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BOLT CARD DEVICE TEST

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TABLE OF CONTENTS

BURROUGHS CORPORATION
COMPUTER SYSTEMS GROUP
SANTA BARBARA PLANT

COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

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P.S. 2228 3626(A)

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P.S. 2228 3626(A)

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INTRODUCTION

The CARD DEVICE TEST is one test procedure in the BOLT software
system.   It is designed to test Card Reader Controls 1 and 2,
Card Read/Punch/Print Controls for 80 and 96 column cards, and
Card Punch Controls 1 and 2.   The Card Device Test consists of
one part; Optional Confidence Test Sections.

OPTIONAL CONFIDENCE TEST SECTIONS

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 of the Control.   Not all the
sections may be used for every Control.   For example, the punch
test could not be used on a Read only device.   Every test
requires operator intervention which is the normal case whenever
a card device is used.   The sections will also test the Control's
ability to report certain conditions (e.g., Not ready).   The test
sections are not common to all Card Device Controls and do not
run by default.

RELATED DOCUMENTS

Document Number	Document Name
P.S. 2100 7778	Standard Interface Specification Card Handling Equipment
P.S. 2204 8623	B/1700/B1800 I/O Bus Subsystem
P.S. 2208 2978	B/1700 80 Column Card Reader Subsystem
P.S. 2211 1371	B/1700 80 Column Card Read/Punch/Print Subsystem
P.S. 2208 2986	B/1700 80 Column Card Punch Subsystem
P.S. 1108 3034	B/1700 96 Column Card Read/Punch Subsystem
P.S. 2228 3543	B1000 BOLT Executive

ABBREVIATIONS

The following abbreviations will be used to represent the different controls. These abbreviations apply to this document only.

Abbreviation	Control
CRC	Card Reader Controls 1 and 2
CPC	Card Punch Controls 1 and 2
CRPPC	80 Column Card/Read/Punch/Print Control
CRPC	96 Column Card/Read/Punch/Print Control

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P.S. 2228 3626(A)

BACKGROUND INFORMATION

The following section of this document gives a brief discussion of the Card Device controls and the Card units to aid in understanding of sections which follow. Occasionally, the reader will be referred to related documents for more detailed information.

GENERAL

There are two types of card devices; single function and multifunction. The single function device either reads or punches a card while the multifunction device may read, punch, print or perform any combination of these on a card. The multifunction device is a two cycle device. Each card is fed from an input hopper through a read station to a selected wait station. The second cycle takes the card from the wait station through the punch and print station to a stacker. The single function device operates in demand mode. When called upon, a card is fed from the input hopper through the READ/PUNCH station and into a stacker.

The multifunction devices have 2 input hoppers; a primary and secondary hopper. These are selected by variants in the operator codes. There may be from 1 to 6 stackers. Again selection is determined by variants in the operator codes. The single function devices have one input hopper and from 1 to 3 stackers.

There are four different types of controls which are tested in the On-Line Card Device Test. Figure 1 gives the list of devices which can be attached to each control and their characteristics.

The 80 column CARD READER controls provide buffering for 80 columns of information (8-bit or 12-bit). The 96-col CARD/READ/PUNCH provides buffering for 96 columns of information (8-bit). All the controls provide for card code to EBCDIC translation and EBCDIC to card code translation where applicable.

DATA TRANSFER

Data is transferred from a control to the system in 8-bit or 12-bit parallel fashion according to the discipline described in P.S. #2204 8623 (B1700/B1800 I/O BUS SUBSYSTEM).

CONTROL	UNIT	READ	PUNCH	PRINT	NUMBER HOPPERS	NUMBER STACKERS	NUMBER CYCLES
CRC-1	B9115 CR	X				1	1	1
(80 column)	B9116 CR	X				1	1	1
	B9117 CR	X				1	1	1
CRC-2	B9111 CR	X				1	1	1
(80 column)								
CARD/READ/PUNCH/PRINT								
(80 column)	B9418-2	X	X	X	2	2	2
CARD/READ/PUNCH								
(96 column)	B9119-1	X				1	1	1
	B9119-2	X				1	3	1
	B9419-2	X	X	X	2	6	2
	B9419-6	X	X	X	2	6	2
CARD PUNCH CONTROL-1								
(80 column)	B9212		X			1	1	1
	B9213		X			1		1
CARD PUNCH CONTROL-2								
(80 column)	B9210		X			1	1	1

FIGURE 1: CARD CONTROLS AND CARD DEVICES

Shown are the four different types of controls that can be tested
by the On-Line Card Device Test and the characteristics of the
devices (units) which can be attached to them.

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OPERATING INSTRUCTIONS

The first step in testing any Card Device Control is to gain exclusive access to the Card Device Drive (for Optional Test Sections) which is to be tested using the BOLT "UNIT" command. For example:

    UNIT CPA   - gain access to the card punch unit CPA.

    UNIT CONTROL CRB   - gain access to CARD READER CONTROL.

    UNIT CDC   - gain access to multifunction device CDC.

When the BOLT "UNIT" command is entered BOLT calls a special Card Device Test initialization procedure to obtain the Card Control ID, verify that the ID is correct, and initialize any Card Device Test variables as is necessary. See section 7 for complete details. This routine is called any time a card device is obtained for BOLT use.

Once access has been granted, the operator has a choice of two testing methods; using PREDEFINED TEST SECTIONS or PCAP MODE TESTING (PCAP means Peripheral Control Analysis Program). PCAP Mode Testing provides the operator with two levels of testing. Note that PCAP Mode Testing requires that access to the Control be granted. Predefined Confidence Test Sections do not require the Control, but no harm is done in selecting it. See Figure 2 below.

Testing with Predefined Test sections is the highest level of testing available to the operator, followed by Logical PCAP testing, then Physical PCAP testing. Predefined Test Sections are selected to be run with the BOLT "SECTION" command. To run these sections using their default parameters requires no more than following the instructions output by each test section. PCAP Mode Testing requires the operator to set up descriptor fields for operations to be performed. Each of the testing methods is discussed in more detail below.

```
                    -------------------
                    I  ACCESS GRANTED  I
                    I     UNIT OR      I
                    I     CONTROL      I
                    -------------------
                          /     \
                         /       \
  Select Unit or        /         \   Control must have been
  Control.             /           \  selected.
                      /             \
  --------------------------     -------------------------
  I  PREDEFINED TEST  I    OR    I    PCAP MODE         I
  I     SECTIONS      I          I    TESTING           I
  --------------------------     -------------------------
                                       /     \
                                      /       \
                                     /         \
                                    /           \
  -------------------------     -------------------------
  I      LOGICAL      I   OR    I       PHYSICAL        I
  I   PCAP TESTING    I         I    PCAP TESTING       I
  -------------------------     -------------------------
```
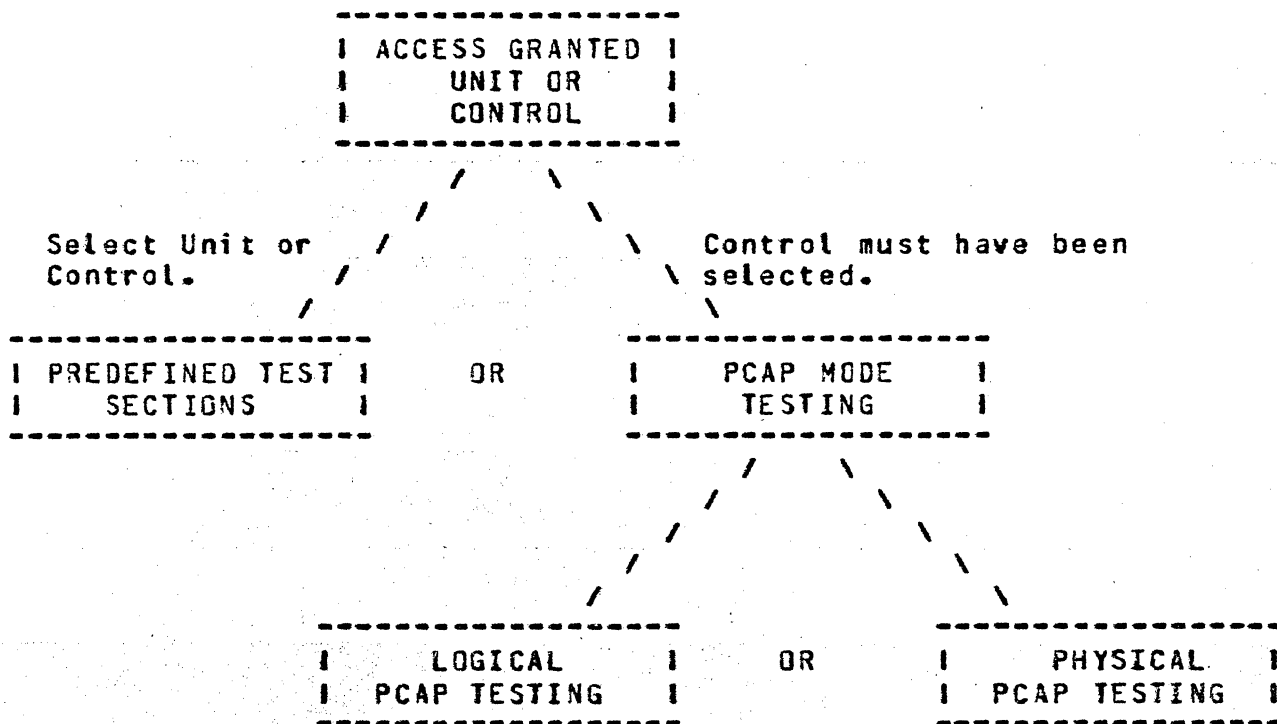
FIGURE 2:   TESTING METHODS AVAILABLE

Shown are the two testing methods available to the operator once
access has been obtained to a Unit or Control. Also depicted are
the two levels of PCAP Mode Testing that are available.

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P.S. 2228 3626(A)

PREDEFINED OPTIONAL CONFIDENCE TEST SECTIONS

These test sections (25-41) 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.

A unit is selected for confidence testing by entering "UNIT CRx" or "UNIT CPx" or "UNIT CDx" where x = an upper case alphabetic letter starting with A. CR is a Card Reader unit, CP a Card Punch unit, and CD a Multifunction unit.

The operator then builds a list of desired test sections using the "SECTION" command. The test sections are executed by entering "GO."

The following are examples of the necessary commands to run Optional Confidence test sections (See Appendix A for more detailed examples):

<job number>AX UNIT CRA;
<job number>AX SEC 37;
<job number>AX GO;   Optional   Confidence   test
                                     section 37 is executed.

<job number>AX SEC 34, 35;
<job number>AX GO;   Optional   Confidence   test
                                     sections   34   and   35   are
                                     executed.

If CRA is "in use" or "saved" by another program, then the UNIT command will generate an error message. The unit will not be secured for use.

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MORE ON PREDEFINED CARD DEVICE TEST SECTIONS

OPERATOR SENSITIVE

Card Device Test Sections are, for the most part, pre-defined
tests which run with some default parameters (e.g. data, length
and number of records). Some test sections allow the operator to
change default parameters by entering the proper BOLT command(s).
A test section is said to be **operator sensitive** if the operator
can alter any of the default parameters. For example, the
operator can change the data pattern rippled in section 25 by
entering the BOLT "DATA" command. The ability to, or not to,
alter test section parameters becomes evident in the description
of each test section.

It should be noted that test section parameters are fixed once
the test section has begun execution. Therefore, if the operator
wishes to change a given default parameter it must be done before
"GO" is entered.

Note that all test sections are sensitive to operator input in
that the operator may enter BOLT commands to change the program
flow (e.g. CLEAR, RESTART, EXIT, ...). The above definition of
"operator sensitive" refers only to the affect of BOLT commands
on test section paramters (e.g. DATA, LENGTH, and RECORDS).

FOR BEST RESULTS WITH PREDEFINED TEST SECTIONS

For the best results when executing Predefined Test Sections the
following guidelines should be considered:

    1.   Select a sequence of test sections to be executed.
        (See SUGGESTED TESTING SEQUENCE).

    2.   Choose the desired parameters (DATA, LENGTH, and
        RECORDS) for the sequence of test sections that
        have been selected. Remember that all tests have
        default parameters.

    3.   Do not change the test section parameters until
        the sequence of test sections has been executed.

    4.   If new test section parameters are desired then
        begin this process over with step 1.

DEVICE GOING NOT READY

If the Card Device being tested should go NOT READY during the
execution of a test section, the test section will be aborted.
To recover from the error simply reexecute the test section.

CLEARING WAIT STATIONS

When testing multifunction devices, it would be good practice to
clear any card from the wait station before a test section is
begun and between the different parts of the section.

CONTROL CARDS "?"

The 96 column Controls flag a CONTROL CARD error if a card
containing the "?" character in the first column is read.   In
general, this exception condition is expected and will be
ignored. For example, sections 25, 27, 28, 30-33, and 34 all
ignore the error. Section 35, however, does not.

TEST SECTION DOCUMENTATION

A brief description of each Card Device Test Section is given in
in sections 8 and 9 of this document.   Each test section is
identified by the section number, section name, and the Controls
on which the section can be run. For example:

        Section #25 -- Punch Ripple Test 96 (CRPC)
        Section #38 -- Read No Check (All Controls)

Section #25 can only be run on 96 multifunction devices, whereas
section #38 can be run on any of the controls. Following the
description of each test section is a list of the default
parameters and a note indicating whether or not they are operator
sensitive. Any special conditions the operator should be aware
of are also noted there.

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SUGGESTED TESTING SEQUENCE (PREDEFINED SECTIONS)

Certain test sections must be run in sequence.   Given below is
the suggested ordering of test sections for each of the Controls.

