

**HP 3000 SERIES II  
COMPUTER SYSTEM  
MANUAL OF STAND-ALONE DIAGNOSTICS**

**STAND-ALONE  
HP 30226A PLOTTER INTERFACE  
DIAGNOSTIC**

Diagnostic D439

HEWLETT  PACKARD

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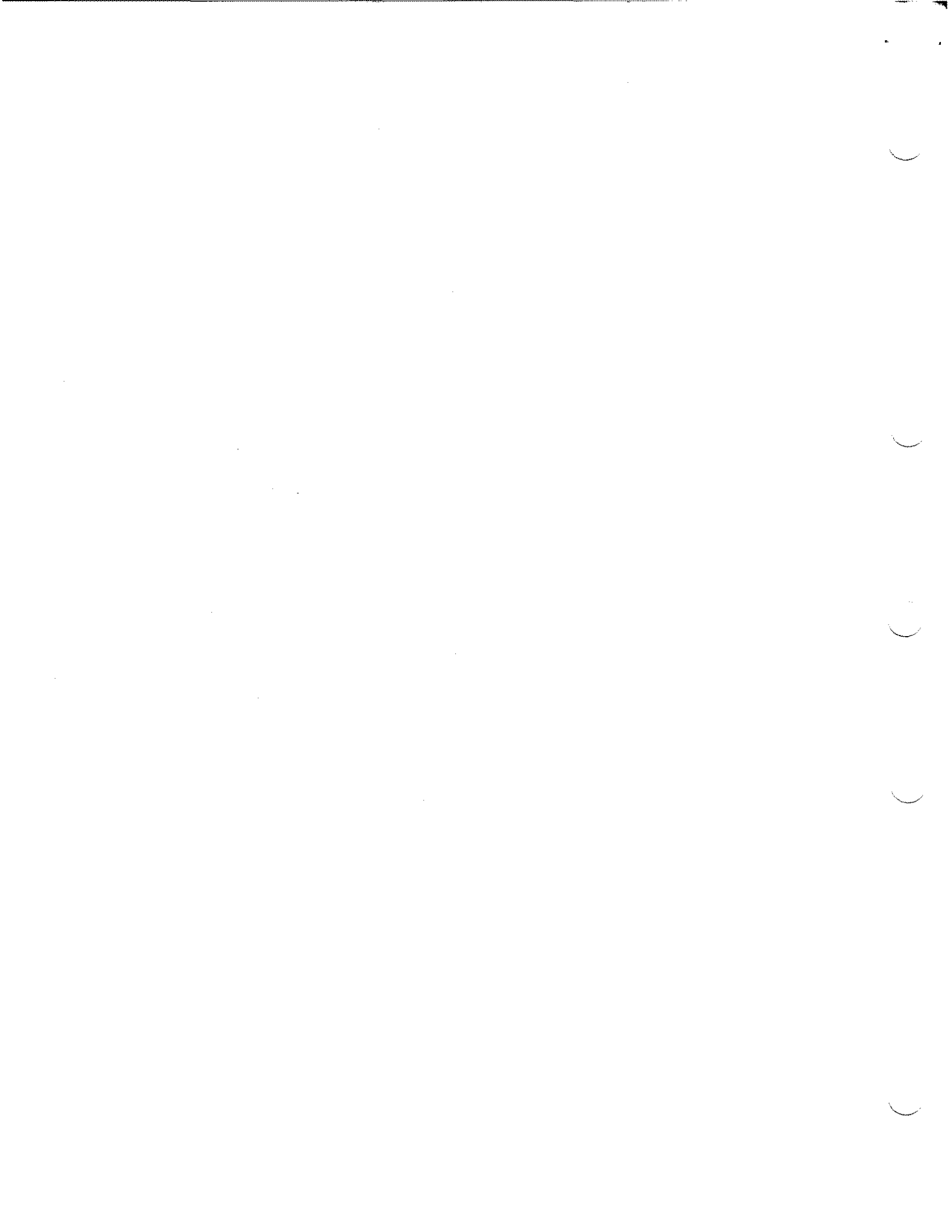
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## 1. INTRODUCTION

The purpose of this diagnostic is to verify the proper operation of the HP30226A Plotter Interface. The program contains two test sections. Test section 1 tests the interface by itself and test section 2 serves to confirm the operation of the interface with a plotter

