File No 1401/1460-30
Form C24-3298-0

IBM Systems Reference Library

Input/Output Control System (on Disk) Operating Procedures IBM 1401 and 1460

Program 1401-IO-068 (Version 2)

This reference publication describes the operating procedures for the IBM 1401 and 1460 IOCS (on disk) program, designed for a 1401 system that includes an IBM 1311 Disk Storage Drive, or a 1460 system that includes an IBM 1301 or 1311 Disk Storage Drive. Use this publication in conjunction with the IBM Systems Reference Library publication Input/Output Control System (on Disk) for IBM 1401/1460: Specifications; Form C24-1489.

Three main sections are included in this publication: combining IOCS routines with the IBM 1401, 1440, and 1460 Autocoder system; assembling an object program; and running an object program. Because IOCS is actually a set of Autocoder library routines, this publication covers only those functions that are unique to IOCS. The reader should be familiar with the operating procedures described in the IBM Systems Reference Library publication Autocoder (on Disk) Program Specifications and Operating Procedures: IBM 1401, 1440, and 1460; Form C24-3259.

For other publications and abstracts, see the IBM bibliography for the associated data processing system.

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The IOCS program for the 1401 or 1460 with an IBM 1311 Disk Storage Drive, or 1460 with an IBM 1301 Disk Storage, is not a complete program in itself. It is a set of library routines that supplements the 1401, 1440, 1460 Autocoder system. It handles input/output operations, including reading and writing, blocking and deblocking, label handling, and error checking.

The specific routines that are required for a particular IOCS program are selected from the corresponding Autocoder library and are incorporated into the user's program at assembly time. The macro-generator phase of each Autocoder program makes this selection on the basis of the DIOCS and DTF entries coupled with the IOCS macro instructions that are part of the user's source program.

This IOCS program, when run on a 1401 or 1460 with a 1311, handles files in the:

IBM 1311 Disk Storage Drive.
IBM 729-II, 729-IV, 729-V, or 7330 Magnetic Tape Units.
IBM 1402 Card Read-Punch.
IBM 1403 and 1404 Printers.

This IOCS program, when run on a 1460 with a 1301, handles files in the:

IBM 1301 Disk Storage.
IBM 1311 Disk Storage Drive.
IBM 729-II, 729-IV, 729-V, or 7330 Magnetic Tape Units.
IBM 1402 Card Read-Punch.
IBM 1403 and 1404 Printers.

An IBM 1401 system used to assemble 1401 or 1460 programs with IOCS must have at least:

4, 000 positions of core storage.
High-Low-Equal Compare Special Feature.
One IBM 1311 Disk Storage Drive Model 4.
One IBM 1402 Card Read-Punch Model 1.
One IBM 1403 Model 2, or 1404 Printer.

An IBM 1440 system used to assemble 1401 or 1460 programs with IOCS must have at least:

4, 000 positions of core storage.
One IBM 1301 Disk Storage Model 11 or 12, or
One IBM 1311 Disk Storage Drive Model 1.
One IBM 1442 Card Read-Punch Model 1 or 2, or
One IBM 1442 Card Reader Model 4, and
One IBM 1444 Card Punch Model 1.
One IBM 1443 Printer.

An IBM 1460 system used to assemble 1401 or 1460 programs with IOCS must have at least:

One IBM 1301 Disk Storage Model 11 or 12, or
One IBM 1311 Disk Storage Drive Model 1.
One IBM 1402 Card Read-Punch Model 3.
One IBM 1403 Printer Model 2.

An IBM 1401 system on which the resultant object program is run must have the high-low-equal compare special feature. The advanced programming special feature (1401) or the indexing-and-store-address-register special feature (1460) is required when:

—Blocked records are processed.
—Unblocked records are processed in work areas.
—Card or printer operations are overlapped with disk-seek operations.

The advanced programming or indexing-and-store-address-register special feature is not required if unblocked records are processed in the input/output area and card or printer operations are not overlapped with disk-seek operations.

