60182000

CONTROL DATA CORPORATION

CONTROL DATA®
1700 SYSTEM
MAINTENANCE MONITOR

Volume 2 of 3

REFERENCE MANUAL

REVISION RECORD

REVISION	DESCRIPTION
01	Original Printing, preliminary edition.
(05-13-66)	
02	Publications Change Order 14307. Reprint with revision which obsoletes all previous editions.
(08-08-66)	Tests were updated and the following new tests were added: 1711/1712 Teletype, 1729 Card
	Reader, 1731 Magnetic Tape, 1706/1716 Buffered Data Channel and Coupling, Random Protect,
	1700 SMM Edit Routine, and Enter Program.
A	Manual released. Publication Change Order 16368. The following new tests are added: 0B (1718
(05-01-67)	Satellite Coupler Test), 0C (1742 Line Printer Test), and 3D (Enter Program). Other tests were
	extensively revised and updated. This edition obsoletes all previous editions.
B	Publication Change Order 17146. To revise existing tests and add new tests. Introduction: page 5
(09-14-67)	revised. Description: pages 7, 12, 15, 18, 25, 26, 27, 30 and 35 revised. Pages 30-a and 30-b
	added. Tests: pages 90-1, 90-2, 100-7, 100-8, 100-10, 101-2, 101-7, 202-1, 202-7, 205-2,
	206-6 thru 206-10, 207-3, 208-2 and 208-6 revised. Page 100-8a added. Tests sections: 102,
	201, 203, 212, 213, and 214 added. Sections 102 Rev A, 201 Rev A and 203 Rev A removed.
C	Publications Change Order 18929. To add 1728 Card Reader/Punch test, No. D.
(02-28-68)	
D	Publications Change Order 19818, to make miscellaneous publication corrections. Pages 37,
(06-11-68)	100-2, 100-18, 101-9, 102-7, 200-10, 201-6, 202-9, 203-7, 204-1, 204-12, 205-14, 206-9, 206-10
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	30-c through 30-f, 51 through 60, 103, 216, 217, 218, 219, 220, 221, 222 and red tab dividers
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G	Manual revised. New tests are added and editorial corrections made. This manual is complete
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H	Manuals revised. This publication is complete through Ed. 2.3. All previous editions are obsolete.
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J	Manuals revised. New tests are added and minor corrections are made. This publication is
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K	Manuals revised. Tests are added, deleted, and corrected.
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REVISION RECORD (CONT'D)

REVISION	DESCRIPTION
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60182000

LIST OF EFFECTIVE PAGES

New features, as well as changes, deletions, and additions to information in this manual, are indicated by bars in the margins or by a dot near the page number if the entire page is affected. A bar by the page number indicates pagination rather than content has changed.

PAGE	REV
Front Cover	-
Title Page	-
ii	N
ii-a/ii-b	R
iii	R
iv	R
v/vi	P
vii	P
viii	R
ix	R
x	R
xi/xii	R
xiii	P
xiv	P
xv	P
1	P
2	N
3	P
4	P
5	P
6	P
7	P
8	P
9	P
10	P
11	R
12	P
13	P
14	P
15	R
16	R
17	P
18	P
19	P
20	P
A-1	P
A-2	N
A-3	P
A-4	M
A-4.1/A-4.2	R
A-5	P
A-6	R
A-7	M
A-8	M
A-9	M
B-1	P
B-2	P
B-3	P
B-4	P
B-5	P
B-6	P
B-7	P
C-1	R
C-2	R
D-1	M
D-2	L

PAGE	REV
D-3	J
D-4	L
D-5	M
D-6	J
D-7	K
D-8	K
D-9	J
D-10	J
D-11	L
D-12	P
D-13	M
D-14	M
D-15	N
D-15.1	N
D-16	J
D-17	L
D-18	L
E-1	J
E-2	J
E-3	J
E-4	J
E-5	J
E-6	J
E-7	P
E-8	J
E-9	P
E-10	P
E-11	J
E-12	J
E-13	J
E-14	P
E-15	P
E-16	J
E-17	J
E-18	J
E-19	J
E-20	J
E-21	J
E-22	J
E-23	J
E-24	M
E-25	J
E-26	J
E-27	J
E-28	J
E-29	J
E-30	J
E-31	J
F-1	P
F-2	P
F-3	P
F-4	P
50-1	R
50-2	P
50-3	P
50-4	R
50-5	R

PAGE	REV
50-6	R
50-7	P
50-8	P
50-9	P
50-10	P
100-1	P
100-2	P
100-3	L
100-4	L
100-5	L
100-6	L
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101-2	N
102-1	P
102-2	J
102-3	J
102-4	J
102-5	J
102-6	J
102-7	J
102-8	J
103-1	R
103-2	R
103-3	R
103-4	R
103-5	R
103-6	R
103-7	R
103-8	R
103-8.1	R
103-8.2	R
103-9	P
103-10	P
103-11	R
103-12	R
103-13	R
103-14	P
103-15	P
103-16	P
103-17	P
103-18	P
103-19	P
103-20	P
103-21	P
103-22	P
103-23	P
103-24	P
103-25	R
104-1	J
104-2	J
104-3	J
105-1	K
105-2	K
105-3	K
105-4	K
106-1	K
106-2	K

PAGE	REV
106-3	K
106-4	K
107-1	P
107-2	P
107-3	P
107-4	P
107-5	P
107-6	P
107-7	P
107-8	P
107-9	P
107-10	P
107-11	P
107-12	P
107-13	P
107-14	P
107-15	P
107-16	P
107-17	P
108-1	P
108-2	P
108-3	P
108-4	P
108-5	P
108-6	P
108-6.1/108-6.2	P
108-7	P
108-8	P
108-9	N
108-10	N
108-11	M
108-12	N
108-13	N
108-14	P
109-1	P
109-2	P
109-3	P
109-4	P
109-5	P
109-6	P
109-7	P
109-8	P
109-9	P
109-10	P
109-11	P
109-12	P
109-13	P
109-14	P
109-15	P
109-16	P
110-1	N
110-2	N
110-3	N
111-1	P
111-2	N
200-1	N

PAGE	REV
200-2	P
200-3	P
200-4	M
200-5	M
200-6	M
200-7	M
200-8	M
200-9	M
200-10	M
200-11	M
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200-17	M
200-18	M
200-19	P
200-20	P
201-1	R
201-2	P
201-3	P
201-4	K
201-5	K
201-6	K
201-7	P
201-8	K
201-9	M
201-10	L
202-1	P
202-2	P
202-3	H
202-4	J
202-5	H
202-6	J
203-1	R
203-2	R
203-2.1/203-2.2	R
203-3	P
203-4	P
203-5	P
204-1	L
204-2	M
204-3	H
204-4	H
204-5	H
205-1	R
205-2	M
205-3	P
205-4	K
205-5	K
205-6	P
205-7	K
205-8	K
205-9	L
206-1	R

