

DIAGNOSTIC PROGRAM PROCEDURES

HP 2100A RECEIVE (ONLY)
INTERFACE (12621) TEST



Order No. HP 24220 (current version)

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HP 2100A RECEIVE (ONLY) INTERFACE (12621) TEST

This diagnostic program confirms proper operation of the HP 12621 Receive (only) Interface Kit with an HP 2100A computer. The program is designed for maximum testing speed. The operator may repeat each function test within the diagnostic as often as desired; or he may run the entire program, stopping after each test to evaluate the results.

HARDWARE CONFIGURATION

This diagnostic runs on an HP 2100A computer and requires a test connector installed on the interface board during execution. Figure ROI-1 shows how the test connector routes the board outputs to the inputs. Figure ROI-2 shows the I/O word formats.

A teleprinter reports errors and messages to the operator. If a teleprinter is not available, errors and messages are reported by displays of MEMORY DATA error codes.

FUNCTIONAL AND OPERATIONAL CHARACTERISTICS

If a teleprinter is used, the SIO teleprinter driver is loaded and configured first. Then the diagnostic program is loaded and configured in two phases:

1. *Program configuration* is accomplished by the switch register settings listed in Table ROI-1.
2. *Program options* for a normal run of the diagnostic are selected by setting the switch register as listed in Table ROI-2, then pressing RUN. These settings become an internal switch register. If a program option has to be changed during the run, the internal switch register is overridden by setting switch register bit 0 and other appropriate bit(s) according to Table ROI-2.

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After configuration, the SIO System Dump program may be used to make a permanent copy of the configured diagnostic. This eliminates configuring each time the diagnostic is used.

If an error is detected, the program prints a message on the teleprinter, then halts with a MEMORY DATA error code displayed. (Exceptions are trap cell halts $1060xx_8$ located in low memory 2_8-77_8 , which do not print a message. The cause of any trap cell halt should be determined by the user before the diagnostic is restarted.) If a teleprinter is not available and the diagnostic halts, the MEMORY DATA display is checked against Table ROI-3 to determine the error or message. If a teleprinter is not available, data is displayed from the A- (or switch) Register. All halt messages are summarized in Table ROI-3.



PROGRAM ORGANIZATION

The diagnostic consists of the routines described below:

- CFGR This routine configures the diagnostic for the proper select code (I/O channel), for the presence or absence of a teleprinter, and sets the internal switch register for the program options selected.
- INIT The Initialize routine sets trap cell halts in locations 2_8-77_8 and prints the start-of-diagnostic message on the teleprinter.
- BI/O The Basic I/O routine begins by clearing the interface, checking all flag instructions and testing the ability to enable and disable interrupts. BI/O then tests the interrupt ability by forcing an interrupt, checking the return address for the correct location, and checking the interrupt acknowledge. BI/O checks the control reset functions, and, if that program option is selected, tests INTERNAL and EXTERNAL PRESET. When the PRESET switches are tested, BI/O checks for flag set, interrupts disabled, and control bit cleared.

NOTE: At the end of BI/O and all of the following routines (except END), the diagnostic tests program option bit 13 for a repeat function request.

- FCTST The Function/Status routine issues a function request to the interface then checks the Data/Status Word. (See Figure ROI-2.) All combinations of functions requests, status returns, and flag setting conditions made possible through the test connector are tested.
- RECVP The Receive Pattern routine tests all data patterns possible for all character sizes in the no-parity, odd-parity, and even-parity modes. Data is issued one-bit-at-a-time on the SA (reverse channel) line and the test clock is forced from a 1 to a 0 state. (See Figure ROI-2.) For each data word transferred, the routine checks for the flag set and checks the Buffer Status and Error bits in the Data/Status Word.
- SPCHR The Special Character routine issues a Special Character Word to specify the special character, and a Control Word to specify the character size, parity mode, and turn on the Special Character mask. (See Figure ROI-2.) Then SPCHR issues and tests the special character data in the manner described for RECVP, tests for flag set, and checks the Special Character bit in the Data/Status Word. SPCHR checks all possible combinations of special characters in all character sizes and parity modes. SPCHR also issues "non-Special Character" data to verify that the Special Character bit will not set for ordinary data.
- SYNCH The Sync Character routine issues a Sync Word to specify the sync code and a Control Word to specify the character size, parity mode, and turn on the sync flag. (See Figure ROI-2.) Then SYNCH issues and tests the sync character data similar to RECVP, tests for flag sets, and checks the Sync Status bit in the Data/Status Word. SYNCH checks all possible combinations of sync codes in all character sizes and parity modes.