MULTIFUNCTION DEVICES

There are several tests which apply to the multifunction devices.
It is suggested that some of the tests be run in sequence.   The
sequence suggested is as follows:

80 Column Multifunction	96 Column Multifunction
	25 -- Punch Ripple
26 -- Punch Ripple	
27 -- Duplicate	27 -- Duplicate
28 -- Punch/Print	28 -- Punch/Print
29 -- Hoppers Empty	29 -- Hoppers Empty
30 -- Punch/Print Same	30 -- Punch/Print Same
31 -- Punch/Print Diff.	31 -- Punch/Print Diff.
32 -- Punch	32 -- Punch
33 -- Print	33 -- Print
34 -- Read Ripple	34 -- Read Ripple
35 -- Read No Check	35 -- Read No Check
36 -- Punch Binary	
37 -- Read Binary	
38 -- Unit Not Ready	38 -- Unit Not Ready
39 -- Use All Stackers	39 -- Use All Stackers
40 -- Test/Wait Ready	40 -- Test/Wait Ready
41 -- Test/Wait Not Ready	41 -- Test/Wait Not Ready

NOTE:
Always run section 25 or 26 before section 34.
Always run section 36 before section 37.

READ ONLY DEVICES

The following test section sequence is suggested when testing a
read only device.   The read only devices are attached to the
CRC-1 or CRC-2 Controls.

        80 Column Read Only Devices
        ----

            34 -- Read Ripple
            35 -- Read No Check
            37 -- Read Binary
            38 -- Unit Not Ready
            39 -- Use All Stackers
            40 -- Test/Wait Ready
            41 -- Test/Wait Not Ready

PUNCH ONLY DEVICES

The following test section sequence is suggested when testing a
punch only device.   The punch only devices are attached to a
CPC-1 or CPC-2 Control.

        80 Column Punch Only
        ----

            26 -- Punch Ripple
            37 -- Read Binary
            38 -- Unit Not Ready
            39 -- Use All Stackers
            40 -- Test/Wait Ready
            41 -- Test/Wait Not Ready

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ERROR REPORTING FOR PREDEFINED TEST SECTIONS

Card Device Test Sections report errors when:

   1. An I/O completes with an exception condition or with
       an unexpected result status.

   2. No data was obtained on a READ operation which had
       expected to receive data.

   3. The data read on a READ operation does not compare
       favorably with the expected data.

The information reported when an error is detected depends on the
type of error that occurred (i.e. 1, 2, or 3 above). For
example, an I/O which completes with an unexpected result status
field would provide an error message, the op code that was
issued, and list the result status bits that are on. Consider:

        CDA:SEC 34; ERR# 02; - THE READ OPERATION HAS FAILED.
        THE OP CODE DISPATCHED WAS: 178000
        THE RESULT STATUS FIELD IS: E00080
        THE FOLLOWING RESULT STATUS BITS ARE ON:
          RS BIT   1: OPERATION COMPLETE
          RS BIT   2: EXCEPTION CONDITION
          RS BIT   3: NOT READY
          RS BIT   17: OPERATION COMPLETE

On the other hand, if the data read miscompared with expected
data the operator would be provided with an error message and the
data that miscompared. Consider:

        CDA:SEC 34:ERR# 02: - MISCOMPARE BETWEEN EXPECTED AND OBSERVED DATA
        FIRST ERROR WAS DETECTD AT HEX 00131
        MAX OF 46 CHARACTERS DISPLAYED STARTING AT THE 1ST DETECTED ERROR

        EXPECTED(00130):C9D1D2 D3D4D5 D6D7D8 D9E2E3 E4E5E6 E7E8E9
        OBSERVED   :C86DD2 D3D4D5 D6DED8 D9E2E3 C4E5E6 E7E8E9
        ERROR(S)   : ***   *   *

        EXPECTED(00166):F1F2F3 F4F5F6 F7F8F9 F06F7B 7C
        OBSERVED   :F1F2F3 F4F5FC F7F8F9 F06F7B 7C
        ERROR(S)   :   *

        TOTAL NUMBER OF 4-BITS IN ERROR: 6

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P.S. 2228 3626(A)

ERROR DOCUMENTATION FOR PREDEFINED TEST SECTIONS

In general, when an error is detected the error message will contain the following information:

1. The device mnemonic (CDA).
2. The number of the section being executed (SEC 34).
3. The number of the error that was detected (ERR 02).
4. A message briefly telling what the error is.

As seen in the previous section:

CDA:SEC 34:ERR# 02: - THE READ OPERTION HAS FAILED.

To find a further explanation of the error one would look in this document for the description of section #34, looking specifically at the documentation for ERROR 02. For section #34, ERROR 02 one would find:

ERROR 02

An attempt was made at reading the next card by issuing a STACKER SELECT READ op ∂17000U∂. The op has failed, timed out, or completed with an exception condition.

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SANTA BARBARA PLANT   P.S. 2228 3626(A)

PCAP TESTING

PCAP Testing provides the operator with an alternate method of
testing card devices.   There are two levels to this alternate
testing method;   **LOGICAL PCAP TESTING** and **PHYSICAL PCAP TESTING**.
Both levels make use of the 6 PCAP Mode I/O descriptors (numbered
zero through five) that BOLT provides.   The purpose of these
descriptors is to allow the operator to build and issue valid I/O
descriptors independently of the Predefined Test Sections.   BOLT
provides the necessary commands to set and display the PCAP Mode
I/O descriptor fields (e.g. LENGTH, DATA, DISPLAY, OP, SEND,
...).   The entire Control must be obtained to issue a PCAP Mode
I/O descriptor since the operator may issue diagnostic ops which
affect the entire Control.   An example of both levels of PCAP
Mode testing is given below.   A more detailed example of each can
be found in Appendix A.

LOGICAL PCAP TESTING

Logical   PCAP   Testing   allows   immediate   execution   of   **basic
operations** to a card device using minimum operator input.   The
operator   may   set   the LENGTH and DATA fields of that descriptor
using the appropriate BOLT commands.   Logical commands initiate
an I/O using the zero-th PCAP Mode I/O descriptor and a single
predefined operation code.   The result of any Logical PCAP Mode
I/O can be viewed by entering "DISPLAY DESC [0]".   The valid
Logical PCAP Mode commands for the card devices are:

TES -- @80000U@
         Dispatch a TEST OP to the selected card device

REA -- @00000U@
         Dispatch a READ OP to the selected card device

WRI -- @40000U@
         Dispatch a WRITE OP to the selected card device

NOTE: Normally, cards are stacked in the first stacker after
being read, punched, or printed.   For the above logical ops,
where applicable, the Error Stacker (last stacker) will be used.

PHYSICAL PCAP TESTING

Physical PCAP Mode Testing is the lowest level of testing that
BOLT provides to the operator.   Complete flexibility is given in
building I/O descriptors at this level.   The LENGTH, DATA, and
OP_CODE fields of each of the 6 PCAP Mode I/O descriptors must be
set manually by the operator.   The operator may also link I/O
descriptors to be issued in succession using the BOLT "LINK"
command. An I/O is initiated by issuing the BOLT "SEND" command.
See the BOLT Specification for for complete details.

EXAMPLE -- LOGICAL AND PHYSICAL PCAP TESTING

Suppose access has been gained to the Card Reader Control, CRA
has a deck of cards loaded, and the device is ready. Below is an
example of how to read the next card from the deck and compare
the data read to some expected data.


```
        DATA [1] "THIS IS THE EXPECTED DATA";
        LENGTH [0] 80;                  % wish to read 80 bytes
        REA;                            % logical op, issue READ
        COMPARE [0] [1];                % compare the data


        DATA [1] "THIS IS THE EXPECTED DATA";
        LENGTH [0] 80;                  % wish to read 80 bytes
        OP [0] @00000003;               % physical op, READ
        SEND [0];                       % issue the op
        COMPARE [0] [1];                % compare the data
```

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P.S. 2228 3626(A)

OPERATION CODES

The operation code (OP code) and variants are contained in a
24-bit Op field.   The leftmost three bits are used to designate
the Op code.   The remaining bits are used for variants and are
described with the description of each operator.   Not all of the
operators are valid for all Controls.   The Controls for which an
operator is valid are specified after the name of the operator.
For example:

    READ (CRPPC, CRPC)

        -- means that this READ operation is valid for the
           80 and 96 column multifunction devices.

The A and B fields which are referred to in the following Op code
descriptions have the following meanings:

    A Field -- Holds the beginning address of data required
                 by the operation.

    B Field -- Holds the ending address plus 1 of the data
                 required by the operation.

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P.S. 2228 3626(A)

READ (CRC)

The Read op code for the Card Reader Control has the following
format:

```
----------------------------------------------------
I 000V    XXXX    XXXX   XXXX    XXXX    XXXX I
----------------------------------------------------
```

Read data from the next card into ascending memory locations
beginning at the location specified by the A field continuing
until but not into the end location specified by the B field, or
until 80 columns of data is read whichever occurs first.

x   =   unassigned
V   =   0   Translate card code to EBCDIC
             1   Binary; do not translate

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READ (CRPPC, CRPC)

The READ op code for the 80 or 96 column READ/PUNCH/PRINT control
has the following format:

```
-----------------------------------------------
I  0000    xSSS    1xIH    xBxC    xxxx    xxxx I
-----------------------------------------------
```

The op causes data to be read as described above.

x	=		unassigned

SSS = 000 Error stacker (stacker 2 for 80 col control, stacker 6
001 Stacker 1   for 96 col control)

       •
       •
       •

110 Stacker 6 (80 column READ has only two stackers)
111 Overflow

I = 0 Do not inhibit card feed.
1 Inhibit card feed.

H = 0 Feed card from hopper 1 (primary).
1 Feed card from hopper 2 (secondary).

B = 0 Translate card code to EBCDIC.
1 Binary; do not translate.

C = (The 96 column control does not have this variant)
0 Report invalid character.
1 Do not report invalid character.

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P.S. 2228 3626(A)

STACKER SELECT/READ (CRPPC, CRPC)

The STACKER-SELECT-AND-READ op code is used by the 80 and 96 READ/PUNCH/PRINT controls and has the following format:

```
-----------------------------------------------
I 0001   xSSS   0xIH   xBxC   xxxx   xxxx I
-----------------------------------------------
```

Read data from a card into ascending memory locations beginning at the location specified by the A field and continuing to, but not into, the end location specified by the B field or until all 80/96 columns have been read, whichever occurs first. Leave this card in the wait station. Stack the prior card.

x   =   unassigned

SSS   =   000 Error stacker (stacker 2 for 80 col control, stacker 6
                               for 96 col control)
            001 Stacker 1
             .
             .
             .
            110 Stacker 6 (80 col control has only 2 stackers)
            111 Overflow (once set, overflow must be manually cleared)

I   =   0   Do not inhibit card feed.
            1   Inhibit card feed.

H   =   0   Feed card from hopper 1 (primary)
            1   Feed card from hopper 2 (primary)

B   =   0   Translate card code to EBCDIC
            1   Binary; do not translate

C   =   (There is no C variant for the 96 column control)
            0   Report invalid character
            1   Do not report invalid character

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B1000 BOLT CARD DEVICE TEST
P.S. 2228 3625(A)

WRITE (CPC)

The WRITE op code for the 80 col CARD PUNCH control has the following format:

```
-------------------------------------------------------
I  010V   xSSx   xxxx   xxxx   xxxx   xxxx  I
-------------------------------------------------------
```

Write data to cards from ascending memory locations beginning at the location specified by the A field continuing until but not from the end location specified by the B field, or until 80 columns of data is written, whichever occurs first.

x   =   unassigned

V   =   0 Translate: punch one card column for each 8 bit of data
             from memory
          1 Binary: punch one card column for each 12 bits of data
             from memory

SS   =   Stacker selection:

SS	B9210 CPC-2	B9212/9213 CPC-2	B9212/9213 CPC-1
00	Normal	Normal	Error
01	Normal	Normal	Normal
10	Normal	Auxiliary	Auxiliary
11	Normal	Auxiliary	Undefined

PUNCH (CRPPC, CRPC)

The PUNCH op code for the 80 and 96 column READ/PUNCH/PRINT controls has the following format:

```
--------------------------------------------------
I   0100   xSSS   0xIH   xBxx   xxxx   xxxx   I
--------------------------------------------------
```

Punch data into a card from ascending memory locations beginning at the location specified by the A field and continuing to, but not into the location specified from the B field or until all 80/96 columns are accounted for whichever occurs first.

x   =   unassigned

SSS   =   000 Error stacker (stacker 2 if 80 col, else stacker 6)
               001 Stacker 1
                •
                •
                •
               110 Stacker 6 (80 col has only stackers 1 and 2)
               111 Overflow (once set, overflow must be manually cleared)

I   =   0   Do not inhibit card feed.
               1   Inhibit card feed.

H   =   0   Feed card from hopper 1 (primary)
               1   Feed card from hopper 2 (secondary)

B   =   0   Translate EBCDIC from card code
               1   Binary: Do not translate.

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P.S. 2228 3626(A)

PRINT (CRPPC)

The PRINT op code for the 80 column READ/PUNCH/PRINT controls has
the following format:

```
-------------------------------------------------
I   0010   xSSS   xIHx   Bxxx   xxxx   xxxx   I
-------------------------------------------------
```

Print data into a card from ascending memory locations beginning
at the location specified by the A field and continuing to, but
not from, the location specified in the B field or until all
80/96 print positions are accounted for, whichever occurs first.
Stack the card.

x   =   unassigned

SSS   =   000 Error stacker (stacker 2 if 80 col, else stacker 6)
                001 Stacker 1
                 •
                 •
                 •
                110 Stacker 6 (80 col control has only stackers 1 and 2)
                111 Overflow (Remains until manually cleared)

I   =   0   Do not inhibit card feed.
                1   Inhibit card feed.

