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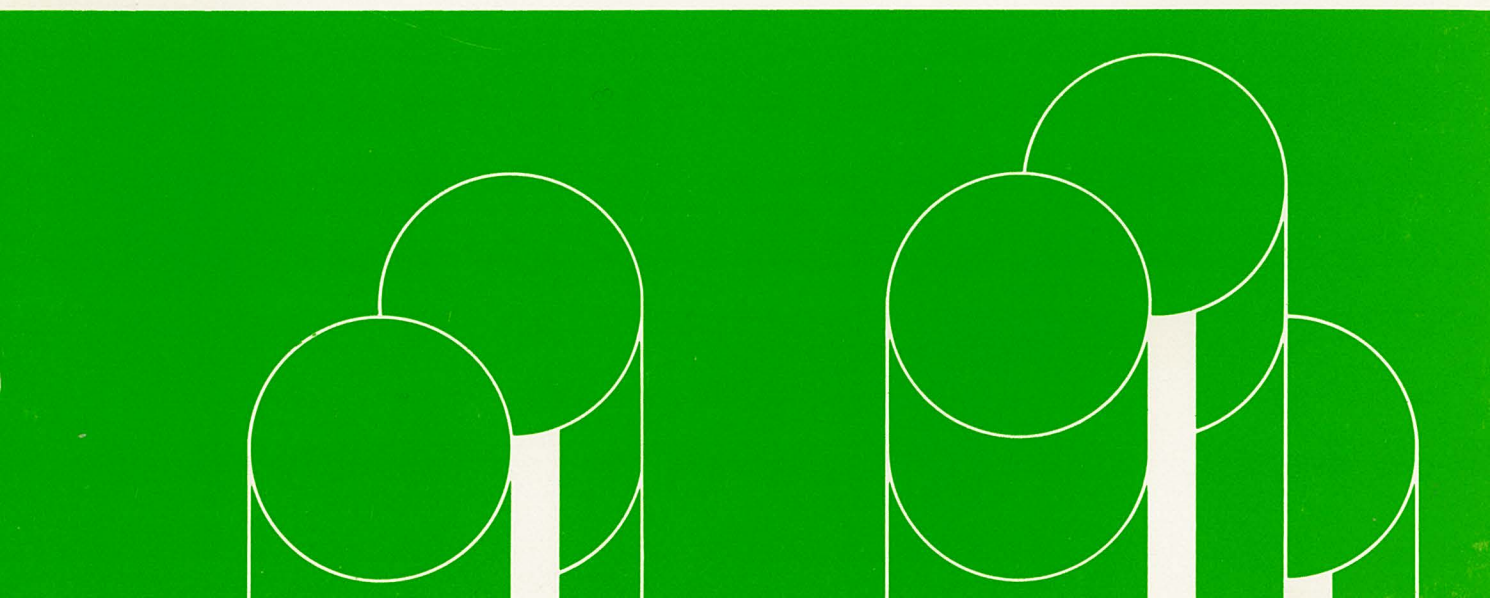
IBM 3880
Storage Control Model 21

Installation and Administration Guide

Cross-System

IBM



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Preface

This manual is intended to give system programmers information for planning or using programming support for the IBM 3880 Storage Control Model 21.

Organization

This manual contains the following sections:

- Chapter 1, "Introduction," gives a brief overview of the 3880 Model 21 and describes the software requirements.
- Chapter 2, "Installation," contains information about installing the 3880 Model 21.
- Chapter 3, "Command Formats," explains the access method services commands, their formats and parameters that may be used with the 3880 Model 21, as well as coding examples.
- Chapter 4, "Measuring Cache Effectiveness," shows how to calculate the "hit" ratio.
- Appendix A, "LISTDATA Report Examples," shows the types of reports produced by the LISTDATA command.
- Appendix B, "User Interface to LISTDATA," describes the parameter list for the interface.
- "Glossary" defines terms as they are used in this book.

Prerequisite Knowledge

To use this book efficiently, you should already understand the IBM 3880 Storage Control subsystems and have a knowledge of access method services commands.

You should also be familiar with the information presented in *Introduction to IBM 3880 Storage Control Model 21*, GA32-0080.

Related Publications

You should be familiar with the information presented in the publications listed below. These publications contain information for installing and using cache devices.

MVS/Extended Architecture Publications

Short Title	Publication Title	Order Number
Access Method Services Logic	*MVS/Extended Architecture Access Method Services Logic*	LY26-3889
Cache Device Administration	*MVS/Extended Architecture Cache Device Administration*	GC26-4017
System Generation	*MVS/Extended Architecture Installation: System Generation*	GC26-4009
System Messages	*MVS/Extended Architecture Message Library: System Messages*, Volumes 1 and 2	GC28-1376 and GC28-1377

MVS/370 Publications

Short Title	Publication Title	Order Number
Access Method Services Logic	*MVS/370 Access Method Services Logic*	LY26-3912
Access Method Services Reference	*MVS/370 Access Method Services Reference for the Integrated Catalog Facility*	GC26-4051
System Generation	*MVS/370 System Generation Reference*	GC26-4063
System Messages	*MVS/370 Message Library: System Messages*, Volumes 1 and 2	GC28-1374 and GC28-1375

Other Publications

Short Title	Publication Title	Order Number
Cache RMF Reporter	*Cache RMF Reporter Program Description/Operations*	SH20-6295
Device Support Facilities User's Guide and Reference	*Device Support Facilities User's Guide and Reference*	GC35-0033
IBM 3880 Storage Control Model 21 Description	*IBM 3880 Storage Control Model 21 Description*	GA32-0081
Introduction to IBM 3880 Storage Control Model 21	*Introduction to IBM 3880 Storage Control Model 21*	GA32-0080
IOCP User's Guide and Reference	*Input/Output Configuration Program User's Guide and Reference*	GC28-1027

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Chapter 1. Introduction

IBM 3880 Storage Control Model 21

The IBM 3880 Storage Control Model 21 is a high-performance storage subsystem that supports paging and swapping functions for MVS/XA, MVS, and VM. It is referred to generically in this book as a paging model of the IBM 3880 Storage Control. The Model 21 has two storage directors and a storage hierarchy consisting of a cache and one or two strings of two to four IBM 3350 Direct Access Storage devices.

