IBM

IBM 5110
Language Support
Maintenance Information Manual

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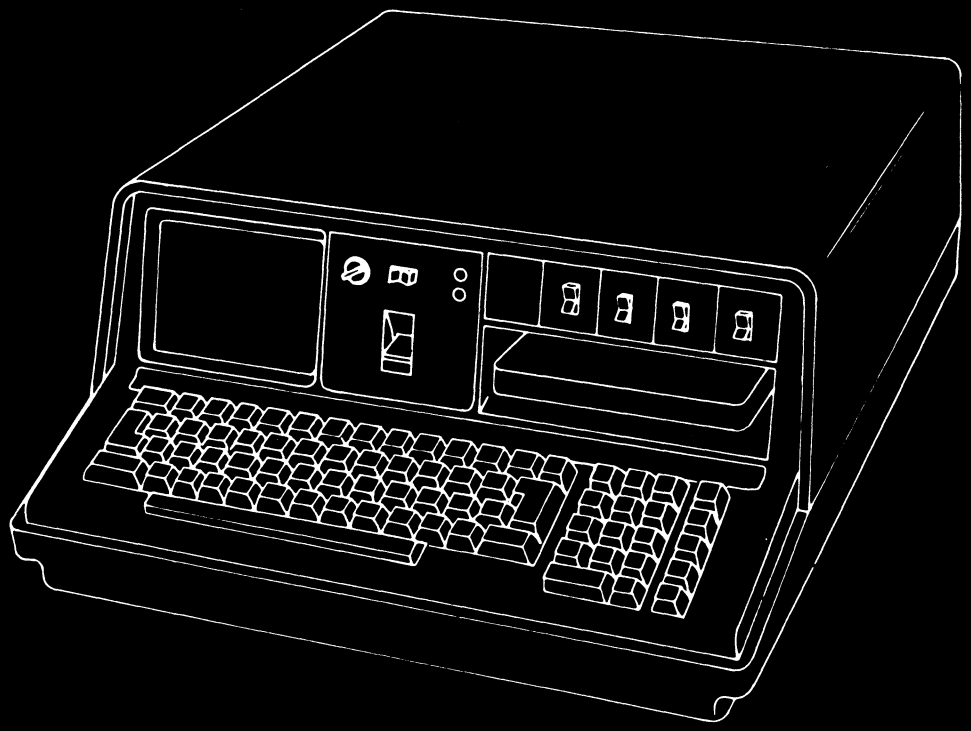

IBM 5110
Language Support
Maintenance Information Manual

SY31-0581-0

Preface

This manual is intended to be used by IBM 5110 service personnel who have problem determination as part of their maintenance responsibility. Service personnel are assumed to have completed the 5110 training course, and to have knowledge of the BASIC language and some familiarity with APL. This manual reviews some diagnostic techniques for locating errors in user's code and contains procedures for reporting problems.

Related Publications

- *IBM 5110 APL Reference Manual*, SA21-9303
- *IBM 5110 APL Reference Card*, GX21-9304
- *IBM 5110 BASIC Reference Manual*, SA21-9308
- *IBM 5110 BASIC Reference Card*, GX21-9309
- *IBM 5110 Computer Maintenance Information Manual*, SY31-0550
- *IBM 5110 Customer Support Functions Reference Manual*, SA21-9311

First Edition (January 1978)

Changes are continually made to the information herein; any such changes will be reported in subsequent revisions or technical newsletters.

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Manual Organization

The first section of this manual presents a review of the language diagnostic tools that are most frequently needed in locating problems in a user's program or user-defined function. The information contained in this section is extracted and condensed from the *IBM 5110 BASIC Reference Manual* and the *IBM 5110 APL Reference Manual* and is not intended to replace any part of either of these manuals.

The second and third sections describe IMF procedures and the use of the microcode trouble report form.

The fourth section of this manual offers hints about recovering data from tape and diskette when normal operation results in media error messages.

The appendix contains charts of the graphics for the IBM 5110 and code translation tables for the character codes used in the IBM 5110.

If the user's program (BASIC) or the user-defined function (APL) fails to yield the expected results, and the system diagnostics run correctly, suspect a logic error in the user's statements. Have the user demonstrate the failure and explain the expected result to you. If an error message is displayed, consult the appropriate language reference manual, *IBM 5110 BASIC Reference Manual* or *IBM 5110 APL Reference Manual.* If the program or function stops, hangs in a loop, or produces incorrect output, you will need to use some of the diagnostic tools that are reviewed in the following charts.

The charts are organized in task/action and question/answer format. When a task or a question applies to both APL and BASIC, actions for both APL and BASIC are specified. When appropriate, examples are provided for quick reference. In examples that require the name of an APL user-defined function, HOWTO has been used as the function name. Replace HOWTO with the name of the customer's user-defined function.

BASIC AND APL

Clear read/write storage.

BASIC	APL
Enter LOAD 0	Enter)CLEAR
and press EXECUTE.	and press EXECUTE
Only IMFs and feature programs remain in read/write storage.	Only IMFs and feature programs remain in read/write storage.

Load stored programs or user-defined functions and/or variables into read/write storage.

BASIC	APL
Use the LOAD command.	Use the)LOAD command.

Copy stored programs or user-defined functions and/or variables into read/write storage.

BASIC	APL
Use the MERGE command. This command merges by statement number. The program loaded with the MERGE command will not overlay a program that already exists in read/write storage unless the statement numbers already in read/write storage are the same as the resultant statement numbers being merged.	Use the)COPY command or the)PCOPY command. The)PCOPY command will not overlay a function or a variable of the same name that already exists in the active workspace.

Write the contents of read/write storage on tape or diskette.

BASIC	APL
Use the SAVE command.	Use the)SAVE command or the)CONTINUE command. You can continue, but cannot save, an active workspace that contains a suspended function.

Print a listing of the user's program or user-defined function.

BASIC	APL
Enter LIST PRINT	Enter ∇HOWTO[⎕]∇
and press EXECUTE.	and press EXECUTE.
To display a listing, omit the print parameter.	If nothing prints, although the listing is displayed, enter)OUTSEL ALL
	and press EXECUTE. Then reenter the above.

Turn on program trace or function trace.

BASIC

Enter `RUN TRACE,PRINT`

and press EXECUTE,

or

enter `GO TRACE`

and press EXECUTE.

APL

To activate trace for steps 4, 5, 6, and 7,

enter `TΔHOWTO←4 5 6 7`

and press EXECUTE.

