HONEYWELL EDP

SOFTWARE BULLETIN

SERIES 200

ANALYZER C

GENERAL SYSTEM: Series 200/Operating SYSTEM-MOD 1

SUBJECT: Analyzer C: A Program for Producing a Printed Listing of the Cross References of Symbolic Tags Appearing in an Easycoder Program.

SPECIAL INSTRUCTIONS: This software bulletin completely supersedes the information bulletin entitled Easycoder Analyzer, DSI-358, dated February 11, 1965

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FOREWORD

This bulletin describes the capabilities of the Analyzer C, a program which produces a printed listing that identifies cross references of symbolic tags appearing in an Easycoder symbolic program.

Section I of this bulletin provides a general description of the program's capabilities. The various operations of Analyzer C are described in Section II, while Section III describes the format for the various directors. The format of the Analyzer C data listing is described in Section IV. Finally, Section V presents the operating procedures for loading Analyzer C from magnetic tape or punched cards.

The reader is assumed to be familiar with the operating procedures for the control panel and the various peripheral devices as presented in the Honeywell Series 200 Equipment Operators' Manual (Model 200) (DSI-294). In addition, the reader should be familiar with the Honeywell Series 200 Programmers' Reference Manual (Models 200/1200/2200), File No. 113.0005.0000.00.00, and (where applicable) the bulletin Models 209/210 Paper Tape Equipment (DSI-322).

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GENERAL DESCRIPTION

INTRODUCTION

Analyzer C is a powerful programming aid which the programmer may use to simplify the task of analyzing any Series 200 program that is coded in the Easycoder symbolic language. From the input program(s), Analyzer C extracts symbolic tags, references (to each tag, to index registers, and to absolute addresses), and calls to library routines and processes this information to produce the Analyzer C printed listing. The Analyzer C listing is arranged in alphanumeric order so that all information about a particular tag, absolute location, or library routine appears grouped in one place on the printed listing.

Programs to be analyzed may be taken from an Easycoder C or D symbolic program tape (SPT), from a card-image magnetic tape, from punched cards, or from paper tape. A maximum of 30 programs may be analyzed in any one run of Analyzer C.

The Analyzer C processing is accomplished in three phases by two Analyzer C program segments and the Tape Sort C program as follows:

Phase 1 — The first segment of Analyzer C (AAJANA01) extracts the pertinent information from the programs being analyzed and prepares an intermediate file which contains the extracted information.

Phase 2 — The intermediate file which was built during phase 1 is sorted into the proper order for printing during phase 3. The processing of this phase is accomplished by the Tape Sort C program, which is described in detail in the software bulletin Tape Sort C and Collate C. File No. 122.6005.021C.00.01.

Phase 3 — The second segment of Analyzer C (AAJANA02), reads the sorted information file and produces the Analyzer C listing.

EQUIPMENT REQUIREMENTS

Because of Analyzer C's adaptability, there is an extensive variety of equipment combinations which may be used. However, once the storage media of the program(s) to be analyzed has been established in one of the three categories indicated in Table 1-1, the number of equipment combinations is reduced to those of its applicable equipment configuration as shown in its referenced illustration. It should be noted that although the peripheral equipment requirements may differ, the memory storage requirements remain the same. Additionally, Analyzer C requires that the system has the Advanced Programming Instructions feature (011) or (010).

Table 1-1. Equipment Requirements for Analyzer C

Program Storage Medium	Required Equipment		Optional Equipment	
	Central Processor	Peripheral Equipment	Central Processor	Peripheral Equipment
Symbolic program tape (Fig. 2-1)	12,288 character storage area	1. One card reader 2. One printer 3. Five magnetic tape units (204B) NOTE A four-tape system can be implemented by substituting a "program" deck for the program tape and using the Card Loader-Monitor B	Additional memory up to 32K may be used to advantage by Tape Sort C	1. A paper tape reader may be used to read directors. 2. Three additional magnetic tape units (204B) may be used for (1) a fourth work tape, (2) a listing print-image tape, (3) a director card-image tape. 3. A console typewriter, type 220, may be used for programmed message output.
Card-image tape (Fig. 2-2)	Same equipment requirements as symbolic program tape above			
Punched cards (Fig. 2-3)	Same as above	1. One card reader 2. One printer 3. Four magnetic tape units (204B) NOTE A three-tape system can be implemented in the manner noted above.	Same as above	1. A paper tape reader may be used to read input. 2. Three additional magnetic tape units (204B) may be used as listed in item 2 above. 3. A console typewriter, type 220, may be used for programmed message output.
NOTE: The use of a fourth work tape significantly increases the speed of the sort operation.				

SECTION II

ANALYZER C OPERATIONS

As previously stated, the programs to be analyzed may be contained on any one of the following:

1. Easycoder C or D symbolic program tape (SPT),
2. Card-image tape,
3. Card deck, or
4. Paper tape.

Depending upon the format of the program to be analyzed, one or more of three possible configurations may be used. As may be observed from Figures 2-1 through 2-3, the use of a particular configuration is dependent upon both the hardware system and the software system available. For example, the configuration shown in Figure 2-1 is applicable only when Easycoder Assembly C or D program is used (to produce the SPT) and the system has a minimum of four (preferably five) magnetic tape drives. The configuration shown in Figure 2-3, however, is applicable for any of the Easycoder assemblers and can be implemented on a system with a minimum of three magnetic tape drives.

ANALYZING A SYMBOLIC PROGRAM TAPE (SPT)

If it is desired to analyze specific programs contained on an Easycoder C or D symbolic program tape, the configuration illustrated in Figure 2-1 should be employed.

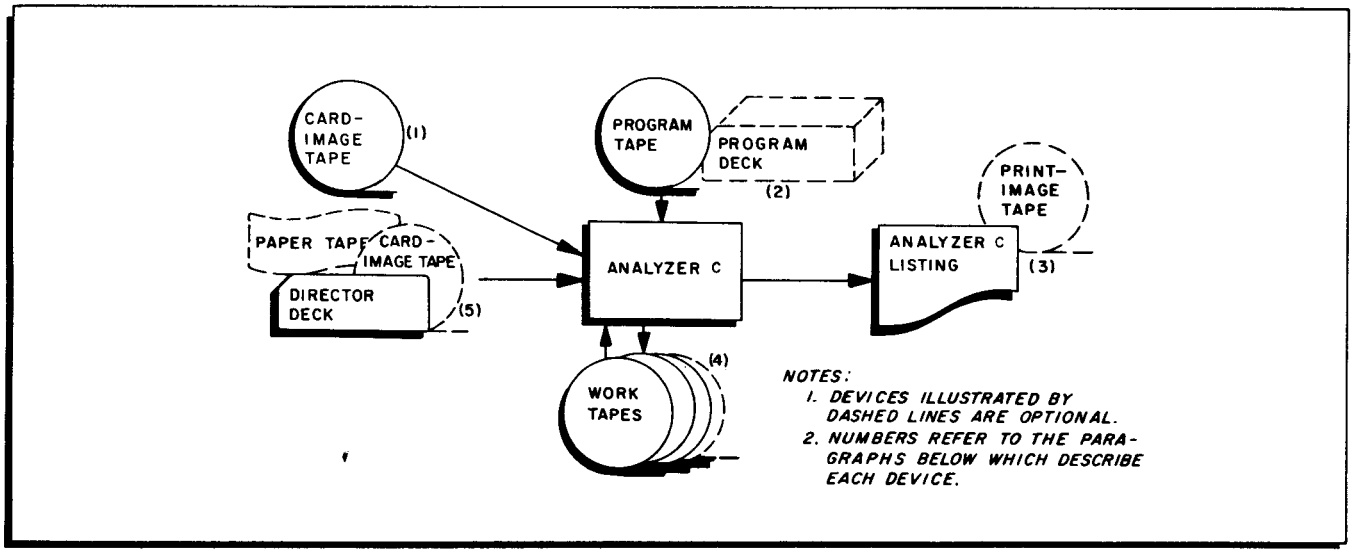


Figure 2-1. Configuration for Analyzing a Symbolic Program Tape

1. Symbolic program tape: In this configuration, the primary input is the symbolic program tape. Under the control of the director deck, specified programs are located on the SPT and placed, in their analyzed form, on the listing. Programs on the SPT which are not to be analyzed are simply bypassed.

