HONEYWELL EDP

SOFTWARE BULLETIN

SERIES 200

EASYTRAN
SYMBOLIC TRANSLATOR D
ADDENDUM #2

GENERAL SYSTEM: SERIES 200/OPERATING SYSTEM - MOD 1

SUBJECT: Additions and corrections to the manual Easytran Symbolic Translator D, published January 25, 1966.

SPECIAL INSTRUCTIONS: With the exception of Section IX, the attached pages contain corrections. These corrected pages should be used to replace the corresponding pages in the manual. The new Section IX, which describes the program Source Program Generator D, should be inserted between Section VIII and Appendix A. With the exception of Section IX, all new or changed information is indicated by change bars. A new table of contents and index are included.

DATE: June 30, 1966

FILE NO.: 123.1405.001D.0-220*

9030
10666
Printed in U.S.A.

*When ordering this publication please specify Title and Underscored portion of File Number.

FOREWORD

The Easytran D System is summarized in Section I of this manual; details of the system operation are presented in Section V. The methods of conversion of various program elements are described in Sections II, III, and IV. The preparation of the Easytran D input deck is presented in Section VI, along with the operating procedures. Section VII describes the output listing, while Section VIII deals with the analysis and correction of any residual problems that may remain after translation. Section IX discusses the Source Program Generator D program. Finally, a series of appendices contain descriptions of internal tables, system tapes, utility routines, and special conversion considerations.

The reader is assumed to be familiar with the following Honeywell publications:

1. Series 200 Programmers' Reference Manual, Models 200/1200/2200 (Order No. 139).
2. Series 200 Equipment Operators' Manual, Model 200 (Order No. 040).
3. Library Processor C (Order No. 051).
4. Easycoder Assemblers C and D (Order No. 041).
5. Tape Loader-Monitor C (Order No. 221).

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

Language Advantages

Another notable difference between Easytran D and previous versions is that 1401 programs are translated into a more powerful symbolic language (Easycoder C). This assembly language is more compatible with Autocoder, especially in the handling of literals and Define Area statements.

Advanced Handling of Actuals

Easytran D floats 1401 actuals (absolute addresses). In previous versions of Easytran, an absolute address in the 1401 program was replaced with an adjusted absolute address in Series 200 memory. Therefore, an absolute address was restricted to a fixed location in memory, and subsequent updates often required manual adjustment of all actuals in the program.

The following types of actuals are differentiated and handled separately by Easytran D:

1. The lowest actual above 333 in the 1401 program.
2. The lowest indexed actual above 333 in the 1401 program.
3. Indexed actuals of value lower than 334.
4. Unindexed actuals of value lower than 334.
5. Data loaded directly into or equated to absolute addresses.

With the exception of references to locations 87 through 100 (see "Mapping of the 1401 Index Register Area," page 1-11), unindexed actuals less than 334 are considered as references to the 1401/1460 fixed input/output areas.

All actuals are related to a series of relocatable tags (see "Mapping the Remainder of Memory," page 1-14). Therefore, if it becomes necessary to change all or part of the actuals in a program, this can be accomplished by simply reassigning the corresponding tags.

Refined Translations

The more intensive analysis made by Easytran D produces translations that more accurately reflect the intent of the original 1401/1460 program.

Translation of 1401 Machine-Language Programs

The Easytran D System includes a special program, Source Program Generator D, which translates 1401 machine-language programs into Autocoder. By preparing 1401 object programs for conversion into Easycoder C language, this program gives an added flexibility to the system over previous versions of Easytran.

EQUIPMENT REQUIREMENTS

The following minimum equipment configuration is required for Easytran Symbolic Translator D, including translation, file update, Library Processor C, and Easycoder Assembler C:

1. Any Series 200 processor with 16K characters of memory (Library Processor C and Easycoder Assembler C require only 12K characters).
2. Advanced Programming Instructions.

3. Editing Instructions
4. Four 1/2-inch magnetic tape units.
5. Printer (132 print positions are required to print entire Easytran listing).
6. Card Reader.

Up to four additional tape units may be used. If one of these drives is used to retrieve 1401 macro routines directly from the Autocoder library, the Series 200 tape control must include the IBM Code Compatibility Feature.

The converted object program requires the following equipment array:

1. A Series 200 processor with additional memory beyond that required by the original 1401/1460 program. This memory requirement is calculated by adding:
   a. The memory requirement of the original 1401/1460 program plus 10% to allow for any expansion in translation.
   b. Up to 6K characters for the Easytran subroutine packages depending on which subroutines are required (see Section IV for subroutine memory requirements).
   c. Memory used by tape buffers (this is required only if buffered tape input/output is used by the converted program).
   d. 1380 characters for Tape Loader-Monitor C (see Order No. 221).
2. Advanced Programming Instructions
3. Up to eight 1/2-inch magnetic tape units as required by the 1401/1460 program. NOTE: The IBM Code Compatibility Feature is required when even parity is used.
4. Any additional equipment and features used by the original 1401/1460 program.

COMPARISON OF 1401/1460 AND SERIES 200

To understand Easytran D better, the user should be aware of the difference between the Autocoder and Easycoder C languages and the major hardware differences between the 1401 and the Honeywell Series 200 computers. Both the 1401 and the Series 200 are character-oriented. This means that a single memory location stores one 6-bit character. In both machines, data fields and instructions of variable length are stored in memory and delineated by word marks.

Table 1-1 compares the hardware features of the Model 200 and the 1401. From a programmer's standpoint, two outstanding advantages of the Model 200 are apparent:

	Model 200	1401
Memory Cycle Time	2 microseconds	11.5 microseconds
Peripheral Simultaneity	Multiple Operations	Serial Operations

Simultaneity of computation with input/output operations and the ability to take advantage of fast memory cycle time are made possible by the Series 200 control memory. In the Model 200, for example, the cycle time of the 16 available control memory registers is 500 nanoseconds. Consequently, control memory has four complete cycles in which operations may be accomplished during a 2-microsecond main memory cycle.

READ A CARD, PUNCH A CARD, PRINT WORD MARKS (2- OR 5-CHARACTER WRP)

Format

	Easytran D Output				Autocoder			
	Op Code[1]	A Address	B Address	Variant	Op	A	B	d
a.	17	aaa		34	WRP	aaa		□
b.	17			34	WRP			□

Function

Format a: Execute functions to read, punch, and print word marks; then branch to the location specified by the A operand.

Format b: Execute functions to read, punch, and print word marks.

Word marks are left undisturbed.

Final address register settings

	SR	AAR	BAR
Format a:	JI (A)	A	NXT
Format b:	NXT	A	unspecified

NOTE: See note on page 2-11.

BRANCH ON INDICATOR (BIN)

Format

	Easytran D Output				Autocoder			
	Op Code	A Address	B Address	Variant	Op	A	B	d
a.	22	aaa		09	BIN	aaa		9
b.	22	aaa		14	BIN	aaa		@
c.	22	aaa		20	BIN	aaa		?
d.	22	aaa		21	BIN	aaa		A
e.	22	aaa		41	BIN	aaa		J
f.	22	aaa		42	BIN	aaa		K
g.	22	aaa		43	BIN	aaa		L
h.	22	aaa		26	BIN	aaa		F
i.	22	aaa		27	BIN	aaa		G

Function

Format a: Branch to the location specified by the A operand if channel 9 in the carriage control table was the last channel reached (see Appendix A).

Format b: Branch to the location specified by the A operand if channel 12 in the carriage control table (end of form) was the last channel reached (see Appendix A).

Format c: Branch to the location specified by the A operand if a card read error is stored.

Format d: Branch to the location specified by the A operand if the Easytran End-of-File card, octal 12 in card column 6, has been sensed in the subroutine card read buffer (i.e., branch on last card).

Format e: Store the overlap register in the B-address register and continue in sequence without a branch.

Format f: Branch to the location specified by the A operand if an end-of-reel condition exists on the last tape unit addressed.

Format g: Branch to the location specified by the A operand if a tape error is stored for the last tape unit addressed. Reset the error indicator.

Format h: Branch to the location specified by the A operand if a word mark is set in location 63_{10} (simulating SENSE switch F ON).

Format i: Branch to the location specified by the A operand if an item mark is set in location 63_{10} (simulating SENSE switch G ON).

Word marks are left undisturbed.

Final address register settings

	SR	AAR	BAR	
Formats a, b, c, d, f, g, h, and i:	JI (A)	A	NXT	(BRANCH)
	NXT	A	B_p	(NO BRANCH)
Format e:	NXT	A	B_p	

CARRIAGE CONTROL (CC)

Format

	Easycoder D Output				Autocoder			
	Op Code	A Address	B Address	Variant	Op	A	B	d
a.	26	aaa		see Table 2-1	CC	aaa		*
b.	26			see Table 2-1	CC			*

Function

Format a: Advance the printer carriage as specified by the variant, which may have any of the values listed in Table 2-1. Branch to the location specified by the A operand.

Format b: Advance the printer carriage as specified by the variant, which may have any of the values listed in Table 2-1.

Word marks are left undisturbed.

Final address register settings

	SR	AAR	BAR
Format a:	JI (A)	A	NXT
Format b:	NXT	A	B_p

*Identical values to those in Table 2-1.

Final address register settings

	SR	AAR	BAR
Format a:	NXT	A	Item marked location + 1

NOTES 1: Double buffering must be specified on the Easytran Control Card (see Section VI) in order that Load Mode Tape instructions can be correctly translated. Buffer size should be increased by 30%.

2: The address adjustment indicates the requested drive number. For example, H. TP(U+1 indicates drive number 1, H. TP(U+2 indicates drive number 2.

WRITE LOAD MODE TAPE (LU)[1]

Format

	Easytran D Output				Autocoder			
	Op Code	A Address	B Address	Variant	Op	A	B	d
a.	43	H. TP (U+x (see note 2)	bbb	66	LU	%UX	bbb	W

Function

Format a: Expand the tape record to be written by placing a word separator character (octal 75) before each word-marked character to be written, and execute a Magnetic Tape Write as described below. The original tape buffer remains in its original format.

Word marks are left undisturbed.

Final address register settings

	SR	AAR	BAR
Format a:	NXT	A	Record Marked Location + 1

NOTES 1: Double buffering must be specified on the Easytran Control card (see Section VI) in order that Load Mode Tape instructions can be correctly translated. Buffer size should be increased by 30%.

2: The address adjustment indicates the requested drive number. For example, H. TP(U+1 indicates drive number 1, H. TP(U+2 indicates drive number 2.

MAGNETIC TAPE READ (MU)

Format

	Easytran D Output				Autocoder			
	Op Code	A Address	B Address	Variant	Op	A	B	d
a.	44	H. TP (U+x (see note 1)	bbb	51	MU	%Ux	bbb	R

Function

Format a: Read one tape record, in even parity, from the tape unit specified by the rightmost character of the A operand into the field specified by the B operand until an interrecord gap is reached. Place an item mark and an octal 32 after the last character transferred from tape.

Word marks are left undisturbed.

Final address register settings

	SR	AAR	BAR
Format a:	NXT	A	Item Marked location + 1

NOTE 1: The address adjustment indicates the requested drive number. For example, H.TP(U+1 indicates drive number 1.

MAGNETIC TAPE WRITE (MU)

Format

	Easytran D Output				Autocoder			
	Op Code	A Address	B Address	Variant	Op	A	B	d
a.	44	H. TP (U+x (see note 1)	bbb	66	MU	%Ux	bbb	W

Function

Format a: Write one tape record, in even parity, to the tape unit specified by the rightmost character of the A operand from the field specified by the B operand until a record mark is reached.

Word marks are left undisturbed.

Final address register settings

	SR	AAR	BAR
Format a:	NXT	A	Record Marked location + 1

NOTE 1: The address adjustment indicates the requested drive number. For example, H.TP(U+1 indicates drive number 1.

HALT (H)

Format

	Easytran D Output				Autocoder			
	Op Code	A Address	B Address	Variant	Op	A	B	d
a.	45	aaa	bbb		H	aaa	bbb	
b.	45	aaa			H	aaa		
c.	45				H			

Function

Formats a, b, c: Execute any form control pending on printer, rewrite last record if any stored tape write error, and reposition input tape if necessary.

Format a: Halt and display contents of A- and B-address registers.

Format b: Halt and display contents of A- and B-address registers. When RUN is pressed, branch to the location specified by the A operand.

Format c: Halt and display contents of A- and B-address registers.

LOAD MODE TAPE OPERATIONS

If a DTF MODEPAR entry specifies LOAD, the EIO DTF routine contains an item-marked 1401 Read/Write Tape with Word Marks instruction. The Easytran subroutines must include the load mode tape routine so that this instruction can be executed. When the load mode is used, double buffering must be used, and the buffer size should be increased by 30% (see page 2-19).

PROCESS OVERLAP

Where an IOCS tape file uses two input/output areas, the EIO automatically provides for buffering of tape operations. When the first GET or PUT operation occurs, the second I/O area is cleared and assigned to the Easytran tape routine (MTAPE) as the buffer for the tape drives used by the file. When the first I/O area becomes empty, these assignments are reversed.

