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COMPUTER SYSTEMS GROUP
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2228 3500

BOLT MULTILINE CONTROL TEST

PRODUCT SPECIFICATION

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INTRODUCTION

The MULTILINE CONTROL TEST is one of the test procedures in the BOLT software system and is designed to test the Multiline Control (MLC).

DEFAULT CONFIDENCE TEST SECTIONS

Most other BOLT tests have a set of confidence tests that run by default when the operator enters GO. All of the confidence tests for the MLC, however, require operator interaction. Therefore the default test section set for MLC is empty.

OPTIONAL CONFIDENCE TEST SECTIONS

The Optional Confidence Test Sections operate the control as a whole unit, using operations similar to those that would be encountered in normal operation of the unit. These test sections are used to gain confidence in the reliability and operability of the control.

LIMITATIONS

On-Line testing requires that the control or line being tested is not being used or saved by the system or user. Confidence testing only requires that the particular device and line to be tested is not in use.

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RELATED DOCUMENTS

Part Number -----	Part Name -----
P.S. 2228 3543	B1000 BOLT Executive
P.S. 2205 7434	B1800/1700 Data Communications Subsystems
P.S. 2212 5454	B1800/1700 Data Communications
P.S. 2212 5421	B1000 DC/AUDIT

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DEVICES

The confidence test sections are designed to work with any device connected to a MLC using a multipoint Poll-select protocol. Listed below are the configurations that have been tested. Other disciplines, bit rates, modems and devices may also work but they have not been tested. Some devices will require that the operator modify the default length and data parameter.

MLC ---	DISCIPLINE -----	BPS ---	MODEM -----	DEVICES -----
2	DIRECT	9600		TD820, TD830
2	SYNC	4800	TA4800 LEASED	TD830, AP310*
2	ASYN	9600	GANDALF LDS140 LEASED	TD820, 9246-3*

* Only sections 25, 26 and 27 are useful for printer devices. The 9246-3 requires that the operator specify the data with a linefeed (a25a) at the end of each line.

PROTOCOLS

The particular protocol used for communication with a data comm device is entirely defined by the system software for MLC. Confidence tests must implement their own protocol drivers by sending the appropriate control characters and waiting for responses from the device. The initial release of this test will only support the two address poll-select protocol for confidence testing of TD8XX devices.

Transmission numbers will be included in write messages to the terminal if the XMN option is set by selecting a transmission number which can be any of "A", "2", "0" or "1"; however, transmission numbers are ignored by the terminal when used by the system except during the calculation of BCC. In addition the TD8XX devices can be programmed to use the optional transmission numbers in which case the system will compare the received and expected transmission numbers.

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OPERATING INSTRUCTIONS

The first step in testing the MLC is to acquire exclusive access to the portion of the multiline to be tested using the BOLT "UNIT" command. Once access has been granted the operator builds a list of test sections to be run using the BOLT "SECTION" command. BOLT will verify that the section numbers are valid for the device being tested and will also verify that the proper access has been granted for the type of section being executed (i.e. diagnostic ops to a control must have access to the entire control).

OPTIONAL CONFIDENCE TESTS

Optional Confidence Tests (sections 25-29) should be the first level of tests run to detect peripheral failure and the last level of tests run to gain confidence in a peripheral and control after a failure has been repaired.

Confidence tests use normal state ops and run on only one unit and line at a time. They do NOT abnormally affect the corresponding Adapter card.

A unit is selected for confidence testing using the command "UNIT MLx" where x = A-Z or 1-6 for a total of 32 selectable units.

"MLA" corresponds to the lowest unit on the lowest port. "MLB" corresponds to the second lowest unit on the lowest port. Since there may be up to 16 units on one multiline port, "MLQ" would represent the lowest unit on the second base card which would be on the highest multiline port (only two base cards are possible).

A particular device on a port and unit (channel is always 0 for multiline) is further selected using the BOLT "ADDRESS" command.

The desired list of test sections is then built by the operator using the "SECTION" command and the tests are executed by entering "GO". Unless otherwise specified the tests will produce the most meaningful results when the sections are run in ascending numerical order.

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Note:

Below is an example of the commands needed to run all Optional Confidence Test sections for the MLC with default data for a TD830 terminal with address "D2" on line 1 of adapter 0 on base 0:

```
<job number>AX UNIT MLB;
<job number>AX SEC 25 - 29;
<job number>AX ADDRESS "D2";
<job number>AX GO;
```

If MLB is "in use" or "saved" by another program then the UNIT command will generate an error message and the operator must wait for the device to become available, or test another device.

Figure 1 below gives an example of what the output would be if Sections 26 and 27 were run on unit MLQ, and no errors were reported.

```
Z BOLT =<JN> ***** ENTER NEXT COMMAND *****
: BOLT =<JN> ACCEPT.
<JN>AX SEC 26 27; GO;
Z BOLT =<JN> BEGINNING OF TEST FOR UNIT MLQ
Z BOLT =<JN> MLQ: BEGIN SECTION 26: SHORT FAST SELECT.
Z BOLT =<JN> MLQ: END SECTION 26: SHORT FAST SELECT.
Z BOLT =<JN> MLQ: BEGIN SECTION 27: LONG FAST SELECT.
Z BOLT =<JN> MLQ: END SECTION 27: LONG FAST SELECT.
Z BOLT =<JN> END OF TEST ON UNIT MLQ -- 0000 ERRORS REPORTED.
Z BOLT =<JN> ***** ENTER NEXT COMMAND *****
```

FIGURE 1: EXAMPLE CONFIDENCE TEST SECTIONS OUTPUT

Figure 2 below gives an example of what the output might be if Sections 28 and 29 were run on unit MLA with user entered options.

