



PAPER TAPE NO. 12622-16001

HP 12622A TRANSMIT SYNCHRONOUS  
DATA SET INTERFACE DIAGNOSTIC  
(PART OF 12618A TRANSMIT-RECEIVE  
SYNCHRONOUS INTERFACE KIT)

for

hp-2100 SERIES COMPUTER

**reference manual**



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12622.070.12622-90008

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## HP 12622A TRANSMIT SYNCHRONOUS DATA SET INTERFACE KIT TEST

### INTRODUCTION

This diagnostic program confirms proper operation of the HP 12622A Transmit Synchronous Data Set Interface Kit for HP 2100 Series Computers.

The diagnostic also identifies hardware malfunctions and facilitates operator corrective action. The operator may run the program in several modes. He can loop the entire diagnostic and/or halt at the end. While running through the diagnostic, he can also loop through individual tests with message printout, and/or halt at the end of the test. Within tests, separate subtests can loop, without message printout, and/or halt, at the end of the subtest.

### HARDWARE REQUIREMENTS

This diagnostic runs on any HP 2100 Series Computer. The diagnostic requires that a test connector, HP part no. 12622-60005, be installed on the interface card during execution. Figure 1 shows how the test connector routes the board outputs to the inputs for test purposes; figure 2 shows the I/O word formats.

A console device may be used (optional) to report errors and messages to the operator. If a console device is not available, errors and messages are reported by Memory Data Register (T-register) error halt codes. A paper tape reader is required only for loading.

### SOFTWARE REQUIREMENTS

The following software is required:

The Diagnostic Configurator (part numbers listed below) is used for equipment configuration and as a console device driver.

Binary object tape part no. 24296-60001  
Manual part no. 02100-90157

HP 12622A Transmit Synchronous Data Set Interface Diagnostic binary object tape part no. 12622-16001.

Note: The Diagnostic Serial Number (DSN) resides in memory location 126g. The DSN for this diagnostic is 103013g.

OUTPUT			CONNECTORS		INPUT		
Output Bit(s)	Symbol	Name	Pin	Pin	Name	Symbol	Input Bit(s)
13	CD	Data Terminal Ready	2,B	20,X	Ring Indicator	CE	12
7	TEST	Test	4,D	23,AA 19,W	Transmission DB Signal Element Timing Data Set Ready	DB CC	- 13
12	CA	Request to Send	1,A	21,Y	Clear to Send	CB	14
0 - 7	BA	Transmitted Data	3,C	22,Z	Secondary Received Data	SBB	11