To take advantage of this feature, the user should request the buffered version of the MTAPE routine but should request no buffers for those files which use two I/O areas. This buffering operation is not performed, of course, for tape files which use one I/O area or to which buffers are already assigned.

Possible Problems

Many converted 1401 programs need no hand-tailoring in areas related to the EIO package. However, the following paragraphs should be reviewed to ascertain if any problems exist with the EIO routines.

ITEM MARKS

Generally, only the 1401 record mark characters and the group mark characters may be item-marked in work areas and input/output areas. (This restriction does not apply to the program area where op codes may be item-marked.) Extraneous item marks in a work or input/output area may interfere with GET and PUT operations. To avoid this problem the user should observe the following rules:

1. For an output item, the user program must supply an item mark at the end of each item.
2. For input items, the EIO GET routine supplies an item mark at the end of the current item. (Other items in an input area may or may not have item marks.)
3. In input/output areas, the 1401 record mark character should not be word-marked.

VARBUILD OPERATION

Any program using variable-length records should be carefully checked for the following:

1. Before each PUT operation is performed, the VARBUILD field must contain the length of the next item as a binary number.

2. After the PUT operation, the VARBUILD field contains the binary address of the next item.

3. The 1401/1460 program must build the output item with a decimal item-length field.

DIOCS ORIGIN

The DIOCSORG parameter specifies the starting location of the EIO routines. Three situations may occur.

1. If the DIOCSORG parameter is omitted, the EIO routines normally start at location H. BASE+333. However, if the user inserts an ORG statement immediately before the DIOCS routine, the EIO routines start at the specified location.

2. If the DIOCSORG parameter is a decimal number, the EIO routines start at location H. BASE plus that number.

3. If the DIOCSORG parameter contains a symbolic tag, the EIO routines start at the location specified by the parameter.

IOCS LABELS

IOCS uses labels beginning with IOC for communication among the various routines. Most of these labels are retained by the EIO routines. The following labels may be referenced:

IOCXR1 IOCXR2 IOCXR3	Series 200 index registers 1, 2, and 3. (Locations 2-13 are initialized to zeros with word marks at 2, 6, and 10. The user must not alter punctuation in these locations.)
IOCSEQ	Reel sequence number.
IOCHSH	Hash total - 10 characters.
IOCRCT	Record count - 10 characters.
IOCBLK-1	Block count - 5 characters.
IOCPSV-9	Rewind option - 1 character as follows: blank - no rewinds. A - rewind at the beginning and end of each reel. B - rewind at beginning of reel, rewind with interlock at end of reel.
IOCTDY	Address of today's date - Tape Loader-Monitor C locations 142-146. Today's date may be entered manually, read from the first RDLIN card, or left in memory from the previous run.
IOCSLB	Leftmost address of 80-character label area. This area is generated if STANDARD or MIXED labels are specified.
IOCSRE	Address which is branched to when returning from exit routines.
IOCQUT	Address which is branched to when returning from the printer OVERFLOW routine.
IOCSRW	Address of closed subroutine which reads and writes tape records and performs read-error correction. If the TAPEUSE entry specifies INPUT or OUTPUT, this routine is generated for read-only mode or write-only mode, respectively.

Therefore, the % and @ characters of the A address (which print as "(" and ":") are changed to octal 00 and 01 as follows:

```
H. TP(U     EQU     3328     (becomes 006400)
H. TP:U     EQU     7424     (becomes 016400)
```

Note that the octal equivalent of 3328 is 006400, and the octal equivalent of 7424 is 016400. These addresses specify to Easytran D that tape is being used, the parity of tape, and the drive number; thus they duplicate the function of the A address of a 1401 tape instruction. The drive number is appended to the tag H. TP(U as an address adjustment, which is then added by assembly to the base address to form a complete tape address.

For example, the 1401 tape instruction is changed as follows:

Easycoder	Autocoder
MCW H. TP(U+1, AREA, R	MLC %U1, AREA, R

It should be noted that although all other characters remain the same, any reference to the left-most A-address character of a tape instruction must be investigated.

Table 4-3. Subroutine Halts at Object Time[1]

A-Address Reg.	B-Address Reg.	Explanation	Corrective Procedure
0000XX	000771	User-program function specified by op code XX is not in the specialized subroutines. (Change sequence register and index register X5 contain the address of the instruction following the trapped instruction which requested the illegal function.	Press RUN to return to the user program.
000000	000X11	Card read error with I/O CHECK STOP switch ON. (X is the peripheral address of the card reader control.) The error card should be in the eject stacker.	Run out cards in the card read feed; return the error card and the two runout cards to the read hopper; press START on the card reader and RUN on the CP control panel.
000000	000X21	More than 10 card punch errors have occurred with I/O CHECK STOP switch ON. (X is the peripheral address of the card punch control.) The error card is rejected.	Press RUN to reject the card following the error card and to repunch both cards that were rejected.

Table 4-3 (cont). Subroutine Halts at Object Time[1]

A-Address Reg.	B-Address Reg.	Explanation	Corrective Procedure
000000	004X17	Undefined carriage control tape channel. (Change sequence register and index register 5 contain the address of the instruction following the trapped instruction which requested the undefined channel.)	Correct the carriage control table and rerun.
000000	00003X	End of tape encountered on drive X while performing the write error routine.	Information only. Press RUN to continue.
xxxxxx (see corrective procedure)	00002X	63 write errors have occurred on tape drive X.	To force end of reel, set a word mark at the location specified in AAR and press RUN. To continue, press RUN.
000000	000001	Tape write record is longer than specified buffer. This halt may also be caused by a runaway EXM instruction.	Update the program to enlarge the buffer or to use single buffering for the tape file.

NOTE: 1. Easytran subroutines do not produce console typeouts.

ASSOCIATED SUBROUTINES

Associated subroutines are stored on the SPT with the normal macro routines IORTNS and MTAPE. They must be called by manually inserting macro calls for the required functions. The associated subroutines automatically modify the common-entry DSA table for entry to themselves. An item mark must be placed on the op code generated by Easytran D to trap into the required subroutine.

Subroutine Macro Calls and Specifications

MOVE CHARACTERS TO MARK (H. MCM)

Format

	Op Code	A Address	B Address	Variant
a.	10	aaa	bbb	v

Function

Format a: Move characters from the field specified by the A operand to the field specified by the B operand until a 1401 record mark or a group mark with a word mark is encountered.

Word marks are left undisturbed.

Card Column	Description
24	2 — 132 print positions are used by the 1401 program. Blank — 100 print positions are used by the program. or Other
25	Not used.
26	1 — The 1401 program ran with the I/O CHECK STOP switch OFF. Blank — The 1401 program ran with the I/O CHECK or STOP switch ON. Other The I/O CHECK STOP switch is used in 1401 programming to indicate whether or not the program is provided with processing for read/punch errors. (If the CHECK STOP switch is ON and a read or punch error occurs, the 1401 branches to the switch and stops. If this switch is OFF, the machine keeps running. Therefore, if the programmer gives instructions to leave the CHECK STOP switch OFF, it means provision is made within the program for processing read/punch errors.) Easytran D interprets column 26 so that if the CHECK STOP switch is ON and a card read error occurs, the machine halts; if this switch is OFF, there is no halt and the program is allowed to handle error processing. In the case of a punch error with the CHECK STOP switch ON, Easytran sets up a branch to the automatic error routine in the punch subroutine. Thus, Easytran always provides for the handling of punch errors regardless of the I/O CHECK STOP switch setting.
27	A "1" punched in this column specifies that the Easytran D load deck includes one Carriage Control card (see below), a "2" that it contains two Carriage Control cards, and a "3" that it contains three such cards. Any other punch (or no punch) specifies that there is no Carriage Control card.
28	A — Designates the standard 1403 printer character set (chain "A," see Appendix B).[1] H — Designates the 1403 Fortran character set (chain "H," see Appendix B). Blank — Designates the standard Series 200 printer character set (see Appendix B).

[1] If other printer character arrangements have been used, designate which of the available sets (A or H) is most similar. Hand-tailoring the Move and Translate table will allow for substitution of other characters needed.

Card Column	Description
29	If column 29 is not blank, use of the Type 223 reader and Type 224 punch is specified; if column 29 is blank, use of the Type 227 reader/punch (or no reader/punch) is specified.
30-35	Blank.
36-40 41-45 46-50 51-55 56-60 61-65	Columns 36 to 65 indicate requirements for magnetic tape input/output routines and buffers. Each five-column field designates one of six tape drives; columns 36-40 specify tape drive 1, 41-45 specify tape drive 2, and so on. Each drive may be used by the object program either with or without a buffer, or it may not be used at all. If no information is punched in any of these six fields, Easytran D does not provide either tape buffers or tape I/O routines. If tape commands were detected in the source program, however, Easytran D provides tape routines but no buffers. For each tape drive requiring a buffer, the buffer size is punched in the corresponding five-column field. The buffer size normally equals the length (in characters) of the largest record to be read from or written onto that tape drive and is punched as five digits (i.e., leading zeros must be punched). The buffer size may not be less than 00014 or greater than 09999. If a record is read which is longer than the size of the buffer set up to receive it, characters are stored until the buffer is full and the remainder of the record is discarded. This feature can be used to read only the first 50 characters of a 200-character record, for example, by reading the record into a 50-character buffer. If a record is to be written which is longer than the buffer set up to write it, a programmed halt occurs (see Table 4-3). If a buffer is to be shared by two or more tape drives (alternating input or output), the buffer size is punched in the normal way in any one of the associated tape drive fields. The field(s) for the other tape drive(s) which share the same buffer are punched with nΔΔΔΔ, where n is the number of the drive for which the buffer-size entry is punched.
66-80	Blank

Carriage Control (CCTL) Card(s)

If the source program produces printer output, a Carriage Control card should be prepared to take the place of the 1401/1460 carriage tape. Zero, one, two, or three Carriage Control cards may be punched for each object program. They follow the Easytran Control (ATOEC) card for that program in the input deck. The cards reflect the format of a single form only (unless the single form contains fewer than eight lines, in which case the format

must be repeated until it equals or exceeds eight lines). A Carriage Control card is divided into 22 three-column sections, each capable of specifying the position of one punch in the 1403 paper carriage control tape. For example, if channel 3, line 20 appears on the paper carriage control tape, the card entry is punched | 3 | 2 | 0 | .

Figure 6-6 illustrates the format of the Carriage Control cards. If the source program produces printer output and these cards are omitted or improperly punched following the ATOEC card, file update assumes that the "standard" print format is to be used, viz., 66 lines per page with the head of form on line 1 (under the control of channel 1) and the end of form on line 58 (under control of channel 12).

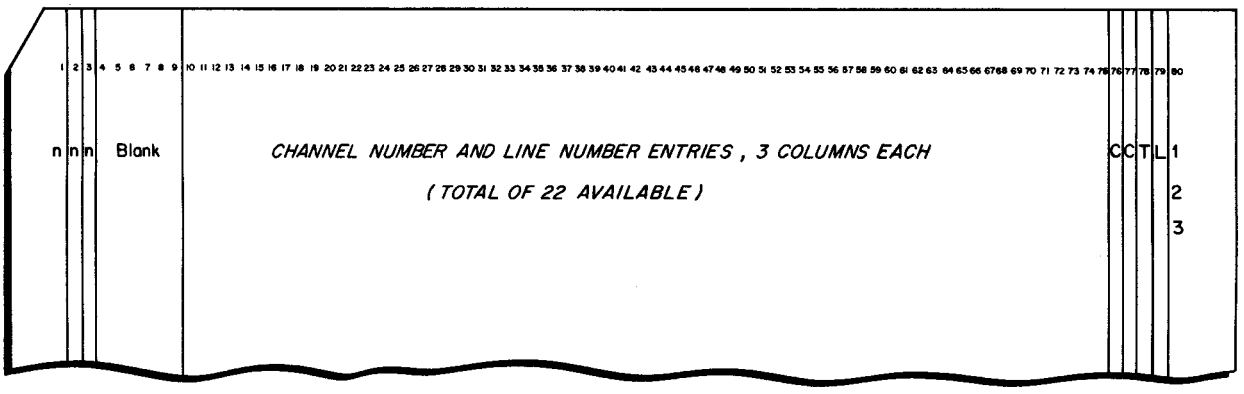


Figure 6-6. Easytran D Carriage Control Card

Card Column	Description
1-3	Interpreted on the first card only, columns 1-3 indicate the length of the print form, which must not be less than 008 nor greater than 136 lines. High-order zeros must be punched.
4-9	Blank
10-75	The first column of each three-digit entry indicates the carriage control channel (1-9 and B, C, D). Never punch more than one channel on the same line. In reading the card from left to right, if less than 22 channel entries are made, the first blank channel encountered terminates the reading of that card. Columns two and three of each entry specify the line number (01-99). If the line number is greater than 99, a 12-zone punch in the units position indicates lines 100-136 Example: | 9 | 2 | G | = channel 9, line 127
76-79	CCTL in these columns identifies a carriage control card.
80	1, 2, or 3 in column 80 indicates the number of the carriage control card. If more than one card is used, they must be submitted in sequence by this number.