When the processor has a page to write to the page data set, the Model 21 places that page into the cache. The page will remain in the cache until it is requested by the processor or until it becomes the least recently used page in the cache. If the page becomes the least recently used, it will be written to the attached DASD without processor intervention.

When the processor requires a page of data, the Model 21 transfers that page from the cache to the channel. (If the cache contains no copy of the page, the Model 21 disconnects from the channel, brings in a copy from DASD, and then reconnects to the channel to transfer the page.)

Having the data available in the cache increases the performance of the subsystem because cache accesses do not involve seek or rotational delays.

For more information about the IBM 3880 Storage Control Model 21, see *Introduction to IBM 3880 Storage Control Model 21.*

Programming Support

The 3880 Model 21 requires at least MVS/SP Version 1.3.3 and MVS/370 Data Facility Product Release 1.1 or MVS/SP Version 2.1.2 and MVS/XA Data Facility Product Release 1.2. For VM users, the 3880 Model 21 requires VM/HPO Release 3.4.

The LISTDATA and SETCACHE commands are access method services commands that can be used with the Model 21.

For each attached device, the subsystem records the number of I/O operations that have been performed on the cache, the total number of I/O operations performed, the amount of storage configured, and the amount of cache available. LISTDATA

allows you to obtain reports containing this information, which can be used to determine if the subsystem cache storage is being used efficiently.

The SETCACHE command can be used to enable or disable paging on the Model 21, setting the subsystem storage online or offline. However, this function is intended for maintenance purposes only; turning off the entire subsystem might cause data to be lost and would probably require an IPL of the system.

The commands that may be used with each caching model of the IBM 3880 Storage Control are shown in Figure 1.

Command	Model 11	Model 21	Model 13	Model 23
BINDDATA	No	No	Yes	No
LISTDATA	Yes	Yes	Yes	Yes
SETCACHE	No	Yes	Yes	Yes

Figure 1. Command/Model Cross-Reference Table

Note: These commands are **not** used for the IBM 3880 Storage Control Models 1, 2, 3, or 4.

Chapter 2. Installation

Performing an I/O Generation

The IODEVICE macro instruction describes the characteristics of an I/O device and its system requirements. Each uniquely addressable I/O device in the machine configuration must be specified in an IODEVICE macro instruction.

During sysgen, a generic name (for example, 3350) is automatically assigned to each collection of devices having the same allocation characteristics. The allocation characteristics are determined by the values specified in the parameters of an IODEVICE macro instruction. For detailed information about the IODEVICE macro, see *System Generation.*

For support of the IBM 3350 Direct Access Storage attached to the IBM 3880 Storage Control Model 21, specify an IODEVICE macro with UNIT=3351P. The UCBs will be generated as 3350 UCBs; all JCL, DATASET macro, and other specifications or references should be designated as 3350 (not 3351P).

The ADDRESS parameter specifies the unit address of one or more devices (MVS/370) or the device number of one or more devices (MVS/XA) and the number of devices.

Example: This example specifies a 3350 attached to a 3880 Model 21, with addresses 2C0 and 2C1.

```
**************************************************

   PAGST  IODEVICE  UNIT=3351P,ADDRESS=(2C0,2)

**************************************************
```

Four addresses are generated for 2C0: the base address 2C0 and three paging addresses 2C4, 2C8, 2CC. Four addresses are generated for 2C1: the base address 2C1 and three paging addresses 2C5, 2C9, 2CD.

Performing an IOCP Generation

For the processor complex, Figure 2 shows the keyword values you specify for the UNIT and TIMEOUT keywords on the IODEVICE macro instruction. Also, the figure shows the keyword values you specify for the UNIT, SHARED, and PROTOCL keywords on the CNTLUNIT macro instruction.

For a full description of the IODEVICE and CNTLUNIT macro instructions, see "Specifying IOCP Macro Instructions" in *IOCP User's Guide and Reference.*

IODEVICE Macro Instruction			CNTLUNIT Macro Instruction			
UNIT=	TIMEOUT=	Notes	UNIT=	SHARED=	PROTOCL=	Notes
3351P	Y	1,4	3880P	N	D/S	2,3,5

Figure 2. IOCP Parameter Values for IODEVICE and CNTLUNIT Macro Instructions

Notes for Figure 2:

1. On the ADDRESS parameter, if you do not specify the number of sequential device addresses to be assigned, a default of 2 is used. For the 3350P or 3351P, IOCP unconditionally assigns two base addresses if you specify none or 1. For the 3351P, IOCP unconditionally assigns four base addresses if you specify 3.

2. For the 3880 Model 21, one CNTLUNIT macro instruction must be specified for each 3880 Storage Director.

3. Each channel path attaching to the 3880 Model 21 can operate independently in either data streaming mode or offset interlock mode. The 3880 has eight channel speed control switches for setting the mode of operation. Regardless of the device types attached to the 3880, it is recommended that you: (a) set all 3880 channel speed control switches for channel paths attached to the processor complex to data streaming mode; and (b) specify PROTOCL=S on the CNTLUNIT macro instructions for each 3880 storage director. These actions allow the maximum data transfer rates and the use of longer cable lengths.

   The processor complex requires all control units attaching a common device to the processor complex to use the same interface protocol. Therefore, when both a 3880 and a 3830 attach a common device to the processor complex, the user must specify PROTOCL=D on both (a) the CNTLUNIT macro instruction for the 3830 storage director, and (b) the CNTLUNIT macro instruction(s) for the attached 3880 storage director(s). In this case, you must set the 3880 channel speed control switches for the channel paths that attach the 3880 storage director(s) to the nondata streaming mode.

4. Specify UNIT=3351P for each 3350 that is attached to the 3880 Model 21.

5. Specify the paging storage director of a 3880 Model 21 as UNIT=3880P. If you specify UNITADD=((aa,32)), then bits 4 and 5 of the binary value of the byte representing aa must be zeros.

Chapter 3. Command Formats

For MVS/XA users, *Cache Device Administration* contains further information about access method services commands for storage controls; for MVS/370 users, *Access Method Services Reference* contains that information.