Figure 1. Test Connector (HP Part No. 12622-60005) Diagram

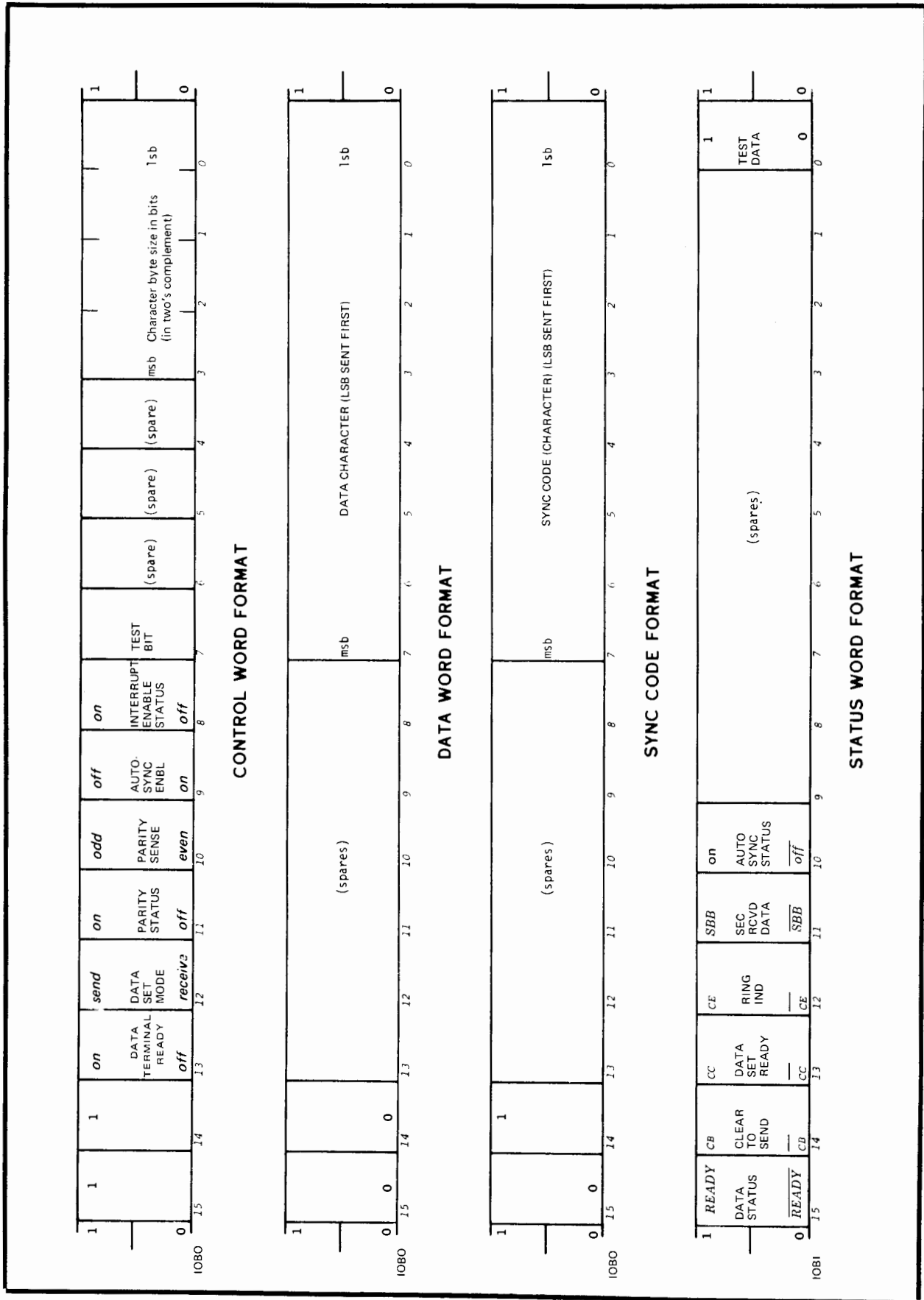


Figure 2. I/O Word Formats



## FUNCTIONAL AND OPERATIONAL CHARACTERISTICS

The Diagnostic Configurator is loaded and configured first, then this diagnostic program is loaded and configured in two phases:

- a. *Program Configuration* is specified by Switch Register settings listed in table 1.
- b. *Program options* for a normal run (suppress printout, suppress halts, etc.) are selected by setting the Switch Register as listed in table 2.

After configuration, a copy of the configured program may be obtained by using the Configurator Dump routine 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 console device, then halts with an error code displayed in the T- (or Memory Data) Register. (Exceptions are trap cell halts  $1060xx_8$  located in low memory  $2_8 - 77_8$ . Trap cell halts are irrecoverable and are beyond the scope of this diagnostic. (The cause of a trap cell halt should be determined by the operator before the diagnostic is restarted.) If a console device is not available, after the diagnostic halts the error code displayed must be checked against table 3 to determine the error or message. (All halt messages are listed in table 3.) If a console device is not available, data may be displayed in the A- (or switch) register (depending on the type of computer in use).

## PROGRAM ORGANIZATION

The diagnostic accommodates the following executive modules:

CONFIGURATION	This routine configures the diagnostic for the proper select code (I/O channel).
INIT	The Initialize routine sets trap cell halts in locations $2_8 - 77_8$ and prints the start-of-diagnostic message on the console device.
EXECX	The Executive routine controls diagnostic execution for tests BI/O, FCTST, TNS, ASON, ASOFF, and ASDTA according to program options selected on the Switch Register.