2. Program tape: This tape (a machine-language tape in the standard BRT format) contains Tape Loader-Monitor C or Floating Tape Loader-Monitor C, the two Analyzer C program segments, and Tape Sort C.

   OPTION: The above information may alternatively be contained in the program card deck.

3. Analyzer C listing: The output of Analyzer C is the listing which includes all symbolic tags defined in the program, the references to each tag, references to absolute addresses, and calls to library routines. A complete description of the Analyzer C listing may be found in Section IV.

   OPTION: The Analyzer C listing may be recorded on tape for off-line printing.

4. Work tapes: The three work tapes must be included in the configuration to enable the three operational phases of Analyzer C (described on page 1-1) to be performed.

5. Director deck: The director deck specifies the programs on the SPT that are to be analyzed. The system header card precedes and the system end card follows the directors. A director card must be included for each program (on the SPT) which it is desired to process. (The director cards must appear in the deck in the same order in which the programs appear on the symbolic program tape.) All cards are described in Section III.

   OPTION: The contents of the director deck may optionally appear on either a card-image magnetic tape or a paper tape.

ANALYZING A CARD-IMAGE TAPE

If it is desired to analyze specific programs contained on a card-image tape, the configuration illustrated in Figure 2-2 should be employed.

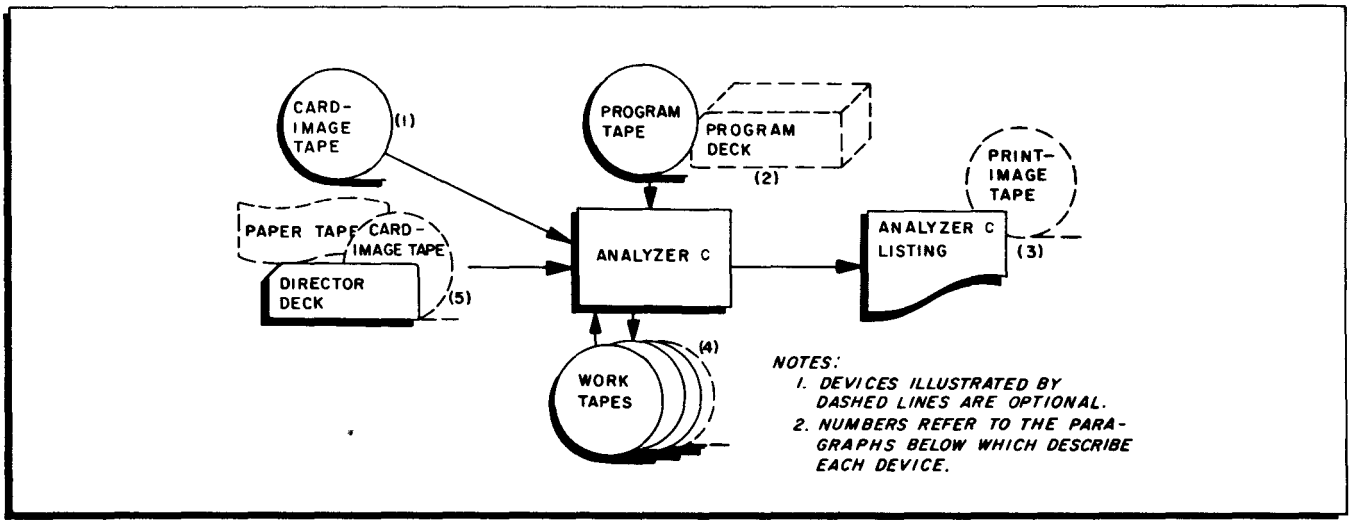


Figure 2-2. Configuration for Analyzing a Card-Image Tape

1. Card-image tape: The primary input in this configuration is the card-image tape. Under the control of the director deck, programs are located on the card-image tape and placed, in their analyzed form, on the listing. Programs on the card-image tape which are not to be analyzed are simply bypassed. (Refer to the note under "Director Cards" on page 3-13).

2. Program tape: This tape (a machine-language tape in the standard BRT format) contains Tape Loader-Monitor C or Floating Tape Loader-Monitor C, the two Analyzer C program segments, and Tape Sort C.

   OPTION: The above information may be contained in the program card deck.

3. Analyzer C listing: The output of Analyzer C is the listing which includes all symbolic tags defined in the program, the references to each tag, references to absolute addresses, and calls to library routines. A complete description of the Analyzer C listing may be found in Section IV.

   OPTION: The Analyzer C listing may be placed on a print-image tape for off-line printing.

4. Work tapes: The three work tapes must be included in the configuration to enable the three operational phases of Analyzer C (described on page 1-1) to be performed.

   OPTION: A fourth work tape may also be specified.

5. Director deck: The director deck specifies the programs on the card-image tape that are to be analyzed. The system header card is the first entry in the director deck. It is followed by the director cards, while the system end card forms the final entry. A director card must appear for each program to be analyzed, and these cards must be positioned in the deck in the same order in which the programs are stored on the card-image tape. (The one exception to this is explained below.) All cards are described in Section III.

   OPTION: (1) The contents of the director deck may optionally appear on either a card-image magnetic tape or on a paper tape.

   (2) If director cards are omitted, all programs on the card-image tape are processed.

ANALYZING PROGRAMS CONTAINED ON CARDS

If it is desired to analyze programs contained on punched cards, the configuration illustrated in Figure 2-3 should be employed.

1. Input deck: A sample input deck is illustrated below. The input deck is composed of the system header card followed by the programs to be analyzed, while the system end card forms the final entry. Note that director cards are not employed with this configuration. Rather, only those programs to be analyzed are placed in the deck — immediately following the system header card.[1] All cards are described in Section III.

[1] Director cards must never be employed when the programs to be analyzed are read from the same device as the system header card.

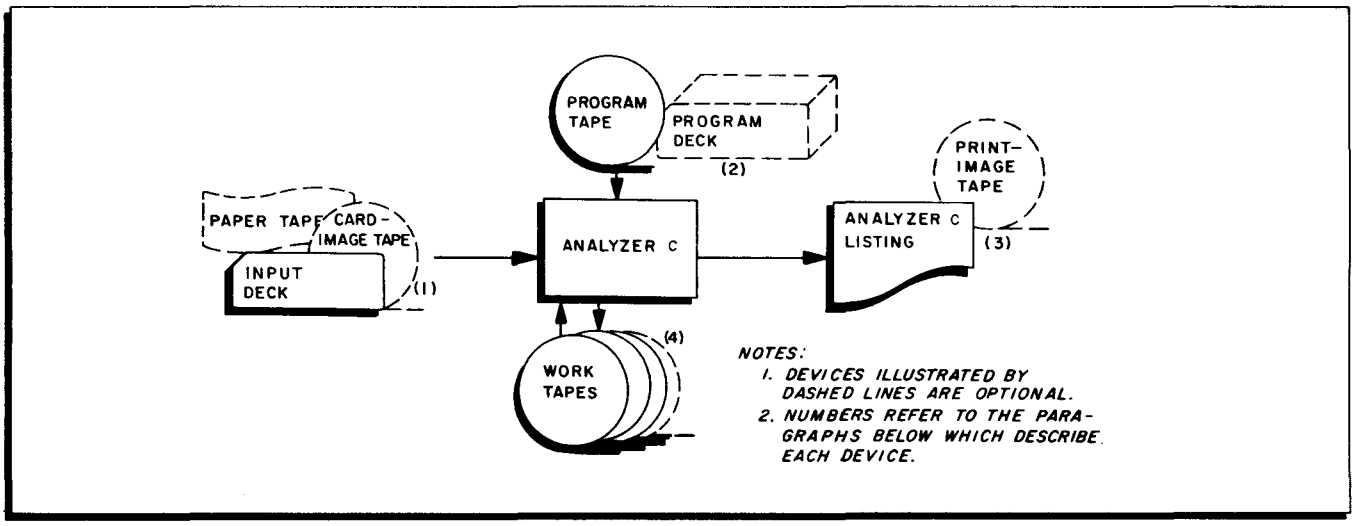
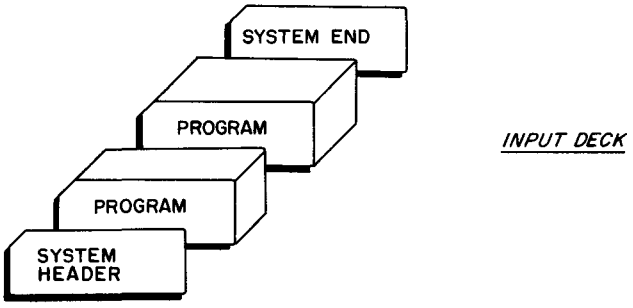