LOCKN The Lock-On Data routine simulates a data transfer by issuing a Sync Word and a Control Word to specify the sync code, character size, and parity mode, then issuing non-sync data followed by two sync patterns. The flag should remain cleared throughout the routine. The Sync Status bit should turn on with the first sync pattern and turn off with the second sync pattern.

ERRFF The Error Flip-Flop routine forces a parity error in both the even- and odd-parity modes, and tests the error bit in the Data/Status Word. (See Figure ROI-2.) Then ERRFF tests the error bit again by issuing two data patterns in the no-parity mode without clearing the flag between each transfer.

END This routine prints the end-of-diagnostic message on the teleprinter, then tests program option bit 12 for a request to halt at the end of the complete diagnostic cycle.

LIMITATIONS

This diagnostic does not check the DMA portion of the interface nor the Request to Send Signal (CA, pin X) which must be tested with a voltage measuring device.

Of the four possible priority string errors that can exist in an interface board, only three can be tested for the HP 12621 Interface as follows:

1. Does the interface receive priority? Tested by this diagnostic.
2. Can the interface be denied priority? To make this test, the user must extract an unused higher-priority board, then run this diagnostic and expect a MEMORY DATA error code 102005₈. (See Table ROI-3.)
3. Does the interface deliver priority? This is tested only by running a diagnostic for a lower priority interface board to some other device.
4. Can the interface deny priority? Not tested by this diagnostic.

OPERATING INSTRUCTIONS

- a. Install the test connector (HP part number 12621-60005) on the interface, then install the interface in the computer.
- b. If a configured HP 12621 diagnostic tape is available, skip directly to step g.
- c. Use the Basic Binary Loader to load the SIO teleprinter driver (if available), configure that driver, then use the Basic Binary Loader again to load the diagnostic.
- d. Load address 2_8 .
- e. Configure the diagnostic in two phases:
 1. Specify the program configuration by setting the switch register per Table ROI-1, then press RUN. If the settings are correct, the program halts with 102074_8 displayed.
 2. Select the internal switch register program options by setting the switch register as listed in Table ROI-2, then press RUN. The program halts with 107077_8 displayed.
- f. Now SIO System Dump can be used to punch a configured HP 12621 diagnostic tape. If not, skip directly to step h.
- g. Use the Basic Binary Loader to load the configured HP 12621 diagnostic tape.
- h. Load address 100_8 .
- i. If program options other than those in the internal switch register are to be used (step e, phase 2), set switch register bit 0 on (up), then select the desired options by setting the switch register as listed in Table ROI-2.
- j. Press INTERNAL and EXTERNAL PRESET and RUN. The diagnostic executes according to the program options selected.
- k. If the PRESET test within BI/O is to be performed, the diagnostic prints a message and/or halts with 102007_8 displayed. Press INTERNAL and EXTERNAL PRESET, then press RUN.

1. After all routines are completed, a printed message signals that the diagnostic has finished. Then, if program option bit 12 is set (see Table ROI-2), the computer halts with 102077_8 displayed.

MESSAGE ANALYSIS

All diagnostic messages printed on the teleprinter are prefixed by an alphanumeric code. An H prefix indicates an operating instruction, while an E prefix signals an error message.

All halts display a MEMORY DATA error code. Refer to Table ROI-3 to analyze the halt conditions, then press RUN to resume the diagnostic program.