To trace all of the steps that are executed in the first seven steps,

enter `TΔHOWTO←⍳7`

and press EXECUTE. Then enter the function name and arguments (if required), and press EXECUTE to start execution of the function.

Stop program trace or function trace.

BASIC

Enter `GO RUN`

and press EXECUTE,

or

enter `GO STEP`

and press EXECUTE.

APL

Enter `TΔHOWTO←⍳0`

and press EXECUTE.

Suspend execution of a program or a function.

BASIC

To stop after statement 0030 and before statement 0040,

enter `0035 PAUSE`

and press EXECUTE.

To stop after executing each statement,

enter `RUN STEP`

and press EXECUTE.

or

enter `GO STEP`

and press EXECUTE.

To stop anywhere in the program,

press ATTN.

APL

To stop before statement 3 and before statement 5, use stop control.

Enter `SAHOWTO←3 5`

and press EXECUTE.

To stop anywhere within an executing function,

press ATTN.

If the cursor is at the leftmost position of line 1 of the display screen, or is on a line that already contains text, the system is probably asking for alphabetic input (quad quote input). Escape by entering the out character (⍬).

If the cursor is on a line following a quad colon (⍞:), the system is asking for numeric input. Escape by entering a right arrow (→).

If the system is in shared variable display mode, the cursor can be positioned anywhere on the screen. To escape from this condition, press EXECUTE and then press ATTN.

Leaving a program or function suspended can make a tape output file or a diskette output file unusable.

Resume execution of a suspended program or a suspended function.

BASIC

Press EXECUTE

or

enter GO

and press EXECUTE.

or

enter GO 0060

and press EXECUTE.

APL

Enter →⎕LC

and press EXECUTE.

To resume function execution with statement 13,

enter →13

and press EXECUTE.

End controlled program suspension or function stop control.

BASIC

If the program suspension is due to a PAUSE statement, delete the PAUSE statement. If the program suspension is due to the program executing in step mode,

enter GO RUN

and press EXECUTE,

or

enter GO TRACE

and press EXECUTE.

APL

Enter SΔHOWTO←⍳0

and press EXECUTE.

Replace a statement in a program or a function.

BASIC

To replace statement 0040 with a statement that assigns the value 653 to Z,

enter 0040 LET Z=653

and press EXECUTE.

APL

To replace statement 4 with a statement that assigns the value 653 to Z,

enter ∇HOWTO[4]Z←653∇

and press EXECUTE.

Insert a statement in a program or a function.

BASIC

To insert a statement between step 0060 and step 0070,

enter `0065`

followed by the new statement, and press EXECUTE.

APL

To insert a statement between step 6 and step 7,

enter `∇HOWTO[6.1]`

followed by the new statement.

Then enter `∇`

and press EXECUTE.

Renumbering of statements is automatic. Any branch to a line number that follows the inserted statement should be corrected. Always branch to a label.

Delete a statement from a program or a function.

BASIC

To delete statement 0045,

enter `0045 DEL`

and press EXECUTE.

To delete all statements from 0045 through 0090,

enter `0045 DEL 0090`

and press EXECUTE.

APL

To delete statement 4,

enter `∇HOWTO[4]∇`

and press EXECUTE.

The system then displays statement 4. Verify that the displayed statement is the one to be deleted.

Press ATTN.

Then press EXECUTE.

Then enter `∇`

and press EXECUTE to close the function.

Because renumbering is automatic, display the statement to be deleted to be sure it is the right one. Avoid branches to a line number. Branch to a label rather than to a line number.

Display intermediate results of a complex operation.

BASIC

Insert PAUSE statements. While program execution is suspended, you can display the variables by entering the variable names and pressing EXECUTE.

or

Insert PRINT statements to display the variables.

or

Break a complex statement into several shorter statements. Choose any variable names that you introduce carefully to avoid changing the value of an existing variable. Also, be aware of the hierarchy of BASIC arithmetic operators.

APL

Suspend the user-defined function between successive lines in the complex operation. While execution of the function is suspended, you can display the variables by entering the variable names and pressing EXECUTE.

or

If the complex operation is specified in a single statement, break the operation into shorter statements. Insert the shorter statements following the original statement, and then delete the

or

Replace the complex statement with []← embedded in the statement to display the results you need. The results are displayed in the order of execution. The values displayed are the results of the operations to the right of the []← characters.

```
      155+[]←([]←40÷8)×[]←3+4
7
5
35
190
```

What is the hierarchy or order of execution of operators?

BASIC

Arithmetic expressions are evaluated according to the hierarchy of the operators involved. Operations enclosed in parentheses are performed first. Operations with a higher priority level are performed before those with a lower priority level. Operations at the same priority level are performed from left to right. The hierarchy of the operators is:

Operator	Hierarchy
1. Enclosed in parentheses	Highest
2. ↑ or **	
3. Positive (+) and negative (-)	
4. * and /	
5. Addition (+) and subtraction (-)	Lowest

APL

APL expressions are evaluated from right to left until a right parentheses is encountered. The expression enclosed in parentheses is then evaluated from right to left.

APL ONLY

Erase global objects (user-defined functions or variables) from active workspace.

Use the)ERASE command.

Replace the active workspace with a stored workspace.

Use the)LOAD command.

Change the number of symbols allowed in the active workspace.

Use the)SYMBOLS command. See the *APL Reference Manual* for the required procedure.

Change the active workspace ID.

Use the)WSID command.

Display the names of the user-defined functions in active workspace.

Enter)FNS and press EXECUTE.

Display the names of global variables in active workspace.

Enter)VARS and press EXECUTE.

Display the state indicator.

Enter)SI and press EXECUTE. The display lists the suspended and pendent functions in reverse order of occurrence (last, first). The line number of the last statement executed in a pendent function is displayed, and the line numbers of the next statement to be executed in a suspended function is displayed. An asterisk flags suspended functions.

Display the state indicator and the names of the local variables in each suspended or pendent function.

Enter)SINL and press EXECUTE. Except for the addition of the names of local objects (functions, variables, and labels), this display is identical to that in response to the)SI command.

Display the number of symbols allowed in active workspace and the number of symbols currently in use.

Enter)SYMBOLS and press EXECUTE.

Display the number of unused bytes in active workspace.

Enter ⎕WA and press EXECUTE.

Display the number of the next statement to be executed in a suspended function.

Enter ⎕LC and press EXECUTE.

Expunge (erase) a user-defined function or a global variable.

