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

STAND-ALONE HP 30032B
TERMINAL DATA INTERFACE DIAGNOSTIC

Diagnostic No. D427A

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1. INTRODUCTION

This diagnostic program serves to verify the operation of the HP 30032B Terminal Data Interface installed in an HP 3000 Series II Computer System. The program consists of two parts; one serving for a go-nogo type of testing, the other for trouble shooting. The go-nogo part can be executed with little change of the normal hardware configuration (i.e. by connecting two selected channels by a test cable on the connector panel of the interface) while the trouble shooting part requires a special test set up including a second terminal data interface with a second connector panel and cable. This part of the diagnostic is primarily meant to be used on systems dedicated for trouble shooting (i.e. not on the customer's system).

2. SIMPLIFIED OPERATING INSTRUCTIONS

Operating instructions for the execution of the go-nogo part (Test sec-
tion 1-7) of the diagnostic are given here. Operating instructions for
the trouble shooting part can be found in Section 3 of this manual. The
go-nogo part has two modes of execution, manual and automatic. The dif-
ference between these two modes is that in the manual mode the operator
selects two channels to be tested while in the automatic mode all 16
channels will be tested, one pair at a time. The preset switch register
options specify manual mode and only this mode is covered here. Operating
instructions for both modes are covered in the Detailed Operating Instruc-
tions Section of this manual (Automatic mode testing requires eight
test cables).

1. Remove all connectors from HP 30062A Terminal Controller/Multiplexer
   Connector Panel (part #30062-60001). Connection will be made between
   channel pairs by test cable 30062-60002 during the test.

   > NOTE: In order to make a complete test of the interface
   > (all 16 channels) 8 successive channel selection
   > should be made. The following convenient order is
   > recommended: Channel 0 to channel 1 first, channel 2
   > to channel 3 second and so on until channel 14 to
   > channel 15.

2. Connect test cable 30062-60002 to the two channels to be tested.

3. Cold Load Diagnostic D427A from stand-alone diagnostic tape. Pro-
   gram will halt with a HALT 6.

4. Select Switch register options (refer to Table 1).

   > NOTE: To run diagnostic with preset configuration
   > set switch register bit 0 OFF.

5. Press RUN. The program halts for channel selection with a HALT 7.

6. Select channel pair to be tested. The two channels connected in step 2.

   a. Enter the lower numbered channel to be tested (octal value) in the first byte (right justified) of the switch register.

   b. Enter the upper numbered channel to be tested (octal value) in the second byte (right justified) of the switch register.

7. Press RUN. HALT 6 occurs. Channel numbers have now been entered.

8. Press RUN. Test sections 1 through 7 will be executed.

   a. If a HALT %16 occurs the test executed without errors. Repeat steps 2 and 6 through 8 for the next channel pair to be tested.

   b. If a HALT %12 is displayed an error has been encountered. For ERROR ANALYSIS refer to paragraph 3.3.

3. DETAILED DESCRIPTION

The first seven test sections comprising the go-nogo test have a common structure, described in Section 3.1, 3.2 and 3.3. Sections 3.4 to 3.10 gives the description of the test sections 1-7. Test section 8 is entirely different from the first 7 test sections and section 3.11 gives a fairly self contained description, including the operating instruction.

3.1 CHANNEL SELECTION

The Terminal Data Interface provides 16 channels numbered from 0 to 15 (send and receive on each channel) and 5 auxiliary channels. In every test section the test is made between two selected main channels. In test section 3 the five auxiliary channels are also tested along with the selected two main channels.

The selection of the two main channels is either made by the operator (manual mode) or it is made automatically by the program (automatic mode). In both modes however each test section is executed twice, for each channel pair selected, to test each channel in the send and in the receive direction respectively. In the manual mode the program halts for channel selection (HALT 7). The operator should insert the test cable 30062-60002 between the two connectors corresponding to the two channels to be selected. Then he should enter the two channel numbers into the operating panel switch register. One number into the first byte, the other into the second byte. Both numbers are octal and right justified in their respective byte location. (See Operating Instructions).

In the automatic mode the test sections are executed first between channel 0 and 1 then between channel 2 and 3 and so on until channel pair 14 and 15 is selected and tested. This sequence is called a complete test cycle and the program will halt (HALT 15) after such a sequence, if the "HALT AFTER COMPLETE TEST CYCLE" switch register option is selected. The corresponding connection of the channels (i.e. 0 to 1, 2 to 3, etc.) is normally made by connecting the eight test cables to the channel connectors on the connector panel 30062-60001.

3.2 TEST PASSES

Each test section further divides into test passes. A pass is a fairly complete test of a particular function (e.g. sending and receiving 10 characters) and the purpose of using several passes in a section is to perform the test with an appropriately chosen set of data and parameter values.