This diagnostic performs the series of tests described below:

BI/O	The Basic I/O test 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. Then BI/O checks the control reset instructions, and, if that option is selected, tests the PRESET switch(es). When the PRESET switch(es) is (are) tested, BI/O checks for flag set, interrupts disabled, control bit cleared, and interface status.
FCTST	The Function/Status test issues a function request to the interface then checks the Status Word. All possible combinations of function requests, status returns, and flag setting conditions that are made possible by the test connector are tested.

TNS	The Test Sync/Non-Sync test checks for proper operation of sync and data patterns in the auto and non-sync modes.
ASON	The Send Pattern with Auto-Sync On test checks all data patterns possible for all character sizes in the no-parity, odd-parity, and even-parity modes.
ASOFF	The Send Pattern with Auto-Sync Off test checks all data patterns possible for all character sizes in the no-parity, odd-parity, and even-parity modes.
ASDTA	The Auto-Sync Pattern test verifies all sync patterns possible for all character sizes in the no-parity, odd-parity, and even-parity modes. No data is transferred during this test.
END	This routine prints the end-of-diagnostic message on the console device, and repeats the diagnostic automatically if program option (Switch Register) bit 12 is set. If Switch Register bit 12 is not set, the diagnostic will halt.

## LIMITATIONS



This diagnostic does not check the following items:

- a. The DMA (called Dual Channel Port Controller (DCPC) in 21MX Series Computers) portion of the interface.
- b. An illegal interrupt (from this interface, CLF 0) when the interrupt system is turned off.
- c. An illegal response (of this interface) to select codes not assigned to this interface. That is, if IOG(B) (pin 15) is forced into the true state, an illegal response cannot be determined with software and, therefore, will not be reported.

Of the four possible priority string errors that can exist on an interface card, only three can be tested for the HP 12622A Interface as follows:

- a. Does the interface receive priority? Tested by this diagnostic program.
- b. Can the interface be denied priority? To make this test, the operator extracts an unused higher-priority card, runs this diagnostic program and checks for an error code 102005g. See table 3.
- c. Does the interface delivery priority? This can be tested only by running a diagnostic program for a lower priority interface card (for some other device).
- d. Can the interface deny priority? Not tested by this diagnostic program.

## OPERATING INSTRUCTIONS

- a. After computer power is shut off,\* install test connector, HP part number 12622-60005, on the interface, and power-up the computer.
- b. Figure 3 is the operating procedure flowchart for loading the Diagnostic Configurator and this diagnostic.
  1. If an unconfigured Diagnostic Configurator is to be used start at entry point A on the flowchart.
  2. If a configured Diagnostic Configurator is to be used start at entry point B on the flowchart.
  3. If a combined configured Diagnostic Configurator and an unconfigured Diagnostic is to be used start at entry point C on the flowchart.
  4. If a combined configured Diagnostic Configurator and a configured Diagnostic is to be used start at entry point D on the flowchart.
- c. After the diagnostic has advanced through all tests a message is output indicating completion of the diagnostic (halt 102077). The diagnostic will come to a halt at the end of each test if Switch Register bit 15 is set. The diagnostic will halt at the end of each subtest if Switch Register bit 8 is set. (See table 2 on Program Options -- Switch Register Settings.)
- d. The operator may press RUN to start another pass after a halt at the end of the diagnostic. To restart the diagnostic without reconfiguring, load address 2000g.
- e. If the PRESET subtest in the BI/O test is to be performed (Switch Register bit 10 set), the program prints a message and/or halts with 102007g displayed. Press PRESET (INTERNAL and EXTERNAL) then press RUN.

## MESSAGE ANALYSIS

All diagnostic messages printed on the console device 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 3 to analyze the halt conditions, then press RUN to resume the diagnostic program.

If a trap cell halt occurs (1060xx) the operator must determine the cause of either the interrupt or the transfer of control to the location shown in the M-register. The diagnostic may have to be reloaded to continue.

Table 1. Program Configuration -- Switch Register Settings

BIT	FUNCTION
0 - 5	Set to the HP 12622A Interface select code.
6 - 15	Reserved

\*If battery is not employed on HP 21MX Series Computers all memory data will be lost by turning the computer OFF. Therefore, place HP 21MX Series Computers in STANDBY mode.