If a trap cell halt occurs on the teleprinter channel, change program option bit 11 to suppress all teleprinter messages (Table ROI-2, bits 0 and 11), then restart the diagnostic at location 100_8 .



| OUTPUT | | | CONNECTORS | | INPUT | | | |
|---------------|--------|---------------------|------------|-----|-------|----------------------|--------------|----|
| Output Bit(s) | Symbol | Name | Pin | Pin | Name | Symbol | Input Bit(s) | |
| 5 | TEST | Test Clock | Y | | F | Serial Clock Receive | SCR | - |
| | | | | | | | | |
| 6 | SA | Supervisory Send | Z | | U | Received Data | BB | 10 |
| | | | | | | | | |
| 12 | CD | Data Terminal Ready | AA | | A | Ringing | CE | 11 |

Figure ROI-1. Test Connector (HP 12621-60005) Diagram

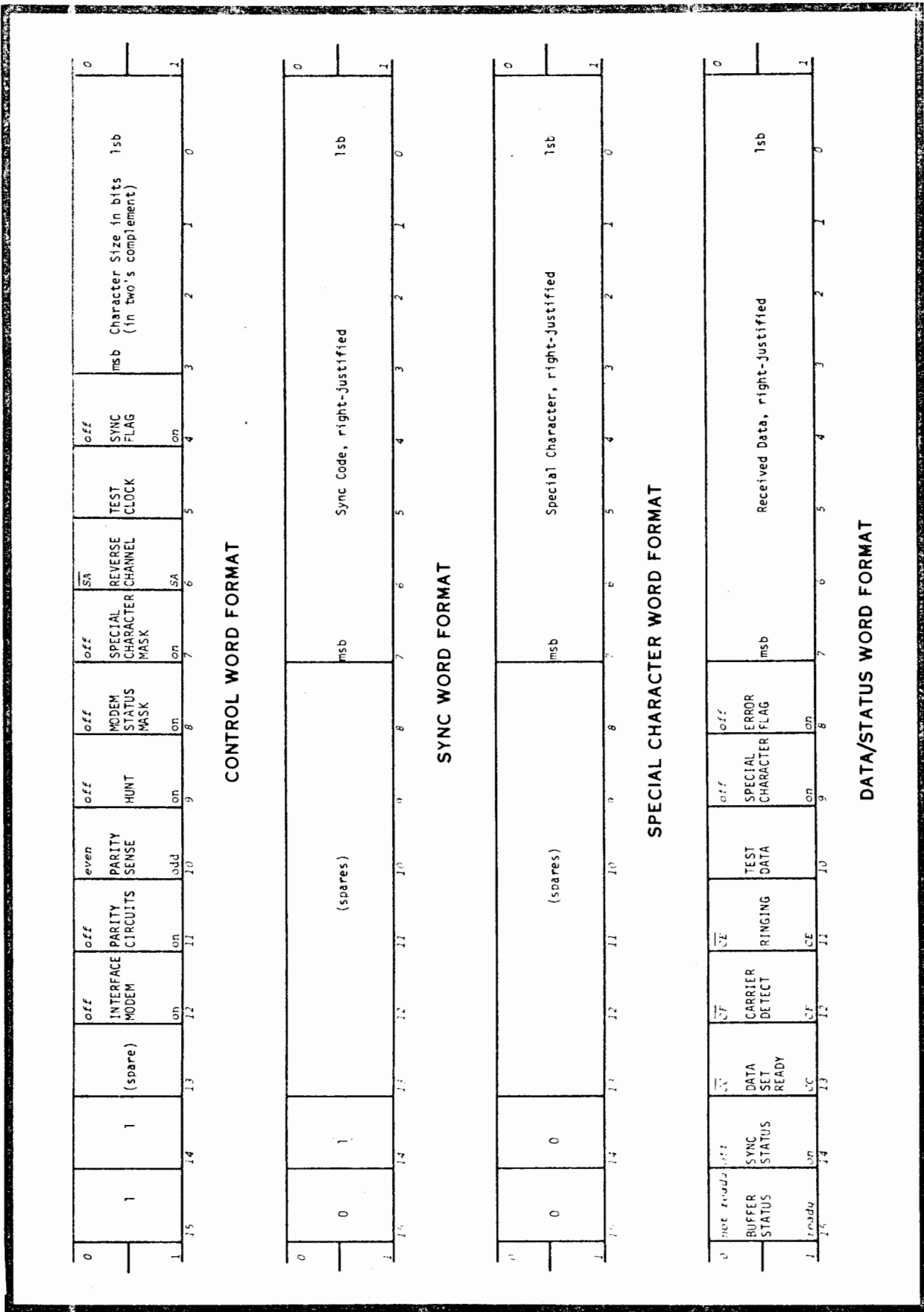


Figure ROI-2. I/O Word Formats

Table ROI-1
 Program Configuration--Switch Register Settings

SWITCH REGISTER

| | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|

| <u>Bits</u> | <u>Functions</u> |
|-------------|--|
| 0-5 | Set to the HP 12621 Interface select code. |
| 6-8 | Spares |
| 9 | Set on if a teleprinter is not available. |
| 10-15 | Spares |



Table ROI-2
 Program Options--Switch Register Settings

SWITCH REGISTER

| | | | | | | | | | | | | | | | |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|

| <u>Bits</u> | <u>Functions</u> |
|-------------|---|
| 0 | Must be set on (may be done at any time) to override the internal switch register to change an option. This bit has no effect when set in the internal switch register. |
| 1-8 | Spares |
| 9 | Set on to suppress start and stop messages. |
| 10 | Set on to run the PRESET test within BI/O. |
| 11 | Set on to suppress all teleprinter messages. |
| 12 | Set on to halt at the end of a complete diagnostic program cycle. |
| 13 | Set on to repeat the routine just ended rather than advance to the next routine. |