Figure 2-3. Configuration for Analyzing Programs Contained on Cards

OPTION: The contents of the input deck may optionally appear on a card-image magnetic tape or on paper tape.



2. Program tape: This tape (a machine-language tape in the standard BRT format) contains Tape Loader-Monitor C or Floating Tape Loader-Monitor C, the two Analyzer C program segments, and Tape Sort C.

   OPTION: The above information may be contained in the program card deck.

3. Analyzer listing: The output of Analyzer C is the listing which includes all symbolic tags defined in the program, the references to each tag, references to absolute addresses, and calls to library routines. A complete description of the Analyzer C listing may be found in Section IV.

   OPTION: The Analyzer C listing may be placed on a print-image tape for off-line printing.

4. Work tapes: The three work tapes must be included in the configuration to enable the three operational phases of Analyzer C (described on page 1-1) to be performed.

   OPTION: A fourth work tape may also be specified.

SECTION III
THE INPUT FILE

The Input File is composed of the Equipment Configuration Descriptor (ECD) and the director deck. If an ECD card is used, it should precede the director deck. This section describes the ECD and the three types of cards which may be included in the Analyzer C director deck.

Note that the directors are described in punched-card format only. If the director entries are to appear on card-image tape or paper tape, the coding format for the various director entries remains the same (assuming normal use of control frames with paper tape).

EQUIPMENT CONFIGURATION DESCRIPTOR

The Equipment Configuration Descriptor specifies, among other things, the input and output devices and the number of memory locations to be used for a system program. Analyzer C, like all system programs, contains 10 standard equipment configurations assembled within itself. Each standard configuration is identified by a number from 0 through 9. Based on the equipment he wishes to make available, the user may specify one of these numbers and so obtain a smooth flow between system programs without the necessity of constructing his own ECD card each time.

In cases of unusual run sequences, or where limited equipment is available, configuration numbers may be specified for each program on an individual, one-at-a-time basis. If the desired configuration has not been included among the standard equipment configurations, a full Equipment Configuration Descriptor card may be constructed.

The standard configurations supplied may be changed at each installation by reassembling the system program see (Appendix B). Specification of memory size is independent of the standard configurations (see below).

Methods of Specifying the Configuration

A four-character area, called the ECD field, has been set aside within the Loader communication area to contain information pertaining to the Equipment Configuration Descriptor for the run. This field, locations 227_8 through 232_8, contains either of the following:

1. A standard equipment configuration number which will be used for all system program runs including Analyzer C (method #1).

2. A device address. The system program will read one record from that device. (There is no anticipatory read – one and only one record will be read.) This record must be an Equipment Configuration Descriptor image and may specify either:

   a. A standard configuration number (method #2)

   or

   b. A full ECD (method #3).

METHOD #1 - STANDARD ECD NUMBER RESIDING IN TAPE OR CARD LOADER-MONITOR

Locations $227\text{-}232_8$ of the Loader communication area contain:

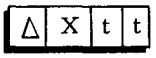


Table 3-1. ECD Field with Standard ECD Number

Character Number	Location (Octal)	Contents
1	227	Blank (Δ)
2	230	Standard Configuration Number (X)
3-4	231-232	Highest memory bank (octal) available to the system program (tt). If these characters are blank, the memory size in the standard configuration is used.

NOTE: If only one configuration number can be used for all system programs including Analyzer C, then no ECD cards are required. The Tape Card Loader-Monitor can be assembled so that locations $227_8\text{-}232_8$ contain ΔXtt as described in the preceding table.

Table 3-2 shows which function Analyzer C will perform (analyzing from cards, from a card-image tape, or from a symbolic program tape) when the ECD field is set up to contain a standard equipment configuration number. If it is desired to analyze programs on a different medium than the one specified by this number, then method #2 should be employed.

NOTE: If location 230_8 contains any number 0 through 4, Analyzer C will analyze programs from cards. If location 230_8 contains the number 6, Analyzer C will analyze programs from a card-image tape. If location 230_8 contains the number 5, 7, 8 or 9 Analyzer C will analyze programs from a symbolic program tape.

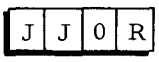
Table 3-2. Standard Configurations for Analyzer C

Configuration Number	0-4	6	5, 7	8, 9
Minimum Number of Tapes	4	5	5	6
Run Description	Analyze from cards-3WRK[2]	Analyze from card-image tape 3WRK	Analyze from SPT-3 WRK	Analyze from SPT SPT - 4 WRK
Logical Tape 0	PT[1]	PT	PT	PT
Logical Tape 1		Program Input (Card-image tape)		
Logical Tape 2	WRK	WRK	WRK	WRK
Logical Tape 3	WRK	WRK	SPT[3]	SPT
Logical Tape 4	WRK	WRK	WRK	WRK
Logical Tape 5				WRK
Logical Tape 6			WRK	WRK
Logical Tape 7				
Card Reader	Program Input	Directors	Directors	Directors
Card Punch				
Printer	Analyzer Listing	Analyzer Listing	Analyzer Listing	Analyzer Listing

1. PT=program tape (BRT), source of system programs. A program card deck may replace this.
2. WRK=Work tape.
3. SPT=The symbolic program tape from which programs are being analyzed.

METHOD #2 - STANDARD ECD NUMBER OBTAINED FROM ECD IMAGE

Locations 227_8-232_8 of the Loader communication area contain:



(Normal)

Table 3-3. ECD Field to Obtain ECD Number from Input Device

Character Number	Location (Octal)	Contents
1	227	Device Type (J)
2-3	230-231	Control Unit and Device (J0)
4	232	Read/Write Channel (R)

NOTE: Under this method, the standard code of JJ0R assembled in locations $227\text{-}232_8$ means that the ECD image will be read from a card reader having a peripheral address of 41 via read/write channel 1. The contents of these locations may be changed by reassembling the Loader-Monitor or by manual entry from the console.

The Equipment Configuration Descriptor image read in must be constructed as shown in Table 3-4.

Table 3-4. Standard ECD Image

Character	Contents	Explanation
5	0-9	The standard configuration which corresponds to this number will be used. If this column is blank, the image is assumed to be a full ECD image (see method #3).
6	E	Identifies an Equipment Configuration Descriptor.
19-20	tt or ΔΔ	tt is the highest memory bank (octal) available to the system program. If these characters are blank, the memory size included in the standard configuration is used.