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```

Z BOLT =<JN> ***** ENTER NEXT COMMAND *****
Z BOLT =<JN> ACCEPT.
<JN>AX REC 50; CYC ON; REP 2; SEC 28 29; DISP OPT; GO
Z BOLT =<JN>          BOLT OPTIONS
Z BOLT =<JN>          -----
Z BOLT =<JN> TEST STATUS          IDLE          ADAPTER SELECTED      NO
Z BOLT =<JN> UNIT SELECTED        MLA          CONTROL SELECTED      NO
Z BOLT =<JN> SECTION NUMBER       028          NUMBER OF RECORDS     050
Z BOLT =<JN> REPEAT VALUE         002          DATA LENGTH          DEFAULT
Z BOLT =<JN> REPEAT COUNT         000          TEST SECTION DATA    DEFAULT
Z BOLT =<JN> RETRY VALUE          001          DELAY TIMEOUT         100
Z BOLT =<JN> UNIT ERROR COUNT     000          MAX. UNIT ERRORS     000
Z BOLT =<JN> SECTION ERRORS       000
Z BOLT =<JN> TERMINAL ADDRESS     D2           TRANSMISSION NO.
Z BOLT =<JN>
Z BOLT =<JN> BOOLEAN OPTIONS:
Z BOLT =<JN> DISPLAY:  ODT=1     PRI=0     BOJ=1     HEX=1     ALPH=0
Z BOLT =<JN> ERROR:    LOCK=0    ELOG=0    HAL ERR=0
Z BOLT =<JN> TRACE:    BUF=0     DESC=0    AUDIT=0
Z BOLT =<JN> OTHER:    CYCL=0    HALT(I/O)=0
Z BOLT =<JN>
Z BOLT =<JN> BEGINNING OF TEST FOR UNIT MLA
Z BOLT =<JN> MLA: BEGIN SECTION 28:  SYSTEM ECHO.
Z BOLT =<JN>      MLA: REPEATING SECTION 28, 0002 TIMES.
Z BOLT =<JN> MLA: END SECTION 28:  SYSTEM ECHO.
Z BOLT =<JN> MLA: BEGIN SECTION 29:  TERMINAL ECHO.
Z BOLT =<JN>      MLA: REPEATING SECTION 29, 0002 TIMES.
Z BOLT =<JN> MLA: END SECTION 29:  TERMINAL ECHO.
Z BOLT =<JN> MLA: BEGIN SECTION 28:  SYSTEM ECHO.
Z BOLT =<JN>      MLA: REPEATING SECTION 28, 0002 TIMES.
Z BOLT =<JN> MLA: END SECTION 28:  SYSTEM ECHO.
Z BOLT =<JN> MLA: BEGIN SECTION 29:  TERMINAL ECHO.
Z BOLT =<JN>      MLA: REPEATING SECTION 29, 0002 TIMES.
Z BOLT =<JN> MLA: END SECTION 29:  TERMINAL ECHO.
Z BOLT =<JN> MLA: BEGIN SECTION 28:  SYSTEM ECHO.
<JN>AX EXIT TEST;
Z BOLT =<JN> MLA: SECTION 28 HAS BEEN EXITED BEFORE COMPLETION.
Z BOLT =<JN> END OF TEST ON UNIT MLA -- 0000 ERRORS REPORTED.
Z BOLT =<JN> ***** ENTER NEXT COMMAND *****

```

FIGURE 2: EXAMPLE OUTPUT WHEN SOME OF THE OPTIONS ARE SET

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WHEN AN ERROR IS DETECTED

The previous section assumed that no errors were detected during the execution of test sections. When an error is detected during the execution of any test section, and any of the BOLT DISPLAY or PRINTER options is enabled, the operator will see the following information displayed:

1. An error message telling what the error was, which section it occurred in, and the error number.
2. If the error was on an I/O then the result descriptor will be displayed with those bits that are on.
3. If the error was on a data compare then a portion of the expected and observed data are displayed with mismatches marked. The total number of data mismatches will be given.
4. If the error was on a value compare then the expected and received values are displayed.

Figures 3 and 4 below give examples of what the output would be if I/O error and data mismatch were detected.

```

% BOLT =<JN> ***** ENTER NEXT COMMAND *****
: BOLT =<JN> ACCEPT.
<JN>AX SEC 25; GO;
% BOLT =<JN> BEGINNING OF TEST FOR UNIT MLQ
% BOLT =<JN> MLQ: BEGIN SECTION 25:  TERMINAL POLL.
% BOLT =<JN> THIS SECTION POLLS THE TERMINAL INDEFINITELY;
% BOLT =<JN> YOU CAN EXIT THE TEST USING EXI, CLE OR RES.
% BOLT =<JN> MLQ:SEC 25: ERR #02: - THE READ OP FAILED.
% BOLT =<JN> THE OP ISSUED WAS  080000
% BOLT =<JN> IO RESULT STATUS FIELD : 000080
% BOLT =<JN> THE FOLLOWING STATUS BITS ARE ON:
% BOLT =<JN>      RS (1):      OPERATION COMPLETE
% BOLT =<JN>      RS (2):      EXCEPTION
% BOLT =<JN>      RS (4):      CHAR PARITY/BCC/FCS ERROR
% BOLT =<JN>      RS (17):     OPERATION COMPLETE
<JN>AX EXIT TEST
% BOLT =<JN> MLQ: END  SECTION 25:  TERMINAL POLL.
% BOLT =<JN> MLQ: SECTION 25 HAS BEEN EXITED BEFORE COMPLETION.
% BOLT =<JN> END OF TEST ON UNIT MLQ -- 0001 ERRORS REPORTED.
% BOLT =<JN> ***** ENTER NEXT COMMAND *****
  
```

FIGURE 3: EXAMPLE OUTPUT WHEN I/O ERRORS ARE DETECTED

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```

Z BOLT =<JN> ***** ENTER NEXT COMMAND *****
: BOLT =<JN> ACCEPT.
<JN>AX ALPHA ON; HEX OFF; SEC 28; GO
Z BOLT =<JN> BEGINNING OF TEST FOR UNIT MLQ
Z BOLT =<JN> MLQ: BEGIN SECTION 28: SYSTEM ECHO.
Z BOLT =<JN> MLQ:SEC 28:ERR# 08: - MISCOMPARE BETWEEN EXPECT-
ED AND OBSERVED DATA.
Z BOLT =<JN> FIRST ERROR DETECTED AT BYTE 704.
Z BOLT =<JN> MAX.OF 46 CHARACTERS ARE DISPLAYED STARTING AT
THE FIRST DETECTED ERROR.

Z BOLT =<JN>
Z BOLT =<JN> EXPECTED(00704):***** ECHO TEST
Z BOLT =<JN> OBSERVED :***** ECHO TEST
Z BOLT =<JN> ERROR(S) :*
Z BOLT =<JN>
Z BOLT =<JN> TOTAL NUMBER OF BYTES IN ERROR: 00001
Z BOLT =<JN> THE DISPATCH IN ERROR WAS 00053.
Z BOLT =<JN> MLQ: END SECTION 28: SYSTEM ECHO.
Z BOLT =<JN> END OF TEST ON UNIT MLQ -- 0001 ERRORS REPORTED.
Z BOLT =<JN> ***** ENTER NEXT COMMAND *****
  