H   =   0   Feed card from hopper 1 (primary).
                1   Feed card from hopper 2 (secondary).

B   =   0   Translate EBCDIC to card code.
        =   1   Binary: Do not translate.

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P.S. 2228 3626(A)

PUNCH-PRINT (CRPPC, CRPC)

The PUNCH-PRINT op code for the 80/96 col READ/PUNCH/PRINT controls has the following format:

```
------------------------------------------------
I   0VV0   xSSS   0WIH   xBxx   xxxx   xxxx   I
------------------------------------------------
```

Punch, print or punch and print data into a card from ascending memory locations beginning at the location specified by the A field and continuing to but not from the address specified by the B field, or until all columns and print positions are accounted for. The punch data must define 80/96 columns and the print data 80/96 print positions (i.e. total is 80/96 if punch data equals print data and 160/192 if punch data not equal print data. Stack the card.

x   =   unassigned

VV   =   (This field only applies to the 96 col control, The
                80 col control VV always has the value 11.)
             00 See STACKER SELECT READ
             01 Print (W = 0 required)
             10 Punch (W = 0 required)
             11 Punch/Print (W = 0 or 1 permitted)

SSS   =   000 Error stacker (Stacker 2 if 80 col, else stacker 6)
                001 Stacker 1
                  •
                  •
                  •
                110 Stacker 6 (80 col control has only 2 stackers)
                111 Overflow (remains until manually cleared)

W   =   0 Print data = Punch data
                1 Print data not equal to Punch data

H   =   0 Read next card from hopper 1 (primary)
                1 Read next card from hopper 2 (secondary)

I   =   0 Do not inhibit card feed.
                1 Inhibit card feed.

B   =   0 Translate EBCDIC to card code and card code to EBCDIC.
                1 Binary: Do not translate.

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SANTA BARBARA PLANT   P.S. 2228 3626(A)

PUNCH-PRINT/READ (CRPPC, CRPC)

The PUNCH-PRINT/READ op code for the 80/96 column
READ/PUNCH/PRINT controls has the following format:

```
---------------------------------------------------
 I   OVV1   xSSS   OWIH   xBxC   xxxx    xxxx   I
---------------------------------------------------
```

Punch and/or print data from ascending memory locations beginning
at the location specified by the A field.   If the operator's
variants specify print only, punch only, or if punch and print
use the same data, 80/96 positions of output data must be
accounted for. If the variants specify punch and print different
data, 160/192 positions of output data must be accounted for.
Stack this card.   Feed a new card and read its data into
ascending memory locations beginning with the memory location
immediately following the location containing the output data.
Continue to, but not into the end location specified by the B
field, or until 80/96 columns are read, whichever occurs first.

x   =   unassigned

VV   00   See STACKER-SELECT-AND-READ.
                01   Print only and read.
                10   Punch only and read.
                11   Punch and print and read.

SSS   =   000   Error stacker (stacker 2 if 80 col, else stacker 6)
               001   Stacker 1
                 •
                 •
                 •
               110   Stacker 6 (80 col control has only stackers 1 and 2)
               111   Overflow (remains until manually cleared)
W   =   0   Punch data = print data   (W only applies if
                1   Punch data not equal print data   DD = 11)

I   =   0   Do not inhibit card feed.
                1   Inhibit card feed.

H   =   0   Feed card from hopper 1 (primary)
                1   Feed card from hopper 2 (secondary)

B   =   0   Translate EBCDIC to card code and card code to EBCDIC
                1   Binary: Do not translate.

C   =   0   Report invalid character (96 col control has no C
                                                            variant)
                1   Do not report invalid character

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B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

TEST (CRC, CPC)

The TEST op code for the CARD-READER or CARD-PUNCH controls has the following format:

```
---------------------------------------------
I   100V    Vxxx    xxxx    xxxx    xxxx    xxxx   I
---------------------------------------------
```

Test the unit and the unit control and report the following information:

      a) Not ready
      b) Control ID

VV   =   00 Store results immediately.
            01 If card unit is Ready, wait until Not Ready before storing result.
            10 If card unit is Not Ready, wait until Ready before storing result.
            11 Undefined.

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B1000 BOLT CARD DEVICE TEST
P.S. 2223 3626(A)

TEST (CRPPC, CRPC)

The TEST op code for the 80/96 col CARD-READ-PUNCH-PRINT controls
has the following format:

```
-----------------------------------------------
|   100V    Vxxx    xxxx    xxxx    xxxx    xxxx   |
-----------------------------------------------
```

Test the unit specified and store the test data as specified by the VV
variants. The test is for:

        a)   Not Ready
        b)   Hopper 1 empty
        c)   Hopper 2 empty

VV   =   00   Store result immediately
              01   Wait until unit is not ready before storing result.
              10   Wait until unit is ready before storing result.
              11   Undefined

RESULT STATUS INFORMATION

The Result Status field for Card unit operations is a twenty-four
(24) bit information field.   For simplicity, bits are referenced
by their bit number, the first bit being 1 (leftmost) and the
last bit 24 (rightmost).   Bit meanings are discussed below. Any
variances for different controls will be noted.

RESULT STATUS BIT MEANINGS

The various bits and their meanings are given in the paragraphs
that follow.   Following these paragraphs are tables for each of
the controls showing which bit conditions described can be
returned in the control's result status field.

OPERATION COMPLETE (BIT 1)

Bit 1:   Bits 1 and 17 are always set to indicate operation
completed.

EXCEPTION CONDITION (BIT 2)

Bit 2:   Bit 2 indicates an exception is set if one or   more of
bits 3 through 16 are set.   An interrupt is also returned
regardless of request.

NOT READY (BIT 3)

Bit 3:   If at the start of an operation the unit is Not Ready,
the operation is terminated immediately and bit 3 is set.

If an operation has started and has not been completed when a Not
Ready condition occurs, the operation is terminated immediately
and bit 3 is set. Exception: see paragraph on Input Check.

VALIDITY ERROR or CONTROL CARD (BIT 4)

Bit 4:   (Validity error) In translate mode, if the Control
detects any invalid characters, it translates them to the "?"
character, and reports a validity error (bit 4).

Bit 4:   (Control card) If on any Read operation, a "?" character
is detected in column 1 of a card, bit 4 is set.   For the normal
read operation,   if the unit has a wait station, the card is
ejected to the same stacker as the previous card. No new card is
fed.

RESERVED (BIT 5)

MEMORY PARITY ERROR (BIT 6)

Bit 6:   Bit 6 is set by the I/O driver if a memory parity error
is detected in data transferred to the control during WRITE
(PUNCH) or WRITE/READ operations.   The sequence terminates
normally.

READ CHECK (BIT 7)

Bit 7:   The unit, before and during each read operation,
automatically performs testing of the card reader, the punched
card, and the positioning of the card.

The first test is the light test, which confirms that before the
card reaches the read station, all channels indicate true. This
checks the light sources and receptors, much of the circuitry and
that nothing is blocking the light path.   The second test is the
dark test, which confirms that all channels indicate false as the
card enters the read station.   This checks the threshold of the
light receptors, and that the card has entered the read station
fairly well aligned.   The punched holes are each read twice and
the results compared.

If any of these tests indicates a malfunction,   Read Check is
reported to the control, which subsequently reports Read Check
(bit 7) in the result status (RS) field.   The card proceeds to
the stacker and the card reader goes not ready.   Not ready,
however, is not reported for the card having the read check.

PUNCH CHECK (BIT 8)

Bit 8:   A punch check error can involve as many as three cards,
the card causing the error (card 1), a card moving to the punch
station (card 2), and a card at the wait station (card 3).

The unit signals punch check error to the control in the cycle
following the one in which the error is detected and goes not
ready at the end of this cycle.   Punch check is reported by the
control to the system for the second operation. Not ready is not
reported until a subsequent operation is received.   All   three
cards are normally routed to the error stacker when a punch check
error is detected on card 1.   Because of the "one-cycle-late"
aspect,   reporting of Not Ready resulting from other error
conditions may intervene.

PRIMARY HOPPER EMPTY (BIT 9)

Bit 9: An empty hopper condition is not reported if read data is
obtained from the peripheral's read buffer by the control. It is
reported when read data is requested and not available.   It is
also reported if the card from the wait station is punched and
the hopper supplying the next card is empty.   TEST operator will
report   the   status   of all hoppers.   No attempt is ever made to
feed a card from an empty hopper.

SECONDARY HOPPER EMPTY (BIT 10)

Bit 10:   The description is the same as that for the Primary
Hopper above.

INPUT CHECK (BIT 11)

Bit 11:   If no card arrives at the read station within 800ms
after card feed has been initiated, the unit goes not ready and
no data is transferred to the control.   For the control, any not
ready occurring while the control is waiting for Read Buffer Full
Level to go true is an input check error and bit 11 as well as
bit 3 is reported.

RESERVED (BITS 12 - 16)

OPERATION COMPLETE (BIT 17)

Bit 17:   Bits 1 and 17 are always set to indicate operation
completed. A result is never stored for the pause operators.

CONTROL ID (BITS 18-24)

Bits 18-24:   Bits 18 through 24 are set as a result of a TEST
operation to indicate the type of control.

VALID RESULT BITS FOR EACH CONTROL

The tables below show the result status bits for each control to be tested. The operation which can cause setting of the bit is also indicated. Those bits not included in the table are reserved bits and will always have a value of 0.

CARD READER CONTOL (CRC)

BIT NO.	MEANING	READ	TEST
1	Operation Complete	x	x
2	Exception Complete	x	x
3	Not Ready	x	x
4	Validity Error	x	
7	Read Check	x	
17	Operation complete	x	x
18 - 24	Control ID (ID = 0101010 for CRC)	x	

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SANTA BARBARA PLANT

COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

80 COLUMN READ/PUNCH/PRINT CONTROL (CRPPC)

BIT NO.	MEANING	READ	PUNCH	PRINT	TEST
1	Operation complete	x	x	x	x
2	Exception condition	x	x	x	x
3	Not Ready	x	x	x	x
4	Validity Error	x			
6	Memory Parity Error		x	x	
7	Read Check	x	x	x	x
8	Punch Check		x	x	
9	Primary Hopper Empty	x	x	x	x
10	Secondary Hopper Empty	x	x	x	x
11	Input Check	x	x	x	
17	Operation Complete	x	x	x	x
18 - 24	Control ID (ID = 0000010)				x

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COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

CARD PUNCH CONTROL (CPC)

BIT NO.	MEANING	PUNCH	TEST
1	Operation Complete	x	x
2	Exception Condition	x	x
3	Not Ready	x	x
4	Punch Error	x	
6	Memory parity error	x	
7	ID Bit (does not cause exception condition) Bit 7 is always set for the B9210 punch. Used by MCP for error recovery.		
17	Operation complete	x	x
18 - 24	Control ID (ID = 0000100)		x

96 COLUMN READ/PUNCH/PRINT CONTROL

BIT NO.	MEANING	READ	PUNCH	PRINT	TEST
1	Operation Complete	x	x	x	x
2	Exception Condition	x	x	x	x
3	Not Ready	x	x	x	x
4	Control Card	x			
7	Read Check	x	x	x	
8	Punch Check	x	x	x	
9	Primary Hopper Empty	x	x	x	x
10	Secondary Hopper Empty	x	x	x	x
11	Feed Check		x	x	
17	Operation Complete	x	x	x	x
18 - 24	Control ID (ID = see note below)				x

Note: ID = 0001010 if Read-Punch Print (B9419-2, -6 Data Recorder)
      ID = 0100110 if Read only (B9319-1, -2)

CARD DEVICE TEST INITIALIZATION PROCEDURES

The Card Device Test has two "initialization" procedures. One of which is called at test initialization time, the other at test section initialization time. Both are described in detail below. Each can produce errors or error messages which are also discussed below.

INITIALIZE CARD DEVICE TEST

When the operator enters the BOLT "UNIT" command, selecting a valid Card device, BOLT calls this procedure to initialize the Card Device Test. The following are done:

1. Put out welcoming messages to the operator.

2. Issue a TEST op to the device to obtain the Card Control ID.

3. Verify that the Card Control ID is one that BOLT recognizes. If not, report the error.

4. If the TEST op did not complete successfully then report the error.

Two examples of the output that one might see from this Card Device Test initialization procedure can be found in Appendix A. Refer to those examples for more detail.

It should be noted that this section of code is not something that the operator can select to run with the BOLT "SECTION" command. Its execution is BOLT controlled when a Card Device is selected.

INITIALIZATION ERRORS

The errors that can be reported during Card Device Test initialization time are given below. Not all of these errors will be numbered as with the errors reported by test sections.

CARD UNIT OBTAINED NOT RECOGNIZED AS BEING VALID.
The Card Control ID returned in the result status field of the
TEST op ə80000Uə is not one that the Card Device Test recognized.
Possible errors are (1) the Control is returning an invalid ID,
(2) an incorrect version of the Card Device Test is being used,
or (3) the Control is not one that BOLT can test.

TEST OP ISSUED TO THE CARD DEVICE COMPLETED WITH AN EXCEPTION.
The TEST op ə80000Uə issued to the Card Device has completed with
an exception condition. This error occurs when the device is not
ready, when all hoppers are not full, or both. In general, this
error is only to inform the operator of the status of the device
just selected with the UNIT command.