3.3 ERROR ANALYSIS

Errors are indicated by error halts (HALT %12). For error halt bit 12 of the switch register must be 1. Information about the error is given on the "top of stack" (RA, RB, RC, RD).
The format of the error information is the following:

Word	byte 0	byte 1
RA	error code	step number
RB		pass number
RC	send channel	receive channel
RD	error word	

Certain error codes are specific to the test sections, but in general it must be interpreted together with the step number.
Table 3 gives the interpretation of the error codes.
The second word on the stack (RB) is the pass number. It goes from 0 to n-1, where n is the number of passes in a certain test section.
The third word on the stack specifies the channel number of the send (byte 0) and the receive channel (byte 1).
The fourth word (RD) is the error word, (e.g. bad data word). The interpretation of this word is dependent on the error code and for certain error codes (e.g. 1 no response to CIO) it is not used at all. The content of the error word is also given in Table 3.

3.4   TEST SECTION 1

It tests the send and receive operation with the interrupt system disabled;
it tests the I/O reset function and the SIN instruction. Only 1 pass is used
(one in each direction).

Step number ranges from %10 to %17

Errors specific to this section:

%13 Missing send complete
%14 Missing receive complete
%15 Missing send and receive complete
%16 Multiple send complete
%17 Multiple receive complete
%20 SIN failed to cause interrupt.

3.5   TEST SECTION 2

It tests the send and receive operation. Nine passes are used to test
the operation with various BAUD-rate, character length parameters and
various character bit patterns. In each pass the channels are configured
and enabled. Then the character corresponding to the particular pass is
sent ten times through the selected send channel. The ten send operations
are sequenced by the ten successive interrupts following the completion of
send operations. The character should be received by selected receive
channel also ten times. The completion of these operations are timed with
the system clock and it should fall between the specified upper and lower
limit. Step number ranges from %20 - %26.

Errors specific to this section

%26 Time out before 10 sends completed.
    Error word: # of sends completed.

%27 Time out before 10 receives completed.
    Error word: # of receives completed.

%30 Operation outside time limit.
    Error word: actual time required to execute 10 send and receive operations.

The following error codes can be generated in the interrupt routine which is
common for sections 2,5,7.

%22 Wrong channel # after send.
    Error word: data word after send.

%23 Wrong status after send.
    Error word: status word after send.

%24 Wrong data word, receive.
    Error word: data word after receive

%25 Wrong status after receive.
    Error word: status after receive.

3.6 TEST SECTION 3

It tests the "speed sense" function. Five passes are used to test the five auxiliary channels, one at a time. In each pass only the receive channel and one of the five auxiliary channels should receive characters. The other four auxiliary channels are also enabled but the BAUD rate and the bit pattern of the character are such that these channels get reset during the transmission. This way the reset function is also tested by this test section. In each pass ten characters are sent and should be received by the receive channel and by one of the auxiliary channels. Step number ranges from %30 to %36.

Errors specific to section 3.

%37 Time-out before 10 characters sent

%40 Number of characters on receive channel <>10

%41 Number of characters on auxiliary channel <>10

Error word for all 3 error codes contains the actual character number. The rest of the error codes are generated in the interrupt routine which is common for Section 3 and 4.

%31 Wrong channel # after send
Error word: Data word

%32 Wrong status after send
Error word: Status word

%33 Wrong data in receive channel
Error word: Data word

%34 Wrong status after receive
Error word: Status word

%35 Wrong data word received - AUX channel or Echo
Error word: Data word

%36 Wrong status after receive - auxiliary channel
Error word: Status word

3.7   TEST SECTION 4

It tests the "echo function". Four passes are used with various speed
and character length. In each pass the character is sent 10 times with
echo bit ON and OFF alternately. The send channel should receive only
when the echo bit of the receiver channel is ON.

Step number ranges from %40 - %46.

Errors specific to this section

%44 Time out before 10 characters sent

%45 Number of characters on receive channel <>10

%46 Number of characters received on the send channel (echo) <>5

3.8   TEST SECTION 5

It tests the "synchronize function". Three passes are used. In each
pass an all-mark character is sent 10 times with the synchronize bit ON
and OFF alternately. Different character length and BAUD rate parameter
is used in the successive passes. The receive channel should receive the
all-mark character only when the synchronize bit is OFF.

Step number ranges from %50 to %56.

Errors specific to this section are

%50 Time out before 10 characters sent

%51 Number of characters on receive channel <>5

3.9   TEST SECTION 6

It tests the "lost character" logic. It uses only one pass. It consists
of 10 sequences in each of which a character is sent (and received) three
times. Acknowledge is given only after the third send and receive operations
are completed. So after the first interrupt no more interrupts should occur
until the end of the third send and receive operation. Upon the acknowledge
an interrupt should occur on the receive and on the send channel.
The status word of the receive channel is tested. The "lost character"
bit should be set. The timing of the three successive send operation is
done by the system clock.
Step number ranges from %60 to %66.