```

FIGURE 4: EXAMPLE OUTPUT WHEN DATA MISCOMPARE ARE DETECTED

The ERROR DOCUMENTATION section gives a brief description about utilizing this document in case of error detection.

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ERROR DOCUMENTATION

When an error is detected during the execution of a test section the operator is informed of the device being tested, the current section number, the error number, and what error occurred. For example, from figure 3 we have:

MLQ:SEC 25:ERR# 02: - THE READ OP FAILED.

To find further explanation of the error, one would look in this document for the description of Section #25 looking specifically at the documentation for ERROR #2 where the error is described in more detail. For ERROR #2 of Section #25 one would find the following explanation:

ERROR 02

A poll READ 208000U2 which expects either data or EOT has either completed with exception, timed out (soft timeout), or the received transmission number, if the terminal has been programmed to use one, has not matched the expected transmission number.

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PCAP TESTING

At the lowest level of testing BOLT allows the operator to issue single predefined normal operations codes to a device through LOGICAL PCAP commands or a chain of up to six operator defined operation codes through PHYSICAL PCAP commands. PCAP commands require that the entire control be obtained since the operator may issue diagnostic ops which affect the entire Base card. The LOGICAL and PHYSICAL PCAP commands are described below.

LOGICAL I/O

BOLT provides a means for the immediate execution of basic operations to each device using minimum operator input. This is accomplished with a set of logical commands. Logical commands use the zero (0) PCAP MODE I/O descriptor; therefore, descriptor fields may be set by using the appropriate BOLT commands. Logical Commands cause an immediate action, implying that all descriptor fields must be changed before the logical command is issued (if the operator so desires). The result descriptor of any Logical IO may be viewed by entering the "DISPLAY DESC [0]" command. The list of valid logical commands for the Multiline control are shown below.

TES -- 280000U2
Dispatch a TEST OP to the control selected by the UNIT command.

STO -- 2E0000U2
Dispatch a STOP OP to the control selected by the UNIT command.

DSC -- 2C0000U2
Dispatch a DISCONNECT OP to the control selected by the UNIT command.

BRE -- 2C2000U2
Dispatch a BREAK OP to the control selected by the UNIT command.

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PHYSICAL I/O

At the lowest level of testing BOLT provides the operator the capability of building up to six physical I/O descriptors, linking them together in any order and dispatching them to the MLC. For more information on how to build physical descriptors refer to the OP, LINK, DATA, LENGTH and SEND commands (P.S. 2228 3543 BOLT EXECUTIVE).

Although the physical I/O allows the operator substantial flexibility in testing and communicating with data comm devices, it also requires a more detailed knowledge of the data comm system. For example when writing to a terminal the operator must specify both the protocol control characters and the data using the DATA command. A STOP op is automatically inserted at the end of every chain by BOLT.

Figure 6 below gives an example of PCAP testing; it fills up a TD830 screen with address "D2" with all "TEST". Anything following "Z" is a comment and would not be present in input.

```

% BOLT =<JN> ***** ENTER NEXT COMMAND *****
: BOLT =<JN> ACCEPT.
<JN>AX OP [0] 24840002; OP [1] 20800002; OP [2] 24840002;
      OP [3] 20800002;
                                % WRITE, READ, WRITE, READ
% BOLT =<JN> ***** ENTER NEXT COMMAND *****
: BOLT =<JN> ACCEPT.
<JN>AX DATA [0] EOT "D2" SEL ENQ; LEN [0] 5;
                                % THIS IS A STANDARD SELECT MESSAGE.
% BOLT =<JN> ***** ENTER NEXT COMMAND *****
: BOLT =<JN> ACCEPT.
<JN>AX DATA [2] SOH "D2" STX "TEST " DC1 ETX; LEN [2] 11;
                                % THIS IS THE ACTUAL MESSAGE.
% BOLT =<JN> ***** ENTER NEXT COMMAND *****
: BOLT =<JN> ACCEPT.
<JN>AX LINK [0] [1] [2] [3];
                                % LINK THE DESCRIPTORS
                                % WRITE -> READ -> WRITE -> READ -> STOP
% BOLT =<JN> ***** ENTER NEXT COMMAND *****
: BOLT =<JN> ACCEPT.
<JN>AX REPEAT 384; SEND [0];
                                % DISPATCH THE DESCRIPTORS.
% BOLT =<JN> ***** ENTER NEXT COMMAND *****
: BOLT =<JN> ACCEPT.

```

FIGURE 6: EXAMPLE OUTPUT PCAP TESTING

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PROGRAM SWITCHES

For BOLT program debugging purposes the following program switches are used:

SW 5 = 1

If this switch is set then procedures and functions entries and exits in MLC test will be traced.

SW 6 = 1

If SW 6 is set then important variables and buffers used in MLC test will be traced; these will include procedures parameters and procedures and functions results.

SW 8 = 1

This switch is used to check error handling facilities of MLC test. If this switch is set the MLC test will simulate error reporting for certain diagnostic sections by modifying the EXPECTED or RECEIVED values before a compare is done.

If an error is suspected in the MLC test program, then a SPO LOG trace should be created using the MCP command KB LP ON with BOLT switches 5 and 6 set to 1. The BOLT command DISPLAY OPTIONS should be entered at the beginning and ending of the trace to record the the setting of the BOLT parameters.