## 2. SIMPLIFIED OPERATING INSTRUCTIONS

1. Cold load Diagnostic D439 from Stand-Alone Diagnostic Tape.
2. On console device press "carriage return". Title message will be printed, followed by a message instructing the operator to enter "switch register options". Program halts (HALT 6).
3. To run diagnostic with preset configuration push RUN with operating panel switch register bit 0 OFF. For changing switch register options and configuration data see the Detailed Operating instruction section.
4. The diagnostic will start to execute. Messages on the console device will instruct the operator when intervention is necessary. The preconfigured section selection is only for test section 1. In this test section the only operator intervention is the installation of the test connector (30226-60003). The program prints a corresponding message on the console and halts (HALT 7). Install test connector and push RUN.
5. The program either runs to completion and halts with HALT %15 indicating that the interface is error-free or in case of error it will print error message(s). The error messages are summarized in Appendix B.

### 3. DETAILED DESCRIPTION

The step by step description of the two test sections follows:

#### Test Section 1

- Step 1 This step tests that the interface can accept a CIO. The return of CCE is verified.
- Step 2 This step tests that the interface can accept a TIO. The return of CCE is verified.
- Step 3 This step tests that the interface can be RESET. A RESET is sent to the interface and the SIO OK status is checked.
- Step 4 This step tests that the interface can cause an interrupt.
- Step 5 This step tests that a RESET MASK holds off the interrupt. The condition of the IRF is checked; it should not get set. The fact that the interrupt was present is checked by examining the interrupt Pending Bit.
- Step 6 This step tests that the interface will interrupt if a SET MASK instruction is given and an interrupt is forced.
- Step 7 This step tests that the limit switch will cause an error condition to be generated. The ANY ERROR status and the LIMIT SWITCH and ANY ERROR STATUS are checked for validity.
- Step #10 This step will test that the board can accept an SIO command. The return of CCE is verified.
- Step #11 This step will test that the board will interrupt after the plotter goes NOT READY the NOT READY status is checked.
- Step #12 This step will test that the board will interrupt when it goes READY. The READY status is also examined.
- Step #13 This step will test the fact that the RIGHT BYTE status can be set. The RIGHT BYTE status will be checked.

- Step #14 This step will test that the LIMIT SWITCH will cause an interrupt when the LIMIT SWITCH is hit during a SOP program.
- Step #15 This step will test that a SUSPEND PLOT will cause an interrupt; the SUSPEND PLOT is generated when an SIO program is being generated. This step will also check that if a CONTINUE PLOT is given, the CPU completes the SIO program.
- Step #16 This step will test that the TYPE 700 DATA in the right Byte of the word is valid. All patterns will be checked.
- Step #17 This step will test that the TYPE 700 DATA in the left Byte of the word is valid. All patterns will be examined.
- Step #20 This step will test that the TYPE 500 DATA is valid. All valid as well as invalid cases will be tested.
- Step #21 This step will test that an ABORT will cause an interrupt. The ABORT and ANY ERROR status is examined.
- Step #22 This step will test that generating a TIMING error will cause an interrupt. The TIMING ERROR and ANY ERROR status is examined.
- Step #23 This step will test that generating a TRANSFER error will cause an interrupt. The TRANSFER error status as well as the ANY ERROR conditions are examined.
- Step #24 This step will check that the PEN UP delay is correct.
- Step #25 This step will check that the PEN DOWN delay is correct.
- Step #26 This step tests that doing a NOT READY during a SIO program will cause a SUSPEND PLOT. This step will also issue a SUSPEND PLOT and then issue a READY command. The fact that the READY interrupt occurs but the plot does not continue will be checked. A CONTINUE plot will be given and the interrupt from SIO completion will be examined.
- Step #27 While in ZIP MODE (700 type plotter) a SUSPEND PLOT will be issued. This SIO program will be allowed to complete. The status will be examined and the absence of the SUSPEND PLOT bit verified. A RESET INTERFACE will be given and the presence of the SUSPEND PLOT bit will be verified.

- Step 430 Test that giving a SUSPEND PLOT command after a NOT READY will suspend the plot.
- Step 431 Test that a TRANSFER error will stop the SIO program.
- Step 432 Test that the interface is capable of handling long SIO programs. Four 20 word SIO programs are written and the data generated by these programs is checked.