| 14 | Set on to suppress error halts. |
| 15 | Set on to halt at the end of each routine (with the appropriate message on the teleprinter, to allow a decision to repeat the routine. See bits 0 and 13. |

Table ROI-3
Diagnostic Messages

| <u>MEMORY DATA</u> | <u>Routine</u> | <u>Message</u> | <u>Comments</u> |
|--------------------|----------------|--|--|
| 102001 | BI/O | E1. CLF DID NOT CLEAR FLAG OR SFS CAUSED SKIP WITH FLAG CLEAR | Test the ability to clear the interface flag and test the SFS instruction. |
| 102002 | BI/O | E2. SFC DID NOT SKIP WITH FLAG CLEAR | Test the ability of the SFC instruction. |
| 102003 | BI/O | E3. STF DID NOT SET FLAG, OR SFC CAUSED SKIP WITH FLAG SET | Test the ability to set interface flag and test the SFC instruction. |
| 102004 | BI/O | E4. SFS DID NOT SKIP WITH FLAG SET | Test the SFS instruction |
| 102005 | BI/O | E5. DID NOT INTERRUPT | Test the interface interrupt capability. |
| 102006 | BI/O | E6. THE RETURN ADDRESS IS NOT CORRECT | The return address that resulted from the interrupt is incorrect. |
| 102007 | BI/O | H7. PRESS INTERNAL AND EXTERNAL PRESET, THEN PRESS RUN | |
| (no halt) | INIT | H8. START RECEIVE(ONLY) INTERFACE DIAGNOSTIC | Message omitted if program option bit 9 set. |
| 102010 | BI/O | E10. EXTERNAL PRESET DID NOT SET THE FLAG | |
| 102011 | BI/O | H11. END BI/O | Select program options and press RUN. |
| 102012 | BI/O | E12. INTERNAL PRESET DID NOT DISABLE INTERRUPTS | |
| 102013 | BI/O | E13. EXTERNAL PRESET DID NOT SET FLAG AND INTERNAL PRESET DID NOT DISABLE INTERRUPTS | |
| 102014 | BI/O | E14. INTERRUPT ACKNOWLEDGE DID NOT WORK. TEST ABORTED | Remaining tests of BI/O are skipped. |
| 102015 | BI/O | E15. CLC 0 DID NOT CLEAR CONTROL FLIP-FLOP | Control bit did not reset with CLC 0 instruction. |