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NORMAL OPERATION CODES

Normal and diagnostic descriptors contain the following 24 bit fields:

```
-----
|  E  |  RS  |  L  |  OP  |  A  |  B  |  C  |
|-----|
```

where each 24 bit field has the following format:

```

                                111 1111 1112 2222
bit #:  msb - 1234 5678 9012 3456 7890 1234 - lsb
          |                                     |
          |-----|
          | xxxx xxxx xxxx xxxx xxDx xxxx |
          |-----|

```

The operation code (op code), variant bits, and unit number are contained in a 24-bit op field. The leftmost four bits of the field are used to designate the operation to be performed. The remaining bits are used to specify different variations of the operation designated. The MLC operation codes and a brief description of each are given below. All bits unassigned or reserved are subject to assignment. Until assigned, these bits should be left as zeros. The D variant (bit 19) indicates that the opcode is for diagnostics only and should always be set to 0 for normal state operations.

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READ

The READ op code has the following format:

```
-----
| 0000  TrAr  CEVV  Pxxx  xr0r  UUUU  |
-----
```

Read data from the remote device into ascending memory locations beginning with the location specified by the AFIELD. Reading ends with the bit immediately before the location specified by the BFIELD unless terminated earlier by an ending code.

r	=		reserved
x	=		unassigned
T	=	1	Translate ASCII to EBCDIC
		0	No translation
A	=	1	Disable all timeout functions
		0	Normal
C	=	1	If no data is received during timeout period, complete the operation but do not report TIMEOUT exception. This allows an absent terminal to be polled (see variant P = 1) without causing an OPERATION COMPLETE bit to be set in the RS field (Standard Direct, BDI and BISYNC disciplines only).
			For TTY disciplines this variant instructs the control to check character parity for correctness.
		0	Normal
E	=	1	Ignore EDT as response code (STD and BISYNC only)
		0	No action
VV	=	00	Perform normal linking (fetch next I/O descriptor if no exceptions are reported).
	=	01	If a non-negative response is received, set LINKING TERMINATED bit in the result and terminate linking (perform normal linking on negative response such as NAK).

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= 10 If a non-positive response is received, set
LINKING TERMINATED bit in the result and terminate
linking (perform normal linking on positive
response such as ACK, ENQ).

= 11 Undefined

P = 1 If no exception is received, do not store a
result in the RS field but fetch the next I/O
descriptor; if an exception is received,
terminate the operation normally by storing
the data and result but do not fetch the next
I/O descriptor (not implemented for TTY).

0 Normal

UUUU = Adapter number (supplied by BOLT UNIT command)

WRITE

The WRITE op code has the following format:

```
-----  
| 0100 TDxr xErr PLL LxOr UUUU |  
-----
```

Write data to the remote device from ascending memory locations beginning with the location specified by the AFIELD. Writing ends with the bit immediately before the location specified by the BFIELD (Transparent BISYNC or dialing), unless terminated earlier by an ending code.

r	=		reserved
x	=		unassigned
T	=	1	Translate EBCDIC to ASCII
		0	No translation
D	=	1	Dial Operation (Burroughs data sets only)
		0	No action
E	=	1	Ignore EDT as response code (STD and BISYNC only)
		0	No action
P	=	1	Write (POLL) starting with data from the location specified by the E address (not for TTY).
		0	No action
LLLL	=		Poll sequence length when P = 1, Possible values = 2 thru 13. Usually set to 5.
UUUU	=		Adapter number (supplied by BOLT UNIT command)

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BREAK-DISCONNECT

The BREAK-DISCONNECT op code has the following format:

```
-----  

| 1100 00Vr xxxx xxxx xx0x UUUU |  

-----
```

The BREAK-DISCONNECT terminates any operation currently in process and either transmits a break signal to the remote terminal or disconnects, as specified by the variant. This op is valid for all disciplines except BDI.

x	=		unassigned
r	=		reserved
V	=	0/1	Non-switched L/A - sent break BISYNC - disconnect
	=	0	Switched L/A - send break
	=	1	Switched L/A - disconnect
UUUU	=		Adapter number (provided by BOLT UNIT command).

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TEST

The TEST op code has the following format:

```
-----  

| 100V xDMr xHrr xxxx xx0x UUUU |  

-----
```

The Test op is used to obtain adapter identification, to test for specific conditions, to preset Data Terminal Ready prior to dialing and to answer the phone.

TEST with variant M = 1 is always required before either manual or automatic dialing, so the dialer can switch the communication lines. Also, TEST with variants VM = 11 is the only operation permitted to answer a telephone.

If no Adapter is present, the Base card returns 2C001C02 and interrupts. If the Adapter is present but has not been down loaded, the Base returns 2CA01C02 and interrupts indicating that the Adapter firmware and line configuration is needed. If the Adapter is loaded but no line configuration is present, then the Base returns 2C201C02 and interrupts indicating that the configuration is needed. If the Adapter is loaded with both the firmware and the line configuration, the Base returns 28001mn2 and links, where mn is the Adapter ID + OP complete + Data comm present.

x = unassigned
 r = reserved

VDMH

0000

Return Adapter ID. Do not change DATA TERMINAL READY status.

0011

Make DATA TERMINAL READY true and then return Adapter ID.

1001

Wait until a ringing condition is true before returning the Adapter ID (switched lines only -- non-switched adapters will wait forever).

1011

Make DATA TERMINAL READY true, then wait until DATA SET READY is true before returning the Adapter ID (switched lines only; leased lines complete immediately and two-wire direct lines wait forever).

UUUU

Adapter number (provided by the BOLT UNIT command).

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STOP

The STOP op code has the following format:

```
-----  

|  11x  xxxx  xxxx  xxxx  xx0x  UUUU  |  

-----
```

The STOP op tells the Multiline Control to go idle for the designated adapter after storing its adapter ID bits in the Result Status field. An interrupt is returned if applicable. Other adapters on the same MLC are not affected.

x = unassigned

UUUU = Adapter number (provided by the BOLT UNIT command).

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RESULT STATUS FIELD

The Result Status (RS) field for Multiline operations is a 24 bit information field. Before and during an operation, the first 15 bits of the RS field hold temporary flags for the I/O Driver and the other nine bits indicate dynamic interrupt information. After an operation, the RS field is used to store the result of the operation. The significance of each bit is shown in the RESULT STATUS TABLE and described below.