Processing ATOEC and Carriage Control Cards

In order that information from the Easytran D listing may be used in preparing the ATOEC and Carriage Control cards, these cards are processed at file update time.

Easytran D sets up the parameters for the macro routines IORTNS and MTAPE as a result of the analysis of the 1401/1460 program. The following parameter values are assumed:

1. I/O CHECK STOP switch ON.
2. 132-position printer.
3. Tapes not buffered.
4. No carriage control table generated.

At file update time, ATOEC and Carriage Control cards may optionally be included immediately following each UPD card. If present, these cards have the following functions:

1. Respecialization of card reader, punch, and printer usage. (If any one of these I/O devices is specified on the ATOEC card, the appropriate parameter is inserted in IORTNS. Note: The ATOEC card cannot be used to delete IORTNS parameters for a device which has been previously specified.)
2. Respecialization of the I/O CHECK STOP switch to OFF and the print position parameter to 100 rather than 132.
3. Inclusion of tape buffers if necessary. (Note: If load-mode tape is specified, buffers must be specified.)
4. Generation of carriage control table.
5. Specification of print chain.
6. Designation of Types 223 and 224 reader and punch.

If IORTNS has been modified via an Easycoder C Correct director (see Easycoder Assemblers C and D, Order No. 041), the results of respecialization via an ATOEC card are unspecified unless the same parameter position in the IORTNS macro is changed by the ATOEC card as was originally changed by the Easycoder correction. Therefore, "hand-tailoring" of I/O macro routines should duplicate the format of IORTNS and MTAPE if it is desired to use ATOEC cards for respecialization.

If the carriage control table is generated by Carriage Control cards, the previous carriage control table (if any) is not deleted. Therefore, an Easycoder C Correct director should be processed during the same file update run to delete the previous carriage control table.

ATOEC and Carriage Control cards are generally submitted only during the first update. If changes are necessary during subsequent updates, Easycoder C Correct directors should be used to make any required changes.

Programmed Halts

The programmed halts that can occur during Easytran D translation, file updating, and CIT/SPT Merge, are shown in Table 6-5. With the exception of tape read/write error, end-of-reel, and mispositioned tape halts, all halts begin with 034 as the first three digits in the B-address register. Programmed halts for Autocoder Library Prepass are shown in Table C-2. Other system programs used during Easytran D processing are Library Processor C, Easycoder Assembler C, and Tape Sorts C and C(V). The halts for these systems programs are given in Tables 6-6, 6-7, and 6-8. Note that read-write error halts are in the form oopp2n, where pp = the peripheral address assignment and n = the device number.

Table 6-5. Programmed Halts for Easytran D Translation, File Update, and CIT/SPT Merge

B-Address Register	Console Typeout	Explanation	Corrective Procedure
034012	none	No ECD image on input device.	Set locations $227\text{-}231_8$ to JJ0. Put the ECD card in the card reader and press RUN to continue.
034013	none	Card reader not available.	Check the card reader and press RUN to continue.
034015	none	Printer not available.	Check the printer and press RUN to continue.
03402n	none	Tape n is not available or is incorrectly set to protect status.	Check tape n and press RUN to continue.
00pp2n	RD ER T	Read or write error on tape n, tape control pp.	Press RUN to try again.
00003n	END OF TAPE	End of reel on tape n.	None. Repeat entire run with less input or with longer tape.
034777	END EASYTRAN - NO LPP	End Easytran - no Library Processor C (i.e., no UPD directors processed).	End of job.
034010	PRINTER ERROR	Printer error.	Check printer and press RUN to continue.
034033	BAD CC	Carriage Control card(s) do not follow ATOEC card.	Run out the card reader. Refeed the necessary Carriage Control card(s), the last card read, and the two cards run out, and press RUN to continue.
034034	NOT TRL OR UPD DIRECTOR	The card just read was not a TRL or UPD director.	Check the card deck and press RUN to continue.

Table 6-5 (cont). Programmed Halts for Easytran D Translation, File Update, and CIT/SPT Merge

B-Address Register	Console Typeout	Explanation	Corrective Procedure
034035	BAD DIRECTOR	The program specified on a UPD director was not found on the input SPT.	Remove any further UPD directors and related cards from the input deck and press RUN to continue.
034037	NO DIRECTORY ON INSPT	The directory records were not found on the input SPT.	To ignore the processing of the directory, press RUN.
03406n	REPLACE INSPT ON n or REPLACE AC INPUT ON n	Tape n (input SPT or Autocoder library tape or Autocoder input tape) is about to be written on.	To preserve the tape, replace it with a work tape and press RUN to continue.
03407n	1 EPI NOT FOUND	No 1EPI record on tape n.	None. The entire run must be repeated.
034001	HOLECNT	Hole-count error.	Refeed the card in the reader.
034002	ILLPNCH	Illegal punch error.	Refeed the card in the reader.
034003	ENDINPT	Autocoder program not found on tape.	To correct the TRL director card and search again for the program, run out the cards in the reader, correct the TRL card, put the cards back in the reader, and press RUN. To search for and translate the next program, run out the cards in the reader, replace the cards (beginning with the TRL card for the next program) in the reader, and press RUN.
034040	ATOECRD	ATOEC card following TRL card (improper card order).	Press RUN to read next card as first card of 1401 program.
034004	LIBRARY NOT ON TAPE	Library not found on BRT.	Press RUN to search for library again.
034000	LIBRARY READ ERROR	Read error when reading library from BRT.	Press RUN to try again.
034011	None	Bad ECD card.	Run out the card reader. Correct the ECD card, refeed, and press RUN to continue.
000000	MISPOSITIONED TAPES	SPT or CIT out of sequence in CIT/SPT Merge.	None. The entire run must be repeated.

Table 6-6. Programmed Halts for Easycoder Assembler C

B-Address Register	Console Typeout	Explanation	Corrective Procedure
007025	: NO E CARD□	The card image that has been specified as the ECD does not contain an E in character 6.	1. If the ECD is to be entered through the input device specified by the ECD parameter in the Loader-Monitor communication area, ascertain that the desired ECD is in the input device and continue the run. 2. If the ECD is not to be entered through the input device specified by the ECD parameter in the Loader-Monitor communications area, the ECD field (locations 227_8-232_8) may be changed as follows: a. Accept the ECD from a different device; or b. Select one of the ten standard equipment configurations. When this has been done, continue the run.
004007	: WRONG INPUT SPT□	Either (1) an incorrect SPT has been mounted or (2) the revision number punched in columns 31-35 of the System Header card is incorrect.	If the SPT is incorrect, mount the correct SPT and continue the run. If the revision number is incorrect, punch the correct revision number in columns 31-35 of the System Header Card and start the run over from the beginning.
004010	: NO SYSTEM HEADER□	The System Header was not found.	Correct the input and restart the run from the beginning.
004014	: NO SPTS□	Neither an input SPT nor an output SPT is specified on the Equipment Configuration Descriptor. (This condition will only occur when using a full ECD or an incorrectly reassembled equipment configuration.)	Correct the director and start the run over from the beginning.
004017	: INVALID BRT□	The tape mounted as the input BRT does not have a valid label for a BRT.	Mount the correct BRT and continue the run.

Table 6-6 (cont). Programmed Halts for Easycoder Assembler C

B-Address Register	Console Typeout	Explanation	Corrective Procedure
004024	: NO WORK TAPE␣	No work tape was specified on the Equipment Configuration Descriptor. (This condition occurs only when using a full ECD or when one or more standard equipment configurations have been incorrectly reassembled.)	Correct the ECD, mount the work tape on the proper drive, and restart the run from the beginning.
004034	: ILLEGAL DIRECTOR␣	One of the following two conditions is present: 1. The card immediately following the END card of an input program is neither a program header nor an end-of-file card. 2. On a program header card, either the action directive is missing (columns 1-3) or the program name is missing (columns 21-26 or columns 28-33 for a CPY directive).	Correct and replace the input deck. Continue the run by typing G or pressing the RUN button.
004044	: PROGRAM nnnnnn NOT FOUND␣	The end-of-file has been reached on the input SPT and the next program in the input deck has an action directive other than INS.	Continue the run. The assembler will ignore the remaining programs in the input deck and execute its end-of-run procedure. The remaining input must be processed in a subsequent assembly run.
004054	: WRONG HASH TOTAL␣	The expected hash total does not agree with the computed hash total.	Continue the run.
005034	: REPOSITION TO act prgnam ␣ (act: action directive prgnam: program name)	A restart message indicating that the card or paper tape input file must be repositioned.	Reposition the card-image input file to the indicated director and continue the run.

Table 6-6 (cont). Programmed Halts for Easycoder Assembler C

B-Address Register	Console Typeout	Explanation	Corrective Procedure
005034 (cont)		If no console typewriter is available, the name of the program to which the file must be repositioned is obtained in the following manner: 1. Display the A-address register (call its contents "DIRLOC"). 2. The action directive is in locations DIRLOC through DIRLOC + 2. 3. The program name is in DIRLOC + 3 through DIRLOC +8. If a console typewriter is available, the action directive and program name to which the file must be repositioned are printed on the typewriter.	
005035	: NO RESTART POSSIBLE □	A restart cannot be attempted as the assembler has not been initialized.	The assembly run must be started from the beginning.
005036	: ENDFILE REPOSITION □	A restart message indicating that the end-of-file card-image has been reached during the search for the PROG card at which the card-image input file is to be repositioned.	Reposition the file correctly and continue the run.
00ppln	: RD ER pp n □	If "pp" is the address of a tape control, an uncorrectable read error has occurred on tape "n" of that control.	Press RUN (or G) to retry the correction procedure. If this action is not effective, corrective measures such as cleaning the tape and restarting the run, recreating the tape which caused the error, etc., should be performed.

Table 6-6 (cont). Programmed Halts for Easycoder Assembler C

B-Address Register	Console Typeout	Explanation	Corrective Procedure
00ppll	: RD ER pp 1␣	If "pp" is the peripheral address of the card reader, a hole-count error has occurred.	1. Remove the cards from the input hopper of the card reader. 2. Run out the cards in the reader. 3. Place the cards from the run-out hopper back into the card reader followed by the remaining input cards. Continue the run.
00pp12	: RD ER pp 2␣	If "pp" is the peripheral address of the card reader, an illegal punch has been detected.	The same action is taken in this case as was taken for a hole-count error (preceding halt). NOTE: The first card in the run-out hopper must be corrected to remove the illegal punch.
00pp2n	: WR ER pp n␣	If "pp" is the address of a tape control, an uncorrectable write error has occurred on tape "n" of that control.	Press RUN (or G) to retry the correction procedure. If this action is not effective, corrective measures such as cleaning the tape and restarting, repeating the run which created the tape, etc., should be performed.
00pp3n	: END pp n␣	If "pp" is the address of a tape control, the end of tape has been reached on output tape "n".	The amount of input must be reduced and the run must be restarted from the beginning.
00pp10	: RD ER pp 0␣	If "pp" is the address of the paper tape control, a parity error has been detected on paper tape.	Continue the run to ignore the error. (The operator may take note of which program is currently being assembled.)
00pp7n	: PRINT pp n␣	If "pp" is the address of a tape control, the print routine has determined there is no printing "stacked" on the print tape on drive n. This halt or message occurs only when an off-line print tape has been specified in the Equipment Configuration Descriptor.	1. If the information on the tape is not to be preserved, continue the run. The assembly listings will be written on this tape. 2. If the tape is to be saved, replace it with a work tape and continue the run. The assembly listings will be written on the work tape.

Table 6-7. Programmed Halts for Library Processor C

B-Address Register	Console Typeout	Explanation	Corrective Procedure
007025	: NO E CARD␣	The card image that has been specified as the ECD does not contain an E in character 6.	1. If the ECD is to be entered through the input device specified by the ECD parameter in the loader communication area, ascertain that the desired ECD is in the input device and continue the run. 2. If the ECD is not to be entered through the input device specified by the ECD parameter in the loader communication area, the ECD field, location 227_8 - 232_8, may be changed to: a. Accept the ECD from a different device or b. Select one of the ten standard equipment configurations. When this has been done, continue the run by depressing RUN button or G key.
004007	: SPT DIRECTORY EXCEEDS MEMORY␣	This should occur only on a 12K memory configuration. Library Processor stores in memory the name of each program on the SPT over which it passes. On a 12K machine, it can store over 300 program names.	Continue the run. Any library routines located on the SPT from this point on will not be processed by Library Processor.
004010	: NO SYSTEM HEADER	Either the director file or the SPT was not found.	Mount the correct input and start the run over.
00pp1n	: RD ER pp n␣	If "pp" is the address of a tape control, an uncorrectable read error has occurred on tape "n" of that control.	Continue the run to retry the correction procedure. If this action is not effective, corrective measures such as cleaning the tape and restarting the run, recreating the tape which caused the error, etc., should be performed.