PAGE	REV
206-2	P
206-3	P
206-4	P
206-5	P
206-6	P
206-7	P
206-8	P
206-9	P
207-1	N
207-2	M
207-3	M
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207-7	M
207-8	M
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300-2	M
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300-6	J
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302-2	P
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302-6	P
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302-10	P
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303-2	P
303-3	P
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303-5	P
303-6	P
303-7	P
303-8	P
303-9	P
350-1	R
350-2	P
350-3	P
350-4	J
350-5	J
350-6	R
350-7	H
350-8	J
350-9	H
350-10	H
351-1	M
351-2	M
351-3	H
351-4	H
351-5	H
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351-7	H
351-8	H
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351-12	H
351-13	H
351-14	H
351-15	H
351-16	H
351-17	H
351-18	H
351-19	H
351-20	H
351-21	H
351-22	H
351-23	H
351-24	J
352-1	M
352-2	M
352-3	L
352-4	L
352-5	L
352-6	L
352-7	L
352-8	M
352-9	M
352-10	M
352-11	L
352-12	M
352-13	M
352-14	M
352-15	M
401-1	N
401-2	J
401-3	L
401-4	H
401-5	H
401-6	H
401-7	H
401-8	H
401-9	H
401-10	H
401-11	H
401-12	H
401-13	H
401-14	H
401-15	H
401-16	H
401-17	H
401-18	H
401-19	H
401-20	H
401-21	H
401-22	H
401-23	H
401-24	H
401-25	L
402-1	M
402-2	L
402-3	H
402-4	H
402-5	H
402-6	H
402-7	H
402-8	H
402-9	H
402-10	H
402-11	H
402-12	H
402-13	H
402-14	H
402-15	K
402-16	K
402-17	K
403-1	L
403-2	L
403-3	H
403-4	H
403-5	H
403-6	H
403-7	H
403-8	H
403-9	J
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404-18	N
404-19	N
450-1	L
450-2	M
450-3	L
450-4	H
450-5	H
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450-7	H
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450-9	H
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450-11	J
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452-6	L
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454-6	M
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454-9	M
454-10	M
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454-12	M
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454-26	M
454-27	M
454-28	M
454-29	M
454-30	M
454-31	M
454-32	M
454-33	M
454-34	M
454-35	M
454-36	M
454-37	M
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455-2	N
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455-4	P
455-5	M
455-6	M
455-7	M
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455-14	M
455-15	N
455-16	N
455-17	N
455-18	N
455-19	N
455-20	N
455-21	N
455-22	N
455-23	N
Comment Sheet	R
Back Cover	-

PAGE	REV
658-44	K
658-45	K
658-46	K
658-47	K
658-48	K
658-49	K
658-50	K
658-51	K
658-52	K
658-53	K
658-54	K
660-1	P
660-2	J
660-3	K
660-4	N
660-5	N
660-6	P
660-7	N
660-8	P
660-9	N
660-10	P
660-11	N
660-12	N
660-13	J
660-14	P
660-14.1	K
660-14.2	P
660-14.3/ 660-14.4	P
660-15	P
660-16	K
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660-18.3	P
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660-20	K
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660-34	K
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660-36	K
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661-4	K
661-5	K
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661-7	K
661-8	K
661-9	K
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663-4	P
663-5	P
663-6	P
663-7	P
663-8	P
663-9	P
663-10	P
663-11	P
663-12	P
663-13	P
663-14	P
663-15	P
Comment Sheet	R
Back Cover	-

PREFACE

This manual is intended to serve as a reference aid for field and checkout personnel involved in the running of the CONTROL DATA® 1700 System Maintenance Monitor (SMM17).

This manual contains a detailed description of the operation and use of the monitor, instructions for the operator, restrictions, and necessary parameters. Detailed test descriptions are also included.

If information is required concerning the SMM17 QSE library, refer to SMM17 QSE Reference Manual, publication no. 60454710.

CONTENTS

1706 BUFFERED DATA CHANNEL TEST

(BD100A Test No. 0A)

OPERATIONAL PROCEDURE

A. RESTRICTIONS

Sections 3, 4, and 5 do not select density on the MT units. However, it is recommended that 200 BPI be selected to allow greater accuracy in testing the CWA register.

B. LOADING PROCEDURE

1. The test operates under control of 1700 System Maintenance Monitor (SMM17).
2. The calling sequence is that specified by SMM17.
3. The test can be restarted after loading from Initial address.

C. PARAMETERS

1. If bit 0 of the Stop/Jump word is set, the program will have one monitor stop displaying $A41 in the A register and the Stop/Jump word in the Q register. Two additional stops with the test parameters displayed in the A and Q registers are defined as follows:

Stop 2	A = WE01,	where the W field is bits 15-11 and defines the BDC to be tested. Enter 2, 7, or C for the BDC numbers 1, 2, or 3 respectively. The E field is bits 10-7 and specifies the equipment number of the 1731/1732 Magnetic Tape Controller.
	Q = 000U,	where U specifies the 601/608/609 Tape Unit which will be used for I/O.
Stop 3	A = XXXX,	the End of Operation interrupt line for the BDC. Only 1 bit is set in this word which must indicate the interrupt line. For example if the End of Operation interrupts are to be received on line 5, Bit 5 would be set.
	Q = XXXX,	the sections of the BDC test to run. Bit 0 of Q will select Section 1 to be run, etc. There are five sections in all. If all five sections were to be run, Q would be set to 001F.
Stop 4	A = XXXX,	illegal equipment (enter into A an equipment address that is unused on your system. This equipment address is used to check internal rejects) E field bits 7-10.
	Q = XXXX,	unused (prestored as 0001)

2. If bit 0 of the Stop/Jump word is not set, the test will be run using the prestored parameters. These parameters assume the following:

   a. BDC number 1 is to be tested and the tape controller is number 3. (WE01 = 1181)

   b. Tape unit 7 is the tape to use for I/O.

   c. The interrupts on End of Operation from the BDC are received on line 3.

   d. All five sections of the test will be run.

3. A typeout of selected parameters will occur after last stop.

D. SELECTIVE SKIP AND STOP SETTINGS

1. STOP - must be set for running of SMM17.

2. SKIP - when the Stop/Jump word is displayed in Q.

E. MESSAGES

1. Typeouts or Alarms

   a. Normal Program Typeouts

      1) Test identification at start of test
         BD100AX 1706 BUFFERED DATA CHANNEL TEST
         VR. 4.0 CP2F IA =XXXX, FC=XX

      2) End of test typeout

A	Q	A	Q
0A24	S/J	Pass No.	Return Address

   b. Error Alarms

      1) The following is typed out:

         a) Identification word

         b) Stop/Jump parameter

         c) Section/Error number

         d) Return address

         e) Information dependent upon specific error

         f) Information dependent upon specific error

2. Error Codes

An error code is displayed in the lower two digits of the A register on the second stop of all error stop sequences. A description of the error codes used and the data displayed in the A and Q registers of the third stop is listed as follows:

Error 01 - Incorrect equipment parameter was entered. Program will make another parameter stop if placed in Run.

A = the equipment parameter entered
Q = 0000

Error 02 - External reject on input of BDC status. If the error condition is not repeated (Bit 4 of Stop/Jump word set) the test will be terminated.

A = the contents of Q when the input instruction was executed
Q = 0000

Error 03 - Internal reject on input of BDC status. If the error condition is not repeated, the test is terminated.