### 3.2 TEST SECTION 2

This section tests the cable and plotter functions. It requires a Cal Comp Plotter of data type 500, 600, or 700. The cable/plotter combination is tested without guaranteeing fault isolation to either piece of hardware. The LIMIT SWITCH receiver and READY SWITCH receiver are tested. Plotter commands are tested.

The following describes tests performed in the steps.

- Step 441 This step tests a type 600 or 700 plotter with a READY/NOT READY option. In particular, the line which carries the READY/NOT READY signal is tested.
- Step 442 This step tests a type 600 or 700 plotter with a LIMIT SWITCH option. In particular, the line which carries the LIMIT SWITCH signal is tested.
- Step 443 This step tests a type 600 or 700 plotter. It verifies the proper connection of data lines. Figure 1 shown in Operating Procedures under Section 2, Type 600/700 plotter, is drawn with the plotter.
- Step 444 This step tests a type 500 plotter. Proper connection of data lines is verified. Figure 2 shown in Operating Procedures under Section 2, Type 500 plotter, is drawn with the plotter.



#### 4. OPERATING INSTRUCTION

1. Cold-load diagnostic D439 from Stand-Alone Diagnostic Tape.
2. The program waits for a "carriage return" from the console. Press the carriage return. The program prints the title messages and instructs the operator to make the selection of the switch register options through the operating panel switch register. Program halts (HALT 6).
3. To run the diagnostic with a preset configuration, press RUN with bit 0 of the operating panel switch register OFF.

For changing switch register options set bit 0 to ON. The rest of the bits of the switch register will be used to update the switch register options. (See Table 1.) The change section selection options or "configuration data" set bit 0 and bit 1 of the operating panel switch register to ON.

#### 4. Section Selection

The message "ENTER SECTION SELECT OPTIONS" will be printed on the console and the program will halt (HALT 5). Enter section select options through the operating panel switch register, bit 1 for Section 1 and bit 2 for Section 2. Bit 0 is used to change configuration constants (Reconfiguration - Section 0). Push RUN. The program either prints the message "ENTER SWITCH REGISTER OPTIONS" and halts (HALT 6) or transfers to the Reconfiguration Section if Section 0 was selected.

5. Reconfiguration - This section serves to read the DRT numbers of the plotter interface and the clock interface (to agree with the DRT-s set on the interface boards) and to change the maximum error number. All 3 questions must be answered successively through the console typing the appropriate number. Following this the program will print the message "ENTER SWITCH REGISTER OPTIONS" and halt (HALT 6).
6. PUSH START. Upon restart the diagnostic starts to execute the selected test sections.

TABLE 1

SWITCH REGISTER ASSIGNMENT

BIT #	
0	Update Switch Register
1	Change Section Selection
2	--
3	--
4	--
5	Suppress "PEN UP" and "PEN DOWN" delay messages
6	--
7	Use lineprinter
8	--
9	Suppress non-error messages
10	Suppress error messages
11	Loop on test step
12	Halt on error
13	Halt at end of step
14	Halt after section
15	Halt after complete cycle

7. Test Section 1. The message "PROPERLY INSTALL THE 30226-60003 TEST CONNECTOR" is printed. The program halts (HALT 7). Press RUN to restart the computer. Errors are indicated by error messages, given in Appendix B. In step #24 and step #25 the following messages will be printed:  
 "THE PEN UP DELAY IN MSEC IS XX"  
 "THE PEN DOWN DELAY IN MSEC IS XX"  
 "SPECIFICALLY, where XX is the actual time in milliseconds."
8. Test Section 2. The following messages are printed:  
 "CONNECT PLOTTER TO INTERFACE"  
 "PLACE PLOTTER POWER ON. INSURE UNIT IS NOT IN STANDBY".  
 The program halts (HALT 7). Make the connection and push RUN. Upon restart the following questions must be answered through the console.

"WHAT IS THE INCREMENT/INCH RATIO OF YOUR PLOTTER?"

Key in the number of increments per inch between 100 and 500 followed by RETURN. Refer to the System Manager/Supervisor Manual for the particular plotter being used to determine valid step sizes. Note the following correspondence between step size and increments per inch.

Step size:	Operator enters:
.01 inches	100
.005 inches	200
.0025 inches	400
.002 inches	500
.10 millimeters	200
.05 millimeters	500

The second query is

TYPE 500 PLOTTER?