Table 6-7 (cont). Programmed Halts for Library Processor C

B-Address Register	Console Typeout	Explanation	Corrective Procedure
00pp11	: RD ER pp 1␣	If "pp" is the peripheral address of the card reader, a hole-count error has occurred.	1. Remove the cards from the input hopper of the card reader. 2. Run out the cards in the reader. 3. Place the cards from the runout hopper back into the card reader followed by the remaining input cards. Continue the run.
00pp12	: RD ER pp 2␣	If "pp" is the peripheral address of the card reader, an illegal punch has been detected.	The same action is taken in this case as is outlined for a hole-count error above. NOTE: The first card in the runout hopper must be corrected to remove the illegal punch.
00pp2n	: WR ER pp n␣	If "pp" is the address of a tape control, an uncorrectable write error has occurred on tape n of that control.	Continue the run to retry the correction procedure. If this action is not effective, corrective measures such as cleaning the tape and restarting, repeating the run which created the tape, etc., should be performed.
00pp21	: WR ER pp 1␣	If "pp" is the peripheral address of the card punch, a hole-count error has been detected.	Continue the run to repunch the error cards.
00pp10	: RD ER pp 0␣	If "pp" is the peripheral address of the paper tape control, a parity error has been detected on paper tape.	Continue the run to ignore the error. (The operator may make note of which program is currently being processed.)

Table 6-8. Programmed Halts for Tape Sort C and C(V)

A-Address Register	B-Address Register	Console Typeout	Segment	Explanation	Corrective Procedure
005555	005555	: S2 ID ER, CARD 1, COLS. 79, 80 ␣	Seg 00	S2 not found in parameter card 1 of Sort C, or SV not found in parameter card 1 of Sort C(V).	Correct card 1 and rerun, or set SENSE switch 1 ON and press RUN.
000000	00pp11	: pp CD RD ER␣	Seg 00 and Presort	Card reader error.	Replace card and press RUN, or rerun.
AAAAAA	007700	: ENTER TCU/DR/MCODE/ PCODE␣	Restart	The following parameters are required: TCU = peripheral address of tape control. DR = drive number of WT2. M code = M or Δ (M if Sort is in the merge) P code = P or Δ (P, operator positions WT1)	The operator must enter the required parameters in the order TCU/DR/M code/P code. The left character must be entered into the location AAAAAA and the remaining parameters are entered into successive locations.
004444	007700	RESTART FAILED␣	Restart and Presort	Restart failed.	Rerun.
000001	000p0n	: pp n HEADER NOT FOUND␣	Presort	Standard header not found.	Reposition input tape and press RUN, or rerun.
000002	000p0n	MISPOSITIONED TAPE␣[1] : PARAM REC NOT FOUND␣[2]	Merge and Last Pass	Tapes are mispositioned.	Rerun.
000004	000p0n	pp n CHANGE OUTPUT DENSITY/ADDRESS␣	Last Pass	Change output tape density or address.	When output tape is ready, press RUN.
001111	000p0n	: pp n MOUNT MERGE WORK TAPE␣	Presort	Halt for input tape rewind.	Continue run when proper tape is dialed for merge work tape.
002222	000p0n	: pp n MOUNT NEXT INPUT TAPE␣	Presort	Next input tape required.	Mount next input tape on this drive and continue run. This halt will occur whenever multireel input is specified and no alternate input drive is provided. If an alternate drive is specified, the program will stall on busy if the next reel is not mounted.
BBBBBB	000p1n	: pp n RD ER␣	All	Tape read error (data)	1. To reread, set SENSE switches 1 and 2 OFF and press RUN. 2. To delete the record (presort and last pass only) set SENSE switch 2 ON and press RUN. 3. Rerun.
BBBBBB	000p2n	: pp n WR ER␣	All	Tape write error	Press RUN for further attempts to achieve a "good" write.
000000	000p3n	: pp n END TP␣	Presort, Merge and Restart	End of tape	Rerun.
000001	000p3n	: pp n MOUNT NEXT OUTPUT TP␣	Last Pass	End of tape	Mount a new reel and press RUN.
BBBBBB	000p4n	: RECORD LENGTH ER␣	Presort	Wrong length data record	To reread, press RUN. To drop the record, set SENSE switch 2 ON and press RUN. Otherwise rerun.
BBBBBB	000p5n	: pp n HDR RD ER␣	Presort and Last Pass	Read error on header record.	To reread, press RUN. To accept, set SENSE switch 1 ON and press RUN.
BBBBBB	000p7n	: pp n RD ER LABEL␣	Presort	Read error on trailer record.	To reread, press RUN. To accept, set SENSE switch 1 ON and press RUN.
BBBBBB	000p6n	: pp n LABEL LENGTH ER␣	Presort	Wrong length label (standard ≠ 80 or 120, nonstandard exceeds data record length)	To process the record, set SENSE switch 1 ON and press RUN. This action supplies an 80- or 120-character label. If a nonstandard label was specified, this action supplies a record equal to the size of an input buffer.
000000	004000	: SEQUENCE ER␣	Merge and Last Pass	Record out of sequence in merge; or record or data out of sequence in last pass.	Rerun.
000001	004000	: PARAM ER, 1-80␣	Presort	Invalid parameter on card 1	Correct parameters and rerun.
000002	004000	: FILE NAME ER␣	Presort	Invalid input file name on a standard header	Rerun with correct tape or corrected parameters, or mount correct tape and press RUN.
000003	004000	: DUP TAPE ADDRESS ER␣	Presort	Duplicate tape addresses.	Correct parameters and rerun.

Table 6-8 (cont). Programmed Halts for Tape Sort C and C(V)

A-Address Register	B-Address Register	Console Typeout	Segment	Explanation	Corrective Procedure
000004	004000	: KEY ER□	Presort	Inconsistency in key parameter values.	Correct parameters and rerun.
000005	004000	: PARAM ER, 81-160□	Presort	Invalid parameter on card 2.	Correct parameters and rerun.
000006	004000	: OWN CODING ER□	Presort	Own-coding lies within Sort.	Correct parameters and rerun.
000007	004000	: INSUFFICIENT MEMORY□	Presort	Insufficient memory to sort.	Correct parameters and rerun.
000010	004000	: BLOCKING DOWN□ NECESSARY	Presort	Blocking down required. [3]	Set SENSE switch 1 ON to accept reduced blocking and press RUN. If halt recurs, record size is too large for memory available.
dddddd	0040X1	: ITEM COUNT ER□	Last Pass	Item-count error (output of presort and input to last pass do not agree). X = 0 Presort high X = 1 Presort low dddddd = amount of discrepancy (decimal)	Press RUN to go to end of job.
007777	000p0n	: pp n END OF JOB□	Last Pass	End of job.	BAR contains output tape address. Press RUN to go to Loader-Monitor general return address.
		: TERMINATE RUN□	All	An incorrect response has been made when the Sort cannot recover. [4]	Press "M" to go to Loader-Monitor general return address.
000003	000p0n	: O/P RETENTION□	Last Pass	O/P retention. [5]	1. Press RUN to override (SENSE switch 1 OFF). 2. Set SENSE switch 1 ON to check a newly mounted reel.
BBBBBB	007777	: INVALID RECORD		Illegal record format. [5]	Check parameter card 1 for blocking indicators. If no error then bad record on tape.

Notes

[1] Typeout for merge.

[2] Typeout for last pass.

[3] This halt and typeout are unique to Sort C.

[4] This error condition appears only as a typeout. This is no associated halt.

[5] This halt and typeout are unique to Sort C(V).

AAAAAA = type-in address

BBBBBB = buffer address

RECOVERY FROM AN UNCOMPLETED RUN

In the event that an Easytran D run is not successfully completed, the following procedure can be used to recover all programs which were correctly translated and/or updated:

1. Run out the cards in the card reader and re-enter the Console Call card, the ECD card, and the Easytran director (UPD or TRL) which was being processed.
2. Set SENSE switch 4 ON.
3. Press RUN.

The resulting actions of the System Monitor depend upon whether the Easytran director which was being processed was an update or a translate director. If the processing of an update director was interrupted, the CIT form of the program being updated is deleted from work tape 1, the input SPT is spaced to the next program header record, and the normal end-of-Easytran processing is performed. If the processing of a translate director was interrupted, the output SPT is backspaced to the program header record and a 1EPI (end-of-preserved-information)

record is written, work tape 1 is backspaced to the position director and a 1EPI record is written, and the normal end-of-Easytran processing is performed. In either case, halt 034777 occurs (see Table 6-5).

NOTE: This procedure cannot be used if the director which was being processed was a combination option director (TRL with a U in column 71).

To perform Library Processor C, CIT/SPT Merge, and Easycoder Assembler C for the updated programs, put the required Library Processor and Assembly director cards in the card reader, set SENSE switch 4 to OFF, and press RUN.

SECTION VIII

ANALYSIS TECHNIQUES

EASYTRAN D DIAGNOSTIC MESSAGES

Diagnostic flags are appended beside the lines which cause them to be generated. The diagnostic flags are printed on the far left-hand side of the listing. There is a limit of three flags to any one line of coding. All Easytran D flags are defined in Table 8-1. Those which appear in any given program listing are also defined on the first page of the listing.

Table 8-1. Easytran Diagnostic Messages

FLAG	MEANING	REMARKS
ADJST	A relative reference cannot be adjusted correctly to reflect a change in memory allocation.	
BASIN	A constant is used as both a base and an increment in address modification.	The constant is converted as an increment, and any reference to it as a base is erroneous (see Appendix B).
BCOND	The B address of a conditional branch instruction references a character the bit configuration of which may have been changed.	The condition on which this instruction branches is dubious (e.g., a functional reference in the B address of a BCE, BBE, or BWZ instruction).
BINIO	The relationship between a binary component and an area not initialized by the program is unclear.	Easytran cannot resolve the relationship between a binary area and a declarative area (e.g., binary information is moved into or out of an input/output area). See Appendix B.
CHAIN	The effect of a use of chaining may not have been preserved.	This flag is generated for all one-character Compare instructions and all one-character CS instructions not chained to CS instructions.
CONFG	An input statement contains an Autocoder format error.	
DELMO	Instruction modification conflicts with the deletion of statements which are either redundant or not translated.	This flag is produced when an instruction is modified in such a way as to cause it to be deleted or when a deleted instruction is modified.
DELTD	Source coding has been deleted.	Information only.
DUPLC	A duplicate symbolic label is present in the source program.	
EDIT	A constant or literal is assumed to be an edit control word. Octal 57's are replaced by octal 40's.	See page 2-29.

Table 8-1 (cont). Easytran Diagnostic Messages

FLAG	MEANING	REMARKS
GENTD	A statement has been added to the program.	Information only.
HILOW	All Branch-high and Branch-low instructions have this tag.	If this flag is not preceded by an HLCMP flag, it may be necessary to item-mark the Compare instruction in order to enter the associated subroutine H. CMPR (see page 4-11).
HLCMP	A Compare instruction is associated with the following Branch-high or Branch-low instruction. The operation will be performed by a subroutine.	
IMARK	A group mark or record mark has been recognized, but no item mark has been set thereon.	A constant or literal with an internal 1401 group mark or record mark (e.g., a group mark in the middle of a defined area).
INCMP	This instruction is modifying another in such a way that the modified instruction is no longer valid.	The flagged MCW or LCA instruction modifies an op code or d-character so as to make the modified instruction invalid, or the flagged Compare instruction references such an improperly modified instruction.
INMOD	An op-code or d-character modification may not yield an equivalent result.	1. An instruction other than MCW modifies an op code or d-character so as to make the modified instruction invalid. 2. An instruction other than Compare refers to an improperly modified instruction. 3. An instruction uses a modified constant to modify another instruction.
LANG	An Autocoder language element is not translated.	The element not translated is a negative address constant or literal, which requires a 16K complement in Autocoder, or an actual in the location field of a Define Area statement.
LBCON	A constant or literal longer than three characters may require conversion to binary.	Although the flagged constant or literal appears to have a functional usage, it is not converted because it is longer than three characters.
LDREG	The extraction of a NOP instruction does not load the Series 200 A and B registers.	Since the flagged NOP instruction is not modified at execution time, it may have been used in the 1401 program to set up the address registers.
LODER	The I-address of this Branch instruction references the card read area.	The flagged Branch instruction has been translated to branch to H. LODR (the routine to load the next segment).

SECTION IX

SOURCE PROGRAM GENERATOR D

INTRODUCTION

Source Program Generator D (SPG) is a program which enables the Easytran D System to process 1401 programs in either machine language or Autocoder symbolic language. Specifically, Source Program Generator D prepares 1401 programs for acceptance into Easytran D by converting them from machine language format to Autocoder format. Under normal circumstances, a program processed by SPG will be converted into Easycoder symbolic language by Easytran D during a single run. However, if necessary, SPG may be used independently to analyze operable 1401 programs prior to Easytran D processing.