Errors characteristic to section 6

%60 Number of interrupts <>1. This is after three send operation - No
    acknowledge in the interrupt routine - so only one interrupt (send
    or receive) is expected.

%61 Time out before 10 full sequences completed.

    The rest of the errors are generated in the interrupt routine.

%63 Wrong channel # after send

%64 Wrong status after send

%65 Wrong channel number - receive

%66 "Lost character" bit should be "0"

%67 "Lost character" bit should be "1"

3.10   TEST SECTION 7

It tests the "break function". BREAK (all-space) and SYNC (all-mark)
characters are sent alternately (10 times). The send channel should
interrupt for both characters. The receive channel however should
interrupt only for the BREAK characters five times altogether.
The step number ranges from %70 - %76.

Errors specific to this section

%71 Time out before 10 send operation completed
    Error word: Number of completed send operations

%72 Number of characters (BREAK) <>5
    Error word: Number of characters

    The rest of the error codes are generated in the interrupt routine
    which is common with that of test section 2.

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3.11   TEST SECTION 8

This section provides two separate tests. In the first one the diagnosed inter-
face is operated in the send direction and in the second it is operated in the
receive direction. Another data interface is used to perform the complementary
operation i.e. receive for send test and send for the receive test. The second
data interface will be called test interface. A common command interpreter is
used for selecting one of the two tests and for the selection of the test
parameters.

Before the description of the two tests, some common features will be discussed:
The system clock is used for running the tests in a cyclic fashion. Each test
cycle (pass) will last for a cycle time which can be selected independently from
the BAUD rate, although the cycle time should be selected somewhat longer than
the "character time". In each pass one send and one receive operation is executed.
In the receive test options are provided to include the reception of echo from
the receive channel and reception by the auxiliary channels. The cyclic operation
continues even in the case of error. Errors are stored away in a buffer and the
printing of the errors is done after the test is stopped. A pass counter is used
to identify the pass in which the error occurred. The pass number is included
in the error records. The pass count is module 256, i.e. after 255 passes the
counter is reset to 0. Optionally the pass limit can be set, (<256) in which case
the test will stop when the limit is reached.

In the error buffer there is space for 256 error records, only the last 256 errors
are retained. Optionally the test can be stopped by setting a limit for the
number of errors (the limit, "Maximum Error Number" must be less than 256). The
program for both tests consists of a main line part and 3 separate interrupt routines,
two for the 2 data interfaces and one for the timer. The main line part has a
initialize part and a cyclic part, which is reinitiated after each timer interrupt.
The cyclic part ends with a waiting loop and this waiting loop should be reached
before the interrupts occur. A step counter is used to track the progress of the
cyclic main program and the interrupt routines uses this step number to generate
error code if the waiting loop was not reached. An interrupt step counter is
used similarly in the interrupt routine of the diagnosed interface. This step
number is used as error code by the timer interrupt if the interrupt from the
diagnosed interface is unfinished at the time when the timer interrupts.

The cyclic part of the main line program of this test performs the following functions:

1. Configures the selected send channel
2. Initiates a send cycle through this channel.

At the beginning of this part of the main line program the step counter is set to 2. A WIO instruction is used to transfer the send parameter to the data interface. No response or not ready condition sets the step counter to 3 and 4 respectively. If the WIO is executed the step counter is advanced to 5. CIO is used to insert the parameter into the circulating memory. "No Response" sets the step counter to 6. If the CIO is executed the step counter is advanced to 7. A second WIO is used to transfer send data to the interface. No response or "Not Ready" sets the step counter to 8 or 9 respectively. After thw WIO is executed the step counter is advanced to 10. A CIO is used to insert the data into the circulating memory and start the send operation. "No Response" sets the step counter to 11. If the CIO is executed the step counter is advanced to 12 and the program finishes in the wait loop.

In the interrupt routine of the diagnosed interface the "after send data" and status is checked and the "buffer busy" flag is reset by an acknowledge command. First the interrupt step counter is set to 60 and status is read by a TIO instruction. No response sets the counter to 61. When the TIO is completed the interrupt step counter is advanced to 62 and after comparing the status with the expected value the "after send data" is read by a WIO instruction. No response or not ready sets the interrupt step counter to 63 and 64 respectively. When the RIO is completed the interrupt step counter is advanced to 66, the data is compared with the expected one and a CIO is used to clear the buffer flag. No response sets the step counter to 66. If the TIO is executed the interrupt step counter is advanced to 67 and the interrupt routine is finished by an EXIT instruction.