NOTE: Since Analyzer C processes input in various forms (e.g., analyzing from a symbolic program tape, from a card-image tape, or from cards), method #2 of specifying the Equipment Configuration Descriptor will probably be the most used.

METHOD #3 - FULL EQUIPMENT CONFIGURATION DESCRIPTOR AS ECD IMAGE

The format of the Full Equipment Configuration Descriptor is described below. Note that column 5 must be blank to distinguish this from an Equipment Configuration Descriptor specifying a standard equipment configuration.

The ECD Field of the Loader communication area is the same as in Table 3-3.

NOTE: If it is desired to specify an equipment configuration not included among the standard configurations, a full ECD image is required. This method is most often used when the Analyzer C listing is to be placed on a tape for later printing. However, if it becomes common practice to use this configuration, one or more of the standard configurations should be reassembled to provide a print tape (see Appendix B).

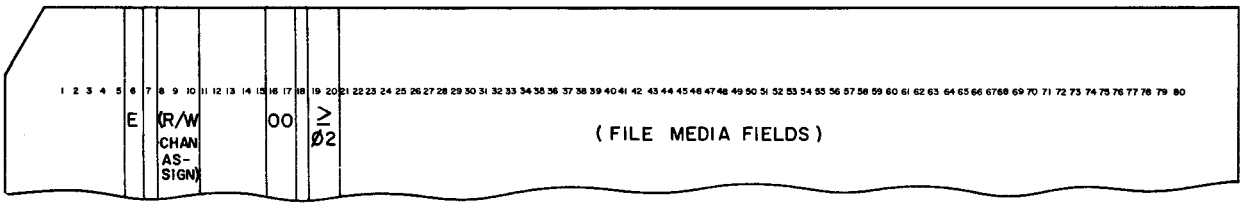


Figure 3-1. Equipment Configuration Descriptor Card

Col. 1-5: Not used.

Col. 6: Contains the letter E to identify the Equipment Configuration Descriptor card.

Col. 7: Not used.

Col. 8-10: Analyzer C was originally coded to use certain read/write channel assignments for its input/output operations. Columns 8 to 10 are normally coded as follows to specify these channels:

Col. 8: R (control character 51_8); designates RWC1.

Col. 9: 11, 8, 2 multipunch (control character 52_8); designates RWC2.

Col. 10: 11, 8, 3 multipunch (control character 53_8); designates RWC3.

Columns 9 and 10, must contain the values stated; however, either of the following values may alternatively be punched into column 8 if RWC1 is reserved for the use of a foreground program.

11, 8 and 2 multipunch (control character 52_8); designates RWC2.

11, 8 and 3 multipunch (control character 53_8); designates RWC3.

NOTE: This field must be punched, even if the channels are not to be reassigned.

Col. 11-15: Not used.

Col. 16-17: Contain the number (octal) of the lowest memory bank used; this number will always be 00.

Col. 19-20: Contain the number (octal) of the highest memory bank used; this number will always be ≥ 02.

Col. 21-80: Contain the file media fields, which designate the equipment configurations to be used. Columns 21 through 80 contain 20 of these file media fields, made up of three columns each. These three columns, in turn, contain three characters which completely specify the tape or device to be used. The contents of each of the fields are listed in Table 3-5.

Table 3-5. Format for Analyzer C File Media Fields

Columns	Designate	First Character Device Type[1]	Second Character Peripheral Address[2]	Third Character Tape Drive[3]
21-23	Program loading device	1 J	(p) (p)	(t) 0
24-26	Console device	2 or 5	(p)	0
27-29	Director input device	J 1 L Δ	(p) (p) (p) Δ	0 (t) 0 Δ
30-32	Listing device[4]	- 1	(p) (p)	0 (t)
36-38	SPT input device[5]	1 Δ	(p) Δ	(t) Δ
39-41	Symbolic card-image input device[5]	1 J L[6] Δ	(p) (p) (p) Δ	(t) 0 0 Δ
48-50	Work tape 1	1	(p)	(t)
51-53	Work tape 2	1	(p)	(t)
54-56	Work tape 3	1	(p)	(t)
57-59	Work tape 4[7]	1 Δ	(p) Δ	(t) Δ
60-80	Not used with the Analyzer C			

NOTES: 1. The first character specifies the device used; the symbol for each device is as follows:

Symbol	Octal Code	Device
Δ	15	File absent
1	01	Tape control
-	40	Printer
J	41	Card reader
2	02	Control panel
5	05	Console Typewriter
L	43	Paper tape reader

2. The second character specifies the peripheral address. This is control character C_2 of the PDT instruction. For tape files, Analyzer C sets bit 1 (I/O bit). For card and print files, this bit must be set correctly in the character as it is punched in the card. In the case of the control panel, this character is 0. For the console typewriter it is 7.

3. The third character specifies the number of the tape drive to be used. This is the low-order octal digit of control character C_3 of the PDT instruction. If a tape drive is not required for a particular device, this third character is 0.

4. If a print-image tape is desired, work tape 1, 3, or 4 may be used for the print file. In this case, columns 30-32 should have the same contents as the columns which designate the applicable work tape (48-50, 54-56, or 57-59).

5. One (but not both) of these fields must be specified. If the programs to be analyzed are located on an SPT, columns 36-38 must be punched while columns 39-41 must be blank. However, if they are contained on cards, paper tape, or on a card-image tape, columns 39-41 must be appropriately punched and columns 36-38 must be blank.

6. For paper tape files, columns 27-29 must be blank.

7. If blank, there is no fourth work tape and Analyzer C uses three tapes.

THE DIRECTOR DECK

The director deck is composed of the system header card, director cards, and the system end card. These cards are described in detail below.

System Header Card

The system header card specifies the date and the name of the system. The format of this card is illustrated in Figure 3-2 and explained below.

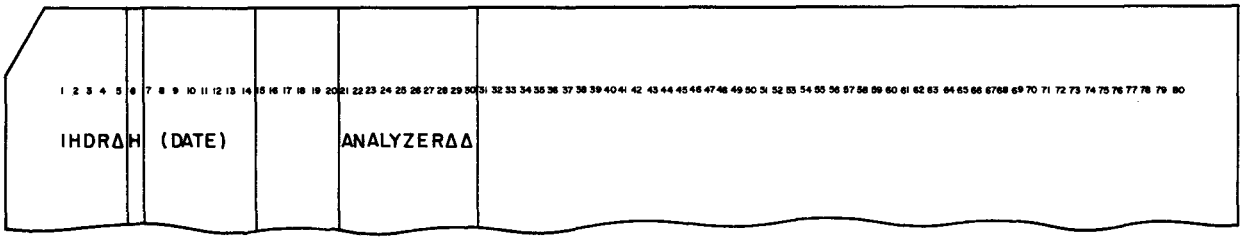


Figure 3-2. System Header Card

Col. 1-5: Contain the symbol 1HDRΔ to identify the beginning of the input.

Col. 6: Contains the letter H to identify the system header card.

Col. 7-14: Contain the date in any desired format.

Col. 15-20: Not used.

Col. 21-30: Contain the system name which, in this case, is ANALYZERΔΔ

Col. 31-80: Not used.

DIRECTOR CARDS

The director cards (see Figure 3-3) specify the programs to be analyzed.

NOTE: Analyzer C bypasses cards containing DEL or POS in columns 1-3. It also bypasses any cards in the input file which are not part of a program (a program is defined by its PROG and END cards). Thus, any standard card-image tape can be analyzed, even though it contains more than one file. Analyzer C examines every card image between the card-image file label (characters 1-5 are 1HDRΔ, and characters 21-30 are CARDIMAGES) and the end of recorded information (characters 1-5 are 1ERIΔ). These records are contained on any card-image tape prepared by a system program (e.g., Library Processor C). A tape prepared by Simultaneous Media Conversion A contains these records if the first record read by Simultaneous Media Conversion A has the format of a card-image file label.