OPERATION COMPLETE (BIT 1)

Bits 1 and 17 are set to indicate that the operation has completed.

EXCEPTION CONDITION (BIT 2)

Bit 2 indicates an exception condition and is set if one or more of bits 4 through 13 are set.

RESERVED (BIT 3)

BIT 3 is reserved for ACU and BDLC use.

DATA ERROR (BIT 4)

BIT 4 indicates the detection of data error via character parity, Block Check Character (BCC) or Frame Check Sequence (FCS) on a READ operation. The operation continues to a normal termination.

MEMORY ACCESS ERROR (BIT 5)

Memory access failure does not terminate a READ or WRITE; The operation continues to a normal termination. On READ, the failure causes loss of one or more characters. On WRITE, it results in transmission of synchronizing characters on synchronizing lines and a steady marking condition on asynchronous lines, with no data lost.

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MEMORY PARITY ERROR/FIRMWARE ALREADY LOADED (BIT 6)

A line adapter used with an MLC is notified of memory parity errors. Termination may be normal or a bad BCC may be forced. If BIT 16 also set then BIT 6 indicates that an attempt was made to load firmware into the adapter, but the firmware was already loaded.

TIMEOUT (BIT 7)

Timeout is reported if the time limit specified by the various adapters for certain events to occur is exceeded. Timeout values are typically specified to detect failure to receive the initial character or subsequent characters of a message or failure to receive a response to Request to Send.

BREAK RECEIVED (BIT 8)

If BIT 16 is not set then BIT 8 indicates that a WRITE was in process and BREAK was received from the remote unit. The adapter ends the operation and sets BIT 8 in the RS field.

ENDING CODE EXPECTED (BIT 9)

BIT 9 indicates that on a READ or WRITE the adapter was terminated before an ending code was received.

LINKING TERMINATED (BIT 10)

BIT 10 is set if the linking has been terminated abnormally during a READ operation which has the linking variants (VV = 01, 10) set.

RESERVED (BIT 11)

BIT 11 is reserved for BOLC and ACU adapters.

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LOSS OF DATA SET READY (BIT 12)

BIT 12 indicates that DATA SET READY was absent at the start of a WRITE, READ or BREAK-DISCONNECT, or was lost during the operation. This applies only to non-direct connections.

LOSS OF CARRIER (BIT 13)

If the carrier is lost, BIT 13 is set in the RS field, but does not terminate the operation. If it happens while data are being received, the data loss starts a timer (about 1 second for most adapters). If the carrier returns before timeout, the adapter continues as before with the carrier loss flagged in the RS field. If the carrier fails to return, the operation terminates with both TIMEOUT and LOSS OF CARRIER flagged in the RS field. This bit applies only to non-direct connections.

RESERVED (BIT 14)

BIT 14 is reserved for ACU and BDLC adapters.

RESERVED (BIT 15)

BIT 15 is reserved for ACU and BDLC adapters.

RESERVED (BIT 16)

OPERATION COMPLETE (BIT 17) BIT 17 is set when the operation has completed.

DATACOMM CONTROL PRESENT (BIT 18)

BIT 18 is returned for TEST and STOP operations if a datacomm control is present.

ADAPTER IDENTIFICATION (BITS 19-24)

BITS 19-24 return the adapter ID for TEST and STOP operations. See ADAPTER IDENTIFICATION TABLE for more information.

RESULT STATUS TABLE FOR MLC

The table below shows which result status bits are valid for the MLC. Also shown is the operation and adapter for which a particular bit may be set.

BIT	----- STD - Adapter			MEANING	Operation	BREAK-DISCONNECT---						
						STOP	TEST	WRITE	READ	UNLOAD	LOAD	
1	x	x	x	Operation completed		x	x	x	x	x	x	x
2	x	x	x	Exceptions indicated by bits 3 to 16		x	x	x	x	x	x	x
3	x	x	x	Reserved								
4	x	x	x	Character parity/BCC/FCS error				x				
5	x	x	x	Memory access error				x				
6	x	x	x	Memory parity error					x			
7	x	x	x	If BIT16 then Firmware already loaded		x				x		
8	x	x	x	Timeout					x	x	x	x
9	x	x	x	Break received						x		
10	x	x	x	Ending code expected, but not received		x	x					
11	x	x	x	Linking terminated		x	x			d		
12	e	x	x	Reserved								
13	e	x	x	Loss/initial absence of DATA SET READY					e	e		e
14	e	x	x	If BIT16 then Reserved								
15	e	x	x	Loss of carrier					e			
16	e	x	x	Loss of CLEAR TO SEND						e		
17	x	x	x	Reserved								
18	x	x	x	Reserved								
19	x	x	x	Reserved								
20	x	x	x	Operation complete		x	x	x	x	x	x	x
21	x	x	x	Datacomm control presence							x	x
22	x	x	x	Adapter ID (see table)							x	x
23	x	x	x	Adapter ID (see table)							x	x
24	x	x	x	Adapter ID (see table)							x	x
25	x	x	x	Adapter ID (always set to zero)		x	x	x	x	x	x	x

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Where

d ==> variants VV=01, 10

e ==> variants non-direct adapters only

ADAPTER IDENTIFICATION TABLE

Result Bits						Adapter Type
19	20	21	22	23	24	
---	---	---	---	---	---	-----
0	0	0	0	0	0	no adapter
0	0	0	0	1	0	STD/DIR or STD leased
1	0	0	0	1	0	STD switched
0	0	1	0	0	0	TTY leased
1	0	1	0	0	0	TTY switched
0	0	1	0	1	0	BISYNC/EBCDIC leased
1	0	1	0	1	0	BISYNC/EBCDIC switched
0	0	1	1	0	0	BISYNC/ASCII leased **
1	0	1	1	0	0	BISYNC/ASCII switched **

** BISYNC/ASCII is not supported for On-Line testing

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MULTI LINE TEST INITIALIZATION PROCEDURES

INITIALIZE/RESTORE MULTI LINE TEST

When the operator selects a multi line unit through the BOLT "UNIT" command, BOLT calls an initialization routine to do the following:

1. Display header messages to the ODT.
2. Issue a TEST op to the control to determine if it is MLC.
3. If the TEST op completes with exception, the result status bits are displayed.
4. Ask the operator to enter the line configuration name if the selected device is MLC.