Key in "YES" or "NO" followed by RETURN.

If the answer was "NO", additional operator interface is required to continue test 2.

Two additional queries are made.

IS THE LIMIT SWITCH OPTION AVAILABLE?

Key in "YES" or "NO" followed by RETURN, according to whether the limit switch option is installed on the plotter.

IS THE READY/NOT READY OPTION AVAILABLE?

Key in "YES" or "NO" followed by RETURN, according to whether the Ready/Not Ready option is installed on the plotter.

If the plotter is designated as a 600 or 700 type plotter and the Ready/Not Ready option is installed (according to queries, above), the message:

**PLACE PLOTTER POWER OFF**

is printed followed by a pause. The operator places power OFF on the plotter and then keys in "Y" to continue. The message:

**PLACE PLOTTER POWER ON, ENSURE UNIT ISN'T IN STANDBY**

is then printed. The operator turns power back ON, ensures that the plotter is not in standby, and then keys in "Y" to continue the diagnostic.

If the plotter is designated as a 600 or 700 type plotter and the Limit Switch option is installed (according to queries, above), the message:

**STRIKE THE LIMIT SWITCH WITH THE PEN**

is printed followed by a pause. The operator strikes the Limit Switch with the plotter pen, then keys in "Y" to continue the test.

If the plotter has been designated type 500, then the diagnostic drives the plotter to produce the drawing shown in Figure 1. The length of the lines will vary according to the configured step size.

If the plotter has been designated type 600/700, then the diagnostic drives the plotter to produce the drawing shown in Figure 2. The length of the lines will vary according to the configured step size.

If no errors are detected and the plot executes correctly, completion of Section 2 is signalled with the message.

Finally, completion of the diagnostic is signalled with the message

**D328 END PLOTTER INTERFACE DIAGNOSTIC**

## 5. PLOTTER INTERFACE CARD STATUS AND CONTROL WORD FORMATS

### STATUS WORD

The status word is a 16-bit word that is fetched from the plotter interface card after executing a direct TIO command or an I/O program End order. This word provides the operational status of the plotter subsystem. With the Special Test Connector installed, the Status Word provides diagnostic status information in addition to the normal status information. See Figure 3 for the format of Status Word.

### CONTROL WORD

The Control Word is sent with CIO from the diagnostic program. Figure 4 describes the format of the Plotter Interface Control Word. To perform a complete interface card reset (Master Clear) and prepare for a plot, a Control Word of  $100000_8$  is issued. This should never be issued while a plot is in progress.

All interrupt conditions are cleared with a Control Word of  $40000_8$ . Other logic remains unchanged.

Current plot is suspended, if plotter is not in Zip Mode and if a Control Word of  $10_8$  is issued. If in Zip Mode, the interface card waits until the plotter exits the zip Mode before it suspends the plot. No data is lost when this command is issued. Restart the suspended plot with a Control Word of  $4_8$ . A plot can only be suspended if an SIO program is in progress. If a Suspend Plot command is issued before an SIO program is started, the plot will suspend as soon as the first word has been transferred, but before any data has been plotted.

Interrupts are allowed by setting the Mask flip-flop with a Control Word of  $1_8$ . Mask is cleared with a Control Word of  $2_8$ . Unused bits are ignored by an interface card.