Error 04 - Ready not set on BDC status. If the condition is not repeated, the test is terminated.

A = BDC status
Q = 0000

Error 05 - External reject on input of BDC current address.

A = contents of Q when the input instruction was executed
Q = 0000

Error 06 - Internal reject on input of BDC current address.

A = contents of Q when the input instruction was executed
Q = 0000

Error 07 = External reject on Terminate Buffer.

A = contents of Q when the input instruction was executed
Q = 0000

Error 08 = Internal reject on Terminate Buffer.

A = contents of Q when the input instruction was executed
Q = 0000

Error 09 = External reject on attempt to output a function to the BDC.

A = contents of Q when output was attempted
Q = contents of A when output was attempted

Error 0A - Internal reject on attempt to output a function to the BDC.

A = contents of Q when output was attempted
Q = contents of A when output was attempted

Error 0B - External reject on direct output of a function to the 1731 Tape Controller.

A = contents of A when ouput was executed
Q = contents of Q when output was executed

Error 0C - Internal reject on direct output of a function to the 1731 Tape Controller.

A = contents of A when output was executed
Q = contents of Q when output was executed

Error 0D - External reject on input of status 1 of the 1731 Tape Controller.

A = the contents of Q when the input was executed
Q = 0000

Error 0E - Internal reject on input of status 1 of the 1731 Tape Controller.

A = the contents of Q when the input was executed
Q = 0000

Error 0F - External reject on input of status 2 of the 1731 Tape Controller.

A = the contents of Q when the input was executed
Q = 0000

Error 10 - Internal reject on input of status 2 of the 1731 Tape Controller.

A = the contents of Q when the input was executed
Q = 0000

Error 11 - No write ring in selected tape unit. If this error condition is not repeated, the test is terminated.

A = the selected tape unit
Q = status 2 of the selected tape unit

Error 12 - The selected tape unit is protected. If this error condition is not repeated, the test will be terminated.

A = the selected tape unit
Q = status 1 of the selected tape unit

Error 13 - External reject on attempt to initiate buffered output to tape.

A = the first word address minus 1 of the buffer area
Q = contents of Q when the output instruction was executed

Error 14 - Internal reject on attempt to initiate buffered output to tape.

A = the first word address minus 1 of the buffer area
Q = contents of Q when the output instruction was executed

Error 15 - External reject on the attempt to initiate a buffered input from tape.

A = the first word address minus 1 of the buffer area
Q = the contents of Q when the output instruction was executed

Error 16 - Internal reject on the attempt to initiate a buffered input from tape.

A = the first word address minus one of the buffer area
Q = the contents of Q when the output instruction was executed

Error 17 - Busy bit (bit 1) of the BDC status was not set after initiating a buffered output.

A = BDC status
Q = 0000

Error 18 - Busy bit (bit 1) of the BDC status was not set after initiating a buffered input.

A = BDC status
Q = 0000

Error 19 - Reply bit (bit 9) of the BDC status was not set after initiating a buffered output.

A = BDC status
Q = 0000

Error 20 - Reply bit (bit 9) of the BDC status was not set after initiating a buffered input.

A = BDC status
Q = 0000

Error 21 - Reject bit (bit 8) of the BDC status was never set (over an arbitrary length of time) after initiating a buffered output.

A = BDC status
Q = 0000

Error 22 - Reject bit (bit 8) of the BDC status was never set (over an arbitrary length of time) after initiating a buffered input.

A = BDC status
Q = 0000

Error 23 - End of Operation bit (bit 4) of the BDC status is set at the same time as the Busy bit.

A = BDC status
Q = 0000

Error 24 - End of Operation bit (bit 4) of the BDC status is not set after the Busy cleared at the end of a buffered output.

A = BDC status
Q = 0000

Error 25 - End of Operation bit (bit 4) of the BDC status is not set after the Busy cleared at the end of a buffered input.

A = BDC status
Q = 0000

Error 26 - No reject received from the BDC when attempting a direct output when the BDC was Busy.

A = BDC status
Q = 0000

Error 27 - No interrupt received from the BDC on End of Operation (buffered output).

A = BDC status
Q = 0000

Error 28 - Alarm bit set in tape status 1 after a buffered output was complete.

A = Tape status 1
Q = 0000

Error 29 - No interrupt received from the BDC on End of Operation (buffered input).

A = BDC status
Q = 0000

Error 2A - Interrupt bit (bit 2) of the BDC status was not set after an End of Operation interrupt occurred.

A = BDC status when interrupted
Q = 0000

Error 2B - Data error

A = Data read
Q = Expected value
A = Failing address
Q = 0000

Error 2C - Current address of the BDC was not equal to one greater than the FWA-1 after initiating a buffered output.

A = Current address which was input
Q = 0000

Error 2D - The current address which was input from the BDC was neither the same as or up to two greater than the previous current address input.

A = Previous current address
Q = Current address

Error 2E - End of Operation status bit (bit 4) was not set in the BDC status when an Interrupt on End of Operation occurred.

A = BDC status
Q = 0000

Error 2F - Buffer terminated at incorrect address.

A3 = Actual address buffer terminated at
Q3 = Expected last word address, at EOP

Error 33 - Incorrect status after initiating buffer to non-existent equipment on this 17X6.

A3 = Expected channel status after initiating a buffer
Q3 = Actual channel status after initiating a buffer
A4 = Expected address register status
Q4 = Actual address register status
A5 = Equipment address when error occurred as modified to reflect the correct W field for 1706
Q5 = Iteration count (range = FFFC-0003)

Error 34 - Current word address was not one greater than FWA-1 after initiating a buffer to illegal equipment on BDC.

A3 = Expected channel status

Q3 = Actual channel status

A4 = FWA-1 output to BDC to initiate buffer

Q4 = CWA of BDC on terminate buffer command

A5 = Same as error 33

Q5

Error 35 - Internal reject on clear controlled direct through BDC

A3 = BDC expected status

Q3 = BDC actual status

A4 = Equipment expected status

Q4 = Equipment actual status

A5 = Equipment address when error detected

Q5 = Not available

Error 36 - External reject on clear controller

Same as error 35

Error 37 - Channel busy or not ready

A3 = 0

Q3 = BDC actual status

A4 = 0

Q4 = 0

A5 = Same as error 33

Q5

Error 38 - Unit/Equipment busy

A3 = 0

Q3 = BDC actual status

A4 = 0

Q4 = Unit status

A5 = Same as error 33

Q5 = Same as error 33

Error 39 - Buffer terminated before programmed LWA+1

A3 = Not available
Q3 = BDC status
A4 = Actual CWA status at EOP
Q4 = Expected CWA status at EOP
A5 = Same as error 33
Q5

Error 3A - Buffer did not terminate at last word ADDES+1

A3 = Not available
Q3 = BDC status
A4 = Current word address when buffer was terminated
Q4 = Expected LWA register

Error 3C - 17X6 not busy before CWA=LWA+1

A3 = Expected BDC status
Q3 = Actual BDC status
A4 = CWA register status
Q4 = LWA+1 sent to BDC
A5 = Same as error 33
Q5

Error 3D - 17X6 buffer hung before CWA=LWA+1 when doing buffered equipment status inputs or buffered clear controller outputs.