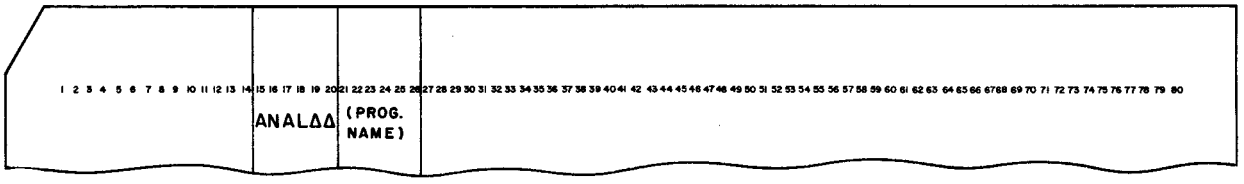


Figure 3-3. Director Card

Col. 1-14: Not used.

Col. 15-20: Contain the symbol ANALΔΔ .

Col. 21-26: Contain the six-character name of the program to be analyzed.

Col. 27-80: Not used.

SYSTEM END CARD

The last card in the director deck must be the system end card. This card is illustrated in Figure 3-4 and explained below.

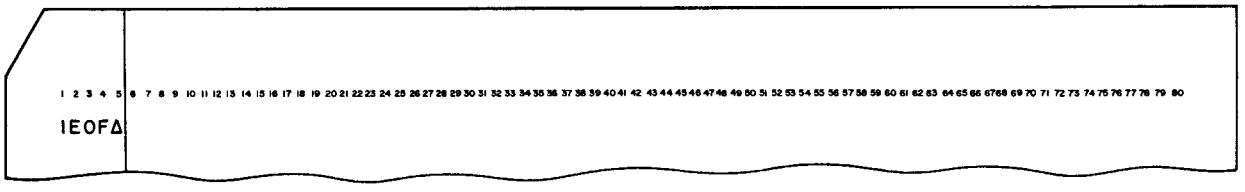


Figure 3-4. System End Card

Col. 1-5: Contain the symbol 1EOFΔ which specifies the termination of the deck.

SECTION IV
ANALYZER C LISTING

The Analyzer C listing, which furnishes the user with a complete documentation of all input programs, is arranged in alphanumeric order. All information about a particular tag, absolute location, or library routine may thus be found grouped in one place on the listing.

Each printed page of the listing contains two header lines followed by the various print lines.

HEADER LINES

First Header Line

The format for the first header line of the Analyzer C listing is illustrated in Figure 4-1. (Sample header lines appear in Figure 4-4.) This line contains the following:

Print Positions

2-7:	Contain the name of the program analyzed.
17-21:	Contain the characters PAGEΔ.
22-24:	Contain the number of the printed page.
34-41:	Indicate the date of the program.

If the program was analyzed from an SPT, this line also contains:

Print Positions

43-50:	Contain the characters SPTΔ DATE.
52-59:	Contain the date the SPT was created.
62-68:	Contain the characters SPTΔ NO.
70-74:	Contain the SPT revision number.
77-92:	Contain the characters PROGRAMΔ REV.Δ NO.
93-95:	Contain the program revision number.

Second Header Line

Figure 4-1 illustrates the format for the second header line; sample header lines appear in Figure 4-4. The following is contained in this line:

Print Positions

2-4:	Contain the letters TAG.
8-14:	Contain the characters LINEΔNO.
16-21:	Contain the characters OPCODE.
23:	Contains the letter F.
25-31:	Contain the title OPERAND.

52-58: Contain the characters LINE ΔNO.

60-65: Contain the characters OPCODE.

67: Contains the letter F.

69-75: Contain the title OPERAND.

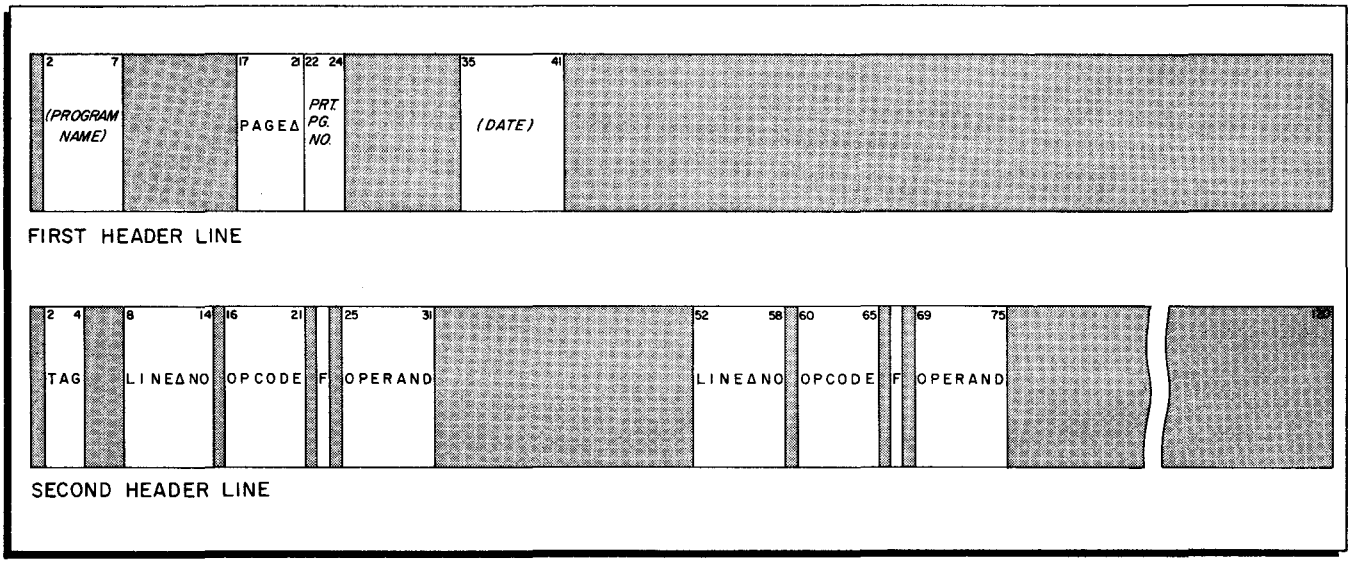


Figure 4-1. Header Lines

DATA LINES

For each symbolic tag, index register, absolute address, or macro routine referenced in the program, a group of data lines (consisting of definition lines and reference lines) appears in the Analyzer C listing. These groups are sorted, using the symbolic tag, index designator, absolute address, or macro name as a key.[1] All absolute references appear first in the listing, since numerics are smaller than alphabetics in the Honeywell Collating sequence.[2] Index groups immediately follow the absolute references. Tag groups and macro name groups appear interspersed in the listing. If two or more names are identical, the tag precedes the macro name.

Definition Line

The first line of each group (of data lines) is always a definition line. A definition line may represent a defined, undefined, index, or macro entry.

1. Defined entry: A defined entry is a tag or an absolute address which appears in the location field, or it is a tag which is defined by an area defining literal. One definition line is printed for each occurrence of the same tag or absolute address in the location field.

[1] The term "name" refers to any member of the set of four expressions; symbolic tag, index designator, absolute address, and macro name.

[2] An operand of a machine instruction, assembly control instruction, or DSA instruction which is entirely numeric and not indexed is considered an absolute address.

2. Undefined entry: An undefined entry is a tag or absolute address which is referenced but does not appear in the location field. Only one definition line is printed for the tag or address, regardless of how many times it is referenced.

3. Index entry: An index entry is an index designator which is referenced in the program. Only one definition line is printed for the index designator, regardless of how many times it is referenced.