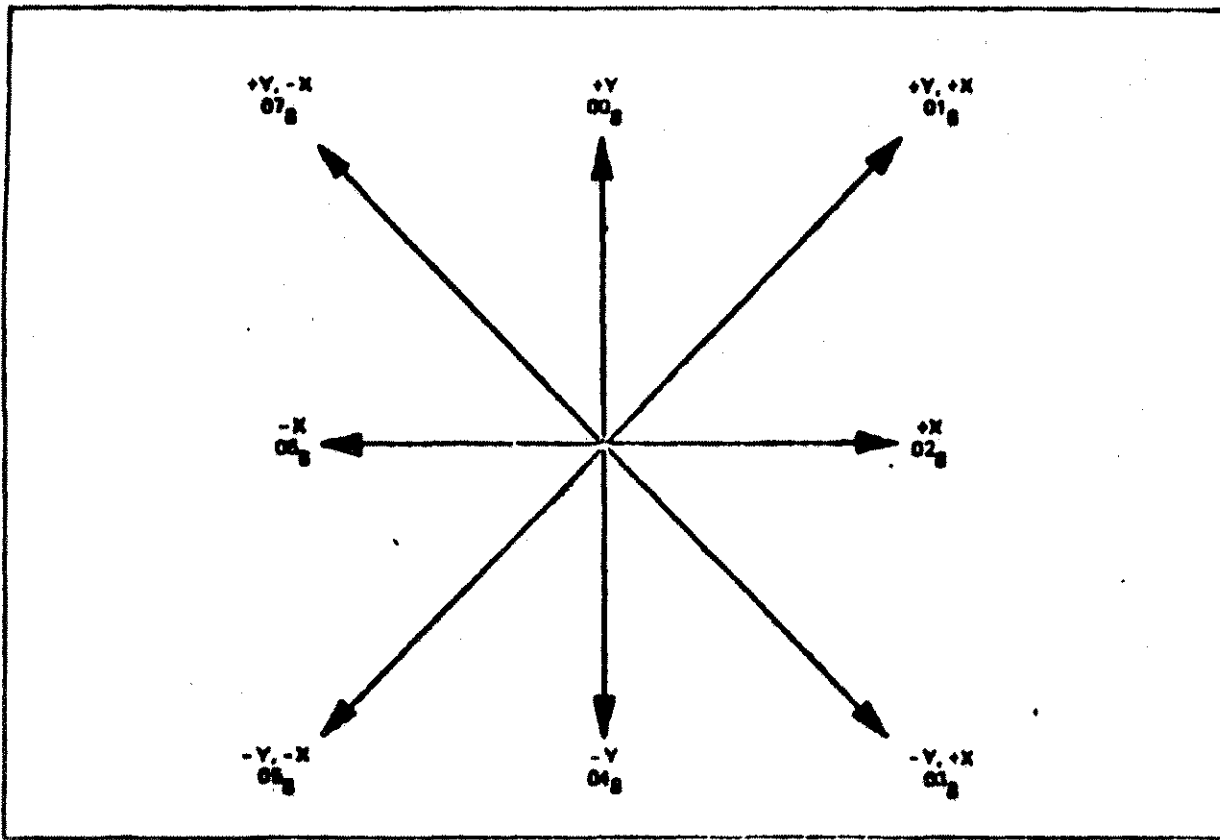


Figure 1. Type 500 Plot

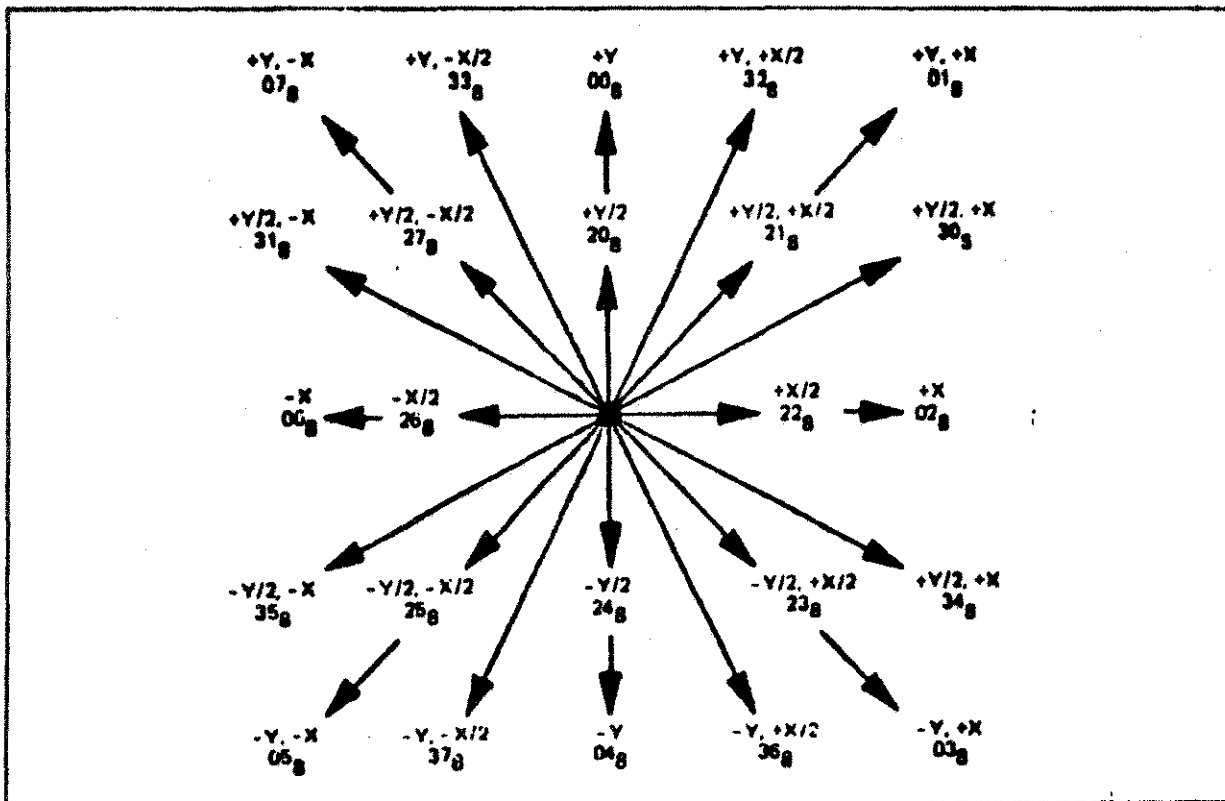


Figure 2. Type 600/700 Plot

Bits	Meaning if Set
0	SIO OK
1	<p><i>With Special Test Connector (Hood) installed: Set means looking at right byte MUX coming from Memory, clear means looking at left byte (used by diagnostic only) without Hood.</i></p> <p><i>Without Hood: RIO, WIO OK (always clear)</i></p>
2	Interrupt Pending
3-8	Data (used by diagnostic only)
9	Plotter Not Ready Interrupt
10	Suspend Plot Interrupt
11	Transfer Error Interrupt
12	Timeout Error Interrupt
13	Abort Condition Interrupt
14	Limit Switch Reached Interrupt
15	Any Error: Transfer Error or Timeout Error or Abort or Limit Switch Reached

Figure 3. Status Word

Bits	Meaning if Set
0	Master Clear
1	Clear All Interrupts
2	Clear all special flip-flops and select type 500 data (used by diagnostic only)
3-5	Not Used
6	Deliver contents of Right Byte MUX into bits 3-5 of Status Word (used by Diagnostic only)
7	Simulate Limit Switch Reach and Interrupt (used by Diagnostic only)
8	Cause false Write Strobe to force Timing Error (See step 38; used by Diagnostic only)
9	Simulate Ready/Not Ready switch hit (used by Diagnostic only)