A3 = Expected status of BDC
Q3 = Actual status of BDC
A4 = CWA register status of hung buffer
Q4 = Expected LWA+1 of buffer
A5 = Same as error 33
Q5 = Same as error 33

3. Error Stops

Error stops will occur if bit 3 of the Stop/Jump word is set and an error occurs in the test.

II. DESCRIPTION

A. INITIALIZATION (UNIT)

1. Convert bias value and frequency count to ASCII and store in typeout routine.
2. Type out test title, initial address, and frequency count.

3. Set up return address (IA+5).

4. Parameter entry stop.

5. Check for correct W field in equipment code. Error stop if incorrect.

7. Exit to SMM.

B. SECTION ONE (S1)

This section checks static conditions of BDC then proceeds to check the CWA register, LWA register, adder, buffer read capabilities, and buffer write capabilities.

1. Check status for ready.

2. Input current address; no Reject expected.

3. Execute terminate buffer and input current address to

   a. No Reject expected.

4. Check EOP interrupt select and clear.

5. Attempt buffer output to non-existent equipment on channel.

   a. Start with FWA-1=0. Expect BDC to hang with CWA one greater than FWA-1. Expect status to be busy.

   b. Do until FWA-1 = $7FFF.

   c. Do a and b three times

6. Attempt buffer input from non-existent equipment on channel (same as 5).

7. Do direct FCN clear controller to selected Equipment Expect Reply.

8. Do 500_{10} word buffer after a clear controller function.

   a. Monitor CWA. Expect termination when CWA=LWA+1.

   b. Monitor BDC status. Expect busy until CWA=LWA+1.

   c. Do 100_{10} times.

9. Do direct input status 1 of selected equipments. Save for use in next step. Expect reply.

10. Do 500_{10} word buffer input of status 1 from selected device.

   a. Same as 8a and 8b.

   b. Compare data from step 9 and report errors.

   c. Do 100_{10} times.

C. SECTION TWO (S2)

This section checks static conditions on the BDC, tape controller, and tape unit.

1. Connect selected tape unit.
2. Check for write enable. Error if not present.
3. Check for tape unit unprotected. Error if protected.
4. Rewind tape.
5. Exit section two.

D. SECTION THREE (S3)

This section does a 500-word buffered Write and Read.

1. Request interrupt line from SMM.
2. Select tape unit and rewind it.
3. Select binary mode.
4. Initiate a 500-word buffered write.
5. Check BDC status for Busy. Repeat from item 2 if Not Busy.
6. Check BDC status for Reply. Should be set.
7. Check BDC status for Reject during output. Should be set.
8. Exit to SMM until buffer is complete.

9. Rewind tape.
10. Repeat from item 4 for a 500-word read.
11. Clear interrupt request in SMM.
12. Exit section three.

E. SECTION FOUR (S4)

This section writes and reads ten 500-word records for each of fifteen patterns. End of Operation interrupt is checked after each record.

1. Request interrupt line from SMM.
2. Select tape.
3. Pick up current data pattern.
4. Select binary mode if pattern number is Odd. Select BCD mode if pattern number is Even.
5. Clear interrupt flag.
6. Select EOP interrupt on BDC.
7. Initiate 500-word buffered write.
8. Check for reject during buffered operation.
9. Exit to SMM until buffer is complete.
10. Check for EOP interrupt. Error if not present.
11. Check tape status for EOT, Parity, Lost Data, and Alarm.
12. Repeat from item 5 for 10 records.
13. Update data pattern.
14. Repeat from item 2 for 15 patterns.
15. Rewind tape.
16. Blank out storage data.
17. Repeat from item 5 using a Read instead of a Write. Data is checked for each record.
18. Exit section four.

F. SECTION FIVE (S5)

This section tests the current word address.

1. Request interrupt line from SMM.
2. Rewind tape, select binary mode.
3. Initiate buffered output. Word Count = $7FFE_{16}$-LOCSEX.
4. Input current address to A. Address should be one greater than the CWA.
5. Store current address.
6. Input current address to A. This address should be equal to or up to two greater than previous address. Error if not one of these two conditions.
7. If current address is one greater than previous address, repeat from item 4.
8. If current address equals previous address, check BDC status for EOP. Loop to item 4 if not set.
9. Check tape status for EOT, Parity, Lost Data, and Alarm. Error if any of these are set.
10. Clear interrupt request.
11. Exit section five.

III. PHYSICAL REQUIREMENTS

A. SPACE REQUIRED

Approximately 2000 locations.

B. INPUT AND OUTPUT TAPE MOUNTINGS

The 601/608/609 Tape Unit selected for I/O must have a write ring and must be ready.

C. TIMING - approximately 1 minute 15 seconds.

D. EQUIPMENT CONFIGURATION

1. 17X4 Computer
2. 17X5 Interrupt Data Channel
3. 1706 Buffer Data Channel
4. 1731/1732 Magnetic Tape Controller
5. 601/608/609 Magnetic Tape Unit

1706/1716 CHANNEL TEST

(BD200F Test No. 0F)

I. OPERATIONAL PROCEDURE

A. RESTRICTIONS

None available

B. LOADING PROCEDURE

1. The test operates under control of 1700 System Maintenance Monitor (SMM17).
2. The calling sequence is that specified by SMM17. The test number for the 1706/1716 test is F.
3. The test can be restarted after loading from initial address.

C. PARAMETERS

1. If bit 0 of the Stop/Jump word is set, the program will allow for test parameter display and/or entry. The first stop made in the parameter sequence displays the identification word in A (0F31) and the Stop/Jump word in Q.

   The second and third stops display the test parameters. The test parameters can be changed by the operator at the time when they are displayed. The contents of the A and Q registers on the second and third stops is defined below. (Parameter typeout will occur after last stop.)

   a. Stop 2

      A = WE01, where the W field is bits 15-11 and identifies the 17X6* equipment address. The allowable values for the 5-bit W field are:

      00010 - for 17X6 number 1
      00111 - for 17X6 number 2
      01100 - for 17X6 number 3

      The E field is bits 10-7 and identifies the 1731/1732 Magnetic Tape Controller
      Q = 000U, where U specifies the 601 or 602 Magnetic Tape Unit which will be used for I/O in sections 2, 3, and 4.

---

*17X6 refers to either 1706 or 1716, whichever is being used or tested.

b. Stop 3

A = The End of Operation interrupt line for the 17X6. Only one bit is set in this word. The bit position must identify the interrupt line. For example, if the End of Operation interrupts from the 17X6 are to be received on line 5, only bit 5 of this word would be set. Q register contents are described below:

Bit 15 = 1: A 1716 is connected to this computer.

Bit 15 = 0: A 1706 is connected to this computer.

Bit 14 = 1: This computer will initiate the first output if section 6 is selected to be run.

Bit 14 = 0: The other computer will initiate the first data transfer if section 6 is selected to be run.

Bit 5 = 1: Run test section 6. This section will use the 1716 to transfer data between two computers which are necessary to run this section. A common 1716 must be connected to both the computers. Bit 14 of this parameter must be set in one of the computers. Bit 14 of the other computer must be equal to zero. The decision to repeat Section 6 must be made in the computer which has bit 14 = 0.