NOTE: An expression of the form Xi may represent either an index designator or a tag, depending upon its use. Thus, such an expression may appear in two groups in the listing, once as a defined or undefined tag entry and once as an index entry.

4. Macro entry: A macro entry is the name of a macro routine referenced in one or more macro instructions. Only one definition line is printed for each routine, regardless of how many times it is called.

The format of a definition line is explained below. In addition, Figure 4-2 illustrates the definition line format for a defined entry; the format for the remaining three entries (undefined, index and macro) is also shown in the same illustration. (A sample listing appears in Figure 4-4.)

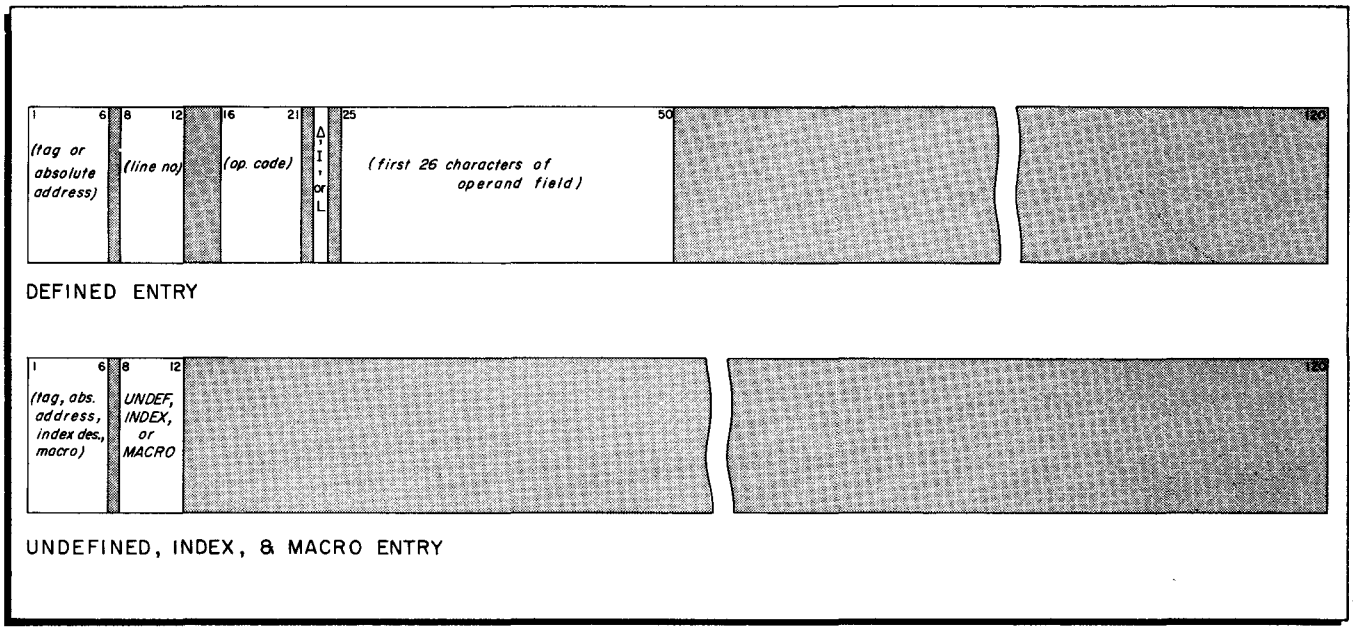


Figure 4-2. Definition Line

Print Positions

1-6: Contain the "name" (i.e., the tag, absolute address, index designator, or macro name) for this group.

8-12: Contain one of the following:

a. For defined entries: The line number of the instruction whose location field contains the name listed in print positions 1-6.

b. For undefined entries: UNDEF.

c. For index entries: INDEX

d. For macro entries: MACRO

16-21: Contain one of the following:

a. For defined entries: The op code of the instruction whose line number appears in positions 8-12.

b. For all other entries: blank.

23: Contains one of the following:

a. For defined entries: The first 26 characters of the operand field of the instruction whose line number appears in positions 8-12.

b. For all other entries: blank.

25-50: Contain one of the following:

a. For defined entries: The first 26 characters of the operand field of the instruction whose line number appears in positions 8-12.

b. For all other entries: blank

Reference Line

Following the definition line(s), any number of reference lines may appear in the Analyzer C listing. Each reference line describes one or two references to the "name" listed on the definition line. A line of blanks is printed after the last reference line to separate the current group from the definition line for the next group.

The format of a reference line is illustrated in Figure 4-3 and described below. (See also the sample listing in Figure 4-4.)

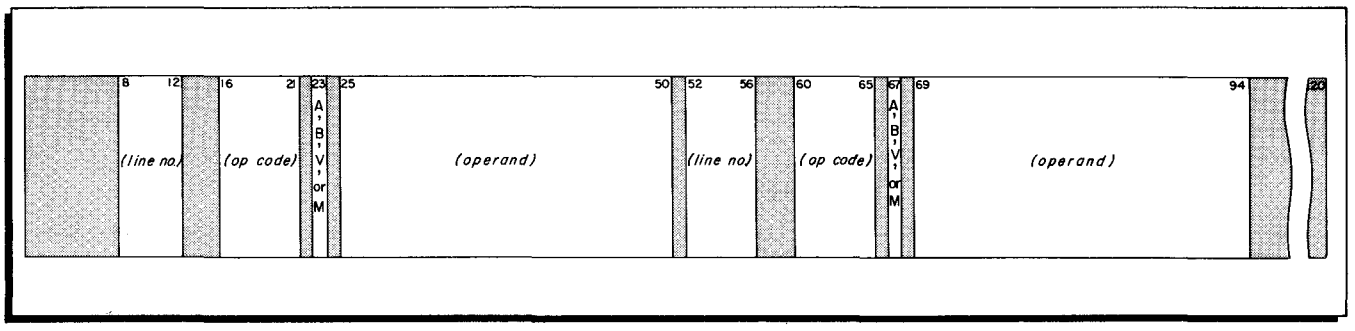


Figure 4-3. Reference Line

Print Positions

8-12: Contain the line number of an instruction which references this name.

16-21: Contain the op code of the referencing instruction.

```
BRDECK          PAGE 003          12/21/64

 TAG    LINE NO OPCODE F OPERAND                          LINE NO OPCODE F OPERAND

CBR     01440   DSA     I CBUF1+X4
        01330   MCW     B CBR+AM-1                        01340   SST     B CBR
        01370   EXM     B (CBR)                           03450   MCW     B (CBR)

CBUF1   01120   DA,     I 1X80,R
        01430   DSA     A CBUF1+X3                        01440   DSA     A CBUF1+X4

CBUF2   01140           2
        01460   DSA     A CBUF2+X3

CBUF3   01160           2
        01450   DSA     A CBUF3+X3

CDERR   00730   PCB       *,
        01540   B       A CDERR                           02580   BCE     A CDERR
        02610   BCE     A CDERR                           03770   B       A CDERR

CKCC    03200   BCC       ANLZ,           BUFF+X1,
        04020   B       A CKCC

CRD     00560   CEQU      =2C5141
        01530   PDT     V CRD                             01830   PDT     V CRD

CRDBY   00570   CEQU      =3C004110
        00730   PCB     V CRDBY

CRDHC   00580   CEQU      =3C004141
        00740   PCB     V CRDHC

CRDIP   00590   CEQU      =3C004142
        00750   PCB     V CRDIP

DIR     00360   EQU       106
        02340   MCW     B DIR

DIREC   01060           1,3
        01810   MCW     A DIREC

DIRTST  02560   C         RELOC,          :POS:
DRIVE   00330   EQU       76
        01690   SST     B DRIVE                           01700   SST     A DRIVE
        02290   SST     A DRIVE

ENTRNC  00400   EQU       130
        02430   B       A ENTRNC

EQ      00490   CEQU      =1C42
        02010   B       V EQ

F0      00340   EQU       86
        02010   B .     A F0
```

Figure 4-4. Sample Analyzer C Listing

23: Contains one of the following:

A: The reference occurred in the A operand.