Source Program Generator D can accept 1401 input from either a card deck or a card-image tape. The SPG program maps the 1401 program in memory, analyzes its instructions and data, translates its instructions into Autocoder symbolic language, and produces a card-image tape containing the program in Autocoder language. This Autocoder tape is used as input to Easytran D. SPG also produces three listings — a table of memory and instruction areas used by the 1401 program; an analysis listing of the program in 1401 machine language and Series 200 machine language; and a translation listing of the program in 1401 machine language and Autocoder symbolic language. In addition, changes may be made to the instruction areas of the 1401 object program by SPG before the Easytran D conversion is performed. The 1401 programs to be translated must be in operable form before SPG conversion. If they are segmented, overlaying is used.

The operation of SPG is monitored by a modified version of Tape Loader-Monitor C which resides in upper memory. Figure 9-1 illustrates the operation of Source Program Generator D.

FUNCTIONS OF SPG

Analysis Phase

The analysis routine loads the 1401 program into memory and establishes the area(s) occupied by the program. During memory mapping, a memory table (MTAB) is created. This memory table lists the beginning and ending locations of each area which contains contiguous 1401 program entries. Individual fields in the program memory area(s) are analyzed to determine whether they contain instructions or data. An instruction table (ITAB), which contains the beginning and ending locations of each contiguous string of instructions, is also created. The memory and instruction tables are shown in Figure 9-2.

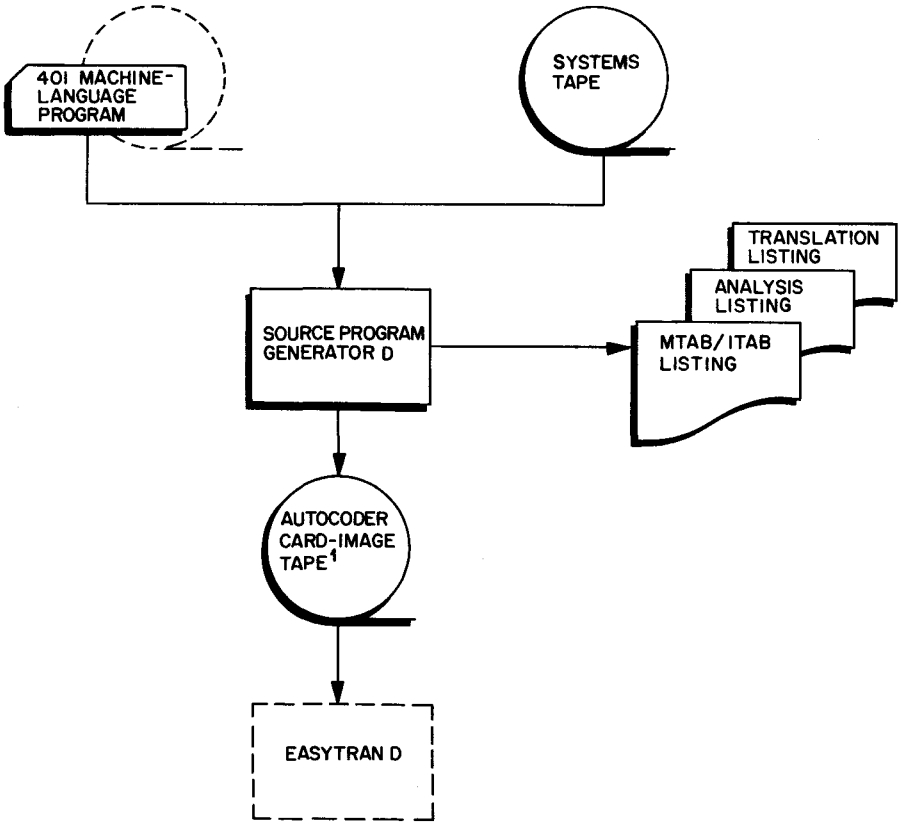


Figure 9-1. System Flow Chart for Source Program Generator D

DECIMAL		OCTAL	
FROM	TO	FROM	TO
	MEMORY		
00200	00900	000310	001604
	INSTRUCTIONS		
00087	00099	000127	000143
00200	00450	000310	000627
00500	00800	000764	001440

Figure 9-2. Printout of Memory and Instruction Tables

If processing of the object program is terminated after MTAB and ITAB have been set up, changes may be made to ITAB. Instructions can be added to or deleted from the instruction table through the use of ITAB director cards.

When the program analysis has been completed, MTAB and ITAB are printed out in a single listing. If additions or deletions have been made to ITAB, MTAB and ITAB are reprinted. If there are no additions or deletions, and if the object program processing was not terminated, a side-by-side listing of the object program in both 1401 machine language and in Series 200 machine language is produced (Figure 9-3).

```
PROGRAM  T007    SEGMENTS 01 TRANSLATE    YES    S.P.G. LABEL = VJB

                DEC    1401 MACHINE            OCTAL  MNMC
  SEQ    CT     LOCN   INSTRUCTION              LOCN  CODE   H200 OBJECT INSTRUCTION               FLAG
 00071   05  00667   U (U4 R                 001233   CSM   44   746404 51
 00072   07  00672   M N96 229               001240   MCW   14   005044  000345
 00073   04  00679   B 925                   001247   B     65   001635
 00074   02  00683   F J                     001253   CSM   35 41
 00075   04  00685   B *60                   001255   B     65   002044
 00076   05  00689   B 702 K                 001261   CSM   22   001276 42
 00077   04  00694   B 925                   001266   B     65   001635
 00078   04  00698   B 685                   001272   B     65   001255
 00079   04  00702   / 299                   001276   CSM   13   000453
 00080   02  00706   F 1                     001302   CSM   35 01
```

Figure 9-3. Analysis Printout

Translation Phase

Analysis is followed by the translation phase. During translation, each 1401 instruction and operand in memory is translated into an equivalent Autocoder statement. Every data statement and instruction is assigned a unique tag. Several passes are made over the file to resolve the references to each tag. A side-by-side listing of the program in Autocoder source language and 1401 machine language is produced (Figure 9-4). Flags are generated to indicate potential problem areas which may require hand-tailoring.

```
FLG LINE *TAG**    OPCD OPERANDS **** PAGE NUMBER 0002 PROG.NAME T007   CT DECAD  O AAD BAD D A-DEC B-DEC
    0036           CC   J                                               02 00453  F         J
X   0037 VJB036    BCE  VJB046,VJB281-30+X2,%                           08 00455  B 518 WQ4 % 00518 01684
    0038           A    VJB310,VJB311                                   07 00463  A M08 M13   02408 02413
    0039           MCW  VJB311,VJB281-35                                07 00470  M M13 W79   02413 01679
X   0040           LCA  VJB295,VJB281-30+X2                             07 00477  L Y26 WQ4   01826 01684
    0041           B    VJB147                                          04 00484  B 981       00981
    0042           BCE  VJB049,VJB311-2,1                               08 00488  B 536 M11 1 00536 02411
X   0043           MCW  VJB309,VJB281-30+X2                             07 00496  M M07 WQ4   02407 01684
X   0044           CW   VJB281-30+X2                                    04 00503  ) WQ4       01684
    0045 VJB044    A    VJB312,X2                                       07 00507  A M16 094   02416 00094
    0046           B    VJB036                                          04 00514  B 455       00455
    0047 VJB046    MCW  VJB314,X2                                       07 00518  M M20 094   02420 00094
```

Figure 9-4. Translation Printout

Processing of the program can terminate after the translation phase if the programmer wishes to update or check his program. Otherwise, the program is written onto a card-image tape which is acceptable only to Easytran D. Note that if this card-image tape is not produced, the 1401 program must be reprocessed by SPG before translation into Easycoder language.

INPUT DECK

The input deck for SPG is set up in the same manner as that for Easytran D with the addition of certain cards required by SPG. These additional cards are the SPG Control card and the ITAB Director cards. The SPG input deck containing the 1401 program and the necessary control cards is illustrated in Figure 9-5. The first cards in the SPG deck must be the Easytran D Console Call card and an ECD card. If the program is to be processed by Easytran D immediately after SPG, the Translate (TRL) Director and the Easytran D Control (ATOEC) card must follow the ITAB End Director. The last card in the deck is an End-of-File (1EOF) card.

1401 Program

The 1401 program can be accepted by SPG from card images on tape or from cards in one of the following formats:

SPS1	Single Load Format
SPS2	Single Load Format
SPS	Condensed Load Card Format
Autocoder	Condensed Load Card Format

These card formats are illustrated in Figures 9-6, 9-7, 9-8, and 9-9.

All Bootstrap, Load, and Clear cards must be removed from the 1401 card deck and replaced with the SPG Control card before the program can be accepted as input to SPG. If the input is on a card-image tape, the 1401 program is recorded in Hollerith code with one card image per tape record. The Bootstrap, Load, and Clear card images must be erased. Also, the two Load card images behind each Execute card must be removed.

All SPG Control cards must be read through the card reader. The 1401 programs can be stacked on a card-image tape with a 1EOF card image following the last program. SPG searches the tape for the program designated in the SPG Control card by checking the program name contained in columns 76-80 of the card images of the 1401 assembled deck. If the search reaches the 1EOF record, SPG halts and error messages are displayed on the console or typewriter.

Each 1401 program is terminated by an End card which is the last card in the 1401 assembled Autocoder or SPS deck. Two versions of the End card are available: one for Autocoder, and one for programs assembled in SPS1, SPS2, or SPS. Figure 9-10 illustrates the formats of both types of End cards.

SPG can process segmented programs having up to 60 segments. Proper referencing of tags between segments is ensured by visually analyzing the translation listing.

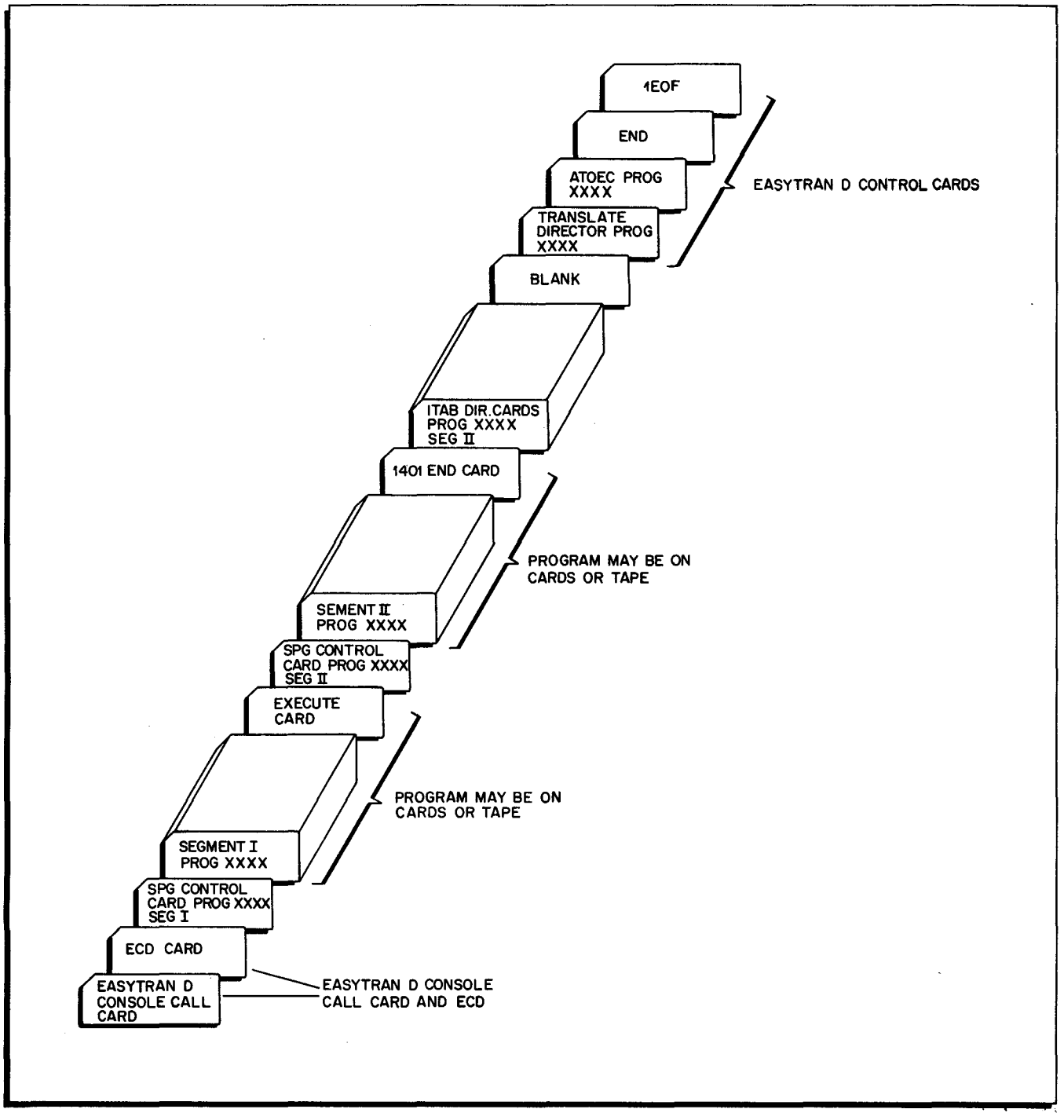
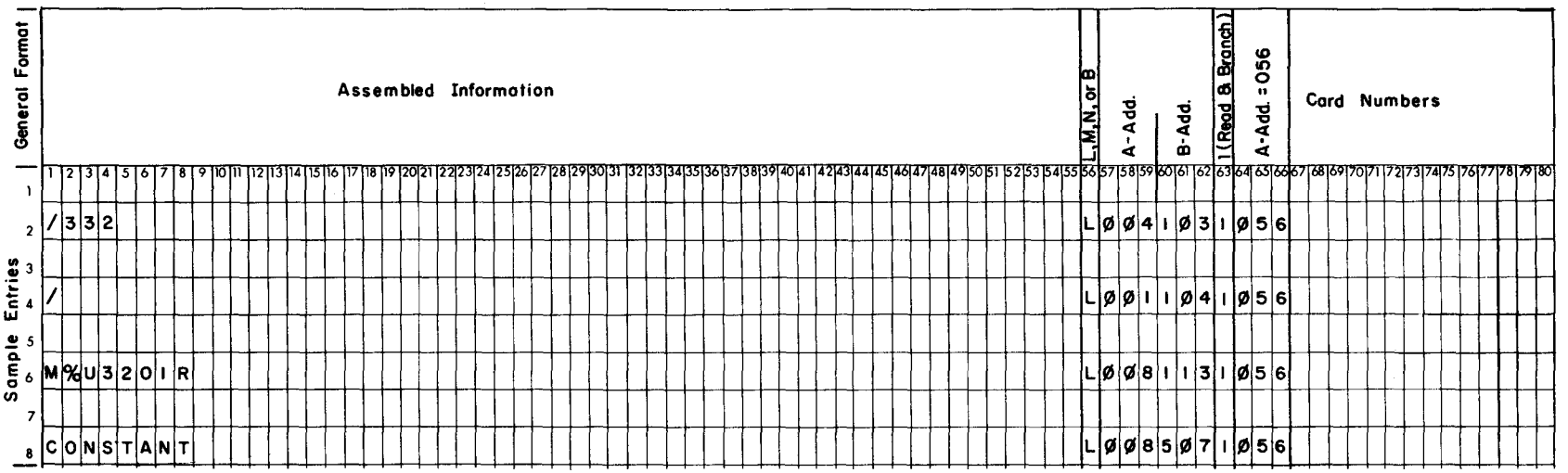