Bit 4 = 1: Run test Section 5. This section will use the 1716 to make block transfers of data within a computer's core storage.

Bit 3 = 1: Run test Section 4. This section uses the 17X6 1731/1732 and a 601/608/609 to test direct output/input of data.

Bit 2 = 1: Run test Section 3. This section uses the 17X6, 1731/1732 and a 601/608/609 to test the current word address of the 17X6.

Bit 1 = 1: Run test Section 2. This section will use the 17X6, 1731/1732 and a 601/608/609 to test buffered output/input.

Bit 0 = 1: Run test Section 1. This section will check the ability of the 17X6 to accept all legal functions (reject should not be received). If a 1716 is connected, this section will also test the flags, masks, and interrupts when corresponding masks and flags are both set.

2. If bit 0 of the Stop/Jump word is not set, the test will be run using the set of prestored parameters. These parameters assume the following:

   a. 1706 number 1 and equipment number of the 1731/1732 Magnetic Tape Controller is 3.

   b. Tape unit 7 is ready and write-enabled.

   c. The End of Operation interrupts from the 17X6 will be received on line 4.

   d. Test Sections 1, 2, 3, and 4 will be run.

3. Selective Skip and Stop Settings

   a. STOP switch must be set for running SMM17.

   b. SKIP switch, when set, displays the Stop/Jump word in Q.

D. MESSAGES

1. Typeouts or Alarms

   a. Normal Program Typeouts

      1) Test identification at start of test
         BD200F, 1706/1716 DATA CHANNEL TEST
         IA = XXXX, FC = XX

      2) End of test typeout

A	Q	A	Q
0F24	S/J word	Pass number	Return Address

   b. Error Typeouts

      If an error occurs, the following information is typed out:

      1) Identification word

      2) Stop/Jump word

      3) Test section/error number

      4) Return address

      5) Additional information related to the specific error

      A sample error typeout is shown and described as follows:

A	Q	A	Q	A	Q
0F38	000F	0107	0507	0201	1800

0F38 is the identification word where

F is the test number

3 is the number of stops in this error stop sequence

8 identifies the stop as an error stop (bit 3 set)

000F is the Stop/Jump word

0107 is the section number and error number (Section 1, error number 7)

0507 is the address in the program (list address) where the error occurred.

0201 was the status of the 17X6 prior to the attempt to terminate the buffer (see information under error number 7).

1800 was the contents of Q when the attempt to terminate the buffer was made (see information under error 7).

2. Error Codes

An error code is displayed in the lower two digits of the A register on the second stop of all error stop sequences. A description of the error codes used and the additional information displayed on each error is described below.

Error	Description
01	Incorrect test parameter was entered. The program will make another parameter stop when restarted.
02/03	External/internal reject on attempt to input 17X6 status. If this error condition is not repeated (bit 4 of the Stop/Jump word set), the test will make a final exit to SMM. A = 0000 Q = Contents of Q when the input was attempted
04	Ready not set on 17X6 status. If the condition is not repeated the test will be terminated. A = 17X6 status Q = Equipment address of the 17X6

Error	Description
05/06	External/internal reject on input of the 17X6 current address A = 0000 Q = Contents of Q when input was attempted
07/08	External/internal reject on Terminate Buffer operation on 17X6 A = 17X6 status prior to the Terminate Buffer operation Q = Contents of Q when Terminate Buffer was attempted
09/0A	External/internal reject on attempt to output a function to the 17X6 A = Contents of A when output was attempted Q = Contents of Q when output was attempted A = Status of the 17X6 prior to the output Q = 0000
0B/0C	External/internal reject on direct output of a function to the 1731/1732 A = Contents of A when the output was attempted (function) Q = Contents of Q when output was attempted A = Status 1 of the 1731/1732 prior to output Q = Status of the 17X6 prior to the output
0D/0E	External/internal reject on input of status one of the 1731/1732 A = Status of the 17X6 prior to the input Q = Contents of Q when the input was attempted
0F/10	External/internal reject on input of status two of the 1731/1732 A = Status of the 17X6 prior to the input Q = Contents of Q when the input was attempted
11	No write ring in selected tape unit A = Status 2 of the tape unit Q = WEOU, where W is the address of the 17X6, E is the equipment number of the 1731/1732 and U is the selected tape unit.
12	Selected tape unit is protected A = Status 1 of the tape unit Q = WEOU

Error	Description
13/14	External/internal reject on attempt to initiate a buffered output to the 601/608/609. A = Contents of A when output was attempted (FWA-1) Q = Contents of Q when output was attempted A = Status 1 of the tape unit prior to the output Q = Status of the 17X6 prior to the output
15/16	External/internal reject on attempt to initiate a buffered input from the 601/608/609. A = Contents of A when the output was attempted (FWA-1) Q = Contents of Q when the output was attempted A = Status 1 of the tape unit prior to the output Q = Status of the 17X6 prior to the output
17/18	Busy bit of the 17X6 status did not set after initiating a buffered output/input A = 17X6 status Q = 0000
19/1A	The Device Reply bit (bit 9) of the 17X6 status was never set within a time period after initiating a buffered output/input. A = the last 17X6 status input Q = 0000
1B/1C	The Device Reject bit (bit 8) of the 17X6 status was never set within a time period after initiating a buffered output/input. A = The last 17X6 status input Q = 0000
ID	The End of Operation bit (bit 4) of the 17X6 status is set at the same time as Busy (bit 1) is set. A = 17X6 status Q = 0000
1E/1F	The End of Operation bit (bit 4) of the 17X6 status is not set after the Busy dropped at the completion of a buffered output/input. A = 17X6 status Q = 0000

Error	Description
20/21	No reject received from the 17X6 on an attempt to execute a direct output/input to the 17X6 when the 17X6 was Busy. A = Status of the 17X6 prior to the output Q = 0000
22/23	No interrupt received from the 17X6 on end of operation after a buffer was completed. A = Status 1 of the tape after the buffer was completed Q = Status of the 17X6 after the buffer was completed
24/25	Alarm bit set in tape status 1 after a buffered output/input was completed A = Status 1 of the tape after the buffer was completed Q = Status of the 17X6 after the buffer was completed
26/27	Interrupt bit (bit 2) of the 17X6 status was not set after an End of Operation interrupt occurred when a buffer output/input was completed. A = Status 1 of the tape unit after the buffer was completed Q = Status of the 17X6 after the buffer was completed
28	Data error occurred A = Data read Q = Expected value A = Word number within the block which is incorrect Q = 0000
29	Current address of the 17X6 was not equal to the first word address after initiating a buffered output. (The 1731/1732 will accept the first data word and the 17X6 will increment the current address prior to the program inputting the current address.) A = The current address which was input Q = 0000

