.IMAGELIB(FCB2ID1),DISP=OLD
```

Note: The RENT and REFR linkage editor attributes are used for performance considerations in a paging environment and may be omitted.

Figure 34. Sample Code to Assemble and Add FCB Load Module to SYS1.IMAGELIB

Retrieving an FCB Image

If you want to modify an FCB image in virtual storage before loading it into a forms control buffer, you can use this sequence of macro instructions to read the FCB image into virtual storage:

1. An IMGLIB macro instruction, with the OPEN parameter.
2. A BLDL macro instruction, to determine whether the FCB image you want is in the image library.
3. A LOAD macro instruction, to load the image into virtual storage.

After the image has been read in, it is necessary to issue another IMGLIB macro, but this time with the CLOSE parameter and the address of the DCB that was built by the first IMGLIB macro. A SETPRT macro instruction can be used to load the forms control buffer with the modified image.

The format of the BLDL and the SETPRT macros is given in *OS/VS Data Management Macro Instructions*; the format of the LOAD macro is given in

OS/VS1 Supervisor Services and Macro Instructions. Shown here is the format of the IMGLIB macro:

[*symbol*]	**IMGLIB**	{**OPEN** | **CLOSE**,*addr*}

OPEN
specifies that a DCB is to be built for SYS1.IMAGELIB and that SYS1.IMAGELIB is to be opened. The address of the DCB is returned in register 1.

CLOSE
specifies that SYS1.IMAGELIB is to be closed.

addr
RX-type address of word that points to the DCB. If coded in the form (1-12), then the register contains the address of the DCB, not the address of the fullword.

Return codes for IMGLIB OPEN:

Decimal Return Code	Meaning
0	Successful.
4	Either the volume containing SYS1.IMAGELIB is not mounted or a required catalog volume was not mounted.
8	Either SYS1.IMAGELIB does not exist on the volume to which the catalog points, or it is not cataloged.
12	An error occurred in reading the catalog or VTOC.

BLDL and LOAD are the only macros that may refer to the DCB built by the IMGLIB macro.

INDEX

For additional information about any subject listed in this index, refer to the publications that are listed under the same subject in *OS/VS1 Master Index,* GC24-5104.

D

E

F

G

I

J

K

L

M

N

O

P

R

S

T

U

V

W

X

1 2 3

GC26-3837-2

OS/VS1 Data Management for System Programmers (File No. S370-30) Printed in U.S.A. GC26-3837-2

IBM®

International Business Machines Corporation
Data Processing Division
1133 Westchester Avenue, White Plains, New York 10604
(U.S.A. only)

IBM World Trade Corporation
821 United Nations Plaza, New York, New York 10017
(International)

OS/VS1 Data Management for
System Programmers
GC26-3837-2

Reader's Comment Form

Your comments about this publication will help us to improve it for you. Comment in the space below, giving specific page and paragraph references whenever possible. All comments become the property of IBM.

Please do not use this form to ask technical questions about IBM systems and programs or to request copies of publications. Rather, direct such questions or requests to your local IBM representative.

If you would like a reply, please provide your name, job title, and business address (including ZIP code).

Fold on two lines, staple, and mail. No postage necessary if mailed in the U.S.A. (Elsewhere, any IBM representative will be happy to forward your comments.) Thank you for your cooperation.

Fold and Staple

First Class Permit
Number 439
Palo Alto, California

Business Reply Mail

No postage necessary if mailed in the U.S.A.

Postage will be paid by:

IBM Corporation
General Products Division
Programming Publishing—Department J57
1501 California Avenue
Palo Alto, California 94304

Fold and Staple

IBM®

International Business Machines Corporation
Data Processing Division
1133 Westchester Avenue, White Plains, New York 10604
(U.S.A. only)

IBM World Trade Corporation
821 United Nations Plaza, New York, New York 10017
(International)

OS/VS1 Data Management for System Programmers (File No. S370-30) Printed in U.S.A. GC26-3837-2