Enter)ERASE 'name' and press EXECUTE. (If a suspended or pendent function in the active workspace has a local object with the same name as the global variable, the global variable cannot be accessed or expunged. An attempt to expunge the global object, or to assign a new value to the global variable, results in action on the local variable in the previously suspended function.)

Load a continued file into active workspace (written with a)CONTINUE command).

Use the)RESUME command if you want to have the same I/O active as when the workspace was continued. Otherwise, use)LOAD.

Verify that a name is available for use as a global variable name.

List the function that is to contain the name to ensure that the name is not specified in the function header as a local variable. Then enter ⎕NC 'NAME' and press EXECUTE. If the result 0 is displayed, enter)VARS NAME. If the first name in the resulting display response is not the name entered, then enter)FNS NAME. If the first name returned in the resulting display is again not the name entered, the name is available for use as a global name.

An IMF (internal machine fix) provides a solution to a specific code problem in read-only storage (ROS) including executable ROS. If a system application fails and an MTR (microcode trouble report) is submitted, plant personnel analyze the problem, and if required, an IMF is generated and distributed.

IMFs, if any, are contained in a separate IMF tape cartridge or diskette, which is supplied to the customer as IMFs are developed. Before it can be used, an IMF must be loaded into read/write storage. You can load IMFs by using the loader program, which is contained in file 1 of the customer support tape or diskette.

LOADER PROGRAM

The loader program allows you to add new IMFs to an IMF tape or diskette, to load a needed IMF into the system and then return to APL or BASIC, or to copy the IMFs to another tape or diskette. Another option allows you to display the EC level of the ROS modules in the system. (The EC levels of executable ROS are not displayed.) Use the LINK command (BASIC) or the)LINK command (APL) to load the loader program.

To load the loader program:

Insert the customer support tape or diskette into tape drive 1 or diskette drive 1.

Enter one of the following:

)LINK 1001	for tape and APL
)LINK 11001	for diskette and APL
LINK 1,E80	for tape and BASIC
LINK 1,D80	for diskette and BASIC

Then press EXECUTE.

After the loader program is loaded, the following prompt is displayed:

```
LOADER FUNCTION

OPTIONS:

     1. LOAD FROM TAPE
     2. LOAD FROM DISKETTE

ENTER OPTION NUMBER AND PRESS EXECUTE
```

Enter 1 if you loaded from tape, or enter 2 if you loaded from diskette. Leave the IBM-supplied customer support media inserted and press EXECUTE.

The next message is a prompt for drive number and for file number. Respond to this prompt with 1 for drive number and with 11 for file number. (File 11 of the IBM-supplied customer support tape or diskette is the IMF file. The file name is IMF.)

If another tape or diskette containing IMFs is to be used, insert that media and respond to the loader program prompts accordingly.

The loader program checks for file type 19 (decimal) and then displays the IMF option list below:

```
ENTER OPTION NO.
1. DISPLAY EC'S
2. COPY IMF'S
3. LOAD IMF'S
4. KEY ENTER IMF
5. END OF JOB
```

LOAD IMFS

If you want to load IMFs, select option 3. The system prompts for the IMF file number with one of the following messages displayed:

```
ENTER FILE NUMBER        or        ENTER FILE NAME OR NUMBER
```

(tape) (diskette)

Enter the file number and press EXECUTE. Depending on the system (APL or BASIC), one of the following options lists is displayed:

```
ALL IMF'S ARE CLEARED                ALL IMF'S ARE CLEARED
LOAD IS FOR THIS SYSTEM              LOAD IS FOR THIS SYSTEM
ENTER LOAD OPTION NUMBER     or      ENTER LOAD OPTION NUMBER
1. LOAD ALL BASIC IMF'S              1. LOAD ALL APL IMF'S
2. LOAD IMF'S BY PROB #              2. LOAD IMF'S BY PROB #
3. DISPLAY IMF PROBID'S              3. DISPLAY IMF PROBID'S
```

When you select option 3, the next display is in the format shown below (if there are any problem IDs).

```
PROBID  PROBID  PROBID  PROBID  PROBID  PROBID  PROBID  PROBID
0001

PRESS EXECUTE TO CONTINUE
```

When you press EXECUTE, the system returns the previous option list to the display. If you choose to load IMFs by problem number (option 2), you are prompted for the four-digit problem number as shown below.

```
ENTER 4-DIGIT PROB # OR ENTER 0000 TO STOP
```

If you attempt to load an IMF that does not apply to the system, the following message is displayed.

```
LOAD ERROR 482
```

After you have loaded the IMFs that you need, enter 0000 in response to the prompt. The system then returns the following display:

```
ENTER 0 TO STOP OR 1 TO LOAD ANOTHER FEATURE
```

Enter 0, and the system returns to BASIC or APL, ready for use.

COPY IMFS

There are five ways you can copy IMFs to a tape or diskette. Select option 2 when the initial option list is displayed. The program responds with the following display.

```
ENTER FILE NUMBER      or      ENTER FILE NAME OR NUMBER
      (tape)                          (diskette)
```

Enter the IMF file number to be copied and press EXECUTE. The system next prompts for the new file ID and number as shown below:

```
ID OF IMF OUTPUT FILE
```

Respond to the prompt. The next display is the copy option table shown below:

```
ENTER SELECTED COPY OPTION NUMBER
1. COPY ALL IMF'S FOR XXXXX
2. COPY ALL XXXXX IMF'S FOR THIS SYSTEM
3. COPY IMF'S BY PROBLEM NUMBER
4. COPY XXXXX IMF'S BY PROB # FOR SYSTEM
5. COPY ALL APL,BASIC IMF'S FOR SYSTEM
```

Note: If the system is APL, XXXXX is replaced by APL. Likewise, if the system is BASIC, XXXXX is replaced by BASIC.

Choose the option you need and follow the prompting messages.

KEY-ENTER IMF

By choosing option 4 in the initial display, you are allowed to enter an IMF with the keyboard. The system prompts for the IMF file number as shown:

```
ENTER FILE NUMBER      or      ENTER FILE NAME OR NUMBER
    (tape)                            (diskette)
```

Enter the IMF file number and press EXECUTE. The system returns the following instructions:

```
ENTER IMF. EACH LINE EXCEPT THE LAST MUST BE FULL.
PRESS EXECUTE AT THE END OF EACH LINE.
```

When you have finished entering the IMF, it is written to tape or diskette. The IMF can then be loaded into the system.