THE CARD TEST HAS FAILED DURING INITIALIZATION.
The TEST op ə80000Uə issued to the Card Device has failed or
timed out. Unable to issue a successful TEST op to the device,
the Card Device Test is aborted. Clear the device (it may be
hung) and try to obtain it again.

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COMPUTER SYSTEMS GROUP   B1000 BOLT CARD DEVICE TEST
SANTA BARBARA PLANT   P.S. 2228 3626(A)

INITIALIZE CARD DEVICE TEST SECTION

The Initialize Card Device Test Section routine is not a test
section. It is called prior to the execution of any test section
to check certain conditions and take the appropriate actions.
The following are checked for:

1. Is it necessary to have the Control selected to run
   the test section ?

2. Can the test section be run on the device that has
   been selected ?

SECTION INITIALIZATION ERRORS

The errors that can occur during the initialization of a test
section are listed below. It should be noted that these error
messages will be displayed before the BOJ message for the
particular test section being executed.

80 COLUMN MULTIFUNCTION OR PUNCH DEVICE NEEDED FOR SECTION.
The test section cannot be executed unless the device is a punch
device or an 80 column multifunction device. Either the wrong
device has been selected or the wrong section has been selected.

96 COLUMN MULTIFUNCTION DEVICE NEEDED FOR SECTION.
The test section cannot be executed unless the device is a 96
column multifunction device. Either the wrong device has been
selected or the wrong section has been selected.

A DEVICE WHICH CAN READ CARDS IS NEEDED.
The test section cannot be executed unless the device is able to
read cards. Either the wrong device has been selected or the
wrong section has been selected.

AN 80 COLUMN PUNCH DEVICE IS NEEDED FOR SECTION.
The test section cannot be executed unless the device is able to
punch cards (80 columns). Either the wrong device has been
selected or the wrong section has been selected.

AN 80 COLUMN CARD READER DEVICE IS NEEDED FOR SECTION.
The test section cannot be executed unless the device is an 30 column card reader or multifunction device. Either the wrong device has been selected or the wrong section has been selected.

AN 80 OR 96 COLUMN MULTIFUNCTION IS NEEDED FOR SECTION.
The test section cannot be executed unless the device is an 80 column or 96 column multifunction device. Either the wrong device has been selected or the wrong section has been selected.

THE CONTROL HAS NOT BEEN SELECTED.
The test section cannot be executed unless the Control has been selected (e.g. UNIT CONTROL CRA). Reenter the unit command (selecting the Control this time), select the desired test section, then enter "GO".

OPTIONAL CONFIDENCE TEST SECTIONS

Section #25 -- Punch Ripple Test 96 (CRPC)

This test section applies to a 96 column multifunction unit, and has two parts.

PART 1: The operator is asked to place 150 or more cards into the primary hopper of the device, then enter "GO". The device should be made ready before "GO" is entered. The cards are punched with rippled data. The rippled data consists of a pattern of EBCDIC characters, and is rippled one position to the left on each successive operation. This process continues until the proper number of records have been processed.

PART 2: The operator is instructed to take the punched cards from stacker 1 and to place them back into the primary hopper. The device should be made ready again. Once the cards have been placed, the operator should enter "GO" to continue the test section. The cards are read and checked for validity. The CONTROL CARD exception is ignored by Part 2.

DEFAULT DATA: EBCDIC Characters.
DATA SENSITIVE: YES
DEFAULT LENGTH: 96
LENGTH OPERATOR SENSITIVE: No
DEFAULT RECORDS: 150
RECORDS OPERATOR SENSITIVE: Yes
WARNINGS: Operator entered data should be EBCDIC
                            patterns; otherwise, errors may occur.

ERROR 01
A TEST op ⌐80000U⌐ is issued to the device to insure it is ready before the section is allowed to begin. The TEST op has either failed or timed out. Make sure the device is not hung.

ERROR 02
The device is primed with the first card before any cards are punched by issuing a STACKER SELECT READ op ⌐17000U⌐. The op has failed, timed out, or completed with an exception condition.

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COMPUTER SYSTEMS GROUP
SANTA BARBARA PLANT

COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2223 3625(A)

ERROR 03
Each card is punched by issuing a MULTI-PUNCH op ⢾47400U⢾. One of the ops has failed, timed out, or completed with an exception condition. If the op has simply completed with an exception condition, the record in error will be displayed along with the result descriptor.

ERROR 04
A TEST op ⢾80000U⢾ is issued to the device to insure it is ready before Part 2 of the section is allowed to begin. The TEST op has either failed or timed out. Make sure the device is not hung.

ERROR 05
Each card is read and checked for validity by issuing a MULTI-READ op ⢾07800U⢾ to the device. One of the ops has failed, timed out, or completed with an exception condition. If the op has completed with an exception condition, the record in error will be displayed with the result descriptor.

ERROR 06
If a card is read successfully by issuing a MULTI-READ op ⢾07800U⢾ to the device, and data was received on the read op, then the data obtained is compared to the data expected. In this case the obtained data is not correct.

ERROR 07
A card is believed to have been read successfully by issuing a MULTI-READ op ⢾07800U⢾ to the device, but no data was received on the read.

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COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2228 3625(A)

Section #26 -- Punch Ripple Test 80 (CRPPC,CPC)

This test section applies to an 80 column multifunction device or an 80 column punch-only device. It has two parts for the multifunction device and one part for the punch-only device.

PART 1: The operator is asked to place 150 or more cards into the primary hopper of the device, then enter "GO". The device should be made ready before entering "GO". The cards are punched with rippled data. The rippled data consists of a pattern of EBCDIC characters which are rippled one position to the right on each successive operation. This process continues until the proper number of records have been processed.

If the device is a punch-only device then the test section is ended at this point. The operator will have to verify the punched cards by running section 34 on a device which can read cards.

PART 2: The operator is instructed to take the punched cards from stacker 1 and place them back into the primary hopper. The device should be made ready again. Once the cards have been placed, the operator should enter "GO" to continue the test section. The cards are read and checked for validity.

DEFAULT DATA: EBCDIC Characters
DATA SENSITIVE: Yes
DEFAULT LENGTH: 80 Columns
LENGTH SENSITIVE: Yes
DEFAULT RECORDS: 150
RECORDS SENSITIVE: Yes
WARNINGS: Operator entered data should be EBCDIC
                             patterns; otherwise, errors may occur.

ERROR 01
A TEST op a80000Ua is issued to the device to insure it is ready before the section is allowed to begin. The TEST op has either failed or timed out. Make sure the device is not hung.

ERROR 02
If the device is an 80 column multifunction device then it is primed with the first card before any cards are punched by issuing a STACKER SELECT READ op a17000Ua. The op has failed, timed out, or completed with an exception condition.

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B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

ERROR 03
Each card is punched by issuing a MULTI-PUNCH op @47400U@ (for a multifunction device) or a PUNCH op @41000U@ (for a punch-only device). While trying to punch one of the cards, the op has failed, timed out, or completed with an exception condition. If the op has simply completed with an exception condition, the record in error will be displayed along with the result descriptor.

ERROR 04
A TEST op @80000U@ is issued to the device to insure it is ready before Part 2 of the section is allowed to begin. The TEST op has either failed or timed out. Make sure the device is not hung.

ERROR 05
Each card is read and checked for validity by issuing a MULTI-READ op @07800U@ to the device. One of the ops has failed, timed out, or completed with an exception condition. If the op has completed with an exception condition, the record in error will be displayed with the result descriptor.

ERROR 06
If a card is read successfully by issuing a MULTI-READ op @07800U@ to the device, and data was received on the read op, then the data obtained is compared to the data expected. In this case the obtained data is not correct.

ERROR 07
A card is believed to have been read successfully by issuing a MULTI-READ op @07800U@ to the device, but no data was received on the read.

Section #27 -- Duplicate Cards (CRPPC, CRPC)

This test may only be run on an 80 or 96 column multifunction device. It consists of two parts.

PART 1:   When execution of this test section begins the operator is asked to do the following:

   a.   Manually clear overflow on the device by turning the ON/OFF LINE switch to the OFF, then the ON position.

   b.   Place 150 (or more) blank cards into the secondary hopper of the device.

   c.   Place the pre-punched deck to be duplicated into the primary hopper of the device.

   d.   Enter the "GO" command.

The device should be made ready before the "GO" command is entered. Once the device is ready, the pre-punched deck of cards in hopper 1 is duplicated. This is done by (1) reading the next card from hopper 1, (2) priming the device with a blank card from hopper 2, then (3) punching the blank card with the data read in (1). This process continues until the proper number of records have been processed.

PART 2:   The operator is instructed to remove the cards from stacker 1 (this will be the original pre-punched deck), then move the duplicated deck from Stacker 2 back into the primary hopper. The device should be made ready again. Once the cards have been placed the operator should enter "GO" to continue the test section. The punched cards are read and checked for validity.

DEFAULT DATA:	That punched in section #25 or #26.
DATA SENSITIVE:	Yes (records punched in section #25 or #26.
DEFAULT LENGTH:	80 or 96 Columns, Device Dependent.
LENGTH SENSITIVE:	No
DEFAULT RECORDS:	That punched in section #25 or #26.
RECORD SENSITIVE:	Yes
WARNINGS:	Run section #25 or #26 before this section.

ERROR 01
A TEST op 280000U2 is issued to the device to insure it is ready before the section is allowed to begin. The TEST op has either failed or timed out. Make sure the device is not hung.

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B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

ERROR 02

The next card to be duplicated it read from the primary hopper by issuing a STACKER SELECT READ op @11000U@. The op has failed, timed out, or completed with an exception condition. If the READ op fails the data read, if any, will still be punched on the following blank card.

ERROR 03

The device is primed with the next card to be punched by issuing a STACKER SELECT READ op @11100U@. The op has failed, timed out, or completed with an exception condition.

ERROR 04

The primed card is punched by issuing a MULTI-PUNCH op @42700U@. The op has failed, timed out, or completed with an exception condition.

ERROR 05

A TEST op @80000U@ is issued to the device to insure it is ready before Part 2 of the section is allowed to begin. The TEST op has either failed or timed out. Make sure the device is not hung.

ERROR 06

Each card is read and checked for validity by issuing a MULTI-READ op @07800U@ to the device. One of the ops has failed, timed out, or completed with an exception condition.

ERROR 07

If a card is read successfully by issuing a MULTI-READ op @07800U@ to the device, and data was received on the read op, then the data obtained is compared to the data expected. In this case the obtained data is not correct.

ERROR 08

A card is believed to have been read successfully by issuing a MULTI-READ op @07800U@ to the device, but no data was received on the read.

BURROUGHS CORPORATION
COMPUTER SYSTEMS GROUP
SANTA BARBARA PLANT

COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

Section #28 -- Punch/Print Diff Data (CRPPC, CRPC)

This test section may only be run on an 80 or 96 column
multifunction device. It consists of two parts.

PART 1:   The operator is asked to place 150 or more cards into
the primary hopper of the device, then enter "GO".   The device
should be made ready before entering "GO". The cards are punched
with the ripple data described in section #25 (if the device is
an 96 column multifunction) or section #26 (if the device is a 80
column multifunction).   On the same card, the words "PRINT DATA
DIFFERS FROM PUNCH DATA" will be printed. This process continues
until the proper number of records have been punched/printed.

PART 2:   The operator is instructed to take the punched/printed
cards from stacker 1 and place them back into the primary hopper.
The device should be made ready again.   Once the cards have been
placed, the operator should enter "GO" to continue the test
section.   The cards are read (in translate mode) and checked for
validity.

DEFAULT DATA: Rippled Data described in Section #25
                                  or #26.
DATA SENSITIVE: Yes
DEFAULT LENGTH: 80 Column or 96 Column
LENGTH SENSITIVE: No
DEFAULT RECORDS: 150
RECORDS SENSITIVE: Yes
WARNINGS: Operator entered data should be EBCDIC
                                  patterns; otherwise, errors may occur.

ERROR 01
A TEST op a80000Ua is issued to the device to insure it is ready
before the section is allowed to begin.   The TEST op has either
failed or timed out. Make sure the device is not hung.

ERROR 02
The device is primed with the first card before any cards are
punched by issuing a STACKER SELECT READ op a17000Ua. The op has
failed, timed out, or completed with an exception condition.

BURROUGHS CORPORATION
COMPUTER SYSTEMS GROUP
SANTA BARBARA PLANT

COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

ERROR 03
The next primed card is punched/printed by issuing a MULTI
PUNCH/PRINT op @67400U@. The op has failed, timed out, or
completed with an exception condition. If the op has simply
completed with an exception condition, the record in error will
be displayed along with the result descriptor.

ERROR 04
A TEST op @80000U@ is issued to the device to insure it is ready
before Part 2 of the section is allowed to begin. The TEST op
has either failed or timed out. Make sure the device is not
hung.

ERROR 05
Each card is read and checked for validity by issuing a
MULTI-READ op @07800U@ to the device. One of the ops has failed,
timed out, or completed with an exception condition.

ERROR 06
If a card is read successfully by issuing a MULTI-READ op
@07800U@ to the device, and data was received on the read op,
then the data obtained is compared to the data expected. In this
case the obtained data is not correct.

ERROR 07
A card is believed to have been read successfully by issuing a
MULTI-READ op @07800U@ to the device, but no data was received on
the read.

BURROUGHS CORPORATION   COMPANY CONFIDENTIAL
COMPUTER SYSTEMS GROUP   B1000 BOLT CARD DEVICE TEST
SANTA BARBARA PLANT   P.S. 2228 3626(A)

Section #29 -- Print Cards, Use All Stackers (CRPC,CRPPC)

This test section may only be executed on an 80 or 96 column
multifunction device. It consists of one part only.

