

DIAGNOSTIC PROGRAM PROCEDURES

HP 2100A SEND/RECEIVE
INTERFACE (12587) TEST



HP Order No. 24221 (current version)



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HP 2100A SEND/RECEIVE INTERFACE (12587A) TEST

This diagnostic test program confirms proper operation of the HP 12587A Send/Receive Data Interface Board with an HP 2100A computer.

The program is designed for maximum testing speed. The operator can repeat each function test within the diagnostic as often as desired; or he can run the entire program, stopping at the end of each function test to evaluate the results.

HARDWARE CONFIGURATION



The diagnostic program should be run in an HP 2100A computer and requires a test connector on the interface board. Figure SRI-1 shows how the test connector routes the board outputs to the inputs; Figure SRI-2 shows the I/O Word Formats. The diagnostic can be used with or without a teleprinter for reporting errors and messages to the operator. Without a teleprinter, errors and messages are indicated by special error code displays of MEMORY DATA.

FUNCTIONAL AND OPERATIONAL CHARACTERISTICS

If a teleprinter is to be used for reporting errors and messages, an SIO Teleprinter Driver must be configured before loading the diagnostic program. Then the diagnostic program must be loaded and configured through switch register settings (see Table SRI-1). A copy of the configured program can be obtained by using the SIO System Dump program, to avoid the configuration process for subsequent uses of the diagnostic. After configuration, the test program options (suppress printout, suppress halts, etc.) are selected via the switch register (see Table SRI-2).

When errors are detected, the Program types a message and halts with a MEMORY DATA error code displayed. (Exceptions to this are the trap cell halts $1060xx_8$ located in low memory, $2_8 - 77_8$, the cause of which must be determined by the user and corrected before the diagnostic is restarted.) If a teleprinter is not available and the computer halts, the MEMORY DATA displayed must be checked against Table SRI-3 to determine the error or message to the operator. If any data associated with the halt must be checked, that data must be displayed from the A-Register (see Table SRI-3).

PROGRAM ORGANIZATION

The diagnostic program consists of the following routines:

CONFIGURATION Configures the diagnostic for the select code (I/O channel), one or two stop bits, high or low speed mode, and with or without a teleprinter.

INITIALIZATION Sets all trap cell halts in locations $2_8 - 77_8$ and types the start message on the teleprinter.

BI/O - Basic I/O Test

Clears the interface board then checks all flag instructions and tests the ability to enable and disable interrupts. Then BI/O tests the ability to interrupt by forcing an interrupt, checking the return address for interrupting at the right place, and checking the interrupt acknowledge. Next, BI/O checks the control reset instructions and the PRESET switches. The PRESET test includes checks for flag set, interrupts disabled, control bit cleared, ready flip-flop set, clock enable reset, and CD, CE line reset (see Figure SRI-2).

CKFRQ - Clock Frequency Test

Obtains the clock frequency and prints the value in decimal on the teleprinter, or displays the value in octal in the A-(or switch) Register if the teleprinter is not available. This subprogram can be used in the recycle mode (see Table SRI-2, bit 13) to aid tuning of the clock frequency.

NOTE: The CKFRQ test was designed to operate the clock in the range of 6400 - 9600 Hz. If the clock operates below 6400 Hz, error message E6J may be indicated. If the clock is operating over 9600 Hz (either by the operator tuning high or by a circuit malfunction), the diagnostic may indicate a frequency below 9600 Hz. The clock should be checked with an oscilloscope to verify proper operation.

FCTST - Function/Status Test

Outputs a function signal and checks the status signal returned. All combinations of function/status signals and flag setting conditions obtainable through the test connector are tested.

SENDP - Send Pattern Test

Tests all patterns possible for all word sizes in the no-parity, odd-parity and even-parity modes.

RECVF - Receive Pattern Test

The same word patterns, word sizes and parity modes are tested in this program as in the SENDP program.

ERRFF - Error Flip-Flop Test

Tests the error flip-flop by forcing a parity error in both the even- and odd-parity modes. Then, in the no-parity mode, two receive cycles are used to test the error flip-flop detection of computer failure to accept two words.

END Prints the end-of-test message (if the teleprinter is available) and, if the repeat diagnostic option is selected (see Table SRI-2 bit 12), restarts the diagnostic.

OPERATING INSTRUCTIONS

- a. Use the Basic Binary Loader (BBL) to load the SIO Teleprinter Driver, configure that driver, then use the BBL again to load the diagnostic program.
- b. Load address 2_8 .
- c. To configure the diagnostic, set the switch register as listed in Table SRI-1, then press RUN. The computer halts with 102075_8 or 107077_8 displayed (see Table SRI-3).
- d. At this point the SIO System Dump program may be used to punch a configured HP 12587 diagnostic tape.
- e. Load address 100_8 .
- f. Select the desired program options by setting the switch register bits as listed in Table SRI-2, then press RUN.
- g. After all tests are completed, the diagnostic prints a message to signal that it has finished. Then, if bit 12 is set (see Table SRI-2), the program halts. In the slowest mode of operation, the diagnostic cycle takes about six minutes.