Figure 7 below is an example of the possible output when selecting a new multi line control.

To release a device, the operator can use either the "RESTART" or "BYE" command or simply select a new device through the "UNIT" command. Note that if the CONTROL has been selected then it takes BOLT about 90 seconds to release the entire CONTROL back to the MCP and during this time the performance of the system is rather slow. When the CONTROL is released BOLT will display the following message:

MLx RELEASED BY BOLT.

INITIALIZATION ERRORS

The following are the descriptions of possible errors during this phase.

ERROR 90

During the initialization process, a TEST op 280000U2 is issued to determine the control type. The TEST op has timed out and as a result Multi Line Test is aborted. The completion of the TEST op with exception does not generate any error.

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INVALID INPUT RECEIVED FROM THE OPERATOR

The operator was asked to enter the line configuration name; the input was scanned and found invalid.

CONFIGURATION NAME MUST BE BETWEEN 1 TO 10 CHARACTERS

The line configuration name can not be more than 10 characters.

MULTI LINE TEST -- VERSION AA

OPTIONAL CONFIDENCE TEST SECTIONS ARE 25 - 29
FOR A DESCRIPTION OF THE MLC TEST ENTER "TEACH ML".
ENTER "TEACH ML <SECTION_NUMBER>" FOR THE DESCRIPTION
OF ANY TEST SECTION LISTED ABOVE.

THE OP ISSUED WAS 800000

ID RESULT STATUS FIELD: CA01C0

THE FOLLOWING STATUS BITS ARE ON:

RS (1): OPERATION COMPLETE
RS (2): EXCEPTION
RS (5): FIRMWARE REQUIRED
RS (7): LINE CONFIGURATION REQUIRED
RS (16): MLC
RS (17): OPERATION COMPLETE
RS (18): DATACOMM CONTROL PRESENCE
RS (19-24): ADAPTER ID = NO ADAPTER OR FIRMWARE REQUIRED

PLEASE ENTER THE CONFIGURATION NAME (UP TO 10 CHARACTERS).
SPECIFY "DEFAULT" FOR DEFAULT CONFIGURATION.

FIGURE 7: EXAMPLE OUTPUT FROM INITIALIZATION PROCESS

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INITIALIZE MULTI LINE SECTION

Prior to the execution of any test section the following conditions are checked and appropriate actions are taken. If any of the conditions are not met or any error is detected during the course of the action taken then the operator will be notified and the test section will be aborted.

1. Is the section length sensitive? If so, is the user specified length valid ?
2. Is the selected device MLC ?
3. Is the section to be executed a Confidence section? If so, is there an adapter present ?
4. Is the selected section a Confidence one? If so, has a terminal address been entered previously ?

SECTION INITIALIZATION ERRORS

The following are the list of errors that can be encountered during the initialization of a test section. Note that these error messages will be displayed before BOJ section message is displayed. Also the errors that are related to the operator invalid requests are not numbered while the errors that are hardware dependent are numbered. The test section is aborted if any of the following errors is detected during the initialization process.

USER SPECIFIED LENGTH IS TOO LARGE FOR TDBXX

The selected section is length sensitive, and the specified LENGTH value by the operator exceeds 1920 (characters) which is a full screen.

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ADAPTER IS NEEDED TO RUN ANY OF THE CONFIDENCE TEST SECTIONS
The Confidence test sections 25 through 29 can not be executed unless an adapter is present.

TERMINAL ADDR REQUIRED FOR CONFIDENCE TESTS. SEE ADDRESS COMMAND
A terminal address is required to run any of the Confidence test sections 25 through 29.

ERROR 91

During the initialization process a TEST op 280000U2 is dispatched to check if the right firmware and configuration have been previously down-loaded. The TEST op has been issued but has timed out.

ERROR 93

A START op 261000U2 was issued to start the execution at the location specified by the contents of location 8000H in the RAM but has either timed out or completed with exception.

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BOLT TEST SECTIONS FOR MLC

The MLC Test Sections are pre-defined tests which run with default parameters. The Optional Confidence Test Sections may require some operator intervention to run. (For example, the operator may be asked to enter data on the TD8XX screen and push XMIT so that the data may be echoed to the system and back). The operator may also change test parameters for some Confidence Test Sections.

All of the MLC Test Sections are described in the sections to follow. A Test Section is said to be "operator sensitive" if the BOLT operator can change test parameters using one of the valid BOLT commands. For example, the data pattern in a write operation may be operator sensitive. This means that the operator may enter the DATA command to alter data used for the write operation.

The data parameters should be modified BEFORE a test section is executed. Data Parameters that are modified while a test section is executing will not be used until the next test section is run.

Note that all test sections are sensitive to operator input in that the operator may enter a command to change the program flow (e.g. CLEAR, RESTART, EXIT, LOCK, ... etc). The above definition refers only to commands affecting test section output (e.g. DATA, RECORDS, and LENGTH).

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OPTIONAL CONFIDENCE TEST SECTIONS (#25-29)

There are five valid optional confidence test sections beginning with SECTION 25 and ending with SECTION 29. These test sections are NOT default and must be scheduled by the operator using the SECTION command. These sections usually require operator intervention or visual verification of the transmitted data.

Section #25 -- TERMINAL POLL

This test section polls the terminal selected by the BOLT <ADDRESS> command indefinitely. If the terminal is not present or not functioning, then the operator is notified every 100 TIMEOUTs or EOTs received. To end the section one can enter any of the BOLT EXIT, CLEAR, RESTART or BYE commands.

A poll write is built with the following data:

2372	(EOT)
ADR1	(Terminal
ADR2	Address)
2972	(POL)
22D2	(ENQ)

The Translate and Ignore EOT variants are set with a poll write length of 5. The poll write is then linked to a poll read which expects data or an EOT from the terminal.