Error	Description
2A	The current address input from the 17X6 was neither greater nor the same as the previous current address input while a buffered output was active. A = The previous current address Q = The last current address input
2B/2C	The End of Operation status bit (bit 4) was not set in the 17X6 status when an Interrupt on End of Operation occurred after a buffered output/input was completed.
2D	Reserve bit (bit 3) in the 1716 status is still set after executing a Terminate Buffer. A = 1716 status Q = 0000
2E	Reserve bit (bit 3) in the 1716 status is still set after executing the function to clear it. A = Contents of A when the function was output Q = Contents of Q on the output A = 1716 status after the function Q = 0000
2F	Flag bit not set in the 1716 status after executing function to set it. A = Contents of A when function was output Q = Contents of Q when function was output A = 1716 status after the function Q = 0000
30	Flag bit set in the 1716 status after executing function to clear it. A = Contents of A when function was output Q = Contents of Q when function was output A = 1716 status prior to function Q = 1716 status after executing function

Error	Description
31	No interrupt received from the 1716 after setting a Mask bit and then setting the corresponding flag bit. A = Contents of A to set mask Q = Contents of Q used when setting the Mask and the Flag bits A = Contents of A to set Flag bit Q = Present status of the 1716
32/33	External/internal reject received from the 1716 when attempting to initiate a buffered transfer. A = Contents of A when output was attempted Q = Contents of Q when output was attempted A = Status of the 1716 prior to attempting the buffered transfer Q = Status of the 1716 after receiving the reject
34	Flag status bits are not equal to the expected flags. The other computer set a cretain configuration of flags and then stored a word in this computer's core storage indicating the present state of the flag bits. The flags did not correspond to the indication word. A = Status of the 1716 Q = Expected status of the 1716 (flag bits are in bits 10-14)
35	Data error in data the other computer sent this one. If the error condition is to be repeated, set bit 4 in the Stop/Jump word of the other computer when it types out error number 36. A = Data received from other computer Q = Data expected A = Word number within data block Q = 0000
36	The other computer detected at least one data error in the data this computer sent it. (The other computer has typed out error number 35 (one or more times). A = Number of errors found by other computer Q = 0000

Error	Description
37	Data error in data this computer sent the other computer and then read back to this one. A = Data word read back Q = Data word originally sent to other computer A = Word number within block Q = 0000
38	Interrupt bit not set in the 1716 status after an interrupt occurred because the corresponding mask bit and flag bit were both set. A = Status of the 1716 after the interrupt occurred Q = 0000
39/3A	Alarm bit set in status 1 of the 1731/1732 after a direct output/input A = Status 1 of the 1731/1732 Q = Status of the 1716
3B	Interrupt not received after a data transfer was completed. A = Status of the 1716 Q = 0000

E. ERROR STOPS

Error stops will occur if bit 3 of the Stop/Jump word is set, the STOP switch is set, and an error occurs.

II. DESCRIPTION

A. METHOD

1. Initialization

   a. Convert bias value and frequency count and store in typeout routine.

   b. Type out the test title, and frequency count.

   c. Store return address.

   d. Make parameter stop if bit 1 of Stop/Jump word is set.

   e. Set up for control to be given to distributor on return from SMM.

   f. Return control to SMM.

2. Distributor

   a. Run Section 1 if selected.

   b. Stop at end of section if bit 1 of Stop/Jump word is set.

   c. Go to a if bit 5 of Stop/Jump word is set (repeat section).

   d. Run Section 2 if selected.

   e. Stop at end of section if bit 1 of Stop/Jump word is set.

   f. Go to d if bit 5 of Stop/Jump word is set.

   g. Run Section 3 if selected.

   h. Stop at end of section if bit 1 of Stop/Jump word is set.

   i. Go to g if bit 5 of Stop/Jump word is set.

   j. Run Section 4 if selected.

   k. Stop at end of section if bit 1 of Stop/Jump word is set.

   l. Go to j if bit 5 of Stop/Jump word is set.

   m. Run Section 5 if selected.

   n. Stop at end of section if bit 1 of Stop/Jump word is set.

   o. Go to m if bit 5 of Stop/Jump word is set.

   p. Run Section 6 if selected.

   q. Add 1 to pass counter.

   r. Stop at end of test if bit 2 of Stop/Jump word is set.

   s. Go to b if bit 6 of Stop/Jump is set (repeat test).

   t. Check if new parameters are to be entered (bit 10 of Stop/Jump word set).

   u. Load bias and exit to SMM.

   v. Go to a if SMM returns control (test frequency was greater than 1).

3. Section 1

   a. Purpose: Check the static conditions of a 17X6. Checks for no rejects on all legal functions which will not initiate data transfer.

   b. Procedure:

      1) Check for Ready set on 17X6.

      2) Check for no reject received on input of current address.

3) Check for no reject received on Terminate Buffer.

4) Check for reserve clear if 1716.

5) Check for no reject received on Select and Clear interrupt functions.

6) If 1706 return to distributor.

7) Clear all masks and flags.

8) Test for interrupts after setting each mask and then the corresponding flag.

9) Return to distributor.

4. Section 2

a. Purpose: To test the data transfer capabilities of the 17X6. Interrupt on End of Operation is also tested.

b. Procedure:

1) Set reserve bit if 1716.

2) Check for selected tape unit write-enabled and non-protected.

3) Rewind.

4) Select 200 BPI.

5) If this is an odd record of the current data pattern, select binary; if even, select BCD.

6) Select interrupt from 17X6 on End of Operation

7) Initiate buffer output.

8) Check for Busy set in 17X6 status.

9) Check for device Reject set.

10) Check for a reject on output to 17X6 while 17X6 is Busy.

11) Check for device Reply set in 17X6 status.

12) Return control to SMM.

13) Check for End of Operation bit set after Busy clears.

14) Check if interrupt occurred on End of Operation.

15) Check if Interrupt and End of Operation bits were set in 17X6 status when interrupt occurred.

16) Check tape status.

17) If 20 records of current data pattern have not been written, go to 5).

18) If all data patterns have not been used, change patterns and go to 5).

19) Rewind.

20) If odd record, select binary; if even, select BCD.

21) Select Interrupt on End of Operation from 17X6.

22) Initiate buffer input.

23) Check for Busy set on 17X6.

24) Check for device Reject set in 17X6 status.

25) Check for a reject on output to 17X6 while it is Busy.

26) Check for device Reply set in 17X6 status.

27) Return control to SMM.

28) Check for End of Operation bit set when Busy clear.

29) Check if Interrupt on End of Operation occurred.

30) Check if Interrupt and End of Operation bits were set in 17X6 status when interrupt occurred.

31) Check tape status.

32) Check data.

33) If 20 records of current data pattern have not been read, go to 20).

34) If all data patterns have not been read, change patterns and go to 20).

35) Rewind.

36) Clear reserve if 1716.

37) Return to distributor.

5. Section 3

a. Purpose: Check the ability of the 17X6 to increment the current address correctly.

b. Procedure

1) Set reserve if 1716.

2) Rewind and select 200 BPI.

3) Initiate buffer output with FWA = 0007.

4) Input current address of 17X6 and check for 0008.

5) Input current address and check for equal or one greater than the previous one input.

6) If End of Operation is not set go to 5).

7) Clear reserve if 1716.

8) Return to distributor.

6. Section 4

a. Purpose: Check the direct I/O of data to a 601/608/609 via the 17X6.

b. Procedure:

1) Set Reserve bit if 1716.