ERROR ANALYSIS

All messages to the operator printed on the teleprinter are prefixed by an alpha-numeric code. An H prefix indicates an operating instruction while an E prefix indicates an error message.

All halts are coded and may be found in Table SRI-3 opposite the appropriate MEMORY DATA value. After the computer has halted, the operator can press RUN to continue with the diagnostic.

If trap cell halts occur on the Teleprinter I/O channel, the diagnostic must be operated through its 'teleprinter is not available' configuration (see Table SRI-1).

The DMA portion of the HP 12587 Interface Board is not tested in this diagnostic.

Four possible priority string errors can exist in an interface board. Each is tested for the HP 12587 board as follows:

1. Does the board receive priority? Tested by this diagnostic.
2. Can the board 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 102005_8 (see Table SRI-3).
3. Does the board deliver priority? This can be tested only by running a diagnostic for a lower priority interface board to some other device.
4. Can the board deny priority? Not tested by this diagnostic.

OUTPUT			CONNECTIONS		INPUT		
Output Bit(s)	Symbol	Name	Pin	Pin	Name	Symbol	Input Bit(s)
		Clock Out	A	1	Clock in		
				23	Data Set Ready	CC	12
Start·0-7·Stop	BA	Transmitted Data	11	22	Data Carrier Detector	CF	11
10	SA	Supervisory Transmit	14	13	Received Data	BB	0-7
				19	Supervisory Receive	SB	14
13(bit 15 enable)	CA	Request to Send	16	12	Clear to Send	CB	(allows clock enable)
14(bit 15 enable)	CD	Data Terminal Ready	20	15	Ring Indicator	CE	10

If Echoplex is turned on, BB will be routed to BA. Consult Figure SRI-2 for the I/O Word Formats