DISPLAY ECS

You can display the EC level of the ROS modules in the system by using the *loader program on the customer support* tape or diskette. Follow this procedure:

1. Load the loader program. (Follow the instruction in *Loader Program* in this section.)

2. Select option 1 in the IMF option list that displays.

The following illustration shows the format of the resulting display:

```
MOD EC   MOD EC   MOD EC   MOD EC   MOD EC   MOD EC   MOD EC   MOD EC
10  00   12  00   12  00   13  00   14  00   15  00   16  00   17  00
18  00   19  00   1A  00   1B  00   2F  A6   10  0A   F6  AA   1A  2A
B4  C3   D9  82   3F  A2   E1  E2   10  00   11  00   12  00   13  00
14  00   15  00   16  00   17  00   18  00   19  00   1A  00   1B  00
40  00   41  00
```

If you want a printed copy of the module EC levels, use the COPY DISPLAY function.

END OF JOB

When you select option 5, end of job, the program returns the system to the loader, and the following prompt is displayed:

```
ENTER 0 TO STOP OR 1 TO LOAD ANOTHER FEATURE
```

Enter 0, and the system returns to BASIC or APL, ready for use.

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The microcode trouble report (MTR), form number Z150-0038, provides a uniform notification procedure for reporting problems encountered in IBM microcode functions. The MTR form should be submitted to report:

- System errors when no cause can be found
- Incorrect results from verified correct procedures, for which there is no explanation or circumvention
- Incorrect results from verified correct procedures, for which there is circumvention

THE MTR FORM

The following is a copy of the MTR form and an explanation of the information required in the report.

IBM

MICROCODE TROUBLE REPORT

M T R

INTERNAL USE ONLY

PREASSIGNED MTR SERIAL #

Ⓐ CUSTOMER NAME

Ⓑ CUSTOMER NO.

Ⓒ CUSTOMER MAILING ADDRESS

Ⓙ MTR SUBMITTED MO. DAY YR.

MTR IDENTITY

Ⓚ SEVERITY CODE 1 2 3 4

ASSIGNED BY MTR CONTROL

Ⓛ TYPE OF APPLICATION

Ⓜ CPU	Controller Storage Size	Host Support	Host Support REL Level	Host Sys	Trans Control Unit Type	Trans Control Unit Prog Lev

Ⓝ MICROCODE IN ERROR/SUSPECTED IDENTITY AND L/C LEVEL

ID NUMBER	EC LEVEL	REA/PATCH LEVEL

IBM REPRESENTATIVE — NAME AND ADDRESS

Ⓓ NAME

MAILING ADDRESS

Ⓟ MATERIAL SUBMITTED WITH MTR

MICROCODE STORAGE DUMP		VTOC LIST	
INTERPRETIVE EXEC DUMP		MODULE E/C LEVEL LIST	
DISK DUMP		OPER PANEL INDICATIONS	
CORE MAP		ZAP LIST	
CUST SOURCE OBJECT		NETWORK CONFIGURATION	
TEST DATA		— INCLUDE MODEM TYPE, LINE SPEED, AND TYPE OF LINE (SWITCHED OR LEASED) AT HOST LOCATION	
SYSTEM LOG			
DIAG OUTPUT			

Ⓔ FE REGION | BRANCH OFF NO | Ⓕ WORLD TRADE COUNTRY NO | NAME

Ⓖ ITPS CODE

Ⓗ IBM — BRANCH OFFICE PHONE

OTHER

Ⓠ SPECIAL ACTIVITIES

Ⓡ SYMPTOM / Ⓢ FAILURE KEYWORD

Ⓣ ABSTRACT

Ⓥ Error description text — Note variations between expected and actual output — differences from previous successful runs — suspected problem area — verify EC level of hardware as adequate for microcode — special configuration, teleprocessing, I/O switching, multi-systems, etc. — identify any bypass, circumvention, or relief given.

Mail MTRs to:
IBM Corporation
5110 MTR Dept
Hwy 52 and 37th St. N.W.
Rochester, Mn 55901

DISTRIBUTION: 1,2 — MTR PROCESSING
4 — ORIGINATOR
3 — MTR PROCESSING

Ⓦ SUBMITTERS NAME (Print) AND SIGNATURE

ORIGINATOR IS:

FE	GSD	OTHER

PAGE _____ OF _____

Z150-0038-0 (U/M 025)

Item	Description	Explanation
Ⓐ	Customer name	Enter the full customer name.
Ⓑ	Customer number	This number can be obtained from the territory maintenance analysis (TMA) report or from the sales office orders and movements group.
Ⓒ	Customer mailing address	Use the complete customer mailing address.
Ⓓ	Name and mailing address	Enter the name (not the title) of the person responsible for handling MTR correspondence. Print the address of the branch office where MTR correspondence can be directed. This address is used for any follow-up required to resolve this MTR.
Ⓔ	Location number	Enter the branch office and region number.
Ⓕ	World Trade countries	World Trade country name and country number.
Ⓖ	ITPS	Enter the ITPS (internal teleprocessing system) code for the responsible branch office. This code is listed in the branch office field directory telephone listing.
Ⓗ	Phone number	Branch office phone number or the MTR originator phone number.
Ⓙ	MTR submitted	Enter month/day/year.
Ⓚ	Severity	Four levels (1 through 4) of severity codes are used to reflect the customer engineer's appraisal of the customer's problem. The severity code is used to determine the priority in processing.
	Code 1	Code 1 indicates that the customer is unable to use the microcode or that the problem results in a critical impact on his operations. In either case, an *immediate solution is required.*

Item	Description	Explanation
	Code 2	The user is able to use the microcode, but the operation is severely restricted.
	Code 3	The user is able to use the microcode with a limited function that is not critical to the overall operation.
	Code 4	A circumvention has been found. the MTR is evaluated, and action is taken as dictated by the problem. *Note:* If this block is left blank, severity code 3 is assigned.
Ⓛ	Type of application	Enter the application type: APL BASIC Include the feature name if applicable.
Ⓜ	System type and configur-ation	CPU: Enter 5110. Controller Storage Size: Enter 5110 read/write storage size. Leave remaining boxes blank.
Ⓝ	Microcode in error	Not applicable.
Ⓟ	Materials submitted with the MTR	Materials listed on the MTR that are applicable to the 5110 and any other materials and information that the customer engineer believes will be helpful in the resolution of the problem should be submitted. (See *Collecting Information to Support the MTR.*)
Ⓠ	Special activities	This block is left blank unless special instructions are available for its use.
Ⓡ	Symptom code	AI
Ⓢ	Failure keyword	APL BASIC Feature name
Ⓣ	Abstract	Up to 66 characters and spaces to describe the problem.