The basic function of the interrupt routine of the test interface is to check the data received from the send channel. It also checks if the main line section is completed and against multiple interrupts. Malfunction of the test interface such as send interrupt instead of receive or receive on a channel not 0 or 1 will cause the diagnostic to halt (HALT 3). Channel 0 is connected to the system console. Only "Control A" is accepted from the terminal, which stops the execution of the send test. Any other character will be disregarded.

The interrupt routine from the timer checks that the main line program has been completed and that both data interfaces (diagnosed and test) interrupted. It also takes out the main line program from the waiting loop by changing the return address to the beginning of the cyclic part of the main line program.

The error codes used by this test are given in the following table.

ERROR CODES IN SEND TEST

Error Code	Description
1	This error code indicates "No Response" to CIO in the initialize part of the test. The function of the CIO is to "Master Clear" the diagnosed interface.
2-11	These error codes indicate that the main line part of the send test was not completed, when the diagnosed interface interrupted. the error code is the step number at the time of interrupt. For no error the step number is 12.
13	This error code indicates that the diagnosed interface interrupted right after the exit from the timer interrupt: The step counter is set to 13 in the timer interrupt routine and it will be reset to 2 at the beginning of the next send cycle.
22-31	These error codes indicate that the main line part of the test program was not finished, when the test interface interrupted. It is the step number at the time of interrupt plus 20.
42-51	These error codes indicate that the timer interrupted before the main line part was completed. The error code is the step number at the time of interrupt plus 40.
60-67	These error codes indicate that the timer interrupted before the interrupt routine of the diagnosed interface was completed. The error code is the interrupt step number at the time of the interrupt.
70	This error code indicates that the status read from the diagnosed interface is different, from the expected one. The wrong status is displayed in the error record.
71	This error code indicates that the data word read in the send interrupt is different from the expected one. The wrong status is displayed in the error record.
72	This error code indicates that the diagnosed interface interrupted more than once in this pass. For each additional interrupt a separate error is recorded.
75	This error code indicates that the test interface interrupted more than once in this pass. (More than one character received.)
76	This error code indicates that the received data is different from the expected one. The wrong data will be displayed in the error record.
77	Error code 77 indicates that the receive interrupt (from test interface) was interrupted by the timer.
78	Missing interrupt from receive (test) interface.
79	Missing interrupt from send (diagnosed) interface

3.11.2 RECEIVE TEST

The cyclic part of the main line program of this test performs the following functions :

1. Configures the selected receive channel .
2. Configures the selected auxiliary channels, if any,
3. Initiates a send cycle through channel 1 of the test interface.

The step counter is set to 103 at the beginning and WIO is used to transfer the parameter word to the receive channel. No response or not ready set the step counter to 104 and 105 respectively. The step counter is advanced to 106 if the WIO is accepted by the interface. Next a CIO is used to insert the parameter to the circulating memory. No response sets the step counter to 107. The step counter is advanced to 108 if the CIO was accepted. The following steps will be executed once for each auxiliary channel that is selected. The parameter word is transferred to the interface by a WIO. No response or not ready sets the step counter to 109 and 110 respectively. The step counter is advanced to 111 if the WIO is accepted by the interface. Next CIO is used to insert the parameter to the circulating memory. No response sets the step counter to 112 and it is advanced to 113 if the CIO is accepted. When all selected auxiliary channels are configured the step counter advances to 114. Next the send data word is transferred to the test interface by a WIO instruction and by a CIO it is inserted to the circulating memory and the send cycle is initiated. The main part of the program is finished in a waiting loop.

The interrupt routine of the diagnosed interface receives the data send by the test interface through the selected channel and also through the auxiliary channel if the diagnosed bit in the parameter word of the receive channel was set and some auxiliary channel was enabled. At the beginning of the interrupt routine the interrupt step counter is set to 160 and the status word of the diagnosed interface is read by a TIO instruction. No response sets the interrupt step counter to 161 and to 162 if the TIO is accepted. Next the data word is read by a RIO instruction. No response or not ready will set the interrupt step counter to 163 and 164 respectively. The step counter is advanced to 165. Next the status and the received data is compared with the expected one. It is done according to the channel number extracted from the data word. If the channel number is different from that of the selected main channel or auxiliary channel, error will be recorded

without comparison. Finally the buffer flag is reset by a CIO instruction. The interrupt step counter is set to 166 if "no response" to the CIO and to 167 if the CIO is accepted. The interrupt routine is completed by an EXIT instruction.

The interrupt routine from the test interface indicates the end of the send operation, or reception of the character by the send channel if the echo bit in the parameter word of the receive channel was set. Beside from channel 1, receive interrupt will be accepted from channel 0, since the system console is connected to this channel. Interrupt from any other channel of the test interface cases the diagnostic to halt (HALT 3).

In the interrupt routine of the timer it is checked if the main line program and all the expected interrupts were completed and then a new test cycle will be initiated.

The error codes used for the receive test are given in the following table.