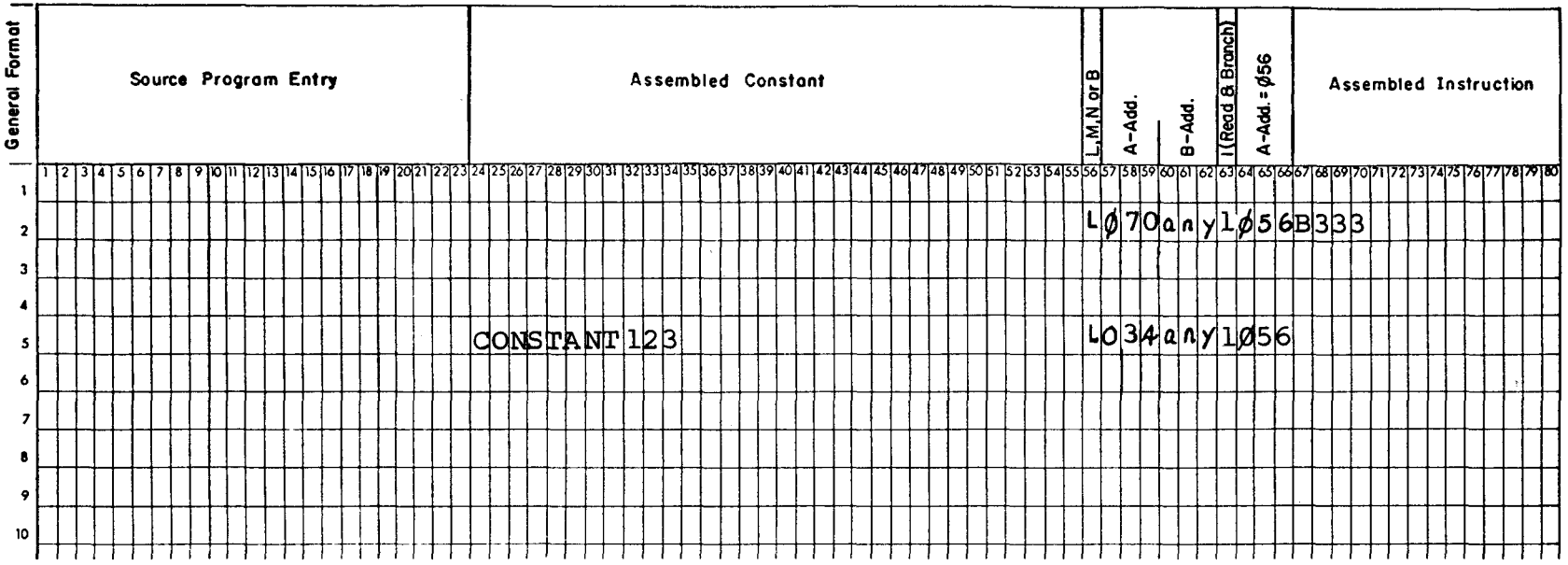
Figure 9-5. SPG Input Deck With Multiple Segments



Column(s)	Entry
1-55	Assembled information
56*	L (Load), M (Move), N (No operation), or B (Branch)
57-59*	A address
60-62	B address
63	1 (Read and Branch)
64-66	A address = 056
67-80	Card numbers

*An Execute or Transfer card in the 1401 program is assembled with a Branch (B) instruction in columns 56 through 59.

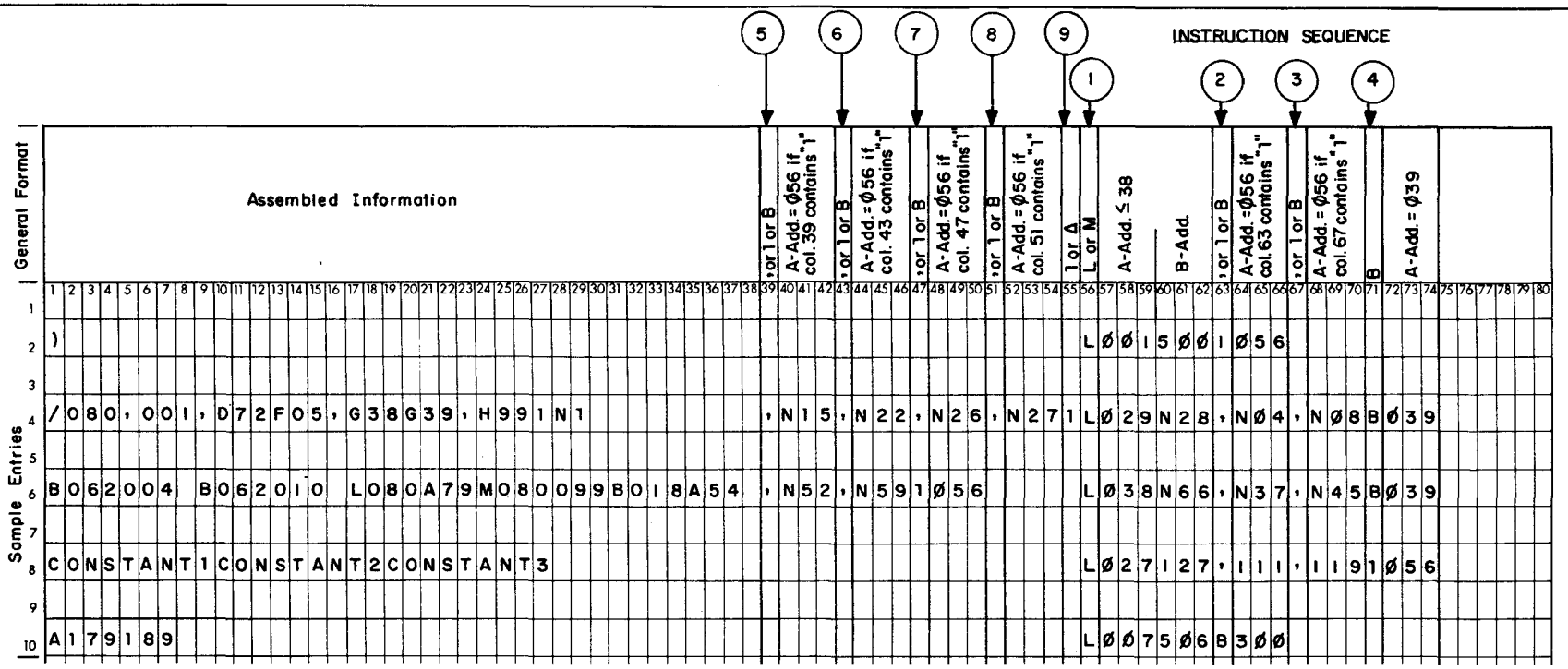
Figure 9-6. SPS1 Format



Column(s)	Entry	
1-23	Source program entry	
24-55	Assembled constant	
56*	L, M, N, or B	Same as SPS1
57-59*	A address	
60-62	B address	
63	1 (Read and Branch)	
64-66	A address = 056	
67-80	Assembled instruction	

*An Execute or Transfer card in the 1401 program is assembled with a Branch (B) instruction in columns 56 through 59.

Figure 9-7. SPS2 Format



Column(s)	Entry	Column(s)	Entry
1-38	Assembled information	56	L or M
39	, or 1 or B	57-59	A address less than or equal to 38
40-42	A address = 056 if col. 39 contains a "1"	60-62	B address
43	, or 1 or B	63	, or 1 or B
44-46	A address = 056 if col. 43 contains a "1"	64-66	A address = 056 if col. 63 contains a "1"
47	, or 1 or B	67	, or 1 or B
48-50	A address = 056 if col. 47 contains a "1"	68-70	A address = 056 if col. 67 contains a "1"
51	, or 1 or B	71	B
52-54	A address = 056 if col. 51 contains a "1"	72-74	A address = 039
55	1 or Δ	75-80	Blank

The following notes refer to the instructions in columns 39 through 74.

Note 1: If an instruction sequence contains a Read and Branch op code (1), instructions which would normally have followed are replaced by blanks.

Note 2: A Branch op code (B) will be generated by an Execute card in the 1401 program.

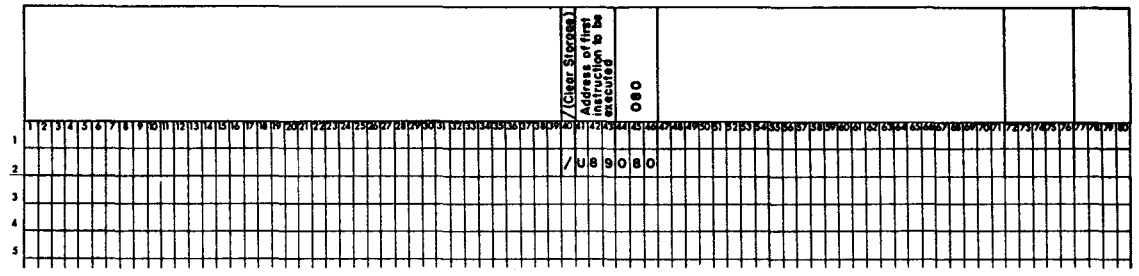
Figure 9-8. SPS Condensed Load Card Format

General Format	Assembled Information (1-39)	L(Load)or N(Nop) (40)	A-Add. (41-43)	B-Add. (44-46)	,or □(Set/Clear wm) (47)	A-Add. (48-50)	B-Add. (51-53)	,(Set Word Mark) (54)	A-Add. (55-57)	B-Add. (58-60)	,(Set Word Mark) (61)	A-Add. (62-64)	B-Add. (65-67)	1(Read and Branch) (68)	A-Add. =040 if col. 68 contains "1" (69-71)	Card Number (72-75)	Identification (76-80)
Sample Entries 1																	
2		L	Ø	3	6	3	8	2	,	Ø	4	Ø	Ø	4	Ø	,	Ø	4	Ø	Ø	4	Ø	,	Ø	4	Ø	Ø	4	Ø	1	Ø	4	Ø		
3																	
4	INTERNAL REVENUE SERVICECARD ICARD 2	L	Ø	3	6	T	3	3	,	T	2	2	T	2	8	,	Ø	4	Ø	Ø	4	Ø	,	Ø	4	Ø	Ø	4	Ø	1	Ø	4	Ø		
5																	
6	MZ6828 5BN36FJMT8720 6MZ7921 9MZ8923 0	L	Ø	3	4	K	1	6	,	J	9	Ø	J	9	4	,	J	9	6	K	Ø	3	,	K	1	Ø	Ø	4	Ø	1	Ø	4	Ø		