Figure SRI-1. Test Connector (12587-60005) Diagram

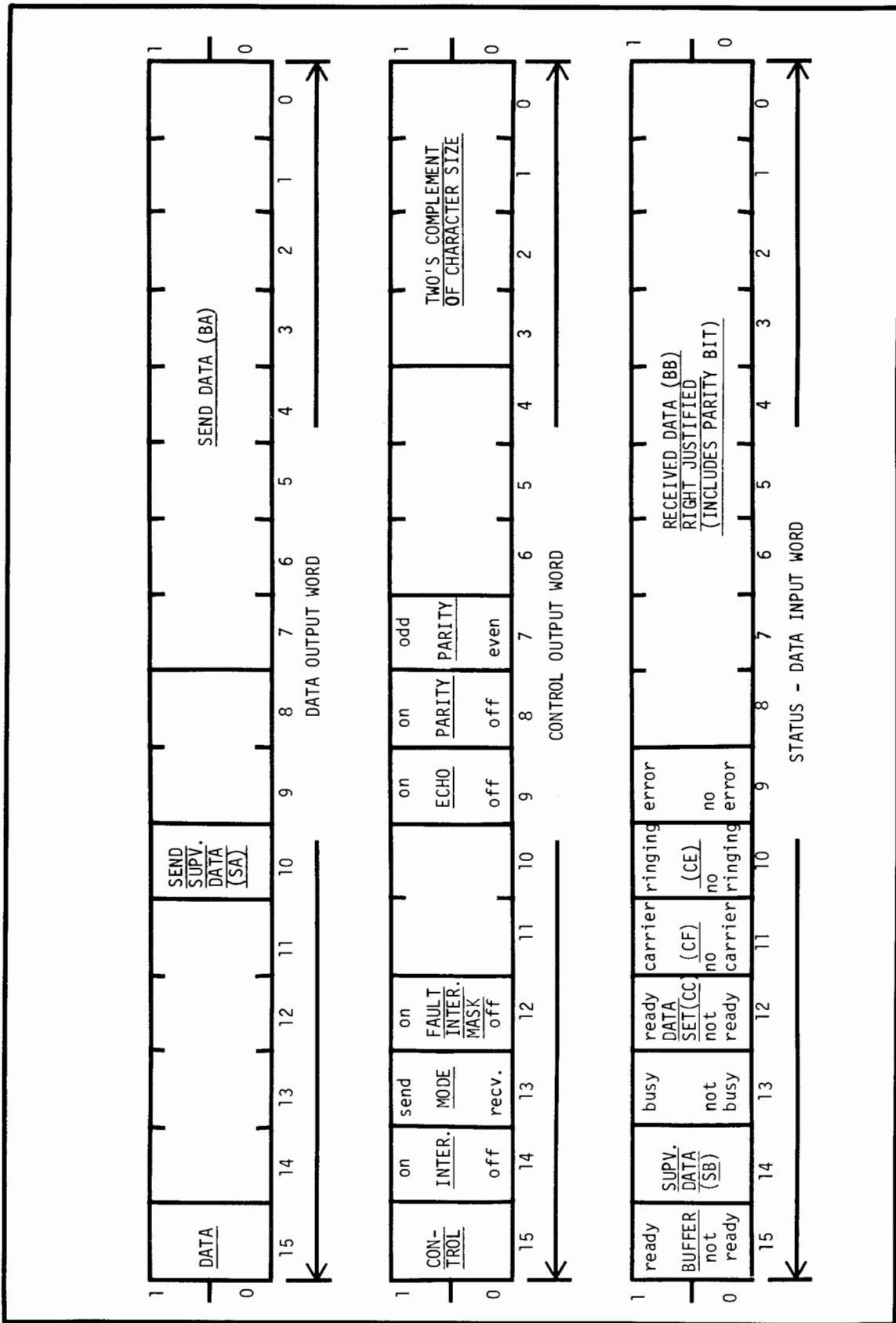


Figure SRI-2. I/O Word Formats



Table SRI-1

Program Configuration -- Switch Register Settings

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

<u>Bits</u>	<u>Function</u>
0-5	Set to the select code of the HP 12587 Interface Board.
6	Spare
7	Set on (up) if interface board is jumpered for two stop bits, or set off (down) if interface board is jumpered for one stop bit.
8	Set on (up) if interface board is jumpered for high-speed mode, or set off (down) if interface board is jumpered for low-speed mode.
9	Set on (up) if a teleprinter is not available, or set off (down) if a teleprinter is available.
10-15	Spares

Table SRI-2

Program Options -- Switch Register Settings

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

<u>Bits</u>	<u>Functions</u>
0-8	Spares
9	To suppress start and stop messages, set on (up).
10	To execute the PRESET and CKFRQ tests, set on (up).
11	To suppress all printed messages, set on (up).
12	To halt the diagnostic at the end of a complete cycle, set on (up).
13	To recycle the current test instead of advancing to the next test, set on (up).
14	To suppress error halts, set on (up).
15	To halt at the end of each separate test within the diagnostic (with the appropriate messages printed on the teleprinter), set on (up). This allows the user to set bit 13 for repetition of the last test performed.

Table SRI-3
Diagnostic Messages

<u>MEMORY DATA</u>	<u>Test</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 the 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 SEND/RECEIVE INTERFACE DIAGNOSTIC	Message omitted if bit 9 set on (up).
102010	BI/O	E10. EXTERNAL PRESET DID NOT SET THE FLAG	
102011	BI/O	H11. END BI/O	Select program options (see Table SRI-2) and press RUN.
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 terminated.
102015	BI/O	E15. CLC Ø DID NOT CLEAR CONTROL FLIP-FLOP	Control bit did not reset with CLC Ø instruction.



Table SRI-3 (cont)

<u>MEMORY DATA</u>	<u>Test</u>	<u>Message</u>	<u>Comments</u>
102016	BI/O	E16. EXTERNAL 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 caused a bad 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 caused a bad skip.
102023	BI/O	E23. STATUS BITS ARE xxxxxx AND SHOULD BE 1 $\emptyset\emptyset\emptyset\emptyset\emptyset$	PRESET switch failed. Bit 15 should = 1, bits 13 and 10 should = 0. No other bits are considered.
102024	BI/O	(none)	First non-TTY display of E23. A-Register contains incorrect status bits.
102025	BI/O	(none)	Second non-TTY display of E23. A-Register contains correct status bits (100000).
102026	CKFRQ	H26. END CKFRQ	Select program options (see Table SRI-2) and press RUN.
102027	BI/O	E27. INTERNAL PRESET DID NOT DISABLE INTERRUPTS	
(no halt)	CKFRQ	H3 \emptyset . THE CLOCK FREQUENCY IS xxxxxx	If test is to recycle, set bit 13 on (up); only the clock frequency (decimal) is printed on the teleprinter.
102030	CKFRQ	(none)	Non-TTY display of H3 \emptyset . A-Register contains the clock frequency (octal).