LISTDATA

The LISTDATA command obtains information about activity within the IBM 3880 Storage Control Model 21. You can get two different types of reports:

- Subsystem Counters Report—a record of the counters within the subsystem at the time the report is requested.
- Subsystem Status Report—a record of the status within the subsystem at the time the report is requested.

With either type of report, you can request a legend that describes the headings and abbreviations used. When you request a legend, it is printed at the end of the report.

A user interface has been provided specifically for nonaccess method services callers (for example, an RMF interval exit). This interface also allows you to obtain subsystem status or count information. The description of the interface is listed in Appendix B, "User Interface to LISTDATA" on page 27.

The format of the LISTDATA command is:

LISTDATA	**{COUNTS | STATUS}** **{FILE(***ddname***) | {VOLUME(***volser***) UNIT(***unittype***)}}** **[DEVICE | SUBSYSTEM | ALL]** **[LEGEND | NOLEGEND]** **[OUTFILE(***ddname***) | OUTDATASET(***dsname***)]**

LISTDATA can be abbreviated: LDATA

LISTDATA Parameters

Required Parameters

COUNTS | STATUS
specifies whether a Subsystem Counters Report or a Subsystem Status Report is to be printed.

COUNTS
specifies that a Subsystem Counters Report is printed.

Abbreviation: CNT

STATUS
specifies that a Subsystem Status Report is printed.

Abbreviation: STAT

FILE(*ddname*) | {VOLUME(*volser*) UNIT(*unittype*)}
specifies a volume that resides in the subsystem for which the report is requested.

FILE(*ddname*)
specifies the name of a DD statement that identifies the device type and volume of a unit within the subsystem. For *ddname*, substitute the name of the DD statement identifying the device type and volume serial number.

VOLUME(*volser*)
specifies the volume serial number of a volume within the subsystem. For *volser*, substitute the volume serial number of the volume.

Abbreviation: VOL

UNIT(*unittype*)
specifies the unit type of the subsystem. This parameter is required only when the VOLUME parameter is specified.

Optional Parameters

DEVICE | SUBSYSTEM | ALL
specifies the subsystem counters to be reported in the Subsystem Counters Report. One of these parameters is specified only when the COUNTS parameter is specified.

DEVICE
specifies that the subsystem counters for the addressed device only are included in the Subsystem Counters Report.

Abbreviation: DEV

SUBSYSTEM
specifies that the subsystem counters for all devices within the subsystem are included in the Subsystem Counters Report.

Abbreviation: SSYS or SUBSYS

ALL
specifies that subsystem counters for all devices on all like models of the IBM 3880 Storage Control are included in the Subsystem Counters Report. ALL is the default parameter when the COUNTS parameter is specified.

LEGEND | NOLEGEND
specifies whether a legend is to be printed at the completion of the requested report.

LEGEND
specifies that the headings and any abbreviations used in the report are listed.

Abbreviation: LGND

NOLEGEND
specifies that the headings and any abbreviations used in the report are not listed.

Abbreviation: NOLGND

OUTFILE(*ddname*) | OUTDATASET(*dsname*)
specifies an alternate target data set if the SYSPRINT data set is not to be used for the report.

OUTFILE(*ddname*)
specifies the name of a DD statement identifying the data set used to contain the report. If an alternate data set is specified, it must meet the output data set requirements. For *ddname*, substitute the name of the DD statement identifying the data set.

Abbreviation: OFILE

OUTDATASET(*dsname*)
specifies the name of the alternate target data set. OUTDATASET can be specified only in MVS systems. For *dsname*, substitute the name of the data set to be used. The data set name must be cataloged.

Note: Be sure to erase the previous alternate target data set before specifying the OUTDATASET parameter. If you do not erase the old data set, your reports may be inaccurate. If a report seems to be in error, compare the time field with the time the job was submitted.

Abbreviation: ODS or OUTDS

LISTDATA Examples

Listing Subsystem Counters for a Particular Device: Example 1

In this example, a Subsystem Counters Report for a particular device is being requested. The actual Subsystem Counters Report is shown in Figure 3 on page 19.

```
//LISTJOB1  JOB    ...
//LISTDATA  EXEC   PGM=IDCAMS
//LISTVOL1  DD     UNIT=3350,VOL=SER=E100,DISP=SHR
//SYSPRINT  DD     SYSOUT=*
//SYSIN     DD     *
  LISTDATA-
   COUNTS-
   FILE(LISTVOL1)-
   DEVICE
/*
```

Job control language statement:

- LISTVOL1 DD, which specifies a 3350 unit and volume E100.

The LISTDATA command parameters are:

- COUNTS, which specifies that a Subsystem Counters Report is printed.
- FILE, which specifies LISTVOL1 as the DD statement that allocates a 3350 unit and volume E100.
- DEVICE, which specifies that the Subsystem Counters Report should include only subsystem counters for the addressed device.

Listing Subsystem Counters for All Devices within a Subsystem: Example 2

In this example, a Subsystem Counters Report for all devices within a subsystem is being requested. The actual Subsystem Counters Report is shown in Figure 4 on page 20.

```
//LISTJOB2  JOB    ...
//LISTDATA  EXEC   PGM=IDCAMS
//OUTDD     DD     DSN=CSYS2.LISTDAT2,DISP=(,CATLG),VOL=SER=SCRC02,
//           UNIT=3380,SPACE=(CYL,(2,1)),
//           DCB=(RECFM=VBA,LRECL=125,BLKSIZE=629)
//SYSPRINT  DD     SYSOUT=*
//SYSIN     DD     *
  LISTDATA-
   COUNTS-
   VOLUME(E100)-
   UNIT(3350)-
   SUBSYSTEM-
   OUTFILE(OUTDD)
/*
```

Job control language statement:

- OUTDD DD, which allocates the output data set (DSN=OUTDS) a 3380 DASD (UNIT=3380) for use by the LISTDATA command. If you do not allocate an output data set, the subsystem counters are printed on the SYSPRINT data set. The DCB parameter is required for the alternate output data set if the data set is new.

The LISTDATA command parameters are:

- COUNTS, which specifies that a Subsystem Counters Report is printed.
- VOLUME, which specifies volume E100.
- UNIT, which specifies a 3350 unit.
- SUBSYSTEM, which specifies that the Subsystem Counters Report should include counters for all devices within the subsystem containing the volume.
- OUTFILE, which specifies OUTDD as the name of the DD statement identifying the data set used to contain the report.