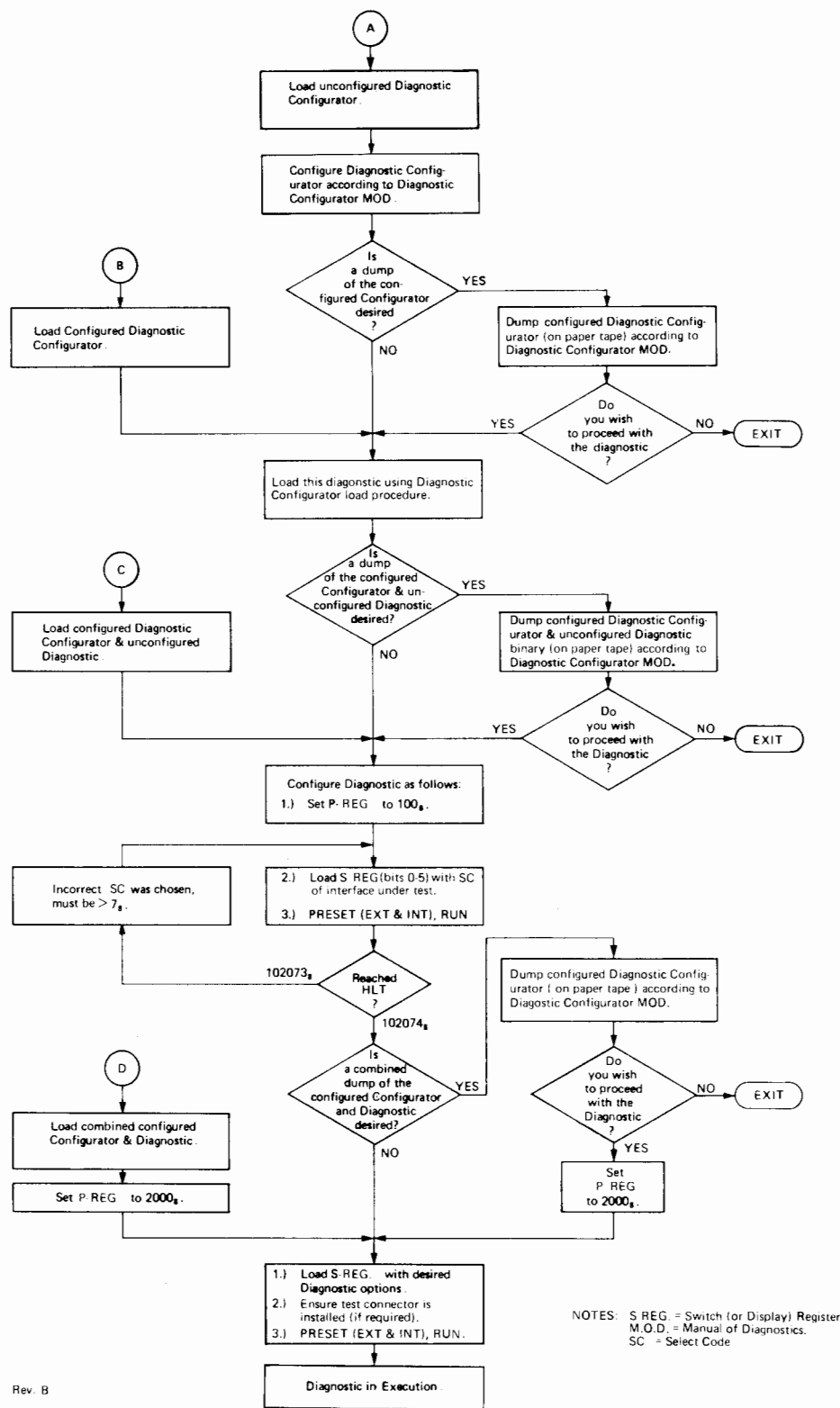


Figure 3. Operating Procedure Flowchart

Table 2. Program Options -- Switch Register Settings

BIT	FUNCTION
0	Reserved (setting ignored).
1	Set to omit the BI/O test.
2	Set to omit the FCTST test.
3	Set to omit the TNS test.
4	Set to omit the ASON test.
5	Set to omit the ASOFF test.
6	Set to omit the ASDTA test.
7*	Set to repeat the preceeding subtest.
8*	Set to halt at the end of the subtest just run (with the appropriate message on the console device), to allow a decision to repeat that subtest. If bit is cleared, program will proceed to next subtest. (T-register halt code is the same as the error halt.) When Switch Register bit 8 is set, with bit 7 set, the halt indicates an error condition (if present) and the same halt code will be displayed again because of bit 8 being set.
9	Set to omit the start and stop message output on the console device.
10	Set to run the PRESET subtest within the BI/O test.
11	Set to suppress all console device messages.
12	Set to repeat the complete diagnostic program cycle. If clear, the diagnostic will halt after a complete cycle of the program.
13*	Set to repeat the test just run.
14	Set to suppress error halts.
15*	Set to halt at the end of the test just run. This allows the operator to continue or repeat a test by setting bit 13.
<p>*Switch Register bits 7 and 8 are used for <i>subtest</i> loops and halts.  Switch Register bits 13 and 15 are used for <i>test</i> loops and halts. (BI-O, FCTST, TNS, ASON, ASOFF, and ASDTA.)</p>	

Table 3. Diagnostic Messages

MEMORY DATA	ROUTINE	MESSAGE	COMMENTS
(no halt)	INIT	H8. START SEND (ONLY) INTERFACE DIAGNOSTIC	None
102000	BI/O	E0. PRESET STATUS ERROR STATUS IS <i>xxxxxx</i> AND SHOULD BE <i>xxxxxx</i>	None
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	None
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	None