Table SRI-3 (cont)

<u>MEMORY DATA</u>	<u>Test</u>	<u>Message</u>	<u>Comments</u>
102062	FCTST	E62. INCORRECT STATUS IS xxxxxx AND SHOULD BE 044000	Bits 14, 11 should = 1, bit 12 should = 0.
102063	FCTST	(none)	First non-TTY display of E62. A-Register contains incorrect status bits.
102064	FCTST	(none)	Second non-TTY display of E62. A-Register contains correct status bits (044000).
102065	FCTST	E65. CLOCK NOT WORKING. TEST ABORTED	Interface clock failure.
102066	FCTST	E66. STATUS BIT 11 NOT SETTING (SERIAL DATA)	Error in Function/Status test 6.
102067	FCTST	E67. BUSY BIT (13) NOT SET	Error in Function/Status test 8.
102070	FCTST	H70. END FCTST	Select program options (see Table SRI-2) and press RUN.
102075	CFGR	(none)	Configuration error halt. Set correct bits in switch register (see Table SRI-1) and press RUN.
(no halt)	END	H77. DIAGNOSTIC HAS BEEN COMPLETED	End of test. If Bit 12 of switch register is on (up), program will halt (102077).
102077	END	(none)	End of test.
1060xx	Any	(none)	Trap cell interrupt. M = memory address when interrupted, xx = the trap cell location.
107002	SENDP	E102. CLOCK NOT WORKING	Interface clock failure.

Table SRI-3 (cont)

<u>MEMORY DATA</u>	<u>Test</u>	<u>Message</u>	<u>Comments</u>
107003	SENDP	E103. ERROR IN SEND PATTERN TEST. xxxx PARITY MODE SELECTED, CHARACTER SIZE IS xx BITS, DATA PATTERN OUT IS xxxxxx, THE PATTERN READ BACK IS xxxxxx AND SHOULD BE xxxxxx	Interface send failure.
107004	SENDP	(none)	First non-TTY display of E103. If A-Register contains 0 = no parity, 1 = odd parity, 2 = even parity.
107005	SENDP	(none)	Second non-TTY display of E103. A-Register contains number of bits in send character.
107006	SENDP	(none)	Third non-TTY display of E103. A-Register contains data pattern out.
107007	SENDP	(none)	Fourth non-TTY display of E103. A-Register contains incorrect data pattern read back.
107010	SENDP	(none)	Fifth non-TTY display of E103. A-Register contains correct data pattern.
107011	SENDP	(none)	A-Register display of current program options. Confirm or change program options (see Table SRI-2) and press RUN.
107020	SENDP	H120. END SENDP.	Select program options (see Table SRI-2) and press RUN.
107021	RECVP	E121. ERROR FLIP-FLOP SET. LAST CONTROL WORD WAS xxxxxx	Error status during receive cycle.
107022	RECVP	(none)	Non-TTY display of E121. A-Register contains last control word.

Table SRI-3 (cont)

<u>MEMORY DATA</u>	<u>Test</u>	<u>Message</u>	<u>Comments</u>
107023	RECVP	(none)	A-Register display of current program options. Confirm or change program options (see Table SRI-2) and press RUN.
107024	RECVP	E124. ERROR IN RECEIVE PATTERN TEST. xxxx PARITY MODE SELECTED, CHARACTER SIZE IS xx BITS, CURRENT DATA PATTERN IS xxxxxx, THE PATTERN READ IN WAS xxxxxx AND SHOULD BE xxxxxx	Interface receive failure.
107025	RECVP	(none)	First non-TTY display of E124. If A-Register contains 0 = no parity, 1 = odd parity, 2 = even parity.
107026	RECVP	(none)	Second non-TTY display of E124. A-Register contains number of bits in receive character.
107027	RECVP	(none)	Third non-TTY display of E124. A-Register contains current data pattern.
107030	RECVP	(none)	Fourth non-TTY display of E124. A-Register contains incorrect pattern read in.
107031	RECVP	(none)	Fifth non-TTY display of E124. A-Register contains correct pattern.
107032	RECVP	(none)	A-Register display of current program options. Confirm or change program options (see Table SRI-2) and press RUN.
107040	RECVP	H14Ø. END RECVP	Select program options (see Table SRI-2) and press RUN.

Table SRI-3 (cont)

<u>MEMORY DATA</u>	<u>Test</u>	<u>Message</u>	<u>Comments</u>
107041	ERRFF	E141. EVEN PARITY CONTROL WORD AND ODD PARITY DATA DID NOT SET ERROR BIT 9 IN STATUS	Error flip-flop failed to set when error condition was forced on interface. Even parity mode.
107042	ERRFF	E142. ODD PARITY CONTROL WORD AND EVEN PARITY DATA DID NOT SET ERROR BIT 9 IN STATUS	Same as E141. Odd parity mode.
107043	ERRFF	E143. TWO RECEIVE CYCLES WITHOUT INPUTTING DATA DID NOT SET ERROR FLAG	Same as E141. No parity mode.
107060	ERRFF	H160. END ERRFF	Select program options (see Table SRI-2) and press RUN.
107077	CFGR	(none)	Configuration complete.