Whenever advanced programming or indexing-and-store-address-register is specified in the Autocoder control card for the object machine, IOCS uses that feature to reduce the number of storage positions required. In this case, the Autocoder loading instructions must be stored starting in position 100 or above, so that they do not conflict with the index registers (positions 87-99). The starting storage location for the loading instructions is also specified in the Autocoder control card.

IOCS also utilizes any or all of the following special features, if they are installed and the programmer specifies them in the descriptive entries:

Feature	Specified In
Direct Seek	DIOCS FEATURES
Processing Overlap	DIOCS FEATURES
Read or Punch Release	DIOCS FEATURES
Scan Disk	DIOCS FEATURES
Track Record	DTF TRACKFORM

If the modify address feature is specified in the Autocoder control card for an object machine with more than 4,000 positions of core storage, IOCS utilizes this feature.

COMBINING IOCS WITH AUTOCODER

The IOCS routines are available in a punched-card format that allows direct insertion in the Autocoder system. The IOCS card deck is distinguished by identification in columns 1-5 and 76-80 of each card:

Columns	Identification
1- 5	Program instruction sequence number. Numbered consecutively starting with 0000b (the INSER statement) for each library routine.
76-77	IOCS program identification number (68).
78-79	Library routine identification number.
80	IOCS version number.

The IOCS Library routines are inserted in the Autocoder program by the librarian phase of Autocoder (see the SRL publication Autocoder (on Disk) Program Specifications and Operating Procedures: IBM 1401, 1440, and 1460; Form C24-3259). The identification numbers and names of the IOCS library routines are:

Name (Col. 6-10)	Identification Number (Col. 78-79)
CLOSE	05
DCLOS	10
DTFFI	15
DTFTP	20
FEORL	25
GETbb	30
IOCSb	35
OPENb	40
PUTbb	45
RDLIN	50
RELSE	55
SCANb	60
SEEKb	65
SKIPb	70
SPACE	75
18000	80

The last routine (18000) is a closed subroutine used only by IOCS to convert 5-character addresses to 3-character addresses.

The identification number (Col. 78-79) is punched in each card of a library routine, but the macro name (Col. 6-10) is punched only in the INSER card. The user must not identify library routines of his own with any of these 16 IOCS names, or with the headers DIOCS or DTF.

PRODUCING THE OBJECT PROGRAM

To assemble an object program that uses IOCS, the symbolic source program must be organized in this specific manner.

1. The first three statements, as in any Autocoder program, must be an AUTOCODER RUN statement, a JOB statement, and a CTL statement, in that order.

2. The next statements must be the DIOCS header and detail entries.

3. Following the DIOCS entry must be the DTF header and detail entries for each file being specified for IOCS operation. DTF FILETYPE must be included as the first detail entry for each file.

4. The user's source program follows the last DTF entry.

With the source program arranged in order, the operating procedure for assembling the object program is the same as described in the Autocoder operating procedures publication.

After the Autocoder processor has read each set of DIOCS or DTF entries, the corresponding IOCS routine is selected from the library. The processor generates all the routines, areas, constants, and literals required by IOCS (with the exception of the input/output and work area DA's, which the user must define). Then the remaining part of the user's program (GET's, PUT's, etc.) is compiled. The program is then passed to the assembler portion of Autocoder.

The organization of an assembled object program that includes the IOCS routines is:

1. Retention period checking routine — tape
2. RDLIN routine — tape
3. Error routine — tape
4. Error routine — disk
5. Seek/read/write routine — disk
6. SCAN routine — disk
7. Control-sequential routine — disk
8. CLOSE routine — disk
9. OPEN routine — disk
10. RDLIN routine — disk
11. Routines and/or constants pertaining to each DTF, in the same order as the DTF's in the source program.
12. The user's program.

ERROR INDICATIONS

A listing of the assembled object program is provided by the Autocoder system. This includes IOCS diagnostic statements of errors, if any errors have been made in the source program. On the Autocoder listing, the specific error is printed as a comments card and described in detail. In most cases, the presence of any one of the error messages requires reassembly. IOCS routines and/or constants are not generated if the nature of the error detected is such that the routines would be of no value to the user. However, if the error permits IOCS routines to function properly, the routines and/or constants are generated. In either case, the user should thoroughly examine the error condition and the routines, if any, to see that they will perform the operations he intended.