Item	Description	Explanation
Ⓥ	Error description text	The problem description should contain three major items: • Conditions required to produce the problem • External logic leading to the failure • Identification of any bypass, circumvention, or relief given *Note:* If additional space is required, use additional MTR forms. Indicate the original customer number and page number on the additional forms. Attach the additional forms to the original form.
Ⓦ	Submitter's name and signature	The person submitting the MTR should print his name above or below his signature.

COLLECTING INFORMATION TO SUPPORT THE MTR

When you submit an MTR, collect as much information about the problem and about the system as possible. A trouble that requires an MTR is usually repeatable, but the problem might require identical conditions.

When you submit an MTR, always send the following information in addition to the information required in the form:

- A dump of lower read/write storage
- A copy of the ROS module EC levels
- A list containing the total system configuration at the time of the trouble
- A tape or diskette copy of the remainder of read/write storage contents at the time of the trouble

With the customer's permission, send a copy of the customer's user-defined function or program. If the trouble is data sensitive, also send a copy of the failing data. Include with the customer's property (the copy of the program or function and data) instructions for the system setup, if appropriate. Also include a description of the intended use or purpose of the failing program or function.

DUMPING LOWER READ/WRITE STORAGE

The first 512 bytes of read/write storage can be dumped only if a printer is available. Do the following:

1. Prepare the printer.

2. Press and hold CMD and press HOLD.

3. Press and hold CMD and press the divide key (/ ÷ on the numeric pad).

The data from the dump reflects the contents of storage at the time of the failure in the event of a system error. (Level 3 registers were used and changed because the keyboard was used to initiate the dump procedure.)

Use the DCP I/O routine to copy the remainder of read/write storage contents. Use hex 0600 for the starting address. Display the contents of hex 00AA for the ending address. See the *IBM 5110 Computer Maintenance Information Manual* for instructions for using the DCP I/O routine.

Several data recovery routines are available to the user in the utilities tape or diskette. See the *IBM 5110 Customer Support Functions Reference Manual* for instructions on the use of these routines. In addition, there are several techniques that you can use to recover information stored on tape or diskette.

If a tape or diskette file is a record-oriented file, and an individual record or a group of records is defective, you can recover the records preceding and following the defective area by referencing them with a READ FILE statement (BASIC). Use the REC= clause to access the records that are not defective.

If the header of a tape file is defective, manually advance the tape beyond the end of the defective file. Files physically beyond the defective file can now be accessed.

If you can determine the format of a bad record in an APL record-oriented diskette file, you can recover the remaining records and create a new file, reserving space for the defective record and maintaining the same record numbers and sequence. Manually offer three shared variables, two for input (such as CTLI and DATI) and one for output (CTLO). Open the input file by assigning INR to CTLI. Open the output file using OUTF. Read the first record by assigning 0,0,1 to CTLI. If the return code is 00, signifying a good read, assign DATI to CTLO to write the record to the new file. Then read the second record by assigning 0,1,1 to CTLI. Check the return code, and, if the read is good, write the record to the new file as before. Continue reading, incrementing the record number, until the bad record is found. Enter a dummy record, and assign the dummy record to CTLO to write the dummy record. Note the defective record number so that the user can update the defective record (dummy record) when the information is available.

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Appendix A. Graphics and Code Translation Tables

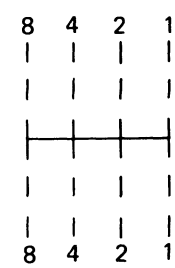
The tables that follow are useful when you display data from tape or diskette. The contents of tape and diskette files can be displayed if you use the DCP I/O routine (read the file to read/write storage) and the diagnostic display function. Tape is normally written in ALC. Diskette data is usually in EBCDIC. However, in nontranslate mode, diskette can be written in Z-code. Both tape and diskette can be written in APL internal representation.

DOMESTIC GRAPHICS TABLE

This chart contains the graphic characters that can be printed and displayed. The characters are arranged in EBCDIC order, with rows keyed to the first hexadecimal digit, and with columns keyed to the second hexadecimal digit of a halfword. The first four rows and hex FF contain unprintable characters that can be displayed.

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	⁘	┐	┬	┐	┬	┐	┬	┐	┌	┐	┌	┐	┌	┐	┌	┐
1	┘	┤	┤	┤	┤	┤	┤	┤	┘	┘	┘	┘	┘	┘	┘	┘
2	┴	┴	┼	┼	┼	┼	┼	┼	┴	┴	┴	┴	┴	┴	┴	┴
3	┘	┤	┤	┤	┤	┤	┤	┤	┘	┘	┘	┘	┘	┘	┘	┘
4		A	B	C	D	E	F	G	H	I	¢	.	<	(	+	‡
5	&	J	K	L	M	N	O	P	Q	R	!	$	*	)	;	¬
6	-	/	S	T	U	V	W	X	Y	Z	¦	,	%	_	>	?
7	&	^	¨	Δ	±	⊞	⊢	⊣	∨	`	:	#	@	'	=	"
8	~	a	b	c	d	e	f	g	h	i	↑	↓	≤	⌈	⌊	→
9	⌷	j	k	l	m	n	o	p	q	r	⊃	⊂	π	⌕	∂	←
A	¯	~	s	t	u	v	w	x	y	z	∩	∪	⊥	[	≥	∘
B	α	ε	ι	ρ	ω	◊	×	\	÷	´	∇	Δ	τ	]	≠	|
C	{	A	B	C	D	E	F	G	H	I	⌅	⌄	∫	Φ	Ψ	⍉
D	}	J	K	L	M	N	O	P	Q	R	⌶	!	Ψ	⍋	⍓	⍝
E	\	Σ	S	T	U	V	W	X	Y	Z	⌿	⍀	⍞	⍟	⍟	⍡
F	0	1	2	3	4	5	6	7	8	9	|	⍠	⍠	⍟	⍟	▒

The displayed, but unprintable characters can easily be translated into EBCDIC. The bit values are as shown in the illustration to the right. Marks above the midline represent the first hexadecimal digit, and marks below the midline represent the second hexadecimal digit.