The operator is asked to manually clear overflow on the device
(turn the ON/OFF LINE switch to the OFF, then the ON position),
put blank cards into both hoppers, and enter the "GO" command.
The device should be made ready before the "GO" command is
entered.   Ten cards are printed and directed to each stacker from
alternate hoppers.   The printed data on each card should reflect
which hopper the card came from and the stacker number to which
it was directed.   For example, the first two cards produced by
this test will have printed on them:

        CARD 1: PRIMARY HOPPER -- STACKER 1
        CARD 2: SECONDARY HOPPER -- STACKER 1

whereas, the tenth and eleventh cards will read

        CARD 10: SECONDARY HOPPER -- STACKER 1
        CARD 11: PRIMARY HOPPER -- STACKER 2

It is up to the operator to verify that the printed data is
correct, and that the cards have been stacked properly.

NOTE: The Card Device Test does not know if a 96 column
multifunction device has 2 or 6 stackers, so 6 is assumed.
Therefore, 70 cards are always printed (stackers 1 thru 6,   and
the error stacker).   If the device has only two stackers, cards
directed to stackers 2 thru 6 and the error stacker will all be
stacked in stacker 2.

DEFAULT DATA: As shown above
DATA SENSITIVE: No
DEFAULT LENGTH: Length of message(s) above
LENGTH SENSITIVE: No
DEFAULT RECORDS: 70 if 96 column unit; 30 if 80 column.
RRECORDS SENSITIVE: No

ERROR 01
A TEST op a80000Ua is issued to the device to insure it is ready
before the section is allowed to begin.   The TEST op has either
failed or timed out. Make sure the device is not hung.

BURROUGHS CORPORATION
COMPUTER SYSTEMS GROUP
SANTA BARBARA PLANT

COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

ERROR 02
The device is primed with the first card before any cards are
punched by issuing a STACKER SELECT READ op ∂17000U∂. The op has
failed, timed out, or completed with an exception condition.

ERROR 03
The next primed card is printed with the appropriate data by
issuing a MULTI-PRINT op ∂2S000U∂ (where S = 0, 1, 2, 3, 4, 5, or
6; depending on the device and number of stackers assumed). The
op has failed, timed out, or completed with an exception
condition. If the op has simply completed with an exception
condition, the record in error will be displayed along with the
result descriptor.

BURROUGHS CORPORATION
COMPUTER SYSTEMS GROUP
SANTA BARBARA PLANT

COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

SPECIAL NOTES FOR TEST SECTIONS 30 THROUGH 33

The following notes concern Test Sections 30, 31, 32, and 33.
Each of these tests is a two pass test to be used on a
multifunction device only. Blank cards are punched with data on
the first pass, and then additional data is punched and/or
printed on the second pass. The first pass starts the punch at
column 1 and may continue into column 40. The second pass starts
the punch and/or print at column 41 and may continue into the
80th column. The following discussion concerns operator entered
data and specifications.

1) If the operator has entered data to be used during the test
    but has not specified the length, then the first 40
    characters in the data buffer will be used for the first pass
    and the next 40 characters will be used for the second pass.

2) If the operator has specified a data length, then the number
    of characters for the first and second passes will be equal
    to half the data length. The second pass will contain the
    extra character in case the length is an odd number. The
    characters for the first pass and second passes will be
    chosen as described in note 1 above.

    The maximum data length is 80; hence, if a length greater
    than 80 is specified it will be treated as though it were 80.

3) If the device being tested is a 96 column multifunction
    device, then the operator entered data should not begin with
    a "?"; otherwise, the CONTROL CARD exception bit will be set
    during every read. The test ignores it, however.

BURROUGHS CORPORATION
COMPUTER SYSTEMS GROUP
SANTA BARBARA PLANT

COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

Section #30 -- Punch/Print/Read (CRPPC, CRPC)

This section applies to an 80 or 96 column multifunction device only. It has three parts. It is suggested that one read the SPECIAL NOTES section of this document before running this test section.

PART 1:   The operator is asked to place blank cards into the primary hopper of the device, then enter "GO". The device should be made ready before the "GO" command is entered. The cards are punched with 40 or fewer columns of data, beginning at column 1. Cards are punched until the proper number of records have been processed.

PART 2:   The operator is instructed to take the punched cards from stacker 1 and place them back into the primary hopper. The device should be made ready again. Once the cards have been placed, the operator should enter "GO" to continue the test section. Each card will be read and checked for validity, placing it in the wait station of the device. As the card is moved through the punch and print stations of the device, it is punched with 40 or fewer columns of data, beginning at column 41, and printed with the same data.

PART 3:   The operator is instructed once again to move the cards from stacker 1 and place them back into the primary hopper, make the device ready, and enter the "GO" command. The cards are read and checked for validity. The data read should be that punched in parts 1 and 2 of this section. It is up to the operator to verify that the printed data is correct.

DEFAULT DATA: Part 1:   FIRST PUNCH (29 blanks)
                                 Part 2:   SECOND PUNCH (28 blanks)
DATA SENSITIVE: Yes
DEFAULT LENGTH: Part 1:   40 columns
                                 Part 2:   40 columns
LENGTH SENSITIVE: Yes (maximum of 80 columns)
DEFAULT RECORDS: 25
RECORDS SENSITIVE: Yes

WARNING: Operator entered data should be EBCDIC
                                 patterns; otherwise, errors may occur.

ERROR 01
A TEST op ə80000Uə is issued to the device to insure it is ready
before the section is allowed to begin. The TEST op has either
failed or timed out. Make sure the device is not hung.

ERROR 02
The device is primed with the first card before any cards are
punched by issuing a STACKER SELECT READ op ə17000Uə. The op has
failed, timed out, or completed with an exception condition.

ERROR 03
The next primed card is punch by issuing a PUNCH PRINT READ op
ə57000Uə. The op has failed, timed out, or completed with an
exception condition.

ERROR 04
A TEST op ə80000Uə is issued to the device to insure it is ready
before Part 2 of the section is allowed to begin. The TEST op
has either failed or timed out. Make sure the device is not
hung.

ERROR 05
The first of the punched cards is read and checked for validity
issuing a STACKER SELECT READ op ə17000Uə. The op has failed,
timed out, or completed with an exception condition.

ERROR 06
If a card is read successfully by issuing a STACKER SELECT READ
ə17000Uə to the device, and data was received on the read op,
then the data obtained is compared to the data expected. In this
case the obtained data is not correct.

ERROR 07
A card is believed to have been read successfully by issuing a
STACKER SELECT READ op ə17000Uə to the device, but no data was
received on the read operation.

ERROR 08
The card currently in the wait station was to be punched and
printed with the same data. However, the PUNCH PRINT READ op
ə77200Uə failed, timed out, or completed with an exception
condition.

BURROUGHS CORPORATION
COMPUTER SYSTEMS GROUP
SANTA BARBARA PLANT

COMPANY CONFIDENTIAL
81000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

ERROR 09
The next card is read and checked for validity issuing a STACKER
SELECT READ op a17000Ua. The op has failed, timed out, or
completed with an exception condition.

ERROR 10
If a card is read successfully by issuing a STACKER SELECT READ
a17000Ua to the device, and data was received on the read op,
then the data obtained is compared to the data expected. In this
case the obtained data is not correct.

ERROR 11
A card is believed to have been read successfully by issuing a
STACKER SELECT READ op a17000Ua to the device, but no data was
received on the read operation.

ERROR 12
A TEST op a80000Ua is issued to the device to insure it is ready
before Part 3 of the section is allowed to begin. The TEST op
has either failed or timed out. Make sure the device is not
hung.

ERROR 13
Each card is read and checked for validity by issuing a
MULTI-READ op a07800Ua to the device. One of the ops has failed,
timed out, or completed with an exception condition.

ERROR 14
If a card is read successfully by issuing a MULTI-READ op
a07800Ua to the device, and data was received on the read op,
then the data obtained is compared to the data expected. In this
case the obtained data is not correct.

ERROR 15
A card is believed to have been read successfully by issuing a
MULTI-READ op a07800Ua to the device, but no data was received on
the read.

BURROUGHS CORPORATION   COMPANY CONFIDENTIAL
COMPUTER SYSTEMS GROUP   B1000 BOLT CARD DEVICE TEST
SANTA BARBARA PLANT   P.S. 2228 3625(A)

Section #31 -- Punch/Print Diff Data/Read (CRPPC, CRPC)

This section applies to an 80 or 96 column multifunction device
only.   It has three parts.   It is suggested that one read the
SPECIAL NOTES section of this document before running this test
section.

PART 1:   The operator is asked to place blank cards into the
primary hopper of the device, then enter "GO". The device should
be made ready before the "GO" command is entered.   The cards are
punched with 40 or fewer columns of data, beginning at column 1.
Cards are punched until the proper number of records have been
processed.

PART 2:   The operator is instructed to take the punched cards
from stacker 1 and place them back into the primary hopper.   The
device should be made ready again.   Once the cards have been
placed, the operator should enter "GO" to continue the test
section.   Each card will be read and checked for validity,
placing it in the wait station of the device.   As the card is
moved through the punch and print stations of the device, it is
punched with 40 or fewer columns of data, beginning at column 41,
and printed with the data punched in Part 1 as well as the data
punched in Part 2.

PART 3:   The operator is instructed once again to move the cards
from stacker 1 and place them back into the primary hopper, make
the device ready, and enter the "GO" command. The cards are read
and checked for validity.   The data read should be that punched
in parts 1 and 2 of this section.   It is up to the operator to
verify that the printed data is correct.

DEFAULT DATA: Part 1:   FIRST PUNCH (29 blanks)
                           Part 2:   SECOND PUNCH (28 blanks)
DATA SENSITIVE: Yes
DEFAULT LENGTH: Part 1:   40 columns
                           Part 2:   40 columns
LENGTH SENSITIVE: Yes (maximum of 80 columns)
DEFAULT RECORDS: 25
RECORDS SENSITIVE: Yes

WARNING: Operator entered data should be EBCDIC
                           patterns; otherwise, errors may occur.

ERROR 01
A TEST op @80000U@ is issued to the device to insure it is ready
before the section is allowed to begin. The TEST op has either
failed or timed out. Make sure the device is not hung.

ERROR 02
The device is primed with the first card before any cards are
punched by issuing a STACKER SELECT READ op @17000U@. The op has
failed, timed out, or completed with an exception condition.

ERROR 03
The next primed card is punch by issuing a PUNCH PRINT READ op
@57000U@.   The op has failed, timed out, or completed with an
exception condition.

ERROR 04
A TEST op @80000U@ is issued to the device to insure it is ready
before Part 2 of the section is allowed to begin. The TEST op
has either failed or timed out. Make sure the device is not
hung.

ERROR 05
The first of the punched cards is read and checked for validity
issuing a STACKER SELECT READ oo @17000U@. The op has failed,
timed out, or completed with an exception condition.

ERROR 06
If a card is read successfully by issuing a STACKER SELECT READ
@17000U@ to the device, and data was received on the read op,
then the data obtained is compared to the data expected. In this
case the obtained data is not correct.

ERROR 07
A card is believed to have been read successfully by issuing a
STACKER SELECT READ op @17000U@ to the device, but no data was
received on the read operation.

ERROR 08
The card currently in the wait station was to be punched and
printed with the data punched in Part 1 and Part 2. However, the
PUNCH PRINT READ op @77600U@ failed, timed out, or completed with
an exception condition.

BURROUGHS CORPORATION
COMPUTER SYSTEMS GROUP
SANTA BARBARA PLANT

COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

ERROR 09
The next card is read and checked for validity issuing a STACKER
SELECT READ op @17000U@. The op has failed, timed out, or
completed with an exception condition.

ERROR 10
If a card is read successfully by issuing a STACKER SELECT READ
@17000U@ to the device, and data was received on the read op,
then the data obtained is compared to the data expected. In this
case the obtained data is not correct.

ERROR 11
A card is believed to have been read successfully by issuing a
STACKER SELECT READ op @17000U@ to the device, but no data was
received on the read operation.

ERROR 12
A TEST op @80000U@ is issued to the device to insure it is ready
before Part 3 of the section is allowed to begin. The TEST op
has either failed or timed out. Make sure the device is not
hung.

ERROR 13
Each card is read and checked for validity by issuing a
MULTI-READ op @07800U@ to the device. One of the ops has failed,
timed out, or completed with an exception condition.

ERROR 14
If a card is read successfully by issuing a MULTI-READ op
@07800U@ to the device, and data was received on the read op,
then the data obtained is compared to the data expected. In this
case the obtained data is not correct.

ERROR 15
A card is believed to have been read successfully by issuing a
MULTI-READ op @07800U@ to the device, but no data was received on
the read.

BURROUGHS CORPORATION
COMPUTER SYSTEMS GROUP
SANTA BARBARA PLANT

COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2223 3626(A)

Section #32 -- Punch/Read (CRPPC, CRPC)

This section applies to an 80 or 96 column multifunction device
only. It has three parts. It is suggested that one read the
SPECIAL NOTES section of this document before running this test
section.

PART 1: The operator is asked to place blank cards into the
primary hopper of the device, then enter "GO". The device should
be made ready before the "GO" command is entered. The cards are
punched with 40 or fewer columns of data, beginning at column 1.
Cards are punched until the proper number of records have been
processed.

PART 2: The operator is instructed to take the punched cards
from stacker 1 and place them back into the primary hopper. The
device should be made ready again. Once the cards have been
placed, the operator should enter "GO" to continue the test
section. Each card will be read and checked for validity,
placing it in the wait station of the device. As the card is
moved through the punch and print stations of the device, it is
punched with 40 or fewer columns of data, beginning at column 41.