Listing Subsystem Counters for All Devices on All Like Subsystems: Example 3

In this example, a Subsystem Counters Report for all devices on all like subsystems is being requested. The actual Subsystem Counters Report is shown in Figure 5 on page 23.

```
//LISTJOB3  JOB    ...
//LISTDATA  EXEC   PGM=IDCAMS
//OUTDD     DD     DSN=CSYS2.LISTDAT3,DISP=(,CATLG),UNIT=3380,
//                 VOL=SER=SCR02,SPACE=(CYL,(2,1)),DCB=(RECFM=VBA,
//                 LRECL=250,BLKSIZE=504)
//SYSPRINT  DD     SYSOUT=*
//SYSIN     DD     *
  LISTDATA-
   COUNTS-
   VOLUME(E100)-
   UNIT(3350)-
   ALL-
   OUTDATASET(CSYS2.LISTDAT3)
/*
```

Job control language statement:

- OUTDS DD, which allocates the output data set (DSN=OUTDATA) on a 3380 DASD (UNIT=3380) for use by the LISTDATA command. If an output data set is not allocated, the report is printed on the SYSPRINT data set. The DCB parameter is required for the alternate output data set. The output data set is cataloged in the VSAM master catalog (DISP=(,CATLG)). This DD statement allocates 2 cylinders for the output data set and, if more space is required for the report, the space is extended in increments of 1 cylinder.

The LISTDATA command parameters are:

- COUNTS, which specifies that a Subsystem Counters Report is printed.
- VOLUME, which specifies volume E100.
- UNIT, which specifies a 3350 unit.
- ALL, which specifies that the Subsystem Counters Report should include subsystem counters for all devices on all like subsystems.
- OUTDATASET, which identifies OUTDATA as the output data set used for the report, rather than the SYSPRINT data set.

SETCACHE

The SETCACHE command can be used with the IBM 3880 Storage Control Model 21.

You can use the SETCACHE command to:

- Make subsystem storage available to the subsystem
- Make subsystem storage unavailable to the subsystem
- Make subsystem storage available to a storage director
- Make subsystem storage unavailable to a storage director

When subsystem storage is made unavailable, paging mode activity ceases.

The format of the SETCACHE command is:

SETCACHE	**{FILE(*ddname*) | {VOLUME(*volser*) UNIT(*unittype*)}}** **{SUBSYSTEM | DIRECTOR (1) | (2)}** **[ON | OFF]**

SETCACHE can be abbreviated: SETC

SETCACHE Parameters

Required Parameters

FILE(*ddname*) | {VOLUME(*volser*) UNIT(*unittype*)}
specifies the volume of a unit within the subsystem.

FILE(*ddname*)
specifies the name of a DD statement that identifies the device type and volume of a unit within the subsystem. For *ddname*, substitute the name of the DD statement identifying the device type.

VOLUME(*volser*)
specifies the volume serial number of a volume within the subsystem. For *volser*, substitute the volume serial number of the volume.

Abbreviation: VOL

UNIT(*unittype*)
specifies the unit type of the subsystem.

SUBSYSTEM | DIRECTOR (1) | (2)

SUBSYSTEM specifies that access to the entire subsystem cache is to be allowed or prohibited.

Abbreviation: SUBSYS or SSYS

DIRECTOR specifies whether the odd or even addressed storage director on a paging subsystem will be allowed to access the cache. Director 1 is the even address and Director 2 is the odd address. This relationship is determined by the labeling on the C.E. panel.

(1)

specifies that storage director 1 (the even address) will be used.

(2)

specifies that storage director 2 (the odd address) will be used.

Abbreviation: SD

Warning: The ability to issue SETCACHE DIRECTOR (1) | (2) OFF is intended to provide a mechanism that will allow concurrent maintenance activities to occur on one storage director (the one set off) while paging operations continue to be supported by the other storage director. However, by setting one director off and then setting the other director off, it is possible to set the entire subsystem off. Note that turning the entire subsystem off (regardless of how the subsystem is turned off) might cause data to be lost and will probably require a re-IPL of the system. After a director has been set off, use SETCACHE SUBSYSTEM ON to set the director on again. If a storage director is offline, vary it back online and use SETCACHE SUBSYSTEM ON.

Optional Parameters

ON | OFF

specifies whether access to the cache is to be allowed or prohibited.

ON

specifies that access to the cache is allowed.

OFF

specifies that access to the cache is prohibited.

SETCACHE Examples

Allowing Access to the Cache for an Entire Subsystem: Example 1

In this example, access to subsystem storage is allowed for the entire subsystem.

```
//SETCACHE  JOB    ...
//STEP1     EXEC   PGM=IDCAMS
//SYSPRINT  DD     SYSOUT=A
//SYSIN     DD     *
  SETCACHE-
   VOLUME(VOL002)-
   UNIT(3350)-
   SUBSYSTEM-
   ON
/*
```

The SETCACHE command parameters are:

- VOLUME, which specifies a volume serial (VOL002) of a volume mounted on a unit within the subsystem.
- UNIT, which specifies a 3350 unit.
- SUBSYSTEM, which specifies that cache access is affected for all devices in the subsystem containing VOL002.
- ON, which specifies that access to the cache is allowed.

Prohibiting Access to the Cache for a Director: Example 2

This is an example that assumes that both storage directors are actively supporting paging activities when it becomes necessary or desirable to make storage director 1 available for concurrent maintenance activities while storage director 2 is still supporting paging mode activities.

```
//SETCACHE  JOB    ...
//STEP1     EXEC   PGM=IDCAMS
//SET01     DD     UNIT=3350,VOL=SER=VOL123,DISP=SHR
//SYSPRINT  DD     SYSOUT=A
//SYSIN     DD     *
  SETCACHE-
   FILE(SET01)-
   DIRECTOR(1)-
   OFF
/*
```

Job control language statement:

- SET01 DD, which allocates a 3350 unit and volume VOL123.

The SETCACHE command parameters are:

- FILE, which specifies SET01 as the DD statement that allocates a 3350 unit and volume VOL123.