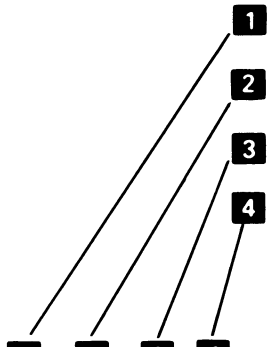


WORLD TRADE GRAPHICS TABLE

Only the characters that differ from domestic characters are contained in this chart.

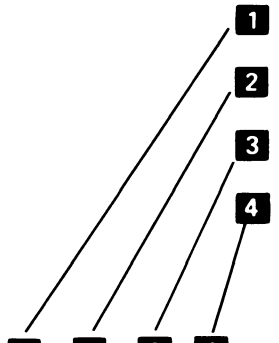
Country	Hex Position											
	4A	5A	5B	5F	6A	79	7B	7C	A1	C0	D0	E0
Austria/Germany	Ä	Ü	$	^	ö	`	#	§	ß	ä	ü	ö
Belgium	[	]	$	^	ù	`	#	à	¨	è	é	ç
Brazil	É	$	Ç	^	ç	ã	Õ	Ã	~	õ	é	\
Denmark/Norway	#	¤	Å	^	ø	`	Æ	Ø	ü	æ	à	\
Finland/Sweden	§	¤	Å	^	ö	é	Ä	Ö	ü	ä	à	É
France	°	§	$	^	ù	`	£	à	¨	è	é	ç
Italy	°	è	$	^	ò	ù	£	§	ì	à	é	ç
Japan	£	!	¥	¬	¦	`	#	@	‾	{	}	$
Portugal	[	]	$	^	õ	`	Ã	Õ	ç	ã	´	Ç
International	[	]	$	^	¦	`	#	@	~	{	}	\
Spain	[	]	₧	¬	ñ	`	Ñ	@	¨	{	}	\
Spanish Speaking	[	]	$	¬	ñ	`	Ñ	@	¨	{	}	\
United Kingdom	$	!	£	¬	¦	`	#	@	‾	{	}	\
French Canadian	à	^	$	^	ù	`	#	@	¨	è	é	ç
EBCDIC	¢	!	$	¬	¦	`	#	@	~	{	}	\

CODE TRANSLATION TABLE IN EBCDIC SEQUENCE



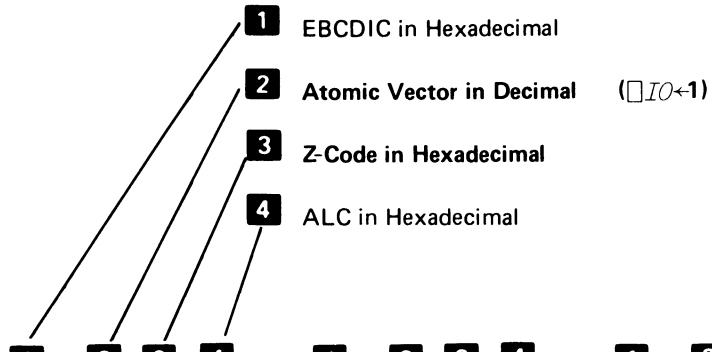
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
00	1	00	C0	20	174	AD	DF	40	153	98	00	60	28	1B	52
01	2	01	C1	21	254	FD	E0	41	114	71	81	61	20	13	25
02	3	02	C2	22	177	B0	E1	42	115	72	82	62	132	83	93
03	4	03	C3	23	178	B1	E2	43	116	73	83	63	133	84	94
04	5	04	C4	24	179	B2	E4	44	117	74	84	64	134	85	95
05	163	A2	C5	25	160	9F	E5	45	118	75	85	65	135	86	96
06	6	05	C6	26	158	9D	DD	46	119	76	86	66	136	87	97
07	7	06	C7	27	255	FE	E6	47	120	77	87	67	137	88	98
08	8	07	C8	28	180	B3	E7	48	121	78	88	68	138	89	99
09	166	A5	C9	29	181	B4	E8	49	122	79	89	69	139	8A	9A
0A	10	09	CA	2A	182	B5	E9	4A	184	B7	7D	6A	220	DB	7F
0B	11	0A	CB	2B	183	B6	EA	4B	151	96	2C	6B	48	2F	2B
0C	12	0B	CC	2C	185	B8	EB	4C	37	24	4A	6C	173	AC	73
0D	13	0C	D4	2D	186	B9	EC	4D	17	10	55	6D	62	3D	32
0E	14	0D	CD	2E	246	F5	ED	4E	27	1A	26	6E	41	28	4E
0F	24	17	CE	2F	244	F3	EE	4F	219	DA	7A	6F	54	35	3D
10	25	18	CF	30	252	FB	F0	50	80	4F	6F	70	222	DD	EF
11	84	53	D0	31	253	FC	F1	51	123	7A	8A	71	35	22	47
12	85	54	C1	32	249	F8	F2	52	124	7B	8B	72	26	19	48
13	86	55	D2	33	250	F9	F3	53	125	7C	8C	73	140	8B	B4
14	9	08	D3	34	243	F2	F4	54	126	7D	8D	74	230	E5	9B
15	157	9C	E3	35	247	F6	F5	55	127	7E	8E	75	170	A9	75
16	159	9E	D5	36	232	E7	F6	56	128	7F	8F	76	224	DF	76
17	164	A3	D6	37	233	E8	F7	57	129	80	90	77	225	E0	77
18	162	A1	D7	38	234	E9	F8	58	130	81	91	78	36	23	50
19	165	A4	D8	39	235	EA	F9	59	131	82	92	79	221	DC	9C
1A	167	A6	D9	3A	236	EB	FA	5A	242	F1	7B	7A	155	9A	58
1B	168	A7	DA	3B	237	EC	FB	5B	83	52	72	7B	82	51	71
1C	169	A8	DB	3C	238	ED	FC	5C	31	1E	3C	7C	81	50	70
1D	175	AE	DC	3D	239	EE	FD	5D	18	11	56	7D	154	99	37
1E	245	F4	FF	3E	240	EF	FE	5E	19	12	57	7E	39	26	4C
1F	176	AF	DE	3F	241	F0	80	5F	171	AA	6D	7F	172	AB	6E

CODE TRANSLATION IN EBCDIC SEQUENCE (Continued)