102005	BI/O	E5. DID NOT INTERRUPT	Test the interface interrupt capabilities.
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 PRESET, THEN PRESS RUN	None
102010	BI/O	E10. PRESET DID NOT SET THE FLAG	PRESET switch failed.
102011	BI/O	H11. END BI-O	None
102012	BI/O	E12. PRESET DID NOT DISABLE INTERRUPTS	PRESET switch failed.
102013	BI/O	E13. PRESET DID NOT SET FLAG AND DID NOT DISABLE INTERRUPTS	PRESET switch failed.
102014	BI/O	E14. INTERRUPT ACKNOWLEDGE DID NOT WORK. ABORT BI-O	None
102015	BI/O	E15. CLC 0 DID NOT CLEAR CONTROL	None
102016	BI/O	E16. PRESET DID NOT CLEAR CONTROL	None
102017	BI/O	(none)	CLF 0 did not disable interrupts or SFS 0 caused a bad skip.

Table 3. Diagnostic Messages (Continued)

MEMORY DATA	ROUTINE	MESSAGE	COMMENTS
102020	BI/O	(none)	CLF 0 did not disable interrupts or SFC 0 caused a bad skip.
102021	BI/O	E21. STF 0 OR SFC 0 DID NOT WORK	STF 0 did not enable interrupts or SFC 0 caused a bad skip.
102022	BI/O	E22. STF 0 OR SFS 0 DID NOT WORK	STF 0 did not enable interrupts or SFS 0 caused a bad skip.
102023	BI/O	E23. CLC ON CHANNEL DID NOT CLEAR CONTROL	Control bit did not reset with CLC CH instruction (CH = channel (select code) of interface (SC)).
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	(none)	First non-TTY display of E0. A- (or Switch) Register contains the incorrect (received) status bit.
102026	BI/O	(none)	Second non-TTY display of E0. A- (or Switch) Register contains the correct status bit.
102027	BI/O	(none)	A- (or Switch) Register display of current program options. Confirm or change (see table 2) and press RUN.
102030	FCTST	E30. READY NOT RESET BY DATA OUTPUT	TST1 of FCTST.
102031	FCTST	E31. STATUS ERROR-BIT 12 NOT = 1	TST2 of FCTST.
102032	FCTST	E32. FLAG NOT SET	TST2 of FCTST.
102033	FCTST	E33. STATUS ERROR-DATA IS <i>xxxxxx</i> AND SHOULD BE <i>xxxxxx</i>	TST3 of FCTST.
102034	FCTST	E34. FLAG NOT SET	TST3 of FCTST.