- DIRECTOR(1) identifies the storage director for which the command is intended.

- OFF, which specifies that access to the cache is prohibited.

It should be noted that, when the concurrent maintenance activities have been completed, the means by which subsystem storage is again made available to the storage director (for whom the subsystem storage was made unavailable) is with a SETCACHE SUBSYSTEM ON command.

Chapter 4. Measuring Cache Effectiveness

The "cache effectiveness ratio" measures the efficiency of an IBM 3880 Storage Control paging model. This ratio is also known as a "cache hit ratio."

In storage control processing, a "hit" means that the storage director searched for a copy of a record in the cache and found it; a "miss" means that the storage director did not find a copy of the record. The subsystem is most efficient when it has a high percentage of hits: It is finding most of the requested pages in the cache and is not having to access the DASD often.

Calculating the Ratio

To calculate the effectiveness ratio, use data from the Subsystem Counters Report, as follows:

1. Issue the LISTDATA command at the beginning and end of the time interval you are considering. (This may be one or more RMF intervals.)

2. Subtract the values in the first report from the corresponding values in the second report. This gives you the data for the interval.

   As an example, after subtracting the first Subsystem Counters Report from the second, this data was obtained:

	TOTAL PAGING	NON-SEQUENTIAL	SEQUENTIAL	SWAP-INS
DATA TRANSFERS	------	------	------	------
READS		105311	1011	0
NO DASD ACCESS	------	56850	624	0
BLOCK WRITES	123080	DASD UPDATES	------	
BLOCK DISCARDS	------	BLOCK UPDATES	55662	

   Note: These are the only fields used for calculating the ratio.

   The formula for the cache effectiveness ratio is:

   Read Hits + Write Hits / Total Reads + Total Writes

where:

Read Hits = NON-SEQUENTIAL READS + SEQUENTIAL (from the NO DASD ACCESS row) + SWAP-INS (from the NO DASD ACCESS row)

Write Hits = BLOCK WRITES - BLOCK UPDATES

Total Reads = NON-SEQUENTIAL + SEQUENTIAL + SWAP-INS (all from the READS row)

Total Writes = BLOCK WRITES

3. Using these values, the Efficiency Ratio is:

$$\frac{56850 + 624 + 0 + (123080 - 55662)}{105311 + 1011 + 0 + 123080} = \frac{124892}{229402} = 54.4\%$$

To calculate a Read Hit Ratio or a Write Hit Ratio, use a subset of the formula:

Read Hit Ratio = Read Hits / Total Reads

Write Hit Ratio = Write Hits / Total Writes

Appendix A. LISTDATA Report Examples

You use the LISTDATA command to list information in a report form about activity within the IBM 3880 Storage Control Model 21. You can get two different types of reports and, optionally, a legend for each report, which describes the headings and abbreviations used in the report. When you request a legend, it is printed at the end of the report.

The Subsystem Counters Report provides a record of the counters within the subsystem at the time the report is requested.

Figure 3 on page 19 is a the example of the Subsystem Counters Report that results from "Listing Subsystem Counters for a Particular Device: Example 1" on page 8.

Figure 4 on page 20 is the example of the Subsystem Counters Report that results from "Listing Subsystem Counters for All Devices within a Subsystem: Example 2" on page 9.

Figure 5 on page 23 is the example of the Subsystem Counters Report that results from "Listing Subsystem Counters for All Devices on All Like Subsystems: Example 3" on page 10.

Subsystem Counters Report Legend

This legend explains the various parts of the Subsystem Counters Report shown in Figure 3 on page 19; it is also applicable to Figure 4 on page 20 and Figure 5 on page 23.

A Volume serial number for which the data is gathered

B Device identifier

C Paging storage director (SD1)

D Number of channel command word chains to the device with a read or write in it

E Number of read CCWs (channel command words)

F Number of data transfer commands completed that receive their data from the cache without referencing DASD

G Number of set paging parameter commands that were not set sequential

H Number of set paging parameter commands that were set sequential

J Number of set paging parameter commands that were set for swap-in

K Number of read channel command words that were part of a swap-in operation

L Number of swap-in read channel command words requiring no DASD access

M Number of 4K-byte blocks written from the host

N Number of internal command chains performing cache-to-DASD transfers

P Number of blocks available for reassignment through discard block channel command words

Q Number of 4K-byte blocks written from cache to DASD

R Paging storage director (SD2)

```
IDCAMS  SYSTEM SERVICES                          TIME: 09:30:22     08/09/84     PAGE 1

                    3350   SUBSYSTEM COUNTERS REPORT

A  VOLUME E100    B  DEVICE ID X'80'  C  SD ID X'58'

                  D  DATA TRANSFERS  E  ...READS..    F  NO DASD ACCESS

     TOTAL PAGING            96908              N/A              94969

G    NON-SEQUENTIAL         123060            28001              26266

H    SEQUENTIAL              63098           283111             281604

J    SWAP-INS                68923        K  125750          L  125429

     TOTAL/1000                255              436                433

          M  BLOCK WRITES          168927

          N  DASD UPDATES            2180

          P  BLOCK DISCARDS             0

          Q  BLOCK UPDATES           7642


     VOLUME E100       DEVICE ID X'80'    SD ID X'59' R

                       DATA TRANSFERS     ...READS..      NO DASD ACCESS

     TOTAL PAGING            98552              N/A              96566

     NON-SEQUENTIAL         126650            28706              26927
     SEQUENTIAL              62922           283099             281587
     SWAP-INS                70658           128192             127841

     TOTAL/1000                260              439                436

               BLOCK WRITES          175178
               DASD UPDATES            2277
               BLOCK DISCARDS             0
               BLOCK UPDATES           7712
```