Table ROI-3 (cont). Diagnostic Messages

| <u>MEMORY DATA</u> | <u>Routine</u> | <u>Message</u> | <u>Comments</u> |
|--------------------|----------------|---|--|
| 102016 | BI/O | E16. PRESET DID NOT CLEAR CONTROL | |
| 102017 | BI/O | (none) | CLF \emptyset did not disable interrupts or SFS \emptyset caused a bad skip. |
| 102020 | BI/O | (none) | CLF \emptyset did not disable interrupts or SFC \emptyset did not skip. |
| 102021 | BI/O | E21. STF \emptyset OR SFC \emptyset DID NOT WORK | STF \emptyset did not enable interrupts or SFC \emptyset caused a bad skip. |
| 102022 | BI/O | E22. STF \emptyset OR SFS \emptyset DID NOT WORK | STF \emptyset did not enable interrupts or SFS \emptyset did not skip. |
| 102023 | BI/O | E23. CLC ON CHANNEL DID NOT CLEAR CONTROL | Control bit did not reset with CLC <i>ch</i> instruction (<i>ch</i> = interface channel.) |
| 102024 | BI/O | E24. CLC CH,C DID NOT CLEAR FLAG OR SFC DID NOT SKIP WITH FLAG CLEAR | This tests the ,C part of the instruction to clear flag. |
| 102025 | BI/O | E25. STATUS BITS ARE xxxxxx AND SHOULD BE $\emptyset\emptyset\emptyset\emptyset\emptyset$ | Bits 8 through 15 should be clear. No other bits considered. |
| 102026 | BI/O | (none) | First non-TTY display of E25. A- (or switch) Register contains the incorrect status bits. |
| 102027 | BI/O | (none) | Second non-TTY display of E25. A- (or switch) Register contains the correct status bits (000000). |
| 102030 | BI/O | (none) | A- (or switch) Register display of current program options. Confirm or change (see Table ROI-2) and press RUN. |

Table ROI-3 (cont). Diagnostic Messages

| <u>MEMORY DATA</u> | <u>Routine</u> | <u>Message</u> | <u>Comments</u> |
|--------------------|----------------|--|--|
| 102031 | FCTST | E31. INCORRECT STATUS. BIT 11 NOT SET | Bit 11 should be set. |
| 102033 | FCTST | E33. INCORRECT STATUS BIT 11 SET | Bit 11 should be clear. |
| 102034 | FCTST | E34. FLAG SET AND SHOULD BE CLEAR | Follows test E33. |
| 102035 | FCTST | E35. STATUS BITS ARE xxxxxx AND SHOULD BE 012000 | Status error. |
| 102036 | FCTST | (none) | First non-TTY display of E35. A- (or switch) Register contains the incorrect status bits. |
| 102037 | FCTST | (none) | Second non-TTY display of E35. A- (or switch) Register contains the correct status bits (012000). |
| 102040 | FCTST | (none) | A- (or switch) Register display of current pro- gram options. Confirm or change (see Table ROI-2) and press RUN. |
| 102041 | FCTST | E41. FLAG NOT SET | Follows test E35. |
| 102042 | FCTST | E42. INCORRECT STATUS. BIT 13 NOT SET | Bit 13 should be set. |
| 102043 | FCTST | E43. FLAG SET AND SHOULD BE CLEAR | Follows test E42. |
| 102044 | FCTST | E44. STATUS BITS ARE xxxxxx AND SHOULD BE 020000 | Status error. |
| 102045 | FCTST | (none) | First non-TTY display of E44. A- (or switch) Register contains the incorrect status bits. |