ERROR CODES IN RECEIVE TEST

Error Code	Description

Error Code   Description

101   Error code 101 indicates "No Response" to CIO in the initialize part of the test. The function of the CIO is to "Master Clear" the diagnosed interface.

102-113   These error codes indicate that the diagnosed interface interrupted before the completion of the main part of the test program. The error code is the step number in the main part at which the interrupt occured. For no error the step number should be 114.

115   Error code 105 indicates that the diagnosed interface interrupted right after the exit from the timer interrupt. The step counter is advanced to 115 in the timer interrupt and it is supposed to get reset to 102 at the beginning of the next pass.

122-133   These error codes indicate that the test interface interrupted before the completion of the main line part of the test. The error code is the step number at which the interrupt occurred plus 20.

142-153   These error codes indicate that the timer interrupted before the completion of the main part of the test. The error code is the step number at which the interrupt occurred plus 40.

160-167   These error codes indicate that the timer interrupted the diagnosed interface interrupt. The error code is the interrupt step number at which the timer interrupted.

170   Error code 170 indicates that no interrupt occurred from the test interface within the specified cycle time. Most likely the cycle time is too short and the error is not due to malfunction of the diagnosed interface.

171   Error code 171 indicates that no interrupt occurred from the diagnosed interface with the specified receive channel number within the cycle time.

172   Error code 172 indicates that no echo interrupt occurred on the send channel within the cycle time.

174   Error code 174 indicates more than one send interrupt from the test interface. This error can not be caused by malfunction of the diagnosed interface.

175   Error code 175 indicates unexpected echo from the receive channel.

176   Error code 176 indicates that data echoed back by the receive channel is not the expected. The wrong data is displayed in this error record.

ERROR CODES IN RECEIVE TEST (Cont.)

Error Code	Description
177	Error code 177 indicates multiple echo from the receive channel.
180	Error code 180 indicates send interrupt from the diagnosed interface. Receive expected.
181	Error code 181 indicates that data received by the selected channel is different from the expected. The wrong data is displayed in the error record.
182	Error code 182 indicates that the status in the interrupt from the selected receive channel is different from the expected one. Received status is displayed in error record.
183	Error code 183 indicates that more than one interrupt occurred from the selected receive channel.
184	Error code 184 indicates that data received by a selected auxiliary channel is different from the expected data. Received data is displayed in error record.
185	Error code 185 indicates that status in an interrupt from a selected auxiliary channel is different from the expected status. Received status is displayed in record.
186	Error code 186 indicates multiple interrupt from a selected auxiliary channel.
187	Error code 187 indicates recieve interrupt is from wrong channel.
196-200	These error codes indicate that a selected auxiliary channel failed to interrupt within the cycle time. The error code is 180 plus the channel number.

3.11.3 COMMAND INTERPRETER

Both tests are controlled by the Command Interpreter. The function of the Command Interpreter is to select one of the two tests available and to configure the selected test. The error printing is also controlled by the Command Interpreter. When the test section is selected, after a short initialization part, the Command Interpreter is entered. Commands are prompted by asterisk (*) and could be entered successively until a command is sued which causes the program to transfer to the execution phase. ST, RT and RU are the commands causing such transfer. Control A (from the console) during any phase of the Command Interpreter will cause prompting for a new command. By this option longer dialogs or error printing can be interrupted and execution initiated. During execution "Control A" will cause a transfer back to the Command Interpreter.

Commands are specified by a two letter command code followed by an optional parameter. Description of the commands together with their respective function follows.

ST SENT TEST - This command selects the send test and it initiates a
                dialog to configure the send test. The format of the
                dialog is shown by the following two examples:

EXAMPLE 1

*ST
SENT TEST
ENTER CYCLE TIME MSEC 10
CONFIGURE SEND CHANNEL
ENTER CHANNEL #0
PARAMETER
     11100 000 00000101 ?
DATA
     01000 11110010011 ?
AFTER SEND EXPECTED STATUS
     XXXX11XX ?
AFTER SEND EXPECTED DATA
     00000 XXXXXXXXXX ?
CONFIGURE RECEIVE CHANNEL
PARAMETER
     10100 000 00000101 ?
EXPECTED DATA
     00001 01110010011 ?