Figure 3. Subsystem Counters Report for One Device Under a Model 21 Control Unit

```
IDCAMS  SYSTEM SERVICES                          TIME: 10:28:20    08/09/84    PAGE 1
                    3350   SUBSYSTEM COUNTERS REPORT

VOLUME E100      DEVICE ID X'80'   SD ID X'58'

                DATA TRANSFERS    ...READS..      NO DASD ACCESS

TOTAL PAGING          99271             N/A             97322

NON-SEQUENTIAL       124696           28680             26937
SEQUENTIAL            65067          293809            292282
SWAP-INS              69527          126664            126343

TOTAL/1000              259             449               445

          BLOCK WRITES        170214
          DASD UPDATES          2180
          BLOCK DISCARDS           0
          BLOCK UPDATES         7642


VOLUME E100      DEVICE ID X'80'   SD ID X'59'

                DATA TRANSFERS    ...READS..      NO DASD ACCESS

TOTAL PAGING         100953             N/A             98964

NON-SEQUENTIAL       128347           29346             27565
SEQUENTIAL            64962          294295            292778
SWAP-INS              71259          129071            128720

TOTAL/1000              264             452               449

          BLOCK WRITES        176697
          DASD UPDATES          2277
          BLOCK DISCARDS           0
          BLOCK UPDATES         7712


VOLUME E101      DEVICE ID X'81'   SD ID X'58'

                DATA TRANSFERS    ...READS..      NO DASD ACCESS

TOTAL PAGING          93363             N/A             91649

NON-SEQUENTIAL       126770           28924             27426
SEQUENTIAL            44606          243183            241658
SWAP-INS              70811          126134            125725

TOTAL/1000              242             398               394

          BLOCK WRITES        171450
          DASD UPDATES          2285
          BLOCK DISCARDS           0
          BLOCK UPDATES         8099
```

Figure 4 (Part 1 of 3). Subsystem Counters Report for All Devices Under a Model 21 Control Unit

```
IDCAMS  SYSTEM SERVICES                          TIME: 10:28:20    08/09/84    PAGE 2
                    3350   SUBSYSTEM COUNTERS REPORT

VOLUME E101      DEVICE ID X'81'   SD ID X'59'

                 DATA TRANSFERS    ...READS..      NO DASD ACCESS

TOTAL PAGING          94571             N/A             92827

NON-SEQUENTIAL       128052           29717             28130
SEQUENTIAL            44774          245073            243449
SWAP-INS              70488          126165            125905

TOTAL/1000              243             400               397

          BLOCK WRITES        171758
          DASD UPDATES          2200
          BLOCK DISCARDS           0
          BLOCK UPDATES         7849


VOLUME E110      DEVICE ID X'90'   SD ID X'58'

                 DATA TRANSFERS    ...READS..      NO DASD ACCESS

TOTAL PAGING          85461             N/A             83679

NON-SEQUENTIAL       118675           23718             22098
SEQUENTIAL            49594          209951            208696
SWAP-INS              69765          123372            123045

TOTAL/1000              238             357               353

          BLOCK WRITES        165487
          DASD UPDATES          2167
          BLOCK DISCARDS           0
          BLOCK UPDATES         7865


VOLUME E110      DEVICE ID X'90'   SD ID X'59'

                 DATA TRANSFERS    ...READS..      NO DASD ACCESS

TOTAL PAGING          86431             N/A             84643

NON-SEQUENTIAL       122146           24092             22495
SEQUENTIAL            50054          211848            210415
SWAP-INS              69767          123583            123297

TOTAL/1000              241             359               356

          BLOCK WRITES        170679
          DASD UPDATES          2202
          BLOCK DISCARDS           0
          BLOCK UPDATES         7754
```

Figure 4 (Part 2 of 3). Subsystem Counters Report for All Devices Under a Model 21 Control Unit

```
IDCAMS  SYSTEM SERVICES                          TIME: 10:28:20    08/09/84    PAGE 3
                    3350   SUBSYSTEM COUNTERS REPORT

VOLUME E111      DEVICE ID X'91'   SD ID X'58'

                DATA TRANSFERS    ...READS..      NO DASD ACCESS

TOTAL PAGING          97816             N/A             96152

NON-SEQUENTIAL       120153           25458             23986
SEQUENTIAL            57411          314854            313193
SWAP-INS              67820          122750            122443

TOTAL/1000              245             436               459

          BLOCK WRITES        167936
          DASD UPDATES          2215
          BLOCK DISCARDS           0
          BLOCK UPDATES         7771


VOLUME E111      DEVICE ID X'91'   SD ID X'59'

                DATA TRANSFERS    ...READS..      NO DASD ACCESS

TOTAL PAGING          99048             N/A             97323

NON-SEQUENTIAL       122500           26129             24597
SEQUENTIAL            57797          315249            313796
SWAP-INS              69504          126085            125733

TOTAL/1000              249             467               464

          BLOCK WRITES        169855
          DASD UPDATES          2152
          BLOCK DISCARDS           0
          BLOCK UPDATES         7643
```

Figure 4 (Part 3 of 3). Subsystem Counters Report for All Devices Under a Model 21 Control Unit

```
IDCAMS  SYSTEM SERVICES                              TIME: 12:03:29     08/09/84     PAGE 1
                    3350   SUBSYSTEM COUNTERS REPORT

VOLUME E100       DEVICE ID X'80'   SD ID X'58'

                 DATA TRANSFERS     ...READS..      NO DASD ACCESS

TOTAL PAGING          103078             N/A             101103

NON-SEQUENTIAL        127055           29578              27809
SEQUENTIAL             71073          314589             313062
SWAP-INS               70473          127921             127600

TOTAL/1000               268             472                468

          BLOCK WRITES         172174
          DASD UPDATES           2197
          BLOCK DISCARDS            0
          BLOCK UPDATES          7687


VOLUME E100       DEVICE ID X'80'   SD ID X'59'

                 DATA TRANSFERS     ...READS..      NO DASD ACCESS

TOTAL PAGING          104612             N/A             102597

NON-SEQUENTIAL        130744           30226              28419
SEQUENTIAL             70505          314022             312505
SWAP-INS               72328          130533             130182

TOTAL/1000               273             474                471

          BLOCK WRITES         178728
          DASD UPDATES           2293
          BLOCK DISCARDS            0
          BLOCK UPDATES          7745


VOLUME E101       DEVICE ID X'81'   SD ID X'58'

                 DATA TRANSFERS     ...READS..      NO DASD ACCESS

TOTAL PAGING           96482             N/A              94763

NON-SEQUENTIAL        128896           29887              28384
SEQUENTIAL             47644          256434             254909
SWAP-INS               71649          127437             127028

TOTAL/1000               248             413                410

          BLOCK WRITES         173198
          DASD UPDATES           2291
          BLOCK DISCARDS            0
          BLOCK UPDATES          8106
```