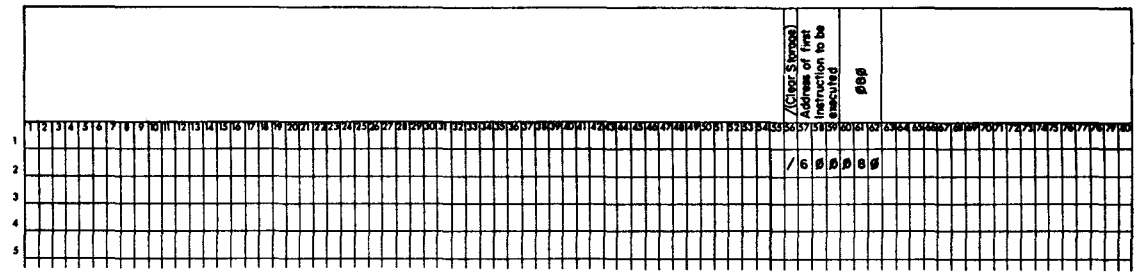
Column(s)	Entry	Column(s)	Entry
1-39	Assembled information	58-60	B address
40	L (Load) or N (NOP) or M (Move)	61	, (set word mark)
41-43	A address	62-64	A address
44-46	B address	65-67	B address
47	, (set word mark) or □ (clear word mark)	68*	1 (Read and Branch)
48-50	A address	69-71*	A address = 040 if column 68 contains a "1"
51-53	B address	72-75	Card number
54	, (set word mark) or □ (clear word mark)	76-80	Identification
55-57	A address		

*An Execute or Transfer card in the 1401 program is assembled with a Branch (B) instruction in columns 68 through 71.

Figure 9-9. Autocoder Condensed Load Card Format



A. Example of End Card for Autocoder Condensed Program



B. Example of End Card for 1401 Program in Any SPS Format

Column(s)		Entry
Autocoder Condensed	SPS (All)	
40	56	/ (Clear storage)
41-43	57-59	Address of first instruction to be executed
44-46	60-62	080

Figure 9-10. 1401 Program End Card Formats

SPG Control Card

Each program segment must be preceded by an SPG Control card. This card describes the format of the input card deck or card-image tape. The format of the SPG Control card is shown in Figure 9-11 and described below.

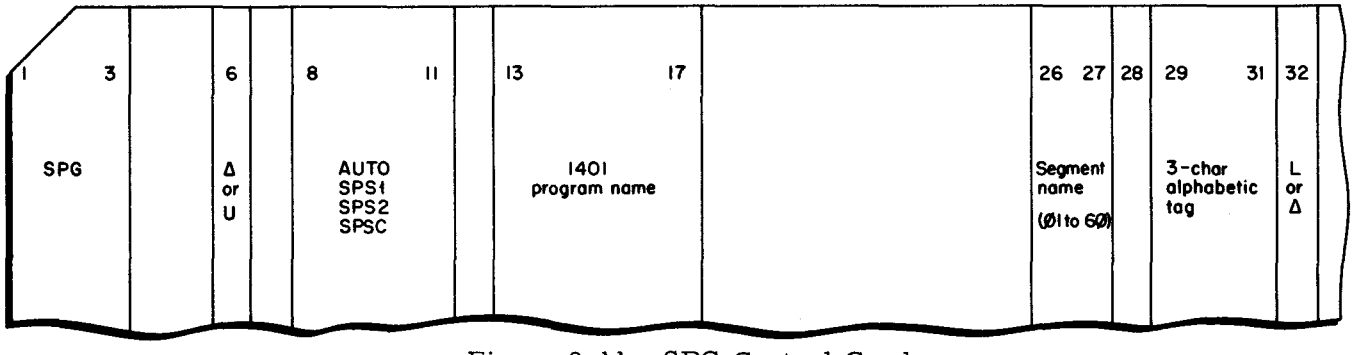


Figure 9-11. SPG Control Card

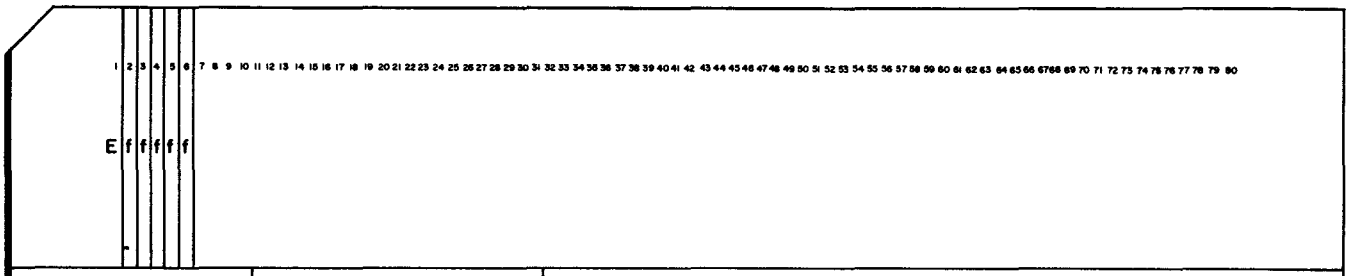
Card Column	Description
1-3	SPG — Identifies the SPG Control card.
4-5	Not used.
6	U-Update ITAB. Δ-No update of ITAB is desired.
7	Not used.
8-11	Specifies 1401 object language format as follows: SPS1 — SPS single load, format 1. SPS2 — SPS single load, format 2. SPS — SPS condensed. AUTO — Autocoder condensed.
12	Not used.
13-17	1401 program name.
18-25	Not used.
26-27	Number of segments (01-60). Punch as two decimal digits (i.e., with a leading zero if necessary).
28	Specifies processing of SPG output. T — Produce translation listing and proceed automatically to an Easytran translation of SPG output. N — Produce translation listing only. Δ — Produce analysis and MTAB/ITAB listing.
29-31	Specifies the three-character alphabetic tag desired for SPG output. If this field is blank or other than alphabetic, "TAG" is generated on the SPG output.
32	L — Produce analysis and MTAB/ITAB listings. Δ — Proceed to SPG translation.
33-38	Not used.

ITAB Director Cards

To make changes to the instruction table (ITAB), Instruction Table directors are required in addition to the SPG Control card. These ITAB directors, which may be Addition directors and/or Eliminate directors, must follow the 1401 program End card. The final ITAB director card is followed by a blank card, called the ITAB End director. The sequence of ITAB director cards with respect to each other is immaterial; however, Eliminate directors should precede Addition directors for optimum efficiency.

ELIMINATE DIRECTOR CARD

The Eliminate director card is used to remove an entry from the instruction table. Figure 9-12 illustrates the format of an Eliminate director.

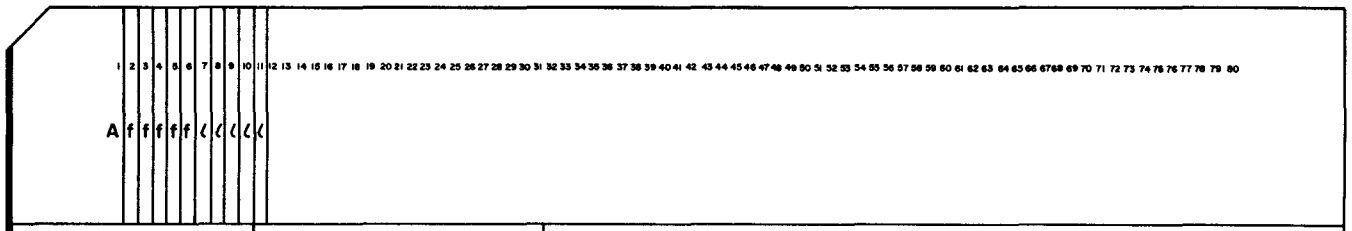


Symbol	Columns	Definition
E	1	Identifies this card as an Eliminate director card.
fffff	2-6	Designates the beginning location of the ITAB entry that is to be eliminated. This address is shown on the MTAB/ITAB printout and is entered as a right-justified decimal address, with leading zeros as necessary.
	7-80	These card columns must be left blank.

Figure 9-12. Eliminate Director Card

ADDITION DIRECTOR CARD

An Addition director card is inserted in the SPG input deck when an entry is made to the instruction table. The format of the Addition director card is given in Figure 9-13.



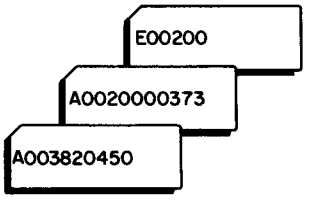
Symbol	Columns	Definition
A	1	Identifies this card as an Addition director card.
fffff	2-6	Designates the beginning location in the ITAB where the addition is to be made. This location is entered as a right-justified decimal address, with leading zeros as necessary.
	7-11	Designates the ending ITAB address (i.e., the rightmost location of the entry). The decimal address where the instruction string terminates is entered, right-justified, with leading zeros.
	8-80	These card columns must be blank.

Figure 9-13. Addition Director Card

Example of Addition and Eliminate Director Use

The Addition and Eliminate directors do not move information in memory; rather, they change the way information in memory is regarded by SPG. Boundaries of instruction and data

areas are moved. When memory and instruction tables are created by SPG after the 1401 program has been read into memory, constants or data may be included in the instruction area. For example, the constant 1EOF is interpreted by SPG as a Read instruction with a three-character address. In Figure 9-14, locations 200 to 450 contain instructions; locations 451 to 499 contain constants. Two constants, 1HDR and 1EOF in locations 374 to 381, have been interpreted as instructions. In order to eliminate these constants from the instruction table the following director cards must be submitted:



LOC	OP	OPERANDS	
00200	L	467 125	Instructions (see Figure 9-4)
	E	055 125	
00370	B	200	
00374	1	HDR	These are constants that will be considered as Read a Card and Branch instructions.
00378	1	EOF	
00382	H	450	
00447	B	000	
00453	DCW	001	Constants
00455	DCW	123456	
00461	DCW	.0	
00471	DCW	1040	
00499	DCW	7890	

Figure 9-14. 1401 Program Requiring ITAB Changes

ITAB END DIRECTOR CARD

A blank card signals the end of a block of ITAB director cards. This blank card must always be placed directly behind the last director card whenever ITAB director cards are used.

OPERATION OF SPG

SPG can be operated in one of three ways as indicated by parameters on the SPG Control card.

SPG can be run to produce analysis and MTAB/ITAB listings only (see Figure 9-1). This method is indicated by a blank in column 28 and an "L" in column 32 on the control card. If all three listings are desired, an "N" is placed in column 28 and column 32 is left blank. These two methods enable the user to take a preliminary look at his program for possible problem areas, updating checks, etc.

For full SPG operation, which includes producing all three listings and a card-image tape acceptable for Easytran D translation, a "T" is punched in column 28 and column 32 is left blank.

Operating Procedures

SPG is operated in the same manner as Easytran D. The following steps detail the operation.

1. Obtain the 1401 object deck or tape.
2. Obtain descriptive information about the program, e.g., memory requirements, number of segments, program listing, pertinent operating procedures.
3. Prepare an Easytran D Console Call card and an ECD card.
4. Prepare an SPG Control card for each segment.
5. Set up the input deck (see Figure 9-5).
6. Mount tapes (see Table 6-3, page 6-18).
7. Start:
   a. Set the ADDRESS MODE switch to 3.
   b. Bootstrap tape 0 to location 0 twice.
   c. Press RUN.

SPG is compatible with Easytran D for all standard equipment configurations except those which use a single tape drive for both the input SPT and work tape 2. For operation with these configurations, a work tape must be mounted in place of the input SPT. In this case, a halt (03405n) occurs, at which time the SPT is mounted on drive n in permit status. The standard SPG tape assignments are shown in Table 6-2, page 6-5.

Programmed Halts

Programmed halts in SPG are compatible with those in Easytran D (see Table 6-5, page 6-21). Halts which are unique to SPG are listed in Table 9-1.

Table 9-1. SPG Halts

B-Address Register	Explanation	Corrective Procedure
000pp2n	Read or write on tape n, tape control pp.	Press RUN to try again.
034003	Input Autocoder program not found on input Autocoder CIT.	Correct SPG Control card or mount correct Autocoder CIT and try again.
034032	Incorrect SPG Control card.	None. Correct card and start run again.
034010	Card read error.	Refeed card, press RUN.
034031	Incorrect tape positioning (job record not found).	Press RUN to try again.
034030	SPG Control card missing.	Correct card, refeed, and press RUN.
03405n	Four-tape translation function.	Mount input SPT in place of work tape 2 on drive n.
034014	Printer error.	Press RUN to reprint line.