IOCS has been designed so that most errors in the user's specifications are detected at assembly time. These include errors such as:

—Specification errors within the DIOCS or DTF entries. For example, specification of both INDEXREG and WORKAREA for the same DTF.

—A misspelling of a nonsubstitution-type parameter (for example, DISK spelled DSIK). If the spelling is incorrect in the first three positions, the parameter is not picked up.

Errors that may cause incorrect operation when the object program is run cannot be detected, and are the responsibility of the user. This type includes such errors as missing word marks or record marks in I/O areas or work areas, specification of erroneous record lengths or blocking factors, etc.

IOCS Labels

IOCS provides two kinds of labels in the model statements that form the subroutines in the assembled object program.

1. Internal labels as defined by Autocoder for use in model statements. Each of these is a 6-character alphameric label starting with a lozenge (⌑).

2. Labels that communicate between different IOCS subroutines, and between IOCS subroutines and the user's program. Each of these is a 6-character label starting with the letters IOC. The labels to which the user may have access are:

IOCADR The address of a 7-character field in which a sector address used by IOCS is stored. The first six characters are the actual sector address, and the seventh character indicates which record in a block is to be made available for processing.

IOCWDC The address to which the programmer must branch after he has completed the processing in his routine specified by the DTF entry WRITEXIT.

IOCnBK The address of the units position of the block-count field. A word mark is associated with high-order position of this field. The letter n indicates the tape drive number specified in the DTF CHANDRIVE entry for this file.

IOCnRC The address of the units position of the 10-position record-count field. A word mark is associated with the high-order position of this field. The letter n indicates the tape drive number specified in the DTF CHANDRIVE entry for this file.

IOCnHS The address of the units position of the 10-position hash-total field. A word mark is associated with the high-order position of this field. The letter n indicates the tape drive number specified in the DTF CHANDRIVE entry for this file.

IOCnSQ The address of the units position of the reel sequence number for this file. A word mark is associated with the high-order position of this field. The letter n indicates the tape drive number specified in the DTF CHANDRIVE entry for this file. If the user wishes to modify this number by using exit 6, he must remember that IOCS adds 1 to this number when he returns to the IOCS routines.

IOCRX1
IOCRX2
IOCRX3 Each of these labels refers to the low-order position of the corresponding index register. IOCS initializes these three index registers with blanks, and with word marks in positions 87, 92, and 97.

IOCSLB This address of the high-order position of the field that IOCS uses to build, write, or read standard tape labels. This field is set up by IOCS only if STANDARD or MIXED is specified in the DIOCS LABELDEF entry. The area contains 120, 84, or 80 positions, depending on the type of standard label specified.

IOCSRE The address to which the user must return from his program after using exits 1-7.

IOCTDY The address of the low-order position of the field in which today's date is stored (82-86), when creating standard output labels.

IOCREL The address of a subroutine for controlling reader and punch operations when RELEASE is specified in the DIOCS entry FEATURES. The routine causes a card to be read if a START-READ-FEED instruction has been given by IOCS, or it causes a card to be punched if a START-PUNCH-FEED instruction has been given. The user must branch to this address if his own processing time between a GET card, or a PUT card, and another GET card or PUT card may cause overextension of the release time. In computing the process time available, allow 2 milliseconds for IOCS processing. The user must also branch to this address if, after a GET card or PUT card, he issues any IOCS macro instruction other than GET, PUT, SCAN, or SEEK. (If the object machine does not have the advanced-programming or indexing-and-store-address-register special feature, the user must move his return address to IOCRLX + 3, before branching to IOCREL.)

IOCRET The address to which the user must return after processing his routine specified by the DTF OVERFLOW entry.

IOCDMP The address to which the user may return after processing his routine specified in the DTF WLR-ADDR entry. He must return to this address if he wants IOCS to dump wrong-length records on another tape for later investigation. IOCS writes the record on the tape indicated by the TAPE, n specification in the DIOCS READERROR entry. Then IOCS reads the next record from the same file.

IOCRMV The address to which the user may return after processing his routine specified in the DTF WLR-ADDR entry. He must return to this address if he does not require that IOCS dump wrong-length records onto another tape. IOCS reads the next record from this file.