B: The reference occurred in the B operand.

V: The reference ocurred in the variant field.

M: The reference is to a macro routine.

25-50: If position 23 contains the letter A, B, or V, positions 25-50 contain the corresponding operand. (Only the first 26 characters of the operand are printed.) If position 23 contains the letter M, the first 26 characters of the operand field of the macro instruction are contained in positions 25-50.

If a second reference is to be made to the "name" defined in the definition line, print positions 52 through 94 contain the following:

Print Positions

52-56: Contain the same format as print positions 8-12.

60-65: Contain the same format as positions 16-21.

67: Contain the same format as position 23.

69-94: Contain the same format as positions 25-50.

SECTION V

ANALYZER C OPERATING PROCEDURES

Analyzer C, which has the loading unit name of AAJANA01, can be loaded using Tape Loader-Monitor C, Floating Tape Loader-Monitor C, or the Card Loader-Monitor B. All methods of loading are described below.

LOADING WITH TAPE LOADER-MONITOR C OR FLOATING TAPE LOADER-MONITOR C

If Tape Loader-Monitor C or Floating Tape Loader-Monitor C is used, it is located on a binary run tape (BRT) which must also contain the two Analyzer C segments and Tape Sort C (AADS2Δ). Although the two Analyzer C segments and Tape Sort C are stored on the BRT (program tape) as separate loading units, instructions in the Analyzer C program provide automatic operation (via program calls) after the first segment of Analyzer C is loaded and started. However, to have automatic operation and to avoid "not found" halts, Tape Sort C must precede the Analyzer C segments on the program tape.

The procedures for setting up the various peripheral devices are described below. Note that in all cases the devices must be set up according to the values specified by the Equipment Configuration Descriptor.

1. Mount the program tape on the tape drive designated as logical 0. Set the PERMIT-PROTECT switch to PROTECT.
2. Mount the work tapes insuring that the "write-enable rings" are inserted and that the PERMIT-PROTECT switches are set to PERMIT.
3. Initialize the printer.
4. If cards are to be read, they should be placed in the card reader at this time. If the Console Call information has been punched on a card (as described below), this card should be placed into the card reader immediately preceding the Equipment Configuration Descriptor card. If an ECD card is not used, the Console Call card should precede the system header card. Initialize the card reader.

   NOTE: If the card reader is not to be used, omit this step and proceed to step 5.
5. If paper tape input is employed, mount this tape on the paper tape reader. Initialize the paper tape reader.

   NOTE: If the paper tape reader is not to be used, omit this step and proceed to step 6.
6. If the file to be processed is located on magnetic tape (i.e., either a symbolic program tape or a card-image tape), this tape should now be mounted. Insure that the PERMIT-PROTECT switch is in the PROTECT position.

7. Press the INITIALIZE button. (This action causes the resetting and/or clearing of the central processor registers necessary for the operation.)

Following these initial setup procedures, the Loader-Monitor is bootstrapped and used to load Analyzer C, as described in the bulletin PLUS — Tape Loader-Monitor, DSI-327, or Floating Tape Loader-Monitor C and Interrupt Control D, File No. 122.5005.001C.00.00.

Console Call Card

The Analyzer C Console Call card is described below and illustrated in Figure 5-1. Note that the contents of this card may optionally be entered from the control panel or console typewriter.

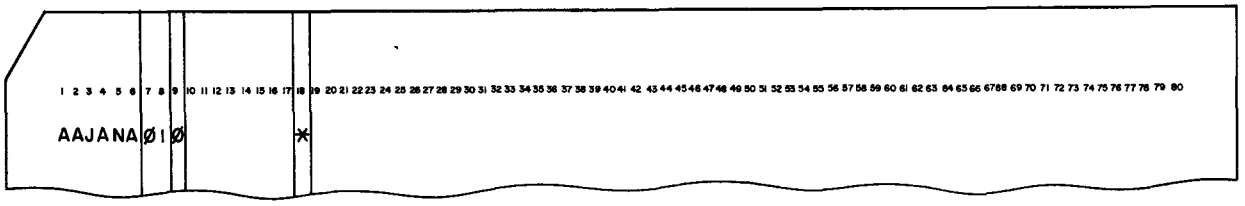


Figure 5-1. Console Call Card for Analyzer C

Columns 1-6:	Contain the program name - AAJANA
Columns 7-8:	Contain the segment name - 01
Column 9:	Contains the logical number of the tape drive (0) from which Analyzer C is to be loaded
Columns 10-17:	May contain the loading unit name (AAJANA01) to cause a halt after Analyzer C is loaded; otherwise, these columns are blank
Column 18:	Contains an asterisk (*) to identify the Console Call card
Columns 19-80:	Not used

LOADING WITH CARD LOADER-MONITOR B

If Card Loader-Monitor B is employed, it is used in conjunction with the two Analyzer C segments and Tape Sort C (AADS2Δ). The procedures for setting up the various peripheral devices are described below. Note that in all cases the devices must be set up according to the values specified on the Equipment Configuration Descriptor.

1. Mount the work tapes, insuring that the "write-enable rings" are inserted and that the PERMIT-PROTECT switches are set to PERMIT.
2. Initialize the printer.
3. Place the self-loading deck containing Card Loader-Monitor B in the card reader. Arrange the two Analyzer C segments, Tape Sort C and any input

cards in the following order, placing these cards into the reader immediately after Card Loader-Monitor B.

AAJANA01

Input cards (if any)

AADS2Δ

AAJANA02

NOTE: Optionally, the Analyzer C segments, input cards, and Tape Sort C may be placed in the card reader following the 17002 halt of Card Loader-Monitor B.

Initialize the card reader.

4. If paper tape input is employed, mount this tape on the paper tape reader. Initialize the paper tape reader.

   NOTE: If the paper tape reader is not to be used, omit this step and proceed to step 5.

5. If the file to be processed is located on magnetic tape (i.e., either a symbolic program tape or a card-image tape), this tape should now be mounted. Insure that the PERMIT-PROTECT switch is in the PROTECT position.

6. Depress the INITIALIZE button. (This action causes the resetting and/or clearing of the central processor registers necessary for the operation.)

Following these initial setup procedures, the Loader-Monitor is bootstrapped and used to load Analyzer C, as described in the software bulletin Card Loader-Monitor B, File No. 122.5105.040B.00.00.

ERROR CONDITIONS

For all halts, the B-address register (which indicates the reason for the halt) should be displayed first. In some cases, the A-address register contains supplementary information. The Analyzer C error conditions are listed in Table 5-1, below. For the error conditions associated with the Tape Sort C and Collate C, File No. 122.6005.021C.00.01.

If Analyzer C is using the control panel, the following conditions occur:

1. Analyzer C halts.
2. Displaying the B address gives the reason for the halt.
3. If the run is to be continued, the RUN button is pressed.

If Analyzer C is using the console typewriter, the following conditions occur:

1. The console warning bell rings.
2. The error message is typed.
3. The TYPE light is illuminated.
4. Analyzer C stalls.
5. If the run is to be continued, the G key is pressed.