2) Rewind and select 200 BPI.

3) If odd record of current data pattern, select binary; if even, select BCD.

4) Do direct output of 500 words.

5) Check for alarm up on tape unit.

6) If 20 records of current data pattern have not been written go to 3).

7) If all data patterns have not been used, change patterns and go to 3).

8) Rewind.

9) Initialize data pattern and record count.

10) If odd record, select binary; if even, select BCD.

11) Do direct input of 500 words.

12) Check for alarm up on tape unit.

13) Check the data.

14) If 20 records of current pattern have not been read, go to 10).

15) If all data patterns have not been used, change patterns and go to 10).

16) Rewind.

17) Return to distributor.

7. Section 5

a. Purpose: Check the abilitiy of a 1716 to transfer a block of data from an area of storage to a different area within the same computer.

b. Procedure

1) Set reserve on 1716.

2) Set up output area.

3) Select Interrupt on End of Operation.

4) Initiate buffered transfer and exit to SMM until complete.

5) Check if interrupt occurred.

6) Check data.

7) Go back to 3) if the current data pattern has not been buffered 100 times.

8) Change data patterns and go back to 2) if all patterns have not been used.

9) Clear reserve.

10) Return to distributor.

3 Stop A / Q
0800 / 8020

8. Section 6 Start the second Computer first.

a. Purpose: Check the ability of a 1716 transfer data between two 17X4 Computers.

b. Procedure: In the following sequence of steps, Computer A is initially defined as the computer in which bit 14 of Q equals 1 on the third parameter stop. The other computer is B. TMESS is an absolute location in "this" computer (location 0052). OMESS is the same absolute location in the "other" computer.

1) If computer B, go to 22).

2) Set reserve on 1716.

3) Wait for B to set OMESS to its FWA of data area.

4) Initiate buffered transfer to B.

5) Set flags equal to the lower five bits of code which identify the data pattern.

6) Transfer data code to OMESS.

7) Wait for OMESS to change values.

8) If negative, B found at least one data error.

9) Initiate buffered transfer from B to A.

10) Check data.

11) Go to 4) if current pattern has not been transferred 100 times.

12) Go to 14) if all data patterns have been transferred.

13) Change data patterns and go to 4).

14) If this computer was initially B, go to 18).

15) Clear reserve on 1716.

16) Store 0 at TMESS, -0 at OMESS.

17) Switch names of computers and go to 22).

18) Stop at end of section.

19) If section is to be repeated, go to 15).

20) Store 0 at TMESS, 0 at OMESS.

21) Clear reserve and return to distributor.

Computer B

22) Clear reserve on 1716.

23) Set TMESS equal to FWA of buffer area.

24) Wait for TMESS to change values.

25) If TMESS is -0, go to 31).

26) If TMESS is 0, go to 32).

27) Check for flags equal to same configuration as lower 5 bits of TMESS.

28) Check data.

29) If data errors, store the complement of the number of errors at TMESS and go to 24).

30) Go to 32).

31) Store 0 at TMESS, change names, and go to 2).

32) Stop at end of section.

33) Return to distributor.

III. PHYSICAL REQUIREMENTS

A. SPACE REQUIRED - Approximately 2500_{10} locations.

B. INPUT AND OUTPUT TAPE MOUNTINGS - If Section 2, 3, or 4 is selected to be run a 601/608/609 Tape Unit must be write-labeled and non-protected.

C. TIMING - 3 min. 15 sec.

D. EQUIPMENT CONFIGURATION - computer with 8K memory.

1. Section 1 - 17X4, 1705, 17X6
2. Section 2 - 17X4, 1705, 17X6, 1731/1732, 601/608/609
3. Section 3 - 17X4, 1705, 17X6, 1731/1732, 601/608/609
4. Section 4 - 17X4, 1705, 17X6, 1731/1732, 601/608/609
5. Section 5 - 17X4, 1705, 1716
6. Section 6 - two 17X4's, two 1705's, one 1716

1738/853, 854 DISK PACK TEST

(DP1008 Test No. 8)
(CP=2F)

I. OPERATIONAL PROCEDURE

A. RESTRICTIONS

1. Cautions to User

   a. The range of cylinders upon which data will be written may be limited during the parameter stop. However, the lower limit is ignored in Section 12 (data is written in cylinder 0 to be autoloaded).

   b. A large number of typeouts and/or stops may occur for error codes 14, 1B, and 1D unless bit 11 of the Stop/Jump parameter is set.

   c. There may be insufficient core for a long buffer operation if memory is only 8k and more than one test is loaded before the disk pack test is loaded. In this case neither section 6 nor 9 will be run unless the operator selects one or both of them. If the operator selects 6 or 9 in this case, short buffer operations are performed and each of these two sections may take an hour for an 853 disk drive unit.

   d. Section 7 (overlap seek) requires two disk packs. If an attempt is made to run this section with only one disk pack, the program will loop on an external reject of an output from A, and the director status will become Not Ready and Not on Cylinder.

   e. In Section 12 (autoload) the program may be destroyed if unnecessary data is loaded into core by the Autoload function. Memory wraparound will occur if an attempt is made to run this section with only 4k of memory.

   f. When using a new pack, it is necessary to ensure that the pack is filled with correct data and checkwords. Data can be destroyed in shipment. Running Sections 6 and 10 first will ensure that the pack contains correct data required for other sections; however, errors may be encountered during the initial pass of Section 6. Ignore these errors and run to completion. Rerun Section 6 for an error-free pass.

   g. Bits 2 and 3 of SMM parameter word must specify the correct machine type.

B. LOADING PROCEDURE

1. The test operates as a subprogram under control of the 1700 System Maintenance Monitor (SMM17).

2. The calling sequence is that specified by SMM17.

3. The test can be restarted after loading from initial address.

C. PARAMETERS

1. Normal operation requires no parameters. The following sections will be run under this condition:

   a) Section 1

   b) Section 2

   c) Section 3

   d) Section 4

   e) Section 5

   f) Section 8

   g) Section 9 (unless core size is insufficient)

   h) Section 13

The test will be run on unit 0, the unit will be assumed to be an 853, and cylinders 0 through 99 will be tested. The interrupt line will be line 2.

2. To alter the parameters, follow the directions stated in SMM17. If the bit is set, the corresponding section or condition will be selected. The parameter words to be displayed are as follows:

   a. First stop: A = 0831, Q = Stop/Jump parameter

   b. Second stop:

      Bit 0 of A = Section 1 - static status check
      Bit 1 of A = Section 2 - random positioning
      Bit 2 of A = Section 3 - write, read, compare
      Bit 3 of A = Section 4 - same as section 3 except under control of Alarm and End of Operation interrupts.
      Bit 4 of A = Section 5 - force address errors, check write and read into next cylinder.
      Bit 5 of A = Section 6 - surface test, Alarm and End of Operation interrupts selected.
      Bit 6 of A = Section 7 - check overlap seek (two disk packs needed)
      Bit 7 of A = Section 8 - same as section 3 except under control of Alarm and Ready, Not Busy interrupts
      Bit 8 of A = Section 9 - same as Section 6 except under control of Alarm and Ready, Not Busy interrupts
      Bit 9 of A = Section 10 - write address tags

Bit 10 of A = Section 11 - positioning timing check

Bit 11 of A = Section 12 - autoload check (Caution: See Restriction).