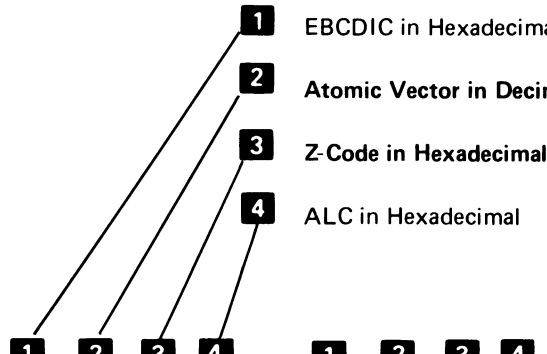
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
80	55	36	40	A0	152	97	49	C0	213	D4	78	E0	251	FA	79
81	187	BA	A5	A1	248	F7	9F	C1	87	56	01	E1	227	E2	A2
82	188	BB	A6	A2	205	CC	B8	C2	88	57	02	E2	105	68	13
83	189	BC	A7	A3	206	CD	B9	C3	89	58	03	E3	106	69	14
84	190	BD	A8	A4	207	CE	BA	C4	90	59	04	E4	107	6A	15
85	191	BE	A9	A5	208	CF	BB	C5	91	5A	05	E5	108	6B	16
86	192	BF	AA	A6	209	D0	BC	C6	92	5B	06	E6	109	6C	17
87	193	C0	AB	A7	210	D1	BD	C7	93	5C	07	E7	110	6D	18
88	194	C1	AC	A8	211	D2	BE	C8	94	5D	08	E8	111	6E	19
89	195	C2	AD	A9	212	D3	BF	C9	95	5E	09	E9	112	6F	1A
8A	56	37	45	AA	60	3B	2F	CA	69	44	67	EA	75	4A	5D
8B	57	38	41	AB	61	3C	42	CB	70	45	68	EB	76	4B	5E
8C	38	25	4B	AC	51	32	2E	CC	215	D6	62	EC	217	D8	74
8D	32	1F	3F	AD	15	0E	29	CD	50	31	59	ED	74	49	5A
8E	33	20	30	AE	40	27	4D	CE	216	D7	63	EE	77	4C	64
8F	23	16	54	AF	65	40	36	CF	63	3E	5B	EF	78	4D	6B
90	66	41	38	B0	43	2A	2D	D0	214	D5	7E	F0	141	8C	1B
91	196	C3	AE	B1	44	2B	31	D1	96	5F	0A	F1	142	8D	1C
92	197	C4	AF	B2	45	2C	35	D2	97	60	0B	F2	143	8E	1D
93	198	C5	B0	B3	46	2D	3E	D3	98	61	0C	F3	144	8F	1E
94	199	C6	B1	B4	47	2E	43	D4	99	62	0D	F4	145	90	1F
95	200	C7	B2	B5	226	E1	A0	D5	100	63	0E	F5	146	91	20
96	201	C8	B3	B6	29	1C	27	D6	101	64	0F	F6	147	92	21
97	202	C9	B5	B7	21	14	51	D7	102	65	10	F7	148	93	22
98	203	CA	B6	B8	30	1D	53	D8	103	66	11	F8	149	94	23
99	204	CB	B7	B9	229	E4	A1	D9	104	67	12	F9	150	95	24
9A	59	3A	44	BA	156	9B	33	DA	64	3F	65	FA	218	D9	7C
9B	58	39	46	BB	113	70	34	DB	49	30	60	FB	161	A0	61
9C	223	DE	9D	BC	52	33	3A	DC	73	48	69	FC	228	E3	A3
9D	53	34	3B	BD	16	0F	2A	DD	72	47	6A	FD	68	43	5C
9E	231	E6	9E	BE	42	29	4F	DE	67	42	5F	FE	79	4E	6C
9F	22	15	28	BF	34	21	39	DF	71	46	66	FF	256	FF	A4

CODE TRANSLATION TABLE IN ATOMIC VECTOR AND Z-CODE SEQUENCE



1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
00	1	00	C0	8E	33	20	30	AF	65	40	36	D2	97	60	0B
01	2	01	C1	BF	34	21	39	90	66	41	38	D3	98	61	0C
02	3	02	C2	71	35	22	47	DE	67	42	5F	D4	99	62	0D
03	4	03	C3	78	36	23	50	FD	68	43	5C	D5	100	63	0E
04	5	04	C4	4C	37	24	4A	CA	69	44	67	D6	101	64	0F
06	6	05	C6	8C	38	25	4B	CB	70	45	68	D7	102	65	10
07	7	06	C7	7E	39	26	4C	DF	71	46	66	D8	103	66	11
08	8	07	C8	AE	40	27	4D	DD	72	47	6A	D9	104	67	12
14	9	08	D3	6E	41	28	4E	DC	73	48	69	E2	105	68	13
0A	10	09	CA	BE	42	29	4F	ED	74	49	5A	E3	106	69	14
0B	11	0A	CB	B0	43	2A	2D	EA	75	4A	5D	E4	107	6A	15
0C	12	0B	CC	B1	44	2B	31	EB	76	4B	5E	E5	108	6B	16
0D	13	0C	D4	B2	45	2C	35	EE	77	4C	64	E6	109	6C	17
0E	14	0D	CD	B3	46	2D	3E	EF	78	4D	6B	E7	110	6D	18
AD	15	0E	29	B4	47	2E	43	FE	79	4E	6C	E8	111	6E	19
BD	16	0F	2A	6B	48	2F	2B	50	80	4F	6F	E9	112	6F	1A
4D	17	10	55	DB	49	30	60	7C	81	50	70	BB	113	70	34
5D	18	11	56	CD	50	31	59	7B	82	51	71	41	114	71	81
5E	19	12	57	AC	51	32	2E	5B	83	52	72	42	115	72	82
61	20	13	25	BC	52	33	3A	11	84	53	D0	43	116	73	83
B7	21	14	51	9D	53	34	3B	12	85	54	C1	44	117	74	84
9F	22	15	28	6F	54	35	3D	13	86	55	D2	45	118	75	85
8F	23	16	54	80	55	36	40	C1	87	56	01	46	119	76	86
0F	24	17	CE	8A	56	37	45	C2	88	57	02	47	120	77	87
10	25	18	CF	8B	57	38	41	C3	89	58	03	48	121	78	88
72	26	19	48	9B	58	39	46	C4	90	59	04	49	122	79	89
4E	27	1A	26	9A	59	3A	44	C5	91	5A	05	51	123	7A	8A
60	28	1B	52	AA	60	3B	2F	C6	92	5B	06	52	124	7B	8B
B6	29	1C	27	AB	61	3C	42	C7	93	5C	07	53	125	7C	8C
B8	30	1D	53	6D	62	3D	32	C8	94	5D	08	54	126	7D	8D
5C	31	1E	3C	CF	63	3E	5B	C9	95	5E	09	55	127	7E	8E
8D	32	1F	3F	DA	64	3F	65	D1	96	5F	0A	56	128	7F	8F