APPENDIX C
AUTOCODER LIBRARY PREPASS

Autocoder Library Prepass, a utility program in the Easytran D system, converts a user's Autocoder library into a form acceptable for insertion on the Easytran D systems tape. This routine "saves" a tape drive during 1401 program translation. To convert a program which contains user macro calls or Autocoder macro calls, the user's Autocoder library may be read directly by Easytran D. However, if the additional drive required for direct reading is not available, the library may be converted and placed on the Easytran D systems tape by Autocoder Library Prepass. The Autocoder Library Prepass routine must be executed prior to 1401 program conversion.

Input to the prepass is the user's Autocoder library file. The program reads this file, reformats the contents, edits out the blanks, and produces an output CIT which is considerably more compact than the input library. This CIT is processed by Easycoder Assembler C. It may then be added to the Easytran systems tape by means of the program Update and Select C (see Honeywell Order No. 025). System flow is shown in Figure C-3.

CONTROL CARD INPUT

The Autocoder library prepass requires a Console Call card and an ECD card. The ECD may specify one of four standard ECD numbers as defined in Table C-1, or it may be a full ECD as shown in Figure C-1. The Console Call card is illustrated in Figure C-2.

Table C-1. Standard ECD Entries for Autocoder Library Prepass

Standard ECD #	INPUT (Logical Drive)	OUTPUT (Logical Drive)	CONSOLE DEVICE
0	Tape 1	Tape 2	Typewriter
1	Tape 1	Tape 2	Control Panel
2	Cards	Tape 2	Typewriter
3	Cards	Tape 2	Control Panel

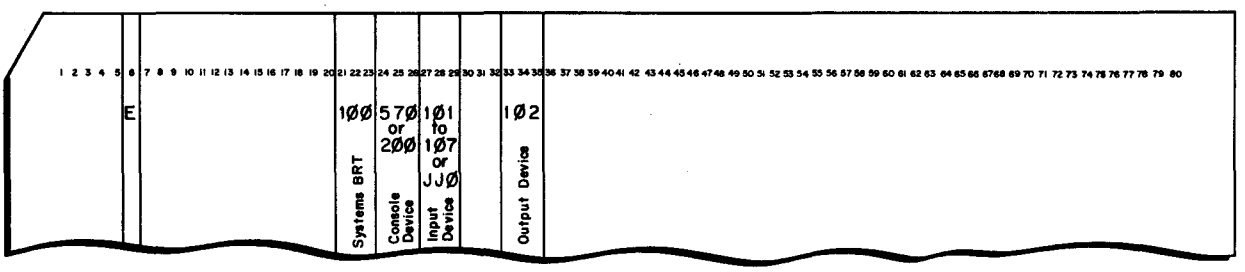


Figure C-1. Full ECD Card for Autocoder Library Prepass

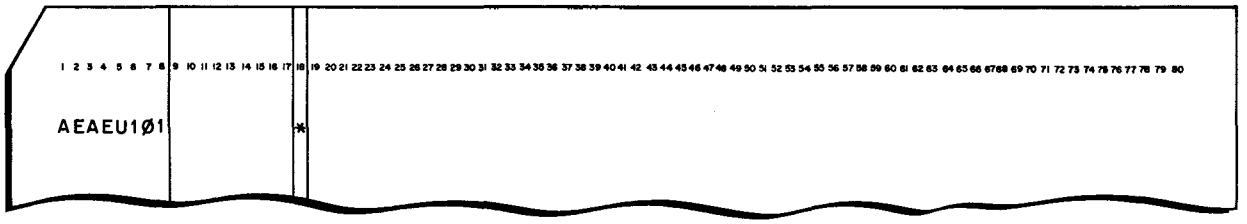


Figure C-2. Console Call Card for Autocoder Library Prepass

EQUIPMENT REQUIREMENTS

The following minimum equipment is required to operate the program:

1. Any Series 200 central processor with 8K characters of memory.
2. Three tape drives.
3. IBM Format and Code Compatibility Features.
4. Card reader.

OPERATING INSTRUCTIONS

Tape Assignments

Drive	Function
0	Easytran Systems Tape
1	Input Tape (Autocoder Library File)
2	Output Tape (Library CIT)

Loading

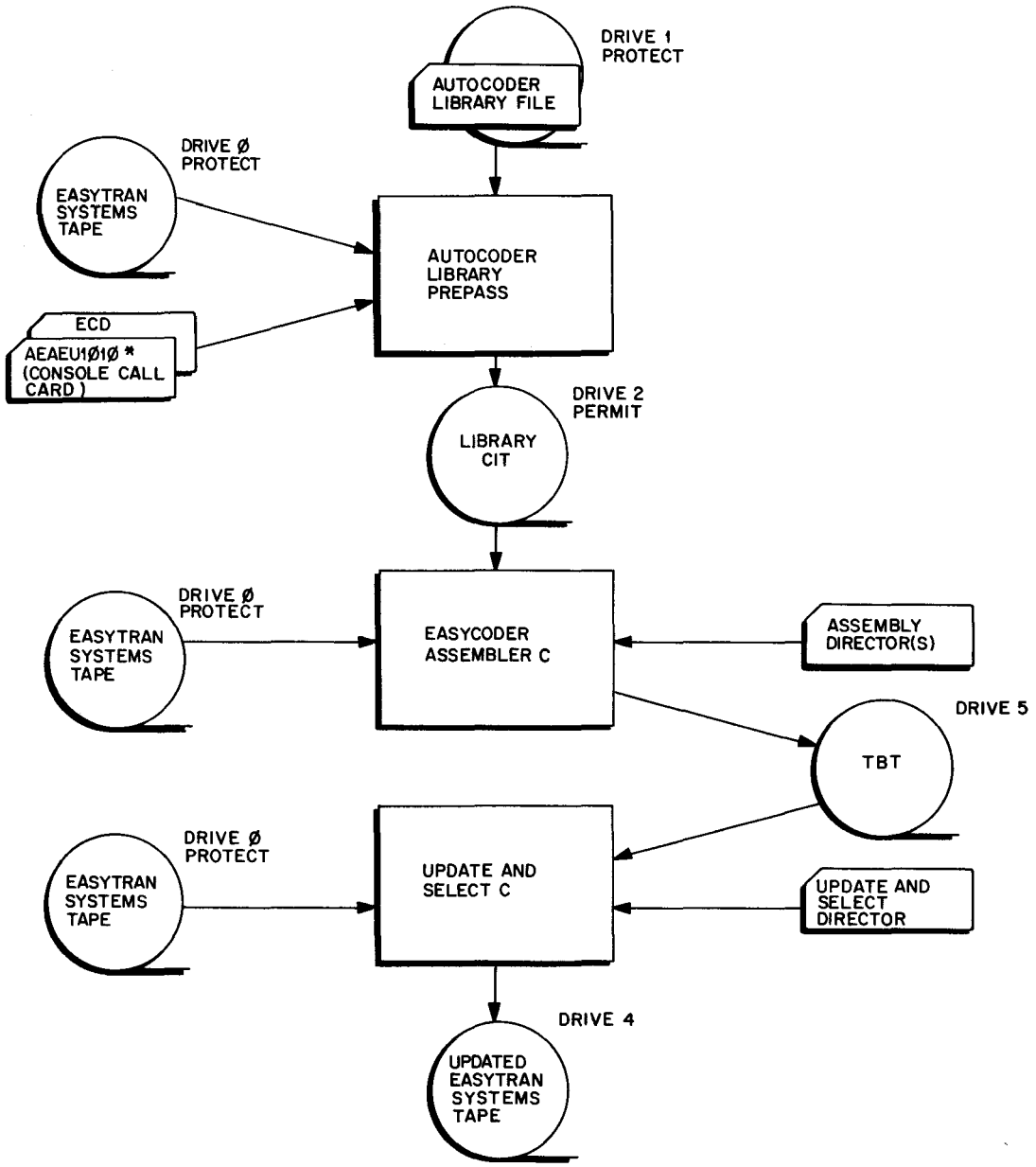
Control cards consist of the Console Call card and the ECD card. When Tape Loader-Monitor C is in memory and the above tapes are mounted, the program is loaded and executed by performing a console call to AEAEU101.

Listing

An option is provided to produce an Easycoder assembly listing of the library. This option is controlled as follows:

SENSE Switch 1 ON = A listing is produced at assembly time.

SENSE Switch 1 OFF = No listing (this case is generally preferred to save time).



NOTE: The combination of tape drives 0, 2, and 5 can be used by Easycoder Assembler C in this application only.

Figure C-3. System Flow Chart for Library Prepass

HALTS

Table C-2 outlines the halts which may occur during the operation of the library prepass. Halts 00001 and 00002 do not produce console typeouts, since they occur before the ECD card has been interpreted.

Table C-2. Halts for Autocoder Library Prepass

A-Address Register	B-Address Register	Explanation	Corrective Procedure
00001	00001	ECD Card Error (either a read error or no "E" in column 6)	Repunch ECD and reload in card reader; press RUN.
00002	00002	Illegal Standard ECD Number	Change ECD number to a number 0, 1, 2, or 3; reload in card reader; and press RUN.
00003	00003	Library Card Read Error	Repunch; reload card in reader; press RUN.
00007	00007	End of Job	

SAMPLE LIBRARY PREPASS RUN

Preparation of Parameters

A sample run, consisting of the Autocoder library prepass, Easycoder Assembler C, and Update and Select C, is to be performed using the following system configuration. The availability of 16K characters of memory and a console is assumed. Parameters are prepared as shown in Figure C-4.

Easytran Systems BRT	Drive 0	(protect)
Autocoder Library Tape	Drive 1	(protect)
Work Tape	Drive 2	(permit)
Work Tape	Drive 3	(permit)
New Easytran Systems BRT	Drive 4	(permit/save)
Work Tape	Drive 5	(permit)

NOTE: Care must be taken in inserting 1401 user macro routines on the systems BRT, since these routines must be written in 1401 collating sequence and since some standard macro routines already exist on the BRT. For example, if the following routines are already stored on the BRT:

```
CLOSE$
DCLOS$
FEOR$
```

then the 1401 user macro routine CTAPE must be inserted between CLOSE$ and DCLOS$, and the 1401 routine DTAPE must be inserted between DCLOS$ and FEOR$. This is accomplished by preparing two insert directors for Update and Select C, as shown in Figure C-4 (see Honeywell Order No. 025). Note also that the library prepass appends $01 to the name of each 1401 macro routine.

Operating Instructions

1. Mount tapes as indicated above.

2. Place the parameter cards (Figure C-4) in the card reader.
3. Bootstrap tape 0 twice, and press RUN.
4. When halt 17001 occurs, press RUN.
5. When halt 17002 first occurs, press RUN.
6. At the next two occurrences of halt 17002, rewind tape 0 and press RUN.
7. At the fourth occurrence of halt 17002, save tape 4 (the new systems BRT including 1401 user macro routines).

EASYCODER
CODING FORM

PROBLEM ______ PROGRAMMER ______ DATE ______ PAGE ___ OF ___

	CARD NUMBER (1–5)	TYPE (6)	MARK (7)	LOCATION (8–14)	OPERATION CODE (15–20)	OPERANDS (21–62)	(63–80)
1							
2	AEAEU	1	Ø	1Ø	*	Library Prepass Console Call Card	
3	Ø	E					
4	AABEZ	C	S	ØØ	*	Assembly Console Call Card	
5		E		R$\overset{x}{8_2}\overset{x}{8_3}$	ØØ Ø3	1ØØ57Ø1Ø2-2Ø 1ØØ1Ø51Ø31Ø4	
6	AAAUP	S	S	1Ø	*	Update & Select Console Call Card	
7		E		R$\overset{x}{8_2}\overset{x}{8_3}$	ØØ Ø3	1ØØ57ØJJØ-2Ø 1ØØ1Ø31Ø4	
8	1HDR	H				UPDATE SEL	
9	INS C	L	O	SE$Ø1	CTAPE$	Ø1	
10	INS D	C	L	OS$Ø1	DTAPE$	Ø1	
11	1EOF						
12							
13							
14						NOTE: If console is not available change card	2 col. 5
15						to 1, cards 4 & 6 col. 24-26 to 2ØØ	
16							
17							

Figure C-4. Library Prepass Parameters

Procedures for Adding an Autocoder Library to an Easytran Systems Tape

1. Execute Autocoder Library Prepass as described above. (This produces a card-image tape containing the Autocoder library.)
2. Execute Easycoder Assembler C using standard ECD #2. (The library is assembled and placed on an SPT.)
3. Execute an Easycoder "Select" run. (The library routines are selected from the SPT and placed on a BRT.)
4. Execute Update and Select C. (The library routines are merged onto the Easytran systems BRT.)

HONEYWELL
ELECTRONIC
DATA
PROCESSING
WELLESLEY HILLS,
MASSACHUSETTS 02181