Bit 12 of A = Section 13 - check for recoverable errors

Bit 13 of A = 0, Unit 0

Bit 13 of A = 1, Unit 1

Bit 14 of A Not used

Bit 15 of A = 0, 853

Bit 15 of A = 1, 854

Q=XXYY

XX=lowest numbered cylinder to be written on (Section 12 ignores this limit)

XX=00-standard

YY=highest numbered cylinder to be written on.

YY=63_{16}- standard for 853

YY=CA_{16}- standard for 854

c. Third stop:

A = interrupt line (e.g., bit 3 in A set for interrupt line 3)

Q = not significant.

d. SELECTIVE JUMP AND STOP SETTINGS

It is advisable to set bit 11 of the Stop/Jump parameter to decrease the number of error typeouts for error code 14 (sections 3, 4, 5, 8), error

3. A typeout of parameters will occur after last stop.

D. SELECTIVE JUMP AND STOP SETTINGS

It is advisable to set bit 11 of the Stop/Jump parameter to decrease the number of error typeouts for error code 14 (sections 3, 4, 5, 8), error code 1B (sections 6, 9), and error code 1D (section 12).

E. MESSAGES

1. Typeouts or Alarms

a. Normal Program Typeouts

1. Disk pack identification during test initialization:

```
DP1008 1738 DISK PACK TEST
CP2F, VER. 4.0
IA = XXXX, FC = XX
```

2. End of Test

A	Q	A	Q
0824	Stop/Jump Parameter	Pass Number	Return Address

b. Error Alarms

All information shown is displayed after General Display **Format.**

General Display Format:

A	Q	A	Q
Information Word (838 for 3 stops, 848 for 4 stops)	Stop/Jump Parameter	Section Error Code	Return Address

c. Error Codes

01 - Internal reject of input to A

A = BADD

Q = contents of Q upon input to A

A = contents of A upon last output from A

Q = contents of Q upon last output from A

02 - Internal reject on output from A

A = director status

Q = address register status

A = contents of A upon output from A

Q = contents of Q upon output from A

03 - Interrupt status bit not set when interrupt occurred

A = selected interrupts

1 - Ready, Not Busy

2 - End of Operation

4 - Alarm

Q = status upon interrupt

A = contents of A upon last output from A

Q = contents of Q upon last output from A

04 - Non-selected interrupt occurred (or interrupt occurred too soon)

Display is the same as for error code 03

05 - Interrupt status bits not cleared by Clear Interrupt function

A = status upon interrupt
Q = status after attempting to clear interrupts

A = contents of A upon last output from A (other than Clear Interrupt function)
Q = contents of Q upon last output from A (other than Clear Interrupt function)

06 - Ready status not present

A = director status
Q = address register status

A = contents of A upon last output from A (other than Clear Interrupt function)
Q = contents of Q upon last output from A (other than Clear Interrupt function)

07 - On Cylinder status not present

A = director status
Q = address register status

08 - Busy not present after an output from A. Display same as for error code 06

09 - Storage parity error

Display same as for error code 06

0A - Defective track

Display same as for error code 06

0B - Address error

Display same as for error code 06

0C - Seek error

Display same as for error code 06

0D - Lost data

Display same as for error code 06

0E - Checkword error

Display same as for error code 06

0F - Protect fault

Display same as for error code 06

10 - Alarm condition present but Alarm Status bit not set Display same as for error code 06

11 - Address register status does not equal loaded address after loading address and waiting for Not Busy

A = BADD
Q = director status

A = address register status
Q = loaded address

12 - Not used

13 - Not used

14 - Word written does not equal word read. (This may occur in sections 3, 4, 5, and 8 of the test) Set bit 11 in the Stop/ Jump parameter to ignore checking for more errors in this sector.

A = address register status
Q = number of word in error

A = word written
Q = word read

15 - No compare status present

A = director status
Q = address register status after load address

16 - Alarm interrupt did not occur when attempting to force address error by loading illegal address

A = loaded address
Q = director status

A = interrupt line
Q = selected interrupts (see error code 03)

17 - An address error was forced but the address error status bit was not set

A = loaded address
Q = director status

18 - No alarm interrupt occurred when attempting to force address error by initiating checkword check with illegal address

Display same as for error code 16

19 - Address error status not present when writing off the end of disk pack

Display same as for error code 17

1A - Not used

1B - Unexpected data was read during surface test. Set bit 11 in the Stop/Jump parameter to ignore rest of errors in this sector or track.

A = sector in error
Q = number of work in error

A = data expected
Q = data read

1C - Maximum positioning time (165 ms) was exceeded

A = time required (ms, hexadecimal)
Q = loaded address

1D - Autoload failed to load correct data
Set bit 11 in the Stop/Jump parameter to ignore the rest of the words in error

A = BADD
Q = number of word in error

A = word written
Q = word in core after autoload

1E - End of Operation status not present

Display same as for error code 06

1F - Status other than Ready, On Cylinder is present (ignoring protect status) during static status check

Display same as for error code 07.

20 - Alarm interrupt did not occur when writing off the end of disk pack

Display same as for error code 16

21 - No interrupt occurred when End of Operation or Ready, Not Busy interrupt was selected

A = selected interrupts (see error code 03)
Q = director status

A = contents of A upon last output from A
Q = contents of Q upon last output from A

22 - Not used

23 - Not used

24 - Alarm status bit set, no alarm conditions

Display same as for error code 06

25 - No Compare status not set after attempting to force No Compare status

A = director status
Q = address register status

26 - First unit went to incorrect address during overlap seek

A = BADD
Q = director status

A = loaded address
Q = address register status

27 - Second unit went to incorrect address during overlap seek.

Display same as for error code 26

28 - Through 2F - Not used

30 - Address upon completion of a Read, Write, Compare, or Checkword Check operation is not equal to the expected address

A = contents of Q upon last output from A (other than Clear Interrupt function)
Q = director status

A = address register status
Q = expected address

31 - Recoverable error occurred during Checkword Check (section 13)

A = address of track causing error
Q = director status when last error occurred

32 - Non-recoverable error occurred during Checkword Check (Section 13)

Display same as for error code 31

33 - through 3F - Not used

40 - Operator error. Interrupt line or equipment address in error. Test must be reloaded.

A = Selected equipment address

Q = Selected interrupt line (if any)

41 - EXT reject on input to A

A = BADD

Q = Equipment address

A = Contents of A (last output)

Q = Contents of Q (last output)

42 - EXT reject output from A

A = Status

Q = Address register status

A = Last function contents of A

Q = Last function contents of Q

d. Error Stops

Stops will occur upon errors if Bit 3 in the Stop/Jump parameter is set.

II. DESCRIPTION

A. METHOD

1. Section 1 - Static Status Check

   a. Select unit

   b. Input director status

      1) Ready should be present.

      2) On Cylinder should be present.

      3) No other status (other than protected) should be present.

   c. Loop to step a 499 times

2. Section 2 - Random Positioning Check

   a. Generate 96 random numbers.