EXAMPLE 2

*ST
SEND TEST
ENTER CYCLE TIME MSEC 50
CONFIGURE SEND CHANNEL
ENTER CHANNEL #8
PARAMETER
     11100 000 00000101 ? CH
     11100 011 00100000
DATA
     01000 11110010011 ? CH
     01000 10101010101
AFTER SEND EXPECTED STATUS
     XXXX11XX ?
AFTER SEND EXPECTED DATA
     01000 XXXXXXXXXX ?
CONFIGURE RECEIVE CHANNEL
PARAMETER
     10100 011 00100000 ?
EXPECTED DATA
     00001 00101010101 ? CH
     00001 XX101010101

In both examples the characters typed by the operator are underlined. The
rest of the test was "displayed" by the program. X-S stands for "don't care".
After the 2 marks either "carriage return" or CH was typed. Carriage return
is used to indicate that the old value is to be retained. CH indicates that
the value is to be replaced. Notice that after the change of a test para-
meter, the following parameters got updated. So at any phase of the dialog
the parameters are consistent and execution of the test can be initiated
without completing the dialog. "Control Λ" is pushed and upon prompt *RU
typed.

Upon completion of the dialog the program automatically transfers to the
execution part.

The test parameters in the first example represents the preset values.

RT - RECEIVE TEST - This command selects the receive test and it initiates
                    a dialog to configure the test. The format of the dia-
                    log is shown by the following two examples:

EXAMPLE 1

```
*RT
RECEIVE TEST
ENTER CYCLE TIME MSEC 1Ø
CONFIGURE SEND CHANNEL
PARAMETER
     111ØØ ØØØ ØØØØØ1Ø1 ?
DATA
     Ø1ØØØ 111ØØ1ØØ11 ?
WILL ECHO BE SELECTED :
CONFIGURE RECEIVE CHANNEL
ENTER CHANNEL #Ø
PARAMETER
     1Ø1ØØ ØØØ ØØØØØ1Ø1 ?
EXPECTED DATA
     ØØØØØ X111ØØ1ØØ11 ?
EXPECTED STATUS
     XXXX1ØXX ?
ENTER AUX CHANNEL #-S:
```

```
EXAMPLE 2
*RT
RECEIVE TEST
ENTER CYCLE TIME MSEC 8
CONFIGURE SEND SHANNEL
PARAMETER
     11100 000 00000101 ? CH
     11100 111 00001000
DATA
     01000 111100010011 ? CH
     01000 1111010101
WILL ECHO BE SELECTED ? YES
TEST CHANNEL RECEIVES ECHO - EXPECTED DATA
     00001 X1111010101 ?
CONFIGURE RECEIVE CHANNEL
ENTER CHANNEL #11
PARAMETER
     10100 111 00001000 ?
EXPECTED DATA
     01011 X1111010101 ? CH
     01011 XXXXXXXXXX
EXPECTED STATUS
     XXXX10XX ?
ENTER AUX CHANNEL #-S :16, 20 17
CHANNEL 16
PARAMETER
     10100 111 00001000 ?
EXPECTED DATA
     10000 X1111010101 ? CH
     10000 XXXX010101
EXPECTED STATUS
     XXXX10XX ?
CHANNEL 17
PARAMETER
     10100 111 00001000 ? CH
     10100 111 00010000
EXPECTED DATA
     10001 X1111010101 ? CH
     10001 XXXXXXXXXX
EXPECTED STATUS
     XXXX10XX ?
CHANNEL 20
PARAMETER
     10100 111 00001000 ? CH
     10100 111 11111111
EXPECTED DATA
     10100 X1111010101 ? CH
     10100 XXXXXXXXXX
EXPECTED STATUS
     XXXX10XX ?
```

The notes after the "send test" example are also applicable to the "receive test" dialog. Upon completion of the dialog the program automatically transfers to execute the receive test. The completion of the dialog can be bypassed by pushing control A. In this case the execution should be initiated by entering the RU command (i.e. typing RU). The first example also gives the preset value of the receive test parameters.

RU RUN - This command causes the execution of the previously selected test (send or receive). The execution continues until "control A" is typed or one of the two stop conditions are met. The two stop conditions are 1. pass limit is reached, 2. error limit reached. The two stop conditions are described with the PL and ME commands respectively.

EX EXIT - Upon this command the program will exit from test section. It returns to the selection part in which a new test section can be selected.

TM XXX
    ENTER CYCLE TIME - The selection of the cycle time is part of the ST and RT dialog, this command is provided to enable the operator to change the value without reinitiating the dialog. XXX specifies the cycle time in milliseconds. It must be between 1 and 1000.

CH XX
    ENTER CHANNEL NUMBER - The channel referred to by this command is the one to be diagnosed, i.e. the send channel in the send test and the receive channel in the receive test. The selection of this channel is part of the ST and RT dialog and this command is provided to enable the operator to change this channel without reinitiating the dialog.

ME XXX

SET MAXIMUM ERROR NUMBER - The Maximum Error Number is a limit. When the
number of errors reaches this limit the execution of the test is stopped.
The following example shows the message displayed for a case in which receive
test was running. The Maximum Error Number was set to 20. The sample also
shows the operation of the ER command, which was entered by the operator
upon the * prompt character following the stop message.