DEFAULT DATA:	Not applicable
DEFAULT LENGTH:	Not applicable
DEFAULT RECORD:	Not applicable
DATA OPERATOR SENSITIVE:	Not applicable
LENGTH OPERATOR SENSITIVE:	Not applicable
RECORD OPERATOR SENSITIVE:	Not applicable

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ERROR 01

A poll WRITE 248400U2 has either completed with exception or timed out (soft timeout). Note that the detection of TIMEOUT, bit #7 in RD, by itself does not generate any error message.

ERROR 02

A poll READ 208000U2 which expects either data or EOT has either completed with exception, timed out (soft timeout), or the received transmission number, if the terminal has been programmed to use one, has not matched the expected transmission number.

ERROR 03

When the system receives data from the terminal, it sends ACK to the terminal if no error has been detected. The system has sent ACK to the terminal but the WRITE op 248400U2 has either timed out (soft) or completed with exception. The detection of TIMEOUT, bit #7 in RD, is not reported as error.

ERROR 04

When the system receives data from the terminal, it sends NAK to the terminal if data errors have been reported. The NAK has been written but the WRITE 248400U2 has either timed out (soft) or completed with exception. The detection of TIMEOUT, bit #7 in RD, does not generate any error.

ERROR 05

A WRITE op for sending ACK or NAK to the terminal is always linked to a READ op 208000U2. ACK or NAK has been sent but the READ op has either completed with exception or timed out.

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Section #26 -- SHORT FAST SELECT

Under default conditions this test section does a home and clear and then generates and transmits 384 Fast Select messages containing 5 data bytes. The operator is notified for every 100 TIMEOUTs or NAKs received. The entire message is as follows:

```

0372 (EDT)
AD1 (Terminal
AD2 Address) (you are)
0A22 (Fast Select Code)
0012 (SOH)
AD1 (Terminal
AD2 Address) (you are)
[XMT] (Transmission Number) (user specified)
0022 (STX)
0E32 ( T )
0C52 ( E )
0E22 ( S )
0E32 ( T )
0402 (SPACE)
0112 (DC1 Control code)
0032 (ETX)

```

This section expects the terminal to be in the RCV mode. The word "TEST" will appear on the screen of the terminal selected by ADDRESS command. If this completes successfully the process will be repeated another 383 times until the TD830 screen is completely filled with 384 five byte messages.

DEFAULT DATA:	"TEST "
DEFAULT LENGTH:	5 characters
DEFAULT RECORD:	384
DATA OPERATOR SENSITIVE:	Yes
LENGTH OPERATOR SENSITIVE:	Yes
RECORD OPERATOR SENSITIVE:	Yes
NOTES:	The data pattern is fixed once the section has begun.

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ERROR 01

At the beginning of the section FSL is used to send a home and clear 2FF2 to the terminal. A transmission number is included in each write message if the user has set the XHN option by selecting a transmission number. A WRITE op 248400U2 has been issued but has either timed out (soft) or completed with exception. It should be noted that the detection of TIMEOUT, bit #7 in RD, is not erroneous.

ERROR 02

A WRITE op for sending a home and clear to the terminal is always linked to a READ op 208000U2; this READ expects either ACK or NAK where the system will retransmit the home and clear for the latter. A READ op has been dispatched but has either completed with exception or timed out.

ERROR 03

A READ op that expects ACK or NAK, in response to the transmission of a home and clear, has completed but neither ACK nor NAK has been received.

ERROR 04

A WRITE op 248400U2 to transmit a FSL message containing data to the terminal has either completed with exception or timed out (soft). A transmission number is included in every message if the operator has chosen to use the option. The detection of TIMEOUT, bit #7 in RD, by itself is not reported as error. The dispatch in error is displayed as part of the generated error message.

ERROR 05

A WRITE op for sending a FSL message containing data to the terminal is always linked to a READ op 208000U2; this READ expects either ACK or NAK where the system will retransmit the same message for the latter. A READ op has been issued but has either timed out or completed with exception. The dispatch in error is displayed as part of the reported error message.

ERROR 06

A READ op that expects ACK or NAK, in response to the transmission of a FSL message containing data, has completed but neither ACK nor NAK has been received. The dispatch in error will be displayed.

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Section #27 -- LONG FAST SELECT

This test section is the same as section 26 with the exception that the text of the select message is 80 bytes long and only 24 Fast Select messages are sent to fill up the screen. Also, unlike section 26, this section is not length sensitive.

DEFAULT DATA:	72 EBCDIC character set followed by 8 blanks
DEFAULT LENGTH:	80 Characters
DEFAULT RECORD:	24
DATA OPERATOR SENSITIVE:	Yes
LENGTH OPERATOR SENSITIVE:	No
RECORD OPERATOR SENSITIVE:	Yes

Section #28 -- SYSTEM ECHO

In this test section Fast Select protocol is used to transmit a message to the terminal selected by the ADDRESS command which reads "Please do not clear the screen at the end of this display, put the terminal in the transmit mode to echo the displayed data back to the system to be verified." The message is followed by a blank line and then six lines the 64 EBCDIC character set each followed by "***** ECHO TEST". The operator is notified for every 100 TIMEDOUTs or NAKs received. This message is read back to the system 100 times and each time the data are verified by the system. the section requires the operator to press XMT once; the system will send NAKs in response to enforce data retransmission. The section takes about 2 minutes to complete under the default conditions.

DEFAULT DATA:	As stated above.
DEFAULT LENGTH:	720 characters
DEFAULT RECORD:	100
DATA OPERATOR SENSITIVE:	yes - the first 64 bytes of the user specified data will replace the 64 EBCDIC char set.
LENGTH OPERATOR SENSITIVE:	No
RECORD OPERATOR SENSITIVE:	Yes
NOTES:	Transmitting from a position other than where the cursor is left will produce an error.

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ERROR 01

At the beginning of the section FSL is used to send a home and clear 2FF2 to the terminal. A transmission number is included in each write message if the user has set the XMN option by selecting a transmission number. A WRITE op 248400U2 has been issued but has either timed out (soft) or completed with exception. Note that the detection of TIMEOUT, bit #7 in RD, is not erroneous.