PART 3: The operator is instructed once again to move the cards
from stacker 1 and place them back into the primary hopper, make
the device ready, and enter the "GO" command. The cards are read
and checked for validity. The data read should be that punched
in parts 1 and 2 of this section. It is up to the operator to
verify that the printed data (there is none) is correct.

DEFAULT DATA: Part 1:   FIRST PUNCH (29 blanks)
                                   Part 2:   SECOND PUNCH (28 blanks)
DATA SENSITIVE: Yes
DEFAULT LENGTH: Part 1:   40 columns
                                   Part 2:   40 columns
LENGTH SENSITIVE: Yes (maximum of 80 columns)
DEFAULT RECORDS: 25
RECORDS SENSITIVE: Yes

WARNING: Operator entered data should be EBCDIC
                                   patterns; otherwise, errors may occur.

ERROR 01
A TEST op @80000U@ is issued to the device to insure it is ready
before the section is allowed to begin. The TEST op has either
failed or timed out. Make sure the device is not hung.

ERROR 02
The device is primed with the first card before any cards are
punched by issuing a STACKER SELECT READ op @17000U@. The op has
failed, timed out, or completed with an exception condition.

ERROR 03
The next primed card is punch by issuing a PUNCH PRINT READ op
@57000U@. The op has failed, timed out, or completed with an
exception condition.

ERROR 04
A TEST op @80000U@ is issued to the device to insure it is ready
before Part 2 of the section is allowed to begin. The TEST op
has either failed or timed out. Make sure the device is not
hung.

ERROR 05
The first of the punched cards is read and checked for validity
issuing a STACKER SELECT READ op @17000U@. The op has failed,
timed out, or completed with an exception condition.

ERROR 06
If a card is read successfully by issuing a STACKER SELECT READ
@17000U@ to the device, and data was received on the read op,
then the data obtained is compared to the data expected. In this
case the obtained data is not correct.

ERROR 07
A card is believed to have been read successfully by issuing a
STACKER SELECT READ op @17000U@ to the device, but no data was
received on the read operation.

ERROR 08
The card currently in the wait station was to be punched with the
data from pass 2. However, the PUNCH PRINT READ op @57200U@
failed, timed out, or completed with an exception condition.

BURROUGHS CORPORATION
COMPUTER SYSTEMS GROUP
SANTA BARBARA PLANT

COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

ERROR 09
The next card is read and checked for validity issuing a STACKER SELECT READ op ə17000Uə. The op has failed, timed out, or completed with an exception condition.

ERROR 10
If a card is read successfully by issuing a STACKER SELECT READ ə17000Uə to the device, and data was received on the read op, then the data obtained is compared to the data expected. In this case the obtained data is not correct.

ERROR 11
A card is believed to have been read successfully by issuing a STACKER SELECT READ op ə17000Uə to the device, but no data was received on the read operation.

ERROR 12
A TEST op ə80000Uə is issued to the device to insure it is ready before Part 3 of the section is allowed to begin. The TEST op has either failed or timed out. Make sure the device is not hung.

ERROR 13
Each card is read and checked for validity by issuing a MULTI-READ op ə07800Uə to the device. One of the ops has failed, timed out, or completed with an exception condition.

ERROR 14
If a card is read successfully by issuing a MULTI-READ op ə07800Uə to the device, and data was received on the read op, then the data obtained is compared to the data expected. In this case the obtained data is not correct.

ERROR 15
A card is believed to have been read successfully by issuing a MULTI-READ op ə07800Uə to the device, but no data was received on the read.

BURROUGHS CORPORATION   COMPANY CONFIDENTIAL
COMPUTER SYSTEMS GROUP   B1000 BOLT CARD DEVICE TEST
SANTA BARBARA PLANT   P.S. 2228 3626(A)

Section #33 -- Print and Read (CRPPC, CRPC)

This section applies to an 80 or 96 column multifunction device
only.   It has three parts.   It is suggested that one read the
SPECIAL NOTES section of this document before running this test
section.

PART 1:   The operator is asked to place blank cards into the
primary hopper of the device, then enter "GO". The device should
be made ready before the "GO" command is entered.   The cards are
punched with 40 or fewer columns of data, beginning at column 1.
Cards are punched until the proper number of records have been
processed.

PART 2:   The operator is instructed to take the punched cards
from stacker 1 and place them back into the primary hopper.   The
device should be made ready again.   Once the cards have been
placed, the operator should enter "GO" to continue the test
section.   Each card will be read and checked for validity,
placing it in the wait station of the device.   As the card is
moved through the punch and print stations of the device, it is
printed with 40 or fewer columns of data, beginning at column 41.

PART 3:   The operator is instructed once again to move the cards
from stacker 1 and place them back into the primary hopper, make
the device ready, and enter the "GO" command. The cards are read
and checked for validity.   The data read should be that punched
in part 1 of this section.   It is up to the operator to verify
that the printed data is correct.

DEFAULT DATA: Part 1:   FIRST PUNCH (29 blanks)
                              Part 2:   SECOND PUNCH (28 blanks)

DATA SENSITIVE: Yes
DEFAULT LENGTH: Part 1:   40 columns
                              Part 2:   40 columns
LENGTH SENSITIVE: Yes (maximum of 80 columns)
DEFAULT RECORDS: 25
RECORDS SENSITIVE: Yes

WARNING: Operator entered data should be EBCDIC
                              patterns; otherwise, errors may occur.

BURROUGHS CORPORATION
COMPUTER SYSTEMS GROUP
SANTA BARBARA PLANT

COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

ERROR 01

A TEST op ᴕ80000Uᴕ is issued to the device to insure it is ready before the section is allowed to begin. The TEST op has either failed or timed out. Make sure the device is not hung.

ERROR 02

The device is primed with the first card before any cards are punched by issuing a STACKER SELECT READ op ᴕ17000Uᴕ. The op has failed, timed out, or completed with an exception condition.

ERROR 03

The next primed card is punch by issuing a PUNCH PRINT READ op ᴕ57000Uᴕ. The op has failed, timed out, or completed with an exception condition.

ERROR 04

A TEST op ᴕ80000Uᴕ is issued to the device to insure it is ready before Part 2 of the section is allowed to begin. The TEST op has either failed or timed out. Make sure the device is not hung.

ERROR 05

The first of the punched cards is read and checked for validity issuing a STACKER SELECT READ op ᴕ17000Uᴕ. The op has failed, timed out, or completed with an exception condition.

ERROR 06

If a card is read successfully by issuing a STACKER SELECT READ ᴕ17000Uᴕ to the device, and data was received on the read op, then the data obtained is compared to the data expected. In this case the obtained data is not correct.

ERROR 07

A card is believed to have been read successfully by issuing a STACKER SELECT READ op ᴕ17000Uᴕ to the device, but no data was received on the read operation.

ERROR 08

The card currently in the wait station was to be printed with the data from pass 2. However, the PUNCH PRINT READ op ᴕ37200Uᴕ failed, timed out, or completed with an exception condition.

ERROR 09
The next card is read and checked for validity issuing a STACKER
SELECT READ op @17000U@. The op has failed, timed out, or
completed with an exception condition.

ERROR 10
If a card is read successfully by issuing a STACKER SELECT READ
@17000U@ to the device, and data was received on the read op,
then the data obtained is compared to the data expected. In this
case the obtained data is not correct.

ERROR 11
A card is believed to have been read successfully by issuing a
STACKER SELECT READ op @17000U@ to the device, but no data was
received on the read operation.

ERROR 12
A TEST op @80000U@ is issued to the device to insure it is ready
before Part 3 of the section is allowed to begin. The TEST op
has either failed or timed out. Make sure the device is not
hung.

ERROR 13
Each card is read and checked for validity by issuing a
MULTI-READ op @07800U@ to the device. One of the ops has failed,
timed out, or completed with an exception condition.

ERROR 14
If a card is read successfully by issuing a MULTI-READ op
@07800U@ to the device, and data was received on the read op,
then the data obtained is compared to the data expected. In this
case the obtained data is not correct.

ERROR 15
A card is believed to have been read successfully by issuing a
MULTI-READ op @07800U@ to the device, but no data was received on
the read.

Section #34 -- Read Only (CRC,CRPPC,CRPC)

This test section applies to any devices which can read cards,
whether they be read-only or multifunction devices. It has two
parts for multifunction devices and one part for read-only
devices.   Part 1 of this test section is not run if a read-only
device has been selected.

PART 1: The operator is asked to place the appropriate
pre-punched deck of cards into the primary hopper of the device.
The appropriate deck is determined as follows:

1. If the device is 80 column then the pre-punched deck
    needed is the standard 80 column ripple deck. It may
    punched in section #26. (PRE PUNCHED ALPHA CARD DECK
    CD 2209 5871 AA).

2. If the device is 96 column then the pre-punched deck
    needed is the standard 96 column ripple deck. It may
    punched in section #25. (PRE PUNCHED ALPHA CARD DECK
    CD 2210 3435 AB).

The cards are read and checked for validity using the STACKER
SELECT READ @17800U@.   The number of records read is determined
by the number of cards punched in section #25 or #26.   For
read-only devices the default number of records is assumed.

PART   2:   The operator is asked to place the appropriate
pre-punched deck into the primary hopper of the device.   (For
multifunction devices the deck will still be in stacker 1).   The
cards are read and checked for validity using the READ op
@00000U@ (for read-only devices) or the MULTI READ op @07800U@
(for multifunction devices).

DEFAULT DATA: Rippled Data Deck
DATA SENSITIVE: Yes (if data selected in section #25
                               or section #26).
DEFAULT LENGTH: 80/96 columns depending on Control.
LENGTH SENSITIVE: No
DEFAULT RECORDS: 150
RECORDS SENSITIVE: Yes (if records selected in section
                               #25 or section #26).

ERROR 01
A TEST op @80000U@ is issued to the device to insure it is ready
before the section is allowed to begin.   The TEST op has either
failed or timed out. Make sure the device is not hung.

BURROUGHS CORPORATION
COMPUTER SYSTEMS GROUP
SANTA BARBARA PLANT

COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

ERROR 02
An attempt was made at reading the next card by issuing a STACKER SELECT READ op ä17800Uä. The op has failed, timed out, or completed with an exception condition.

ERROR 03
If a card is read successfully by issuing a STACKER SELECT READ op ä17000Uä, and data was received on the read op, then the data obtained is compared to the data expected. In this case the obtained data is not correct.

ERROR 04
A card is believed to have been read successfully by issuing the read op discussed in ERROR 02, but no data was received on the read operation.

ERROR 05
A TEST op ä80000Uä is issued to the device to insure it is ready before Part 2 of the section can begin. The TEST op has either failed or timed out. Make sure the device is not hung.

ERROR 06
A READ op ä00000Uä (for read-only devices) or a MULTI-READ op ä07800Uä (for multifunction devices) was issued to the device in an attempt to read and verify the next card. The op has failed, timed out, or completed with an exception condition.

ERROR 07
If a card is read successfully by issuing a READ or MULIT-READ op (see ERROR 06), and data was received on the read op, then the data obtained is compared to the data expected. In this case the obtained data is not correct.

ERROR 08
A card is believed to have been read successfully by issuing a READ op or a MULTI-READ op (see ERROR 06), but no data was received on the read operation.

Section #35 -- Read No Check (CRC,CRPPC,CRPC)

This test section applies to any devices which can read cards,
whether they be read-only or multifinction devices.   It has one
part.

The operator is asked to place any deck of cards into the primary
hopper of the device, then enter "GO". The device should be made
ready before "GO" is entered. The cards are read by issuing READ
ops ə10000Uə (for read-only devices) or MULTI-READ ops ə07840Uə
(for multifunction devices). As each card is read it is counted.
This test section verifies the units capability of feeding and
stacking cards, and that the deck of cards can indeed be read.
The section is terminated on any exception condition.   When the
whole deck has been read the device goes not ready, raising the
exception condition. This is normal completion of the test
section so the NOT READY error is not reported. Should any other
exception condition be flagged it is considered an error and is
reported as such.   The number of cards read is reported when the
section terminates.

DEFAULT DATA:	Not applicable
DATA SENSITIVE:	Yes - Operator must supply the cards
DEFAULT LENGTH:	80/96 columns depending on Control
LENGTH SENSITIVE:	No
DEFAULT RECORDS:	Not applicable
RECORDS SENSITIVE:	Yes - All cards in the hopper
NOTES:	For 96 column multifunction devices, a CONTROL CARD exception condition terminates this test section.

ERROR 01
A TEST op ə80000Uə is issued to the device to insure it is ready
before the section is allowed to begin.   The TEST op has either
failed or timed out. Make sure the device is not hung.

ERROR 02
Cards are read by issuing a READ op ə10000Uə (for read-only
devices) or a MULTI-READ op ə07840Uə (for multifunction devices).
One of these ops has failed, timed out, or completed with an
exception condition.

BURROUGHS CORPORATION
COMPUTER SYSTEMS GROUP
SANTA BARBARA PLANT

COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

Section #36 -- Punch Binary Test (CRPPC, CPC)

This section may only be used to test an 80 column multifunction unit or the single function Card Punch unit. It consists of one part.

The operator is asked to place 150 or more blank cards into the primary hopper of the device. The cards will be punched with binary patterns by issuing PUNCH op ə51000Uə (punch-only device) or a MULTI-PUNCH op ə47040Uə (multifunction device). The data will consist of two twelve bit words, the first word from the first twelve bits in the data buffer and the second from the next twelve bits. The words will be alternated such that one card is punched repeatedly with the first data pattern until all 80 columns are filled and then the next is card punched with the second data pattern, alternating in this fashion until the proper number of records have been processed.

```
DEFAULT DATA:            ə555ə and əAAAə
DATA SENSITIVE:          Yes
DEFAULT LENGTH:          80
LENGTH SENSITIVE:        No
DEFAULT RECORDS:         150
RECORDS SENSITIVE:       Yes
WARNING:                 Only the first 24 bits of user entered
                         will be used.
```

ERROR 01
A TEST op ə80000Uə is issued to the device to insure it is ready before the section is allowed to begin. The TEST op has either failed or timed out. Make sure the device is not hung.