Figure 5 (Part 1 of 3). Subsystem Counters Report for All Devices on All Like Subsystems

```
IDCAMS  SYSTEM SERVICES                          TIME: 12:03:29    08/09/84    PAGE 2
                    3350   SUBSYSTEM COUNTERS REPORT

VOLUME E101      DEVICE ID X'81'   SD ID X'59'

                DATA TRANSFERS     ...READS..      NO DASD ACCESS

TOTAL PAGING          97729             N/A              95974

NON-SEQUENTIAL       130360           30701              29103
SEQUENTIAL            47851          258612             256988
SWAP-INS              71206          127250             126990

TOTAL/1000              249             416                413

          BLOCK WRITES        173637
          DASD UPDATES          2216
          BLOCK DISCARDS           0
          BLOCK UPDATES         7867


VOLUME E110      DEVICE ID X'90'   SD ID X'58'

                DATA TRANSFERS     ...READS..      NO DASD ACCESS

TOTAL PAGING          87612             N/A              85824

NON-SEQUENTIAL       120707           24286              22660
SEQUENTIAL            51288          218799             217544
SWAP-INS              70664          124564             124237

TOTAL/1000              242             367                364

          BLOCK WRITES        167397
          DASD UPDATES          2178
          BLOCK DISCARDS           0
          BLOCK UPDATES         7882


VOLUME E110      DEVICE ID X'90'   SD ID X'59'

                DATA TRANSFERS     ...READS..      NO DASD ACCESS

TOTAL PAGING          88687             N/A              86888

NON-SEQUENTIAL       124113           24650              23042
SEQUENTIAL            51866          221092             219659
SWAP-INS              70730          124948             124662

TOTAL/1000              246             370                367

          BLOCK WRITES        172585
          DASD UPDATES          2214
          BLOCK DISCARDS           0
          BLOCK UPDATES         7767
```

Figure 5 (Part 2 of 3). Subsystem Counters Report for All Devices on All Like Subsystems

```
IDCAMS  SYSTEM SERVICES                                  TIME: 12:03:29     08/09/84     PAGE 3
                    3350   SUBSYSTEM COUNTERS REPORT

VOLUME E111       DEVICE ID X'91'   SD ID X'58'

                 DATA TRANSFERS     ...READS..       NO DASD ACCESS

TOTAL PAGING          101808             N/A              100137

NON-SEQUENTIAL        122062           26069               24590
SEQUENTIAL             61906          334443              332782
SWAP-INS               68843          124217              123910

TOTAL/1000               252             484                 481

          BLOCK WRITES          169904
          DASD UPDATES            2221
          BLOCK DISCARDS             0
          BLOCK UPDATES           7777


VOLUME E111       DEVICE ID X'91'   SD ID X'59'

                 DATA TRANSFERS     ...READS..       NO DASD ACCESS

TOTAL PAGING          103131             N/A              101399

NON-SEQUENTIAL        124586           26782               25243
SEQUENTIAL             62369          335092              333639
SWAP-INS               70325          127293              126941

TOTAL/1000               257             489                 485

          BLOCK WRITES          171792
          DASD UPDATES            2172
          BLOCK DISCARDS             0
          BLOCK UPDATES           7665
```

Figure 5 (Part 3 of 3). Subsystem Counters Report for All Devices on All Like Subsystems

Appendix B. User Interface to LISTDATA

This user interface is provided specifically for nonaccess method services callers (for example, an RMF exit). Its purpose is to invoke the access method services LISTDATA routine, IDCSS01, to obtain subsystem status or count information. To use the interface, you must be in an authorized library before linking to IDCSS01 (contained in SYS1.LINKLIB). You pass a three-word parameter list, pointed to by register 1, to IDCSS01.

The Cache RMF Reporter (5798-DQD), an IBM Program Offering, implements the user interface to LISTDATA. It consists of an RMF Exit and a batch Post Processor Report Program. The RMF Exit obtains all 3880 Model 21 subsystem counts and status, calculates the difference in the device counts (from the previous read), and writes these values and the subsystem status to the System Management Facilities (SMF) data set as user records. Statistics such as hit ratios and read-to-write ratios are calculated by the Post Processor Report Program. A detailed explanation of this program offering can be found in *Cache RMF Reporter*.

Register 1 Parameter List

Word 1
must be zero.

Word 2
contains a pointer to the argument list SSGARGL (detailed below), which IDCSS01 requires. Within this argument list is a field named SSGOADR, which points to the buffer area where IDCSS01 returns subsystem status or counts information. The buffer area may be obtained by the caller or may be left for IDCSS01 to obtain. IDCSS01 will issue MODESET KEY=0,MODE=SUPERVISOR to perform I/O and will issue another MODESET KEY=NONZERO,MODE=PROB before returning to caller.

Word 3
points to a 4-byte area where IDCSS01 returns a return code.

Possible return codes are:

0 – Successful completion

4 – GETMAIN failure

8 – I/O error

12 – Requested volume not found

16 – ESTAE not established

20 – Real address in SSGOADR not valid

24 – Passed buffer not large enough

28 – ddname not found in TIOT

36 – Path to storage director(s) not available

40 – No paths available

Note: If you pass the buffer or the return code is not 4, 12, or 28, the calling routine is responsible for freeing the buffer.

Passed Argument List — SSGARGL

The following is a description of the area pointed to by word 2 of the parameter list passed to IDCSS01. Some fields must be established by the caller; other fields are established by IDCSS01.

The caller must set an option flag to indicate whether information requested is status (SSGRSS) or counts (SSGRPD) and, if counts, must indicate whether for all subsystems (SSGALL), for a specific subsystem (SSG1SS), or for a specific device (SSGDEV). In addition, you must either pass the ddname (via SSGADDN) of a DD statement that results in the allocation of a 3880 (caching) subsystem volume or identify the volume and unit (via SSGAVOL and SSGUNIT) of a 3880 (caching) subsystem volume for which information is being requested. If SSGADDN is passed, IDCSS01 will establish SSGAVOL and SSGUNIT. Other fields that are established by IDCSS01 are listed below.