CODE TRANSLATION TABLE IN ATOMIC VECTOR AND Z-CODE SEQUENCE (Continued)



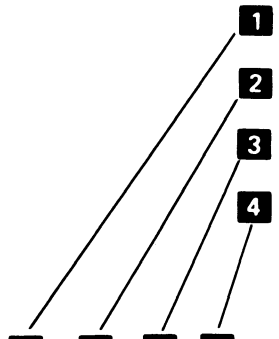
1	2	3	4
57	129	80	90
58	130	81	91
59	131	82	92
62	132	83	93
63	133	84	94
64	134	85	95
65	135	86	96
66	136	87	97
67	137	88	98
68	138	89	99
69	139	8A	9A
73	140	8B	B4
F0	141	8C	1B
F1	142	8D	1C
F2	143	8E	1D
F3	144	8F	1E
F4	145	90	1F
F5	146	91	20
F6	147	92	21
F7	148	93	22
F8	149	94	23
F9	150	95	24
4B	151	96	2C
A0	152	97	49
40	153	98	00
7D	154	99	37
7A	155	9A	58
BA	156	9B	33
15	157	9C	E3
26	158	9D	DD
16	159	9E	D5
25	160	9F	E5

1	2	3	4
FB	161	A0	61
18	162	A1	D7
05	163	A2	C5
17	164	A3	D6
19	165	A4	D8
09	166	A5	C9
1A	167	A6	D9
1B	168	A7	DA
1C	169	A8	DB
75	170	A9	75
5F	171	AA	6D
7F	172	AB	6E
6C	173	AC	73
20	174	AD	DF
1D	175	AE	DC
1F	176	AF	DE
22	177	B0	E1
23	178	B1	E2
24	179	B2	E4
28	180	B3	E7
29	181	B4	E8
2A	182	B5	E9
2B	183	B6	EA
4A	184	B7	7D
2C	185	B8	EB
2D	186	B9	EC
81	187	BA	A5
82	188	BB	A6
83	189	BC	A7
84	190	BD	A8
85	191	BE	A9
86	192	BF	AA

1	2	3	4
87	193	C0	AB
88	194	C1	AC
89	195	C2	AD
91	196	C3	AE
92	197	C4	AF
93	198	C5	B0
94	199	C6	B1
95	200	C7	B2
96	201	C8	B3
97	202	C9	B5
98	203	CA	B6
99	204	CB	B7
A2	205	CC	B8
A3	206	CD	B9
A4	207	CE	BA
A5	208	CF	BB
A6	209	D0	BC
A7	210	D1	BD
A8	211	D2	BE
A9	212	D3	BF
C0	213	D4	78
D0	214	D5	7E
CC	215	D6	62
CE	216	D7	63
EC	217	D8	74
FA	218	D9	7C
4F	219	DA	7A
6A	220	DB	7F
79	221	DC	9C
70	222	DD	EF
9C	223	DE	9D
76	224	DF	76

1	2	3	4
77	225	E0	77
B5	226	E1	A0
E1	227	E2	A2
FC	228	E3	A3
B9	229	E4	A1
74	230	E5	9B
9E	231	E6	9E
36	232	E7	F6
37	233	E8	F7
38	234	E9	F8
39	235	EA	F9
3A	236	EB	FA
3B	237	EC	FB
3C	238	ED	FC
3D	239	EE	FD
3E	240	EF	FE
3F	241	F0	80
5A	242	F1	7B
34	243	F2	F4
2F	244	F3	EE
1E	245	F4	FF
2E	246	F5	ED
35	247	F6	F5
A1	248	F7	9F
32	249	F8	F2
33	250	F9	F3
E0	251	FA	79
30	252	FB	F0
31	253	FC	F1
21	254	FD	E0
27	255	FE	E6
FF	256	FF	A4

CODE TRANSLATION TABLE IN ALC SEQUENCE



1 EBCDIC in Hexadecimal

2 Atomic Vector in Decimal (⎕*IO*←1)

3 Z-Code in Hexadecimal

4 **ALC in Hexadecimal**

1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
40	153	98	00	F5	146	91	20	80	55	36	40	DB	49	30	60
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C8	94	5D	08	9F	22	15	28	72	26	19	48	CB	70	45	68
C9	95	5E	09	AD	15	0E	29	A0	152	97	49	DC	73	48	69
D1	96	5F	0A	BD	16	0F	2A	4C	37	24	4A	DD	72	47	6A
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F0	141	8C	1B	9D	53	34	3B	CF	63	3E	5B	5A	242	F1	7B
F1	142	8D	1C	5C	31	1E	3C	FD	68	43	5C	FA	218	D9	7C
F2	143	8E	1D	6F	54	35	3D	EA	75	4A	5D	4A	184	B7	7D
F3	144	8F	1E	B3	46	2D	3E	EB	76	4B	5E	D0	214	D5	7E
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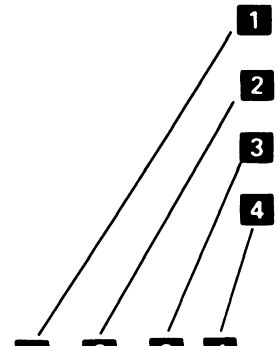

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49	122	79	89
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52	124	7B	8B
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54	126	7D	8D
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79	221	DC	9C
9C	223	DE	9D
9E	231	E6	9E
A1	248	F7	9F

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B9	229	E4	A1
E1	227	E2	A2
FC	228	E3	A3
FF	256	FF	A4
81	187	BA	A5
82	188	BB	A6
83	189	BC	A7
84	190	BD	A8
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86	192	BF	AA
87	193	C0	AB
88	194	C1	AC
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91	196	C3	AE
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28	180	B3	E7
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2B	183	B6	EA
2C	185	B8	EB
2D	186	B9	EC
2E	246	F5	ED
2F	244	F3	EE
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32	249	F8	F2
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34	243	F2	F4
35	247	F6	F5
36	232	E7	F6
37	233	E8	F7
38	234	E9	F8
39	235	EA	F9
3A	236	EB	FA
3B	237	EC	FB
3C	238	ED	FC
3D	239	EE	FD
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