ERROR 02

A WRITE op for sending a home and clear to the terminal is always linked to a READ op 208000U2; this READ expects either ACK or NAK where the system will retransmit the home and clear for the latter. A READ op has been dispatched but has either completed with exception or timed out.

ERROR 03

A READ op that expects ACK or NAK, in response to the transmission of a home and clear, has completed but neither ACK nor NAK has been received.

ERROR 04

The WRITE op 248400U2 to transmit a FSL message, containing the message to the operator, to the terminal has either completed with exception or timed out (soft). A transmission number is included in the message if the operator has chosen to use the option. The detection of TIMEOUT, bit #7 in RD, by itself is not reported as error.

ERROR 05

The WRITE op for sending a FSL message containing data to the terminal is always linked to a READ op 208000U2; this READ expects either ACK or NAK where the system will retransmit the same message for the latter. A READ op has been issued but has either timed out or completed with exception.

ERROR 06

The READ op that expects ACK or NAK, in response to the transmission of the FSL message containing the message, has completed but neither ACK nor NAK has been received.

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ERROR 07

After sending the message to the terminal successfully, the system polls the terminal continuously until it receives the echoed data from the terminal. A poll WRITE 248400U2 has either completed with exception or timed out (soft timeout). Note that the detection of TIMEOUT, bit #7 in RD, by itself does not generate any error message.

ERROR 08

A READ 208000U2 which expects either data or EOT has either completed with exception, timed out (soft timeout), or there have been data miscompare between the expected and observed data and transmission number, if the terminal has been programmed to use transmission numbers. The dispatch in error will be displayed as part of the generated error message.

ERROR 09

To force the terminal to retransmit the data, the system sends NAK to the terminal after receiving the data. One of the WRITE ops 248400U2 has either completed with exception or timed out. The dispatch in error will be included in the displayed error message. Note that the detection of TIMEOUT, bit #7 in RD, is not reported as error.

ERROR 10

At the end of the section an ACK is sent to the terminal to stop data retransmission. The WRITE op has been dispatched but it has either completed with exception or timed out (soft).

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Section #29 -- TERMINAL ECHO

This section displays to the terminal selected by the ADDRESS command the message "Free form terminal echo section... please home the cursor and enter data to be echoed or enter one or more blanks to end the section and press XMT. The echoed data will appear beginning at the cursor position." The section will read the data but will not compare since the data are user specified. The operator is notified for every 100 EOTs or TIMEOUTs received. The result status information from the terminal read will be checked, and the data will be written back to the terminal.

DEFAULT DATA:	Not applicable
DEFAULT LENGTH:	Not applicable
DEFAULT RECORD:	Not applicable
DATA OPERATOR SENSITIVE:	Not applicable
LENGTH OPERATOR SENSITIVE:	Not applicable
RECORD OPERATOR SENSITIVE:	Not applicable

ERROR 01

At the beginning of the section FSL is used to send a home and clear 2FF2 to the terminal. A transmission number is included in each write message if the user has set the XMN option by selecting a transmission number. A WRITE op 248400U2 has been issued but has either timed out (soft) or completed with exception. Note that the detection of TIMEOUT, bit #7 in RD, is not erroneous.

ERROR 02

A WRITE op for sending a home and clear to the terminal is always linked to a READ op 208000U2; this READ expects either ACK or NAK where the system will retransmit the home and clear for the latter. A READ op has been dispatched but has either completed with exception or timed out.

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ERROR 03

A READ op that expects ACK or NAK, in response to the transmission of a home and clear, has completed but neither ACK nor NAK has been received.

ERROR 04

The WRITE op 248400U2 to transmit a FSL message, containig the message to the operator, to the terminal has either completed with exception or timed out (soft). A transmission number is included in the message if the operator has chosen to use the option. The detection of TIMEOUT, bit #7 in RD, by itself is not reported as error.

ERROR 05

The WRITE op for sending a FSL message containig data to the terminal is always linked to a READ op 208000U2; this READ expects either ACK or NAK where the system will retransmit the same message for the latter. A READ op has been issued but has either timed out or completed with exception.

ERROR 06

The READ op that expects ACK or NAK, in response to the transmission of the FSL message containing the message to the operator has completed but neither ACK nor NAK has been received.

ERROR 07

After sending the message to the terminal successfully, the system polls the terminal continuously until it receives the user entered data from the terminal. A poll WRITE 248400U2 has either completed with exception or timed out (soft timeout). Note that the detection of TIMEOUT, bit #7 in RD, by itself does not generate any error message.

ERROR 08

A READ 208000U2 which expects either data or EOT has either completed with exception, timed out (soft timeout), or there has been miscompare between the expected and observed transmission number, if the terminal has been programmed to use transmission numbers.

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ERROR 09

When the system receives data from the terminal, it sends ACK to the terminal if no error has been detected. The system has sent ACK to the terminal but the WRITE op 248400U2 has either timed out (soft) or completed with exception. The detection of TIMEOUT, bit #7 in RD, is not reported as error.

ERROR 10

When the system receives data from the terminal, it sends NAK to the terminal if data errors have been reported. The NAK has been written but the WRITE 248400U2 has either timed out (soft) or completed with exception. The detection of TIMEOUT, bit #7 in RD, does not generate any error.

ERROR 11

A WRITE op for sending ACK or NAK to the terminal is always linked to a READ op 208000U2; where the READ expects to receive EOT. ACK or NAK has been sent but the READ op has either completed with exception or timed out.

ERROR 12

The data received from the terminal are written back to it using Fast Select Protocol. Each message contains a transmission number if the user has chosen to use one. A WRITE op 248400U2 has been issued but has either timed out (soft) or completed with exception. Note that the detection of TIMEOUT, bit #7 in RD, by itself does not generate any error.

ERROR 13

A WRITE op for sending a FSL message containing user entered data to the terminal is always linked to a READ op 208000U2; this READ expects either ACK or NAK where the system will retransmit the same message for the latter. A READ op has been issued but has either timed out or completed with exception.

ERROR 14

A READ op that expects ACK or NAK, in response to the transmission of a FSL message containing user entered data, has completed but neither ACK nor NAK has been received.

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