Table 5-1. Analyzer C Error Conditions

Contents of B-Address Register	Console Typewriter Message	Cause and Action
07025	: 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 in the ECD field of 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 in the ECD field of the Loader communication area, the ECD field (locations 227-232$_8$) 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.
04010	: NO SYSTEM HEADER ⊔	The System Header of an input file was not found. Mount correct input (card, card-image tape, paper tape, or SPT), and restart the run.
04021	: PROG nnnnnn NOT FOUND ⊔ (nnnnnn= program name)	The program named on the Analyzer C director card was not found in the input file. If no console typewriter is present, the name of the missing program can be found by displaying the contents of the A-address register The program name is in six locations beginning with the address displayed. Continue the run to complete the analysis of the previous programs.
0culd	: RD ER cu d ⊔	If "cu" is the number of a tape control unit, an uncorrectable read error has occurred on tape "d" 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.
0cull	: RD ER cu l ⊔	If "cu" is the control unit number 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.

Table 5-1 (cont). Analyzer C Error Conditions

Contents of B-Address Register	Console Typewriter Message	Cause and Action
0cu11 (cont)		3. Place the cards from the runout hopper back into the remaining input cards. Continue the run.
0cu12	: RD ER cu 2 ⊐	If "cu" is the control unit number 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. NOTE: The first card in the runout hopper must be corrected to remove the illegal punch.
0cu2d	: WR ER cu d ⊐	If "cu" is the number of a tape control, an uncorrectable write error has occurred on tape d 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.
0cu3d	: END cu d ⊐	If "cu" is the number of a tape control unit, end of tape has been reached on output tape "d". The amount of input must be reduced and the run must be restarted from the beginning.
0cu10	: RD ER cu 0 ⊐	If "cu" is the number of the paper tape control unit, 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 analyzed.)
0cu7d	: PRINT cu d ⊐	If "cu" is the number of a tape control, the print routine has determined there is no printing "stacked" on the print tape on drive "d". This halt or message occurs only when an off-line print tape has been specified in the Equipment Configuration Director. 1. If the information on the tape is not to be preserved, continue the run. The Analyzer C listing will be written on the tape. 2. If the tape is to be saved, replace it with a work tape and continue the run. The Analyzer C listing will be written on this tape.

APPENDIX A
OPTIONS AVAILABLE WITH PAPER TAPE

Analyzer C may be reassembled to allow for various modifications of paper tape input. These modifications are described below.

PARITY CHECK

The Analyzer C constant tagged CINTY has a standard value of #1C77 (the 77 means no parity checking). If even parity checking is desired, this constant should be changed to #1C00; for odd parity, the constant should be changed to #1C04.

PUNCTUATION

All internal codes are word marked and the control characters are record marked.

SIX LEVEL TAPE

To read six data channels (not including parity) using a single, non-standard translation table, the 64-character table beginning at the location tagged CINTT must be changed. The revised translation table must not include a control frame indicator for "switch tables" (35_8 with an item mark), and the data channels must always be punched as the low-order six channels on the paper tape. Parity may be punched in either channel 7 or channel 8. (The tape may be 7/8-inch or 1-inch wide.)

SIX-LEVEL TAPE WITH TWO TRANSLATION TABLES

It may at times be desired to read six data channels (not including parity) using two translation tables (so that a paper tape frame may have two different meanings depending on which translation table is being used). To accomplish this operation, the first (lower-case) translation table should be set up as a 64-character table beginning at the location tagged CINTT, while the second (upper-case) translation table should be set up as a 64-character table beginning at the location tagged CINTR.

The data channels must always be punched as the low-order six channels on the paper tape, and parity may be punched in either the seventh channel or eighth channel. (The tape may be 7/8-inch or 1-inch wide.)

SEVEN-LEVEL TAPE

To read seven data channels (not including parity) the Analyzer C constant tagged CINMK should be changed (from its standard value of #1C00) to #1C01. In addition, the 64-character translation table must be expanded to 128 characters. This latter operation should be performed by (1) modifying the table beginning at location CINTY to contain the internal codes corresponding

to paper tape frames between 000_8 and 077_8; and (2) inserting the internal codes corresponding to paper tape frames between 100_8 and 177_8 (starting at the location tagged CINTR). The resulting 128-character translation table must not include a control frame indicator for "switch tables" (35_8 with an item mark).

The data channels must always be punched as the low-order seven channels on the paper tape, and parity may be punched in channel eight. (The tape may be 7/8-inch or 1-inch wide.)

FIVE-LEVEL TAPE

It may occasionally be desired to read five data channels (not including parity) using two translation tables (so that a paper tape frame may have two different meanings depending on which translation table is being used). To accomplish this operation, the first (lower-case) translation table should be set up as a 32-character table beginning at the location tagged CINTT, while the second (upper-case) translation table should be set up as a 32-character table beginning at the location tagged CINTR. Following this, the 32-character table starting as CINTT should be repeated starting at location CINTT+32, and the 32-character table starting at CINTR should be repeated starting at location CINTR+32.

The data channels must always be punched as the low-order five channels on the paper tape, and parity may be punched in the sixth, seventh, or eighth channel. (The tape may be 11/16-inch, 7/8-inch or 1-inch wide.)

APPENDIX B

PROCEDURE FOR CHANGING STANDARD EQUIPMENT CONFIGURATIONS

Although the standard configurations have been chosen to accommodate the majority of users, there will be occasions when it becomes desirable to change them. For example they must be changed to allow Analyzer C to accept paper tape input or to type messages on the console.

Each of the ten standard configurations is represented in a segment of Analyzer C by an 80-character ECD area. The contents of this area correspond exactly to the ECD card-image described in Section III as method #3 (full ECD). The leftmost character of each ECD area is tagged ECDn, where n is the number of the standard configuration corresponding to that ECD image. Figure B-1 illustrates the ECD areas for Analyzer C configurations 5 and 7.

1. To allow Analyzer C, or any system program, to use a console typewriter, change the Console Device field of each ECD area to:

   DC @5u0@ CONSOLE DEVICE

   where u is the address of the typewriter control.

2. To allow input to read from the paper tape reader, change the Card Input Device field to:

   DC @Lu0@ CARD INPUT DEVICE

   where u is the address of the paper tape reader control.

EASYCODER
CODING FORM

PROBLEM _____ PROGRAMMER _____ DATE _____ PAGE ____ OF ____

	CARD NUMBER	TYPE	MARK	LOCATION	OPERATION CODE	OPERANDS	
	1 2 3 4 5	6	7	8 14	15 20	21 62	63 80
1				ΔECD7	DC	@ΔΔΔΔΔEΔ@	
2					DC	#3C51,5253 RWC ASSIGNMENT	
3					DC	@ΔΔΔΔΔØØΔ@	
4					DC	@Ø2@ HIGHEST BANK AVAILABLE	
5					DC	@1ØØ@ LOADING DEVICE	
6					DC	@2ØØ@ CONSOLE DEVICE	
7					DC	@JJØ@ CARD INPUT DEVICE	
8					DC	@-2Ø@ LISTING	
9					DC	@ΔΔΔ@ NOT USED	
10					DC	@1Ø3@ FILE 1: INPUT SPT	
11					DC	@ΔΔΔ@ FILE 2: NOT USED	
12					DC	@ΔΔΔ@ FILE 3: NOT USED	
13					DC	@ΔΔΔ@ FILE 4: NOT USED	
14					DC	@1Ø2@ FILE 5: WORK TAPE	
15					DC	@1Ø4@ FILE 6: WORK TAPE	
16					DC	@1Ø6@ FILE 7: WORK TAPE	
17					DC	@ΔΔΔ@ FILE 8: NOT USED	
18			L		DCW	#1CØØ	

Figure B-1. Coding for Analyzer C Standard Configurations 5 and 7

HONEYWELL EDP TECHNICAL PUBLICATIONS
USERS' REMARKS FORM

TITLE: SERIES 200 ANALYZER C

DATED: November 15, 1965

FILE NO: 122.2305.001C.0-019

ERRORS NOTED:

Fold

SUGGESTIONS FOR IMPROVEMENT:

Fold

FROM: NAME _____ DATE _____

COMPANY _____

TITLE _____

ADDRESS _____

_____

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