Table 3. Diagnostic Messages (Continued)

MEMORY DATA	ROUTINE	MESSAGE	COMMENTS
102035	FCTST	(none)	First non-TTY display of E33. A- (or Switch) Register contains the incorrect (received) status bits.
102036	FCTST	(none)	Second non-TTY display of E33. A- (or Switch) Register contains the correct status bit.
102037	FCTST	(none)	A- (or Switch) Register display of current program options. Confirm or change (see table 2) and press RUN.
102040	FCTST	E40. FLAG NOT SET	TST4 of FCTST.
102041	FCTST	E41. FLAG NOT CLEAR	TST5 of FCTST.
102043	FCTST	E43. FLAG NOT SET	TST5 of FCTST.
102044	FCTST	E44. STATUS ERROR-DATA IS <i>xxxxxx</i> AND SHOULD BE <i>xxxxxx</i>	TST4 of FCTST.
102045	FCTST	(none)	First non-TTY display of E44. A- (or Switch) Register contains the incorrect (received) status bits.
102046	FCTST	(none)	Second non-TTY display of E44. A- (or Switch) Register contains the correct status bits.
102047	FCTST	(none)	A- (or Switch) Register display of current program options. Confirm or change (see table 2) and press RUN.
102052	FCTST	H52. END FCTST	None
102053	ASON	E53. ERROR IN SEND DATA PATTERN TEST WITH AUTO-SYNC ON. <i>xxxx</i> PARITY MODE SELECTED, CHARACTER SIZE IS <i>xx</i> BITS, WORD RECEIVED WAS <i>xxxxxx</i> AND SHOULD BE <i>xxxxxx</i>	None



Table 3. Diagnostic Messages (Continued)

MEMORY DATA	ROUTINE	MESSAGE	COMMENTS
102054	ASON	(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	ASON	(none)	Second non-TTY display of E53. A- (or Switch) Register contains the character size in bits.
102056	ASON	(none)	Third non-TTY display of E53. A- (or Switch) Register contains the character sent.
102057	ASON	(none)	Fourth non-TTY display of E53. A- (or Switch) Register contains the character received.
102060	ASON	(none)	A- (or Switch) Register display of current program options. Confirm or change (see table 2) and press RUN.
102061	FCTST	E61. STATUS ERROR-DATA IS xxxxxx AND SHOULD BE xxxxxx	TST5 of FCTST.
102062	FCTST	(none)	First non-TTY display of E61. A- (or Switch) Register contains the incorrect (received) status bits.
102063	FCTST	(none)	Second non-TTY display of E61. A- (or Switch) Register contains the correct status bits.
102064	FCTST	(none)	A- (or Switch) Register display of current program options confirm or change (see table 2) and press RUN.
102065	ASON	H65. END ASON	None

Table 3. Diagnostic Messages (Continued)

MEMORY DATA	ROUTINE	MESSAGE	COMMENTS
102070	BI/O	E70. PRESET FAILED, ABORT BI-O	Preset subtest failed; determine cause.
102073	CFGR	(none)	Configuration error halt. Enter values in Switch Register and press RUN.
102074	CFGR	(none)	Select Switch Register program options by setting Switch Register as listed in table 2 and press RUN.
102077	END	H77. DIAGNOSTIC COMPLETE	None
103000	TNS	E200. 1ST SYNC INCORRECT	E200-203 check for three sync patterns followed by a data pattern with auto-sync on.
103001	TNS	E201. 2ND SYNC INCORRECT	See remarks for code 103000.
103002	TNS	E202. 3RD SYNC INCORRECT	See remarks for code 103000.
103003	TNS	E203. DATA INCORRECT	See remarks for code 103000.
103004	TNS	E204. 1ST SYNC INCORRECT	E204-213 check for three sync patterns followed by four more sync patterns, followed by a data pattern with auto-sync on.
103005	TNS	E205. 2ND SYNC INCORRECT	See code 103004.
103006	TNS	E206. 3RD SYNC INCORRECT	See code 103004.
103007	TNS	E207. 4TH SYNC INCORRECT	See code 103004.
103010	TNS	E210. 5TH SYNC INCORRECT	See code 103004.
103011	TNS	E211. 6TH SYNC INCORRECT	See code 103004.
103012	TNS	E212. 7TH SYNC INCORRECT	See code 103004.
103013	TNS	E213. DATA INCORRECT	See code 103004.