ERROR 02
If the device being tested is a multifunction device then the first card must be primed (placed into the wait station). A STACKER SELECT READ ə17000Uə was issued to the device but failed, timed out, or completed with an exception condition.

ERROR 03
The first 12-bit pattern was to be punched on the card but the punch op (ə51000Uə or ə47040Uə) has failed, timed out, or completed with an exception condition.

ERROR 04
The second 12-bit pattern was to be punched on the card but the punch op (ə51000Uə or ə47040Uə) has failed, timed out, or completed with an exception condition.

Section #37 -- Read Binary Test (CRPPC, CRC)

This section may only be used on devices which read 80 column
cards.   It has two parts for multifunction devices and one part
(PART 1) for read-only devices.

PART 1:   The operator is asked to place the pre-punched binary
deck into the primary hopper or the device, and enter "GO". The
proper deck is that obtained from executing section #36 or the
PREPUNCHED BINARY CARD DECK - CD 2209 5889 AA.   The cards are
read and checked for validity by issuing READ ops ⓐ10000Uⓐ (for
read-only devices) or STACKER SELECT READ ops ⓐ17840Uⓐ (for
multifunction devices). If the device is a read-only device then
the section is ended here.

PART 2:   This part of the test section is only executed if the
device is a multifunction device.   The operator is instructed to
take the cards from stacker 1 and place them back into the
primary hopper of the device. The cards are read and checked for
validity once again by issuing MULTI-READ ops ⓐ07840Uⓐ.

DEFAULT DATA: ⓐ5555ⓐ and ⓐAAAⓐ
DATA SENSITIVE: Yes (must run section #36 first).
DEFAULT LENGTH: 80 columns
LENGTH SENSITIVE: No
DEFAULT RECORDS: 150
RECORDS SENSITIVE: Yes (must run section #36 first).
WARNING: Data and records are not operator
                                 sensitive if device is read-only.

ERROR 01
A TEST op ⓐ80000Uⓐ is issued to the device to insure it is ready
before the section is allowed to begin. The TEST op has either
failed or timed out. Make sure the device is not hung.

ERROR 02
The next card is read and checked for validity by issuing a READ
op ⓐ10000Uⓐ (read-only device) or a STACKER SELECT READ op
ⓐ17840Uⓐ.   The op has failed, timed out, or completed with an
exception condition.

ERROR 03
If a card is read successfully by issuing the read op (see ERROR
02), and data was received on the read op, then the data obtained
is compared to the data expected. In this case the obtained data
is not correct.

BURROUGHS CORPORATION
COMPUTER SYSTEMS GROUP
SANTA BARBARA PLANT

COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

ERROR 04
A card is believed to have been read successfully by issuing the read op discussed in ERROR 02, but no data was received on the read operation.

ERROR 05
A TEST op 380000U3 is issued to the device to insure it is ready before part 2 of the section can begin. The TEST op has either failed or timed out. Make sure the device is not hung.

ERROR 06
The next card is read and checked for validity by issuing a MULTI-READ op 307840U3. The op has failed, timed out, or completed with an exception condition.

ERROR 07
If a card is read successfully by issuing the MULTI-READ op (see ERROR 06), and data was received on the read op, then the data obtained is compared to the data expected. In this case the obtained data is not correct.

ERROR 08
A card is believed to have been read successfully by issuing the MULTI-READ op discussed in ERROR 06, but no data was received on the read operation.

BURROUGHS CORPORATION
COMPUTER SYSTEMS GROUP
SANTA BARBARA PLANT

COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

Section #38 -- Card Unit Not Ready (All controls)

The test applies to all devices. The operator is asked to make
the Card Unit not ready. Several valid ops are dispatched. The
result descriptor will be checked to ensure that the Exception
bit and the Not Ready bit are set.

```
DEFAULT DATA:              Not applicable
DATA SENSITIVE:            Not applicable
DEFAULT LENGTH:            Not applicable
LENGTH SENSITIVE:          Not applicable
DEFAULT RECORDS:           Not applicable
RECORD SENSITIVE:          Not applicable
NOTE:                      Make the device Not Ready before
                           entering "GO".
```

ERROR 01
A TEST op @80000U@ was issued to the device.   It has failed,
timed out, or completed with an unexpected result status field.

ERROR 02
A READ op @C0000U@ was issued to the device.   It has failed,
timed out, or completed with an unexpected result status field.

ERROR 03
A PUNCH op @40000U@ was issued to the device. It has failed,
timed out, or completed with an unexpected result status field.

ERROR 04
A MULTI-PUNCH op @47000U@ was issued to the device.   It has
failed, timed out, or completed with an unexpected result status
field.

ERROR 05
A MULTI-PRINT op @27000U@ was issued to the device.   It has
failed, timed out, or completed with an unexpected result status
field.

ERROR 06
A MULTI PUNCH/PRINT op @67000U@ was issued to the device. It has
failed, timed out, or completed with an unexpected result status
field.

BURROUGHS CORPORATION
COMPUTER SYSTEMS GROUP
SANTA BARBARA PLANT

COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

ERROR 07
A PUNCH PRINT READ op @57000U@ was issued to the device.   It has
failed, timed out, or completed with an unexpected result status
field.

ERROR 08
A PUNCH PRINT READ op @77000U@ was issued to the device.   It has
failed, timed out, or completed with an unexpected result status
field.

ERROR 09
A PUNCH PRINT READ op @37000U@ was issued to the device.   It has
failed, timed out, or completed with an unexpected result status
field.

ERROR 10
A MULTI-READ op @07000U@ was issued to the device.   It has
failed, timed out, or completed with an unexpected result status
field.

BURROUGHS CORPORATION
COMPUTER SYSTEMS GROUP
SANTA BARBARA PLANT

COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2223 3626(A)

Section #39 -- Hoppers Empty (CRPPC, CRPC)

This test may be run on any multifunction device. The operator
is asked to empty both hoppers of the card device. The TEST op
which is valid for the particular unit is dispatched. The result
descriptor   should   return   with   the   NOT_READY,
PRIMARY_HOPPER_EMPTY, and SECONDARY_HOPPER_EMPTY exception bits
on.   The result descriptor is checked to insure that the proper
result was returned.

DEFAULT DATA: Not applicable
DATA SENSITIVE: Not applicable
DEFAULT LENGTH: Not applicable
LENGTH SENSITIVE: Not applicable
DEFAULT RECORDS: Not applicable
RECORDS SENSITIVE: Not applicable

ERROR 01
No exception condition was flagged in the result status field.

ERROR 02
The PRIMARY_HOPPER_EMPTY result status bit was not set in the
result descriptor.

ERROR 03
The SECONDARY_HOPPER_EMPTY result status bit was not set in the
result descriptor.

ERROR 04
The NOT_READY result status bit was not set in the result
descriptor.

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COMPUTER SYSTEMS GROUP   B1000 BOLT CARD DEVICE TEST
SANTA BARBARA PLANT   P.S. 2228 3626(A)

Section #40 -- Test Wait/Ready (All controls)

The section may be run on any device.   The operator is asked to
make the device Not Ready.   A Test Wait for Ready op 39000CU9 is
dispatched to the Control.   The op will not complete until the
operator has made the device ready. The operator should make the
device ready again as soon as possible. Successful completion of
the op after the device has been made ready is expected. Failure
of the op to complete in this case indicates a Control failure.

DEFAULT DATA: Not applicable
DATA SENSITIVE: Not applicable
DEFAULT LENGTH: Not applicable
LENGTH SENSITIVE: Not applicable
DEFAULT RECORDS: Not applicable
RECORDS SENSITIVE: Not applicable
NOTES: The device must be made ready and not
                               ready as requested.

                               A SECONDARY HOPPER EMPTY error may
                               occur if the device has two hoppers
                               and only one was filled with cards.

ERROR 01
The TEST/WAIT FOR READY op 390000U9 was issued to the device. It
has failed, timed out, or completed with an exception condition.

Section #41 -- Test Wait/Not Ready (All controls)

This test section may be run on any device. The operator is
asked to make the device Ready. A Test Wait for Not Ready op is
dispatched to the Control. The op will not complete until the
operator has made the device Not Ready. The operator should make
the device Not Ready as soon as possible. Successful completion
of the op is expected. If the op hangs then a fault with the
Control is suspected.

```
DEFAULT DATA:              Not applicable
DATA SENSITIVE:            Not applicable
DEFAULT LENGTH:            Not applicable
LENGTH SENSITIVE:          Not applicable
DEFAULT RECORDS:           Not applicable
RECORDS SENSITIVE:         Not applicable
NOTES:                     The device must be made ready and not
                           ready as requested.
```

ERROR 01
The TEST/WAIT FOR NOT READY op @88000U@ was issued to the device.
The result status field did not show an exception condition as
was expected.

ERROR 02
The TEST/WAIT FOR NOT READY op @88000U@ was issued to the device.
The result status field showed an exception condition but the
NOT_READY exception was not flagged as expected.

APPENDIX A -- EXAMPLES

This appendix is provided to give the reader several examples of
possilbe operator input to BOLT and the output that would
probably be seen on the ODT from which BOLT was being executed.
For the examples below, the BOLT job number is 10 and the BOLT
"ODT" option is enabled.

ON-LINE TEACH INFORMATION

```
10AX TEACH CD 35
: BOLT=10  CARD:  SECTION #35:   READ ONLY, NO CHECK TEST
: BOLT=10  ----------------------------------------------------
: BOLT=10
: BOLT=10      THIS TEST SECTION IS DESIGNED TO ESTABLISH CONFIDENCE  IN
: BOLT=10  THE CARD DEVICES ABILITY TO FEED AND STACK THE CARDS PROPER-
: BOLT=10  LY.  THIS TEST SECTION TERMINATES ON ANY EXCEPTION CONDITION.
: BOLT=10  SINCE THIS TEST SECTION READS ANY DECK OF CARDS, A NOT READY
: BOLT=10  CONDITION IS  ASSUMED TO  MEAN "NO MORE CARDS".  AS AN ADDED
: BOLT=10  FEATURE, THIS TEST SECTION ALSO COUNTS THE CARDS READ.
: BOLT=10
: BOLT=10  DEFAULT DATA:        NOT APPLICABLE
: BOLT=10  DATA SENSITIVE:      NOT APPLICABLE
: BOLT=10  DEFAULT LENGTH:      80/96 COLUMNS, DEVICE DEPENDENT
: BOLT=10  LENGTH SENSITIVE:    NO
: BOLT=10  DEFAULT RECORDS:     NOT APPLICABLE
: BOLT=10  RECORD SENSITIVE:    NO
: BOLT=10  DEVICES:             CRC, CRCT, CRPPC, CRPC
: BOLT=10
: BOLT=10
: BOLT=10 ***** ENTER NEXT COMMAND  *****
: BOLT=10 ACCEPT
```

SELECTING A CARD DEVICE -- DEVICE READY, HOPPERS FULL

```
10AX UNIT CONTROL CDB
: BOLT=10                    UNIT TABLE INFORMATION
: BOLT=10                    ----------------------
: BOLT=10
: BOLT=10 TOTAL UNITS OBTAINED = 01
: BOLT=10 UNIT NAME = CDB        PORT = 7    CHANNEL = 6     UNIT = 0
: BOLT=10
: BOLT=10             CARD DEVICE TEST -- VERSION AA
: BOLT=10             ------------------------------------
: BOLT=10
: BOLT=10        OPTIONAL CONFIDENCE TEST SECTIONS ARE  25 - 41
: BOLT=10        OPTIONAL DIAGNOSTIC TEST SECTIONS ARE  50 - 53
: BOLT=10
: BOLT=10 FOR A BRIEF EXPLANATION OF THE CARD DEVICE TEST ENTER "TEACH"
: BOLT=10 FOLLOWED BY A CARD DEVICE MNEMONIC ("CR" "CP" "CD").  FOR  AN
: BOLT=10 EXPLANATION OF ANY CARD  DEVICE TEST  SECTION  ENTER  "TEACH"
: BOLT=10 FOLLOWED BY A CARD DEVICE  MNEMONIC  AND THE SECTION YOU WISH
: BOLT=10 TO READ ABOUT  (I.E. TEACH CP 36).
: BOLT=10
: BOLT=10 ***** ENTER NEXT COMMAND *****
: BOLT=10 ACCEPT
```