Table ROI-3 (cont). Diagnostic Messages

| <u>MEMORY DATA</u> | <u>Routine</u> | <u>Message</u> | <u>Comments</u> |
|--------------------|----------------|--|--|
| 102046 | FCTST | (none) | Second non-TTY display of E44. A- (or switch) Register contains the correct status bits (020000). |
| 102047 | FCTST | (none) | A- (or switch) Register display of current program options. Confirm or change (see Table ROI-2) and press RUN. |
| 102050 | FCTST | E50. FLAG NOT SET | Follows test E44. |
| 102051 | FCTST | E51. FLAG SET AND SHOULD BE CLEAR | Interface not clearing flag. |
| 102052 | FCTST | H52. END FCTST | Select program options and press RUN. |
| 102053 | RECV | E53. ERROR IN RECEIVE PATTERN TEST. xxxx PARITY MODE SELECTED, CHARACTER SIZE IS xx BITS, WORD RECEIVED WAS xxxxxxx AND SHOULD BE xxxxxxx | Interface receive failure. The data received did not compare with the data sent. |
| 102054 | RECV | (none) | First non-TTY display of E53. A- (or switch) Register contains 0 for no-parity mode, 1 for odd-parity mode, or 2 for even-parity mode. |
| 102055 | RECV | (none) | Second non-TTY display of E53. A- (or switch) Register contains the character size in bits. |
| 102056 | RECV | (none) | Third non-TTY display of E53. A- (or switch) Register contains the word sent to the interface. |
| 102057 | RECV | (none) | Fourth non-TTY display of E53. A- (or switch) Register contains the word received. |

Table ROI-3 (cont). Diagnostic Messages

| <u>MEMORY DATA</u> | <u>Routine</u> | <u>Message</u> | <u>Comments</u> |
|--------------------|----------------|--|--|
| 102060 | RECVP | (none) | A- (or switch) Register display of current program options. Confirm or change (see Table ROI-2) and press RUN. |
| 102061 | RECVP | E61. STATUS ERROR IN RECEIVE TEST. STATUS IS xxxxxx AND SHOULD BE 100000 | Bit 15 should be 1, bit 8 should be 0. |
| 102062 | RECVP | (none) | First non-TTY display of E61. A- (or switch) Register contains the incorrect status bits. |
| 102063 | RECVP | (none) | Second non-TTY display of E61. A- (or switch) Register contains the correct status bits (100000). |
| 102064 | RECVP | (none) | A- (or switch) Register display of current program options. Confirm or change (see Table ROI-2) and press RUN. |
| 102067 | RECVP | E67. FLAG NOT SET AFTER RECEIVE CYCLE | Follows tests E53 and E61. |
| 102070 | RECVP | H70. END RECVP | Select program options and press RUN. |
| 102074 | CFGR | (none) | Select internal switch register program options by setting switch register as listed in Table ROI-2 and press RUN. |
| 102075 | CFGR | (none) | Configuration error halt. Set correct bits in switch register and press RUN. |
| (no halt) | END | H77. DIAGNOSTIC HAS BEEN COMPLETED | End of test. If program option bit 12 is set, diagnostic will halt with 102077 ₈ displayed. |

Table ROI-3 (cont). Diagnostic Messages

| <u>MEMORY DATA</u> | <u>Routine</u> | <u>Message</u> | <u>Comments</u> |
|--------------------|----------------|--|---|
| 102077 | END | (none) | End of Test. |
| 103000 | SPCHR | E100. ERROR IN SPECIAL CHARACTER TEST. xxxx PARITY MODE SELECTED, CHARACTER SIZE IS xx BITS, DATA WORD IS xxxxxx. STATUS RECEIVED IS xxxxxx AND SHOULD BE 101000 | Interface failure |
| 103001 | SPCHR | (none) | First non-TTY display of E100. A- (or switch) Register contains 0 for no-parity mode, 1 for odd-parity mode, or 2 for even-parity mode. |
| 103002 | SPCHR | (none) | Second non-TTY display of E100. A- (or switch) Register contains the character size in bits. |
| 103003 | SPCHR | (none) | Third non-TTY display of E100. A- (or switch) Register contains the word sent to the interface. |
| 103004 | SPCHR | (none) | Fourth non-TTY display of E100. A- (or switch) Register contains the incorrect status bits, which should be 101000. |
| 103005 | SPCHR | (none) | A- (or switch) Register display of current program options. Confirm or change (see Table ROI-2) and press RUN. |
| 103006 | SPCHR | E106. FLAG NOT SET AFTER SPECIAL CHARACTER TEST | Follows test E100. |
| 103007 | SPCHR | E107. SPECIAL CHARACTER BIT IS SET | The Special Character bit should be clear. |
| 103010 | SPCHR | H110. END SPCHR | Select program options and press RUN. |