Table 3. Diagnostic Messages (Continued)

MEMORY DATA	ROUTINE	MESSAGES	COMMENTS
103014	TNS	E214. 1ST DATA INCORRECT	E214-221 checks for data send twice followed by a received mode control word followed by three syncs. The card should not send, but forcing a toggle should return all ones. Test with auto-sync on.
103015	TNS	E215. 2ND DATA INCORRECT	See code 103014.
103016	TNS	E216. 1ST SYNC INCORRECT	See code 103014.
103017	TNS	E217. 2ND SYNC INCORRECT	See code 103014.
103020	TNS	E220. 3RD SYNC INCORRECT	See code 103014.
103021	TNS	E221. ALL ONE'S NOT RETURNED	See code 103014.
103022	TNS	E222. 1ST DATA INCORRECT	E222-227 checks for data send twice followed by four syncs with auto-sync on.
103023	TNS	E223. 2ND DATA INCORRECT	See code 103022.
103024	TNS	E224. 1ST SYNC INCORRECT	See code 103022.
103025	TNS	E225. 2ND SYNC INCORRECT	See code 103022.
103026	TNS	E226. 3RD SYNC INCORRECT	See code 103022.
103027	TNS	E227. 4TH SYNC INCORRECT	See code 103022.
103030	TNS	E230. ALL ZERO'S NOT RETURNED	Check for no sync sent when auto-sync off. A forced toggle should transfer zero's.
103031	TNS	E231. DATA INCORRECT	E231-233 checks for data sent, data repeat. Then send a receive mode control word and check for all ones by forcing a toggle. Test with auto-sync off.
103032	TNS	E232. DATA DID NOT REPEAT	See code 103031.
103033	TNS	E233. ALL ONE'S NOT RETURNED	See code 103031.

Table 3. Diagnostic Messages (Continued)

MEMORY DATA	ROUTINE	MESSAGE	COMMENTS
103070	TNS	E270. END TNS	None
1060xx	ANY	(none)	Trap cell interrupt. M-register = memory address when interrupted, xx = trap cell location.
107020	ASDTA	E120. ERROR IN SYNC. PATTERN TEST. xxxx PARITY MODE SELECTED, CHARACTER SIZE IS xx BITS, WORD RECEIVED WAS xxxxxx AND SHOULD BE xxxxxx	None
107021	ASDTA	(none)	First non-TTY display of E120. A- (or Switch) Register contains 0 for no-parity mode, 1 for odd-parity mode, or 2 for even-parity mode.
107022	ASDTA	(none)	Second non-TTY display of E120. A- (or Switch) Register contains the character size in bits.
107023	ASDTA	(none)	Third non-TTY display of E120. A- (or Switch) Register contains the character sent.
107024	ASDTA	(none)	Fourth non-TTY display of E120. A- (or Switch) Register contains the character received.
107025	ASDTA	(none)	A- (or Switch) Register display of current program options. Confirm or change (see table 2) and press RUN.
107040	ASDTA	H140. END ASDTA	None
107067	ASOFF	E167. ERROR IN SEND DATA PATTERN TEST WITH AUTO-SYNC OFF. xxxx PARITY MODE SELECTED, CHARACTER SIZE IS xx BITS, WORD RECEIVED WAS xxxxxx AND SHOULD BE xxxxxx	None

Table 3. Diagnostic Messages (Continued)

MEMORY DATA	ROUTINE	MESSAGE	COMMENTS
107070	ASOFF	(none)	First non-TTY display of E167. A- (or Switch) Register contains 0 for no-parity mode, 1 for odd-parity mode, or 2 for even-parity mode.
107071	ASOFF	(none)	Second non-TTY display of E167. A- (or Switch) Register contains the character size in bits.
107072	ASOFF	(none)	Third non-TTY display of E167. A- (or Switch) Register contains the character sent.
107073	ASOFF	(none)	Fourth non-TTY display of E167. A- (or Switch) Register contains the character received.
107074	ASOFF	(none)	A- (or Switch) Register display of current program options. Confirm or change (see table 2) and press RUN.
107076	ASOFF	H176. END ASOFF	None





### Introduction

Topaz Ultra-Isolation Transformers are constructed with three individual electrostatic barrier shields which can be connected in several ways. The type of noise which is to be attenuated in a particular application will determine the connection to be used. The purpose of this application note is to guide the user to the proper connection and to assist him in understanding the characteristics of the Topaz Ultra-Isolation Transformer and its uses.