RECEIVE TEST
    20 PASS COMPLETED
    20 ERRORS
    *ER
       0   181   00000 0111001001l
       1   181   00000 011100100l1
       2   181   00000 0111001001l
       3   181   00000 011100100l1
       4   181   00000 0111001001l

The maximum number is 255. The explanation for this will be given with
the ER command. ME entered without a number is interpreted as no error
limit.

PL XXX

SET PASS LIMIT - This command is to be used to stop the execution of the
send or receive test after the specified number of pass is completed. The
stop message will be the same as it is in the sample given in the ME command.
The maximum number is similarly 255.

ER DISPLAY ERROR - This command is to be used to get a listing of the errors
encountered in the preceding test. In the introductory part of this section
the cyclic use of the two error buffers was described showing that error
records will be successively overwritten when the limit of the buffer (256)
is reached. In the printing, the errors will be in the same order as they
were encountered, starting with the earliest one not yet overwritten. The
format of the error records is shown in the following two samples:

```
RECEIVE TEST
  20 PASS COMPLETED
  20 ERRORS
 *ER
    0      181      00000 01110010011
    1      181      00000 01110010011
    2      181      00000 01110010011
    3      181      00000 01110010011
    4      181      00000 01110010011
    5      181      00000 01110010011
    6      181      00000 01110010011

SEND TEST
MORE THAN 256 PASS COMPLETED
MORE THAN 256 ERRORS
 *ER
    4       78
    5       78
    6       78
    7       78
```

The stop message preceding the ER command as it can be seen from the 2 samples indicate whether the old error has been overwritten or not. The message "MORE THAN 256 ERRORS" indicates that only the last 256 errors are retained.

The format of the error records is the following. The first entry is the pass number, (MODULO 256), the second entry is the error code, additional information, such as wrong data in case of error code 181, appears as the third entry of the record.

4.   DETAILED OPERATING INSTRUCTIONS

    1. Configure hardware for diagnostic

        Diagnostic configuration for test section 1-7.

        These test sections can be executed either in manual or in automatic
        (channel selection) mode. In the manual mode the interface cable
        should be connected to connector J18 on the connector panel,
        30062-60001, and the connection between two selected channels should
        be made with test cable 30062-60002 between the channel connectors
        corresponding to the two channels. Terminals from the other channels
        should be disconnected.

        For the automatic mode all 16 channels should be connected pair-wise
        by 8 separate test cables.

        For the execution of test section 8 an additional 30032-60001 Terminal
        Data Interface with interface cable and connector panel is required.
        This second interface should be error-free. Both Terminal Data Inter-
        face should be connected to its own connector panel through connector
        J18 of the panel, and a console device should be connected to channel
        0 of the error-free Terminal Data Interface. Channel 1 of this interface
        will be used for testing the second "unknown" interface. The connection
        from channel 1 of test interface to the selected channel of the tested
        interface should be made with the test cable, 30062-60002 between the
        two connector panels.

    2. Cold load diagnostic D427 from stand-alone diagnostic tape program
        halts with HALT 6 (enter switch register options).

    3. To run diagnostic with preset configuration push RUN with "operating
        panel switch register" bit 0 OFF.

        For new switch register option selection set bit 0 of the operating
        panel switch register to ON. The rest of the switch register bits will
        be used to update the switch register options (see Table 1).

        For changing the section selection set both bits 0 and 1 to ON.

        Any time during the execution bit 0 and bit 1 of the operating panel
        switch register can be used as described above.

    4. Section Selection - The program halts (HALT 5). Enter section select
        options through operating panel switch register. Switch register bits
        1-8 correspond to the 8 test sections.

Select any combination of sections 1-7 or section 8. Section 8
requires special hardware configuration and cannot be executed in
combination with the other sections. For the execution of the
first 7 sections the configuration data consisting of the DRT
number of the terminal data interface (DB+ 3) must correspond to the
DRT number set on the interface. To change the DRT number (at DB+3)
section Ø (configuration section) should be selected (together with
the other test sections to be executed). The program will halt
(HALT Ø). Enter DRT number through switch register (octal - right
justified). Push RUN. Program halts again (HALT 6) to allow the
resetting of the switch register according to switch register options.
Push RUN.

5. Test Section 8 - If this test section is selected, the program halts
   with HALT 1. Enter the DRT of the test Terminal Data Interface
   through the switch register. (Octal - right justified). Push RUN.
   The control now is transferred to the console device. The control
   panel switch register will not be read until EX (exit command) is
   typed. To start the execution of the test sections push "carriage
   return" on the console. Title message will be printed followed by
   a prompt character (*). Use the commands as described in Section
   3.11.3 to perform the desired test.