Table ROI-3 (cont). Diagnostic Messages

| <u>MEMORY DATA</u> | <u>Routine</u> | <u>Message</u> | <u>Comments</u> |
|--------------------|----------------|--|---|
| 103025 | SYNCH | E125. ERROR IN SYNC CODE TEST. BIT 15 IS NOT SET. xxxx PARITY MODE SELECTED, CHARACTER SIZE IS xx BITS, DATA WORD IS xxxxxx | Bit 15 should be set. |
| 103026 | SYNCH | (none) | First non-TTY display of E125. A- (or switch) Register contains 0 for no-parity mode, 1 for odd-parity mode, or 2 for even-parity mode. |
| 103027 | SYNCH | (none) | Second non-TTY display of E125. A- (or switch) Register contains the character size in bits. |
| 103030 | SYNCH | (none) | Third non-TTY display of E125. A- (or switch) Register contains the word sent to the interface. |
| 103031 | SYNCH | (none) | A- (or switch) Register display of current program options. Confirm or change (see Table ROI-2) and press RUN. |
| 103034 | SYNCH | E134. FLAG NOT SET AFTER SYNC CODE TEST | Follows test E125. |
| 103037 | SYNCH | E137. ERROR IN SYNC CODE TEST. BIT 15 IS SET. xxxx PARITY MODE SELECTED, CHARACTER SIZE IS xx BITS, DATA WORD IS xxxxxx. | Bit 15 should be clear. |
| 103040 | SYNCH | (none) | First non-TTY display of E137. A- (or switch) Register contains 0 for no-parity mode, 1 for odd-parity mode, or 2 for even-parity mode. |
| 103041 | SYNCH | (none) | Second non-TTY display of E137. A- (or switch) Register contains the character size in bits. |

Table ROI-3 (cont). Diagnostic Messages

| <u>MEMORY DATA</u> | <u>Routine</u> | <u>Message</u> | <u>Comments</u> |
|--------------------|----------------|---|---|
| 103042 | SYNCH | (none) | Third non-TTY display of E137. A- (or switch) Register contains the word sent to the interface. |
| 103043 | SYNCH | (none) | A- (or switch) Register display of current program options. Confirm or change (see Table ROI-2) and press RUN. |
| 103045 | SYNCH | H145. END SYNCH | Select program options and press RUN. |
| 103050 | LOCKN | E150. BIT 14 NOT SET | Bit 14 should be set when non-sync pattern data is sent to interface. |
| 103051 | LOCKN | E151. FLAG SET AND SHOULD BE CLEAR | Follows test E150. |
| 103052 | LOCKN | E152. BIT 14 SET AND SHOULD BE CLEAR | Bit 14 should be clear when two sync patterns have been sent to interface. |
| 103053 | LOCKN | E153. FLAG SET AND SHOULD BE CLEAR | The interface is designed to set flag when data is transferred, but not when sync is recognized. This test follows test E152. |
| 103054 | LOCKN | H154. END LOCKN | Select program options and press RUN. |
| 103060 | ERRFF | E160. ERROR BIT 8 NOT SET WITH EVEN PARITY CONTROL WORD AND ODD PARITY DATA | Error status bit failed. |
| 103061 | ERRFF | E161. ERROR BIT 8 NOT SET WITH ODD PARITY CONTROL WORD AND EVEN PARITY DATA | Error status bit failed. |



Table ROI-3 (cont). Diagnostic Messages

| <u>MEMORY DATA</u> | <u>Routine</u> | <u>Message</u> | <u>Comments</u> |
|--------------------|----------------|--|--|
| 103062 | ERRFF | E162. ERROR BIT 8 NOT SET WITH TWO DATA TRANSFERS WITHOUT A CLF ON CHANNEL | A CLF instruction (on device channel) should separate data received. With this instruction suppressed, the error bit failed. |
| 103063 | ERRFF | H163. END ERRFF | Select program options and press RUN. |
| 1060xx | ANY | (none) | Trap cell interrupt. M = memory address when interrupted, xx = the trap cell location. |
| 107077 | CFGR | (none) | Configuration complete. |