10	<i>If Set:</i> means look at 600/700 type data <i>If Clear:</i> means look at 500 type data (used by diagnostic only)
11	Reverse Parity on Device Number to force Transfer Error (used by diagnostic only)
12	Suspend Plot
13	Continue Plot
14	Reset Mask
15	Set Mask

Figure 4. Control Word



APPENDIX A

HALT CODES

00

01

UNEXPECTED TRAPS

02

03

04

05

HALT TO ENTER SECTION SELECTION

06

HALT TO ENTER SWITCH REGISTER OPTIONS

07

HALT FOR INSTALLING TEST CONNECTOR

10

11

12

ERROR HALT

13

HALT AFTER STEP

14

HALT AFTER SECTION

15

HALT AFTER COMPLETE PROGRAM CYCLE

16

17

MAXIMUM ERROR LIMIT REACHED

APPENDIX B

ERROR MESSAGES

- E1 NO RESPONSE TO CIO IN STEP XX
- E2 NO RESPONSE TO TIO IN STEP XX
- E3 NO RESPONSE TO SIN IN STEP XX
- E4 NO RESPONSE TO SIO IN STEP XX
- E5 NOT READY FOR SIO IN STEP XX
- E6 STATUS ERROR IN STEP XX  
STATUS IS X XXX XXX XXX XXX XXX  
SHOULD BE Y YYY YYY YYY YYY YYY
- E7 DATA ERROR IN STEP XX  
DATA IS KKKKKK  
SHOULD BE YYYYYY  
NNN TYPE DATA CONTAINED IN ZZZZ BYTE  
NNN is either 500 or 700  
ZZZ stands either for LEFT or RIGHT.
- E10 ILLEGAL INTERRUPT IN STEP XX
- E11 NO INTERRUPT IN STEP XX
- E12 TRANSFER ERROR DID NOT STOP SIO IN STEP 31.