IOCSCN-1 (IOCSCN minus 1) The address to be used in processing the user's routine specified in the DIOCS entry READERROR. IOCSCN-1 is the 3-position field that contains the address of the high-order position of the input record in error.

IOCSCN-4 (IOCSCN minus 4) The address of the core position that contains the number of the tape drive on which the error condition was detected.

IOCREX The address to which the user must return after processing the user routine specified by the DIOCS entry READERROR.

RUNNING THE OBJECT PROGRAM

The operating procedure for running an object program that contains IOCS routines is essentially the same as that for any object program produced by Autocoder.

If the program utilizes an output file with standard labels, today's date must be loaded into positions 82-86 in storage. To accomplish this, a DATE card may be punched (as specified here) and inserted as the eighth card, immediately behind the Autocoder loading deck, in the condensed deck before loading the object program:

Columns	Punch	Description
1- 3	082	Storage location
4- 5	05	Number of characters
6	0-5-8	Word separator
7-11	xx¦xxx (Yr. ¦ Day)	Today's date

Whenever today's date is stored, the Autocoder loading instructions must be stored starting in position 87 or above. This is specified in the Autocoder control card.

If the user's program contains a RDLIN (read label information) macro instruction to alter standard header labels, disk drive numbers, and/or disk-file limits, one or more RDLIN information cards must be included when the object program is run. At the time the RDLIN macro is executed, a RDLIN information card must be available in the card reader. If two or more files are named in the RDLIN macro instruction, a separate card must be inserted for each file. These cards must be in the same sequence as the file names in the instruction.

IOCS-Generated Halts

Several halts are generated by IOCS. Each halt can be identified by displaying either the B-address register, the I-address register, or the A-register, as indicated in Figure 1. This figure lists the reason for each halt and a procedure to be followed if it occurs. If use of the procedure specified does not allow processing to continue, the job must be restarted from the beginning.

When a halt occurs, the B-address register should be referred to first. If the units and tens positions are blank, the A-register identifies the halt.

If a tape operation causes a halt, the tape SELECT light that is ON identifies the tape unit concerned.

HALTS IDENTIFIED BY B-ADDRESS REGISTER ON A-REGISTER			
A-REGISTER	B-ADDRESS	REASON	PROCEDURE
1	xxbb	Disk error condition other than those defined elsewhere in this list	Press START twice to retry the disk operation.
2	xxbb	Lower and upper limits in standard header label, for a disk input file, do not check	Visually check the disk pack and label specifications. Press START, START RESET, and START again to process the file with this condition. Mount a new pack, if required, and press START twice to recheck all header labels. The new pack must have the address range already specified by the DTF entry or RDLIN card.
3 C21	xxbb	Disk light on: Access-inoperable condition on a disk header label read or write operation Disk light off: Disk header label does not contain IHDRb in the first five positions	Press START, START RESET, and START again to recheck all header labels on this pack for this logical file.
4	xxbb	Parity, wrong-length-record, or unequal-address-compare error detected while reading or writing a disk header label	Press START to recheck all header labels on this pack for this logical file.
5 C41	xxbb	No header label found for the specified disk input file	Visually check the disk pack and label specifications. Mount a new pack, if required, and press START to re-check all header labels. The new pack must have the address range already specified by the DTF entry or RDLIN card.
6 C42	xxbb	RDLIN information card missing for a disk file	Remove cards from the hopper, Run cards out, Place the proper cards (including correct RDLIN card) in the hopper, and Press START, START RESET, and START again to read the RDLIN card. (The A-address register contains the high-order address of the DTF table area if the Advanced Programming, or Indexing and Store Address Register, special feature is used. If not, the A-address register contains the low-order address of the DTF table area.)
7 421	xxbb	Card read error	Remove cards from the hopper, Run cards out, Replace cards in the hopper (corrected error card first), and Press START
8	xxbb	A total of ten card-punch errors detected	Press START to continue. The same data will be punched again.
9 C81	xxbb	Printer error	Press START to continue.
+0 CBA82	xxbb	First halt (parity error) when DIOCS READERROR specifies SCAN (The error stop switch on the tape adapter unit must be off.)	Set the tape-select switch to D, Turn the check stop switch off, and Press START to re-read the error block for scanning. (Second halt at label IOCSCN + 1, under I-Address below.)
⌑ CBA84	xxbb	Parity error detected while reading tape header label	Press START to read header label again.
-0 B82	xxbb	Expiration date for this tape has not been reached or to-day's date is not present in the specified core location	Press START twice to check the retention period again. Press START, START RESET, and START again to use this reel anyway.
L B21	xxbb	Parity error detected while writing tape header label	Press START to write header label again.
$ CB821	xxbb	Tape input header label does not check with the user's specifications	Press START twice to check the header label again. Press START, START RESET, and START again to process this reel of data anyway.
* B84	xxbb	Tape input trailer does not check with totals accumu-lated by IOCS	Press START to ignore this condition and continue pro-cessing.
/ CA1	xxbb	Parity error detected while reading tape trailer label	Press START to read trailer label again.