Offset	Bytes	Field Name	Description: Contents
0(0)	8	SSGHEAD	Will be set to SSGARGL by IDCSS01.
8(8)	4	SGADDN	Address of ddname; zero if none. Volume serial number and device type are retrieved from UCB if nonzero. Return code 28 if the ddname pointed to by SSGADDN is not found in the task input/output table.

Offset	Bytes	Field Name	Description: Contents
12(C)	4	SSGAVOL	Address of volume serial; zero if none. Return code 12, if the volume serial number pointed to by SSGAVOL is not found in the UCBs. A counts report is produced on all like subsystems when the volume serial number is unknown, by pointing to the model number in the form 'FFFFFFFFFFxx', where 'xx' is: X'08' for an IBM 3880 Model 11 X'09' for an IBM 3880 Model 13 X'0A' for an IBM 3880 Model 21 X'0B' for an IBM 3880 Model 23 *Note:* SSGAMD must be set on to indicate the model passed instead of the volume pointer. SSGALL must be set on to indicate the request is for all subsystem counts. Return code of 12 indicates an invalid model.
16(10)	4	SSGUNIT	Four-byte unit type (required when the address of the volume serial number is used). The format is that of UCBTYP (for example, X'30E02009').
20(14)	4	SSGOLN	Length of buffer storage area. If zero, IDCSS01 will get the storage. If passed buffers, it is: 56 bytes for Models 11 and 13 status and 100 bytes for Models 21 and 23 status. Counts size is dependent on the request (for example, all subsystems, specified device, or specified subsystem) and it is better to let IDCSS01 calculate the size and get the buffer. Return code 24 if the buffer passed is not large enough.
24(18)	l4	SSGOADR	Address of buffer area — passed by the calling routine if SSGOLN is nonzero or returned by IDCSS01 when the buffer is gotten by IDCSS01. In either case, the calling routine is responsible for freeing the buffer area. Return code 20 if the LRA (Load Real Address) instruction fails.
28(1C)	1	SSGOPT	Options byte — reflects request.
	1...	SSGRPD	Request to sense subsystem counts.
	.1..	SSGRSS	Request to sense subsystem status.

Offset	Bytes	Field Name	Description: Contents
	..1.	SSGCACHE	Set on for 3880 Models 11 and 21; off for 3880 Models 13 and 23.
	...1	SSGSDS	Set on for 3880 Model 11; off for 3880 Models 13, 21, and 23.
	.... 1...	SSGALL	Request for all subsystem counts.
	.... .1..	SSG1SS	Request counts for a specified subsystem.
	.... ..1.	SSGDEV	Request counts for a specified device.
	1	SSGAMD	Pointer to 3880 model passed instead of a pointer to the volume.
29(1D)	3	SSGOPT	Options bytes continued; set by IDCSS01.
	1...	SSG2SD	Print both SDs (counts and status for 3880 Models 21 and 23).
	.111 1111	—	Reserved.

Buffer Area Returned from IDCSS01

For each volume in the subsystem, the request for counts returns the following information for each volume. If subsystem status was requested, only one entry per subsystem is returned, with the volume and unit address specifying the unit used for the I/O operation.

Offset	Bytes	Field Name	Description: Contents
0(0)	6	SSGDAVOL	Volume serial number; 0's delimiter.
6(6)	2	—	Reserved.
8(8)	3	SSGDAUA1	Three-character unit address.
11(B)	3	SSGDAUA2	Three-character unit address second read; valid for models except Model 11.
14(E)	2	SSGDALN	Data length.
16(10)	var	SSGDADA	Data obtained via SENSE request(s).
		SSGDASS	40 – subsystem status entry length for Models 11 and 13.

Offset	Bytes	Field Name	Description: Contents
		SSGDA2SD	80 – subsystem status entry length for Models 21 and 23.
		SSGDAIPF	80 – subsystem counts entry length for Model 11.
		SSGDASPF	160 – subsystem counts entry length for all other models.

The format of the data provided is returned from the subsystem in response to SENSE SUBSYSTEM STATUS and SENSE SUBSYSTEM COUNTS commands. For further information, see *IBM 3880 Storage Control Model 21 Description.*

Glossary

The following terms are defined as they are used in this book. If you do not find the term you are looking for, see the index or the *Vocabulary for Data Processing, Telecommunications, and Office Systems*, GC20-1699.

access method services. A multifunction service program that defines VSAM data sets and allocates space for them, converts indexed-sequential data sets to key-sequenced data sets with indexes, modifies data set attributes in the catalog, reorganizes data sets, facilitates data portability between operating systems, creates backup copies of data sets and indexes, helps make inaccessible data sets accessible, and lists the records of data sets and catalogs. Also provides device-specific commands for devices. The LISTDATA and SETCACHE commands are part of this support.

buffer. Storage used to compensate for a difference in rate of flow of data, or time of occurrence of events, when transferring data from one device to another.

cache. In a storage control unit, a high-speed buffer storage that is continually updated to contain recently accessed records. Its purpose is to reduce access time.

channel command word (CCW). A doubleword at the location in main storage specified by the channel address word. One or more CCWs make up the channel program that directs data channel operations.

direct access storage device (DASD). A device in which the access time is effectively independent of the location of the data.

error recovery procedure (ERP). A procedure designed to help isolate and, where possible, to recover from errors in equipment. The procedure is often used in conjunction with programs that record the statistics of machine malfunctions.

paging. A technique in which blocks of data or "pages" are moved back and forth between main storage and auxiliary storage. Paging is the implementation of the virtual storage concept.

snap dump. (1) (ISO) A dynamic dump of the contents of one or more specified storage areas. (2) A selective dump performed at various points in a machine run.

swapping. (1) A process that interchanges the contents of an area of main storage with the contents of an area in auxiliary storage. (2) Under TSO, a paging technique that writes the active pages of a job to external page storage and reads pages of another job from external page storage to real storage.

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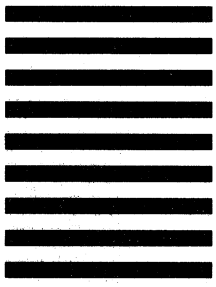

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