### Definitions

COMMON MODE NOISE appears between both sides of the power line and ground. (Oscilloscope pictures A and B in Figure 1 are the same.)

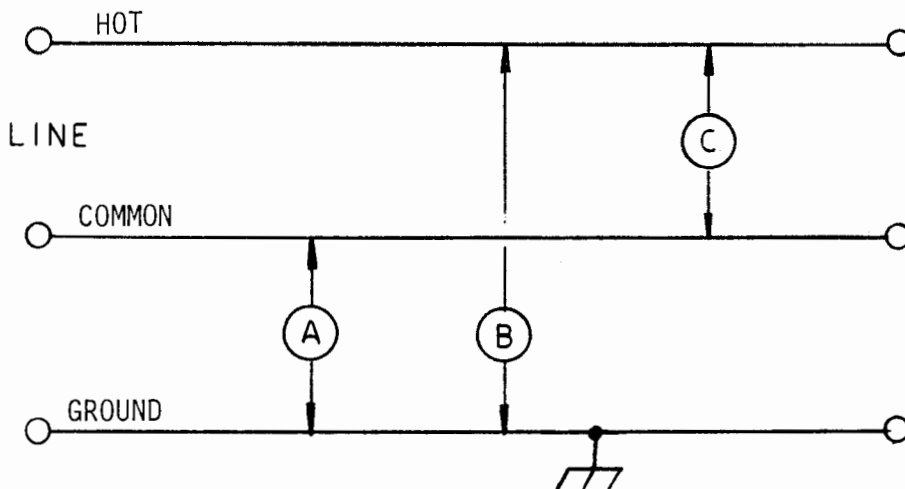


Figure 1

### Common Mode and Transverse Mode Noise

TRANSVERSE MODE NOISE appears from line to line (C in Figure 1). In circuits involving power transformers, transverse mode noise on the secondary often results from common mode noise on the primary as well as transverse mode noise on the primary.



Capacitors should be of the AC oil type with a voltage rating equal to or greater than the transformer output voltage. The capacitance value should be selected such that the AC current in the capacitor does not exceed approximately 10% of the transformer current rating. (Much lower values of capacitance may be highly effective and this value should be considered a maximum.) Determine the load current and find the maximum capacitor value by the following relationship:

$$C = \frac{265 I}{E}$$

where C = maximum capacitor value in microfarads  
I = rated load current in amperes  
E = transformer secondary voltage

or 
$$C = \frac{265 VA}{E^2}$$

where VA = power rating of the transformer in volt amperes.

#### Connection Methods for Unknown or Unidentified Noise Problems

If the noise problem is difficult to observe and identify, it may be helpful to make the following sequence of hook-ups and observe the results. This sequence is in approximate order of the frequency of use and will generally lead to a rapid cure of unidentified noise problems.

- A. Common mode noise connection of Figure 2.
- B. Common mode noise connection of Figure 3.
- C. Transverse mode noise connection of Figure 5.
- D. Common mode noise connection of Figure 4, if applicable.

#### What an Ultra-Isolation Transformer Shouldn't be Expected to Do

- A. Store or create energy - It is basically a highly shielded transformer and contains no batteries or capacitors for storing energy for use when the primary power is temporarily absent, as during power factor correction switching, power line sags, brownouts, etc.
- B. Clean up wave shapes - It is basically a highly shielded transformer, designed to remove high frequency noise. It must, of course, pass low frequency waveforms (e.g. the 60 Hz power line) faithfully. If the primary power line contains low frequency distortion, the Ultra-Isolation Transformer will pass it on faithfully.