6. Execution of Test Section 1-7 - Depending on the mode selection
   (bit 5), the test will be executed either with automatic or manual
   channel selection.
   With automatic channel selection the selected test sections will be
   executed 8 times with 8 successful channel-pair combinations (channel
   0, channel 1 first, channel 2 and channel 3 second, and so on until
   channel 14 and channel 15 are tested).
   Depending on the "recycle option" (bit 15) the program halts after
   the complete test cycle (HALT %15) or it will recycle starting over
   with channel 0, channel 1. HALT %15 without any error halt indicates
   error free interface. Errors are indicated by HALT %12. The error
   information is displayed on the "top of stack" as it is described in
   section 3.3. For interpretation of the error codes use Table 3.

7. Manual Channel Selection - The program will halt with HALT 7, if
    the mode select bit (bit 5) of the switch register options is ON.
    The channel number of two selected channels should be entered
    through the switch register. The first byte should be used for one
    channel and the second byte for the other. Both numbers should be
    octal and right justified in their respective bytes. The selected
    channels must be connected by the test cable. Push RUN. The pro-
    gram will halt (HALT 6) to allow resetting the switch register
    according to the switch register options. The selected test sections
    will be executed continuously, if switch register option "Halt after
    Complete Test Cycle" is not selected or it will halt with HALT %16.
    After HALT %16 a new channel pair can be selected and the test re-
    started. The procedure is identical with the one used after HALT 7.
    From any other respect the operating procedure is identical with
    the one used in automatic mode.

TABLE 1
Switch Register Assignment

Bit	Function
0	Select external switch register
1	Set to change section selection register (switch 0 also set)
2	
3	
4	
5	Move select – OFF: automatic/ON: manual
6	
7	
8	
9	
10	
11	Loop on last pass
12	Halt on error
13	Halt at end of pass
14	Halt at end of section
15	Halt after a complete program cycle

TABLE 2
Halt Codes

Halt Code (%)	Indication
00	Halt for reconfiguration
01	In Section 8, halt to enter DRT # of /test interface
02	
03	
04	
05	Halt to enter section selection
06	Halt to restore switch register
07	Halt to enter channel pair numbers/manual
10	
11	
12	Error halt
13	Halt after pass
14	Halt after section
15	Halt after complete program cycle/automatic
16	Halt after complete program cycle/manual
17	

TABLE 3

Error Codes

1	No response to CIO
2	No response to TIO
3	Wrong status Error word: Actual status
4	No response to SIN
5	No response to WIO
6	Not ready for WIO
7	No response to RIO
%10	Not ready for RIO
%11	Wrong data (RIO) Error word: Data word
%13	Missing send complete (section 1)
%14	Missing receive complete (section 1)
%15	Missing send & receive complete (section 1)
%16	Multiple send complete (section 1)
%17	Multiple receive complete (section 1)
%20	SIN failed to cause interrupt (section 1)
%22	Wrong channel number after SEND from interrupt routine of (section 2,5,7.) Error word: data word after send
%23	Wrong status after SEND (section 2,5,7.) Error word: data word after SEND
%24	Wrong data after receive (section 2,5,7.) Error word: data word after receive
%25	Wrong status after receive (section 2,5,7.) Error word: status after receive
%31	Wrong channel # after send (section 2,5,7.) Error word: data word
%32	Wrong status after send (section 3,4.) Error word: status
%33	Wrong data after send (section 3,4.) Error word: data word
%34	Wrong status after receive (section 3,4.) Error word: status word
%35	Wrong data after receive Aux Channel or Echo (section 3,4.) Error word: data word

TABLE 3
(cont)

%36 Wrong status after receive (Aux Channel)(section 3,4.)
   Error word: status

%37 Time out before 10 character sent (section 3)
   Error word: number of character sent

%40 Number of characters received <>10 (section 3)
   Error word: number of characters received

%41 Number of characters received on auxiliary channel <>10 (section 3)
   Error word: number of characters on auxiliary channel

%44 Time out before 10 characters sent (section 4)
   Error word: number of characters sent

%45 Number of characters received <>10 (section 4)
   Error word: number of characters received

%46 Number of characters received as echo <>5 (section 4)
   Error word: number of characters echoed

%50 Time out before 10 characters sent (section 5)
   Error word: number of characters sent

%51 Number of characters on receive channel <>5 (section 5)
   Error word: number of characters received

%60 Number of interrupts after 3 sent <>1 (section 6)
   Error word: number of interrupts

%61 Time out before 10 full sequence completed (section 6)
   Error word: number of completed sequences

%63 Wrong channel # after send (section 6)
   Error word: data word

%64 Wrong status after send (section 6)
   Error word: status word

%65 Wrong channel # after receive (section 6)
   Error word: data word

%66 "Lost character" bit=1 (section 6)

%67 "Lost character" bit=0 (section 6)

%71 Time out before 10 send operations completed (section 7)
   Error word: number of completed send operations

%72 Number of characters (BREAK) <>5
   Error word: number of breaks received