Figure 1. IOCS-Generated Halts (Part 1 of 2)

A-REGISTER	B-ADDRESS	REASON	PROCEDURE
x CA421	xxbb	End-of-reel condition but no alternate tape device has been specified	Mount next reel of data for this file and press START.
, CA821	xxbb	Parity error detected while writing tape trailer label	Press START to write trailer label again.
% A84	xxbb	Thirty parity-error detections while attempting to write a block of data	Press START to attempt thirty more times to write this block correctly.
# 821	xxbb	D specified in DIOCS LABELDEF but no type A, B, or C label specified in col 80 of RDLIN card	Remove cards from the hopper, Run cards out, Place proper cards (including corrected RDLIN card) in the card reader, and Press START to read the RDLIN card.
@ C84	xxbb	Parity error detected while writing on dump tape	
. BA821	xxbb	RDLIN information card missing for a tape file	Remove cards from the hopper, Run cards out, Place proper cards (including correct RDLIN card) in the card reader, and Press START to read the RDLIN card.
	222	Seven unequal-address-compare detections during a disk operation	Press START twice to try ten more times. (The A-address register contains the high-order address of the disk-control field.)
	333	Seven parity-error detections during a disk operation	Press START twice to try ten more times. (The A-address register contains the high-order address of the disk-control field.)
	444	Access-inoperable error detected during a disk operation	Determine the disk drive number, by examining the storage position specified by the A-address register. Alter-in a different number, if required. Press START to retry with the same or altered drive number.
	555	Seven wrong-length-record detections during a disk operation	Press START twice to try ten more times. (The A-address register contains the high-order address of the disk-control field.)
	666	Disk drive specification missing for an output file (This applies to labelled files only.)	Mount a disk pack, if missing. Alter-in the disk drive number of the address specified by the A-address register, and press START to recheck all header labels.
	777	The portion of a pack specified (DTF FILESTART and FILEND) for a random or consecutive disk output file contains active records (This applies to labelled files only and is detected by the dates in the header label), or today's date is not present with specified core location	Check the FILESTART and FILEND specifications. (The A-address register contains the high-order address of the DTF table area if the Advanced Programming, or Indexing and Store Address Register, special feature is used. If not, the A-address register contains the low-order address of the DTF table area.) Mount a different disk pack or alter-in different DTF specifications. Press START twice to recheck all header labels. Press START, START RESET, and START again to use the original pack without altering. This automatically deletes the data in the file-identification field of the header label.
	888	Pack serial number in a labelled disk output file does not check	Press START, START RESET, and START again to write the disk header label with this condition. Press START twice to recheck all header labels.

HALT IDENTIFIED BY I-ADDRESS REGISTER

I-ADDRESS	REASON	PROCEDURE
One position after label IOCSCN	Second halt when DIOCS READERROR specifies SCAN	Scan for parity-error character and correct if possible, Reset the tape-select switch to N, Turn the check stop switch on, Press CHECK RESET, and Press START RESET and START to process a corrected block, or press START to bypass an incorrect block and resume processing.

Figure 1. IOCS-Generated Halts (Part 2 of 2)

READER'S SURVEY FORM

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