SELECTING A CARD DEVICE -- ONE HOPPER NOT FULL

```
10AX UNIT CONTROL CDB
: BOLT=10                    UNIT TABLE INFORMATION
: BOLT=10                    ----------------------
: BOLT=10
: BOLT=10 TOTAL UNITS OBTAINED = 01
: BOLT=10 UNIT NAME = CDB       PORT = 7    CHANNEL = 6    UNIT = 0
: BOLT=10
: BOLT=10              CARD DEVICE TEST -- VERSION AA
: BOLT=10              ------------------------------------
: BOLT=10
: BOLT=10        OPTIONAL CONFIDENCE TEST SECTIONS ARE  25 - 41
: BOLT=10        OPTIONAL DIAGNOSTIC TEST SECTIONS ARE  50 - 63
: BOLT=10
: BOLT=10 FOR A BRIEF EXPLANATION OF THE CARD DEVICE TEST ENTER "TEACH"
: BOLT=10 FOLLOWED BY A CARD DEVICE MNEMONIC ("CR" "CP" "CD").  FOR  AN
: BOLT=10 EXPLANATION OF ANY CARD  DEVICE TEST  SECTION  ENTER  "TEACH"
: BOLT=10 FOLLOWED BY A CARD DEVICE  MNEMONIC  AND THE SECTION YOU WISH
: BOLT=10 TO READ ABOUT  (I.E. TEACH CP 36).
: BOLT=10
: BOLT=10 TEST OP ISSUED TO CARD DEVICE COMPLETED WITH EXCEPTION.
: BOLT=10 THE OP CODE DISPATCHED WAS:   300000
: BOLT=10 THE RESULT STATUS FIELD IS:   C04082
: BOLT=10 THE FOLLOWING RESULTS STATUS BITS ARE ON:
: BOLT=10     RS BIT        1:  OPERATION COMPLETE
: BOLT=10     RS BIT        2:  EXCEPTION CONDITION
: BOLT=10     RS BIT       10:  SECONDARY HOPPER EMPTY
: BOLT=10     RS BIT       17:  OPERATION COMPLETE
: BOLT=10     RS BITS 18-24:  80 COLUMN CARD READ/PUNCH/PRINT CONTROL
: BOLT=10
: BOLT=10 ***** ENTER NEXT COMMAND *****
: BOLT=10 ACCEPT
```

TEST EXECUTION -- SECTION 40

```
10AX SECTION 40; GO;
: BOLT=10 BEGINNING OF TEST ON CDA
: BOLT=10 CDA: BEGIN SECTION 40:  TEST/WAIT FOR READY.
: BOLT=10 PLEASE MAKE THE CARD DEVICE NOT READY.
: BOLT=10 THEN ENTER GO.
: BOLT=10
: BOLT=10 ***** ENTER NEXT COMMAND *****
: BOLT=10 ACCEPT
10AX GO
: BOLT=10
: BOLT=10 A "TEST AND WAIT FOR READY" OPERATION HAS BEEN ISSUED TO CDA.
: BOLT=10 YOU HAVE 1 AND 1/2 MINUTES TO MAKE THE CARD DEVICE READY.
: BOLT=10
: BOLT=10 TEST/WAIT OP COMPLETED WITHOUT EXCEPTION OR AS EXCEPTION.
: BOLT=10 CDA: END   SECTION 40: TEST/WAIT FOR READY.
: BOLT=10 END OF TEST ON UNIT CDA -- 0 ERRORS REPORTED.
: BOLT=10 ***** ENTER NEXT COMMAND *****
: BOLT=10 ACCEPT
```

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COMPUTER SYSTEMS GROUP   B1000 BOLT CARD DEVICE TEST
SANTA BARBARA PLANT   P.S. 2228 3626(A)

TEST EXECUTION --   SECTION 40 (WITH EXCEPTION)

10AX SECTION 40; GO;
: BOLT=10 BEGINNING OF TEST ON CDA
: BOLT=10 CDA: BEGIN SECTION 40: TEST/WAIT FOR READY.
: BOLT=10 PLEASE MAKE THE CARD DEVICE NOT READY.
: BOLT=10 THEN ENTER GO.
: BOLT=10
: BOLT=10 ***** ENTER NEXT COMMAND *****
: BOLT=10 ACCEPT
10AX GO
: BOLT=10
: BOLT=10 A "TEST AND WAIT FOR READY" OPERATION HAS BEEN ISSUED TO CDA.
: BOLT=10 YOU HAVE 1 AND 1/2 MINUTES TO MAKE THE CARD DEVICE READY.
: BOLT=10
: BOLT=10 CDA:SEC 40:ERR# 01 - TEST/WAIT FOR READY OPERATION FAILED.
: BOLT=10 THE OP CODE DISPATCHED WAS: 900000
: BOLT=10 THE RESULT STATUS FIELD IS: C0408A
: BOLT=10 THE FOLLOWING RESULT STATUS BITS ARE ON:
: BOLT=10   RS BIT   1:   OPERATION COMPLETE
: BOLT=10   RS BIT   2:   EXCEPTION CONDITION
: BOLT=10   RS BIT   10:   SECONDARY HOPPER EMPTY
: BOLT=10   RS BIT   17:   OPERATION COMPLETE
: BOLT=10   RS BITS 18-24:   96 COLUMN CARD READ/PUNCH CONTROL
: BOLT=10 CDA: END   SECTION 40: TEST/WAIT FOR READY.
: BOLT=10   0001 SECTION ERROR(S) REPORTED.
: BOLT=10 END OF TEST ON UNIT CDA -- 1 ERRORS REPORTED.
: BOLT=10 ***** ENTER NEXT COMMAND *****
: BOLT=10 ACCEPT

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COMPUTER SYSTEMS GROUP
SANTA BARBARA PLANT

COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2228 3625(A)

TEST EXECUTION -- SECTION 26

```
10AX SECTION 26; GO;
: BOLT=10 BEGINNING OF TEST ON CDA
: BOLT=10 CDA: BEGIN SECTION 26: PUNCH RIPPLE TEST 80.
: BOLT=10 PLEASE PLACE 150 (OR MORE) BLANK CARDS IN HOPPER 1.
: BOLT=10 THEN ENTER "GO".
: BOLT=10
: BOLT=10 ***** ENTER NEXT COMMAND *****
: BOLT=10 ACCEPT
10AX GO
: BOLT=10 OPERATOR:  PLEASE MAKE THE CARD DEVICE READY. THEN ENTER "GO".
: BOLT=10
10AX GO
: BOLT=10 TAKE THE CARDS FROM STACKER 1 AND PLACE THEM IN HOPPER 1.
: BOLT=10 PUSH THE RESET BUTTON THEN THE START BUTTON ON THE DEVICE.
: BOLT=10 THEN ENTER "GO".
: BOLT=10
: BOLT=10 ***** ENTER NEXT COMMAND *****
: BOLT=10 ACCEPT
10AX GO
: BOLT=10 CDA: END    SECTION 26: PUNCH RIPPLE TEST 80.
: BOLT=10 END OF TEST ON CDA -- 0 ERRORS REPORTED.
: BOLT=10 ***** ENTER NEXT COMMAND *****
: BOLT=10 ACCEPT
```

TEST EXECUTION -- SECTION 30

```
10AX SECTION 30; GO;
: BOLT=10 BEGINNING OF TEST ON CDA
: BOLT=10 CDA: BEGIN SECTION 30: PUNCH/PRINT READ.
: BOLT=10 PLEASE PLACE 150 (OR MORE) BLANK CARDS IN HOPPER 1.
: BOLT=10 THEN ENTER "GO".
: BOLT=10
: BOLT=10 ***** ENTER NEXT COMMAND *****
: BOLT=10 ACCEPT
10AX GO
: BOLT=10 TAKE THE CARDS FROM STACKER 1 AND PLACE THEM IN HOPPER 1.
: BOLT=10 PUSH THE RESET BUTTON THEN THE START BUTTON ON THE DEVICE.
: BOLT=10 THEN ENTER "GO".
: BOLT=10
: BOLT=10 ***** ENTER NEXT COMMAND *****
: BOLT=10 ACCEPT
10AX GO
: BOLT=10 TAKE THE CARDS FROM STACKER 1 AND PLACE THEM IN HOPPER 1.
: BOLT=10 PUSH THE RESET BUTTON THEN THE START BUTTON ON THE DEVICE.
: BOLT=10 THEN ENTER "GO".
: BOLT=10
: BOLT=10 ***** ENTER NEXT COMMAND *****
: BOLT=10 ACCEPT
10AX GO
: BOLT=10 CDA: END   SECTION 30: PUNCH/PRINT READ.
: BOLT=10 END OF TEST ON CDA -- 0 ERRORS REPORTED.
: BOLT=10 ***** ENTER NEXT COMMAND *****
: BOLT=10 ACCEPT
```

TEST EXECUTION -- SECTION 35

```
10AX SECTION 35; GO;
: BOLT=10 BEGINNING OF TEST ON CDA
: BOLT=10 CDA: BEGIN SECTION 35: READ NO CHECK TEST.
: BOLT=10 PLEASE PUT ANY DECK OF CARDS INTO HOPPER 1.
: BOLT=10 THEN ENTER "GO".
: BOLT=10
: BOLT=10 ***** ENTER NEXT COMMAND *****
: BOLT=10 ACCEPT
10AX GO
1 BOLT=10 150 CARDS WERE READ IN "READ NO CHECK" TEST SECTION.
: BOLT=10 CDA: END   SECTION 35: READ NO CHECK TEST.
: BOLT=10 END OF TEST ON CDA -- 0 ERRORS REPORTED.
: BOLT=10 ***** ENTER NEXT COMMAND *****
: BOLT=10 ACCEPT
```

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COMPANY CONFIDENTIAL
B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

USING BOLT TRACING OPTION -- TRACE DESC

```
10AX SECTION 38; TRACE DESC;
: BOLT=10 ***** ENTER NEXT COMMAND ****
: BOLT=10 ACCEPT
10AX GO
: BOLT=10 BEGINNING OF TEST FOR UNIT CRA
: BOLT=10 CRA: BEGIN SECTION 38:  CARD UNIT NOT READY.
: BOLT=10 OPERATOR:  PLEASE MAKE THE CARD DEVICE NOT READY.
: BOLT=10 THEN ENTER "GO".
: BOLT=10
: BOLT=10 ***** ENTER NEXT COMMAND ****
: BOLT=10 ACCEPT
10AX GO
: BOLT=10 ***** TRACE OF TEST SECTION DESCRIPTOR BEFORE DISPATCHING:
: BOLT=10                 TEST  DESCR.
: BOLT=10            ---------------
: BOLT=10
: BOLT=10 OP:     800000   AFIELD:    000000   RESULT:    000000
: BOLT=10 LINK: -0000001   BFIELD:    000000   XRSLT1:  00000000
: BOLT=10 PRT/CH:      72   CFIELD:    000000   XRSLT2:  00000000
: BOLT=10                   LENGTH:    000000 (000000)
: BOLT=10
: BOLT=10 ***** TRACE OF TEST SECTION DESCRIPTOR AFTER DISPATCHING:
: BOLT=10                 TEST  DESCR.
: BOLT=10            ---------------
: BOLT=10
: BOLT=10 OP:     800000   AFIELD:    000000   RESULT:    E00080
: BOLT=10 LINK: -0000001   BFIELD:    000000   XRSLT1:  00000000
: BOLT=10 PRT/CH:      72   CFIELD:    000000   XRSLT2:  00000000
: BOLT=10                   LENGTH:    000000 (000000)
: BOLT=10
: BOLT=10 ***** TRACE OF TEST SECTION DESCRIPTOR BEFORE DISPATCHING:
: BOLT=10                 TEST  DESCR.
: BOLT=10            ---------------
: BOLT=10
: BOLT=10 OP:     000000   AFIELD:    000000   RESULT:    000000
: BOLT=10 LINK: -0000001   BFIELD:    000000   XRSLT1:  00000000
: BOLT=10 PRT/CH:      72   CFIELD:    000000   XRSLT2:  00000000
: BOLT=10                   LENGTH:    000000 (000000)
: BOLT=10
: BOLT=10 ***** TRACE OF TEST SECTION DESCRIPTOR AFTER DISPATCHING:
: BOLT=10                 TEST  DESCR.
: BOLT=10            ---------------
: BOLT=10
: BOLT=10 OP:     000000   AFIELD:    000000   RESULT:    E00080
: BOLT=10 LINK: -0000001   BFIELD:    000000   XRSLT1:  00000000
: BOLT=10 PRT/CH:      72   CFIELD:    000000   XRSLT2:  00000000
: BOLT=10                   LENGTH:    000000 (000000)
```

```
: BOLT=10
: BOLT=10 CRA:  END    SECTION 38:  CARD UNIT NOT READY.
: BOLT=10 END OF TEST ON UNIT CDA -- 0 ERRORS REPORTED.
: BOLT=10 ***** ENTER NEXT COMMAND *****
: BOLT=10 ACCEPT
```

PCAP MODE TESTING

Suppose that there are 100 cards in the primary hopper of CRA and
the device is ready.   To read the first 50 columns of all 100
cards using LOGICAL I/O the following is done:

```
    LENGTH [0] 50;              % 50 columns will be read
    REPEAT 100;                 % issue the op 100 times
    REA;                        % this is the logical op
```

Recall that LOGICAL I/O uses the zero PCAP Mode I/O descriptor.
No descriptors can be linked using this level of PCAP Mode
Testing.   To accomplish the same thing with Physical PCAP I/O
(using PCAP Mode I/O descriptor 4 this time) one would do the
following:

```
    LENGTH [4] 50              % 50 columns will be read
    REPEAT 100;               % issue the op 100 times
    OP [4] 00000003;          % this is the physical op
    LINK [4];                 % make sure descriptor not linked
    SEND [4];                 % issue the read ops
```

BURROUGHS CORPORATION
COMPUTER SYSTEMS GROUP
SANTA BARBARA PLANT

B1000 BOLT CARD DEVICE TEST
P.S. 2228 3626(A)

INDEX

BURROUGHS CORPORATION   COMPANY CONFIDENTIAL
COMPUTER SYSTEMS GROUP   B1000 BOLT CARD DEVICE TEST
SANTA BARBARA PLANT   P.S. 2228 3626(A)

BURROUGHS CORPORATION   COMPANY CONFIDENTIAL
COMPUTER SYSTEMS GROUP   B1000 BOLT CARD DEVICE TEST
SANTA BARBARA PLANT   P.S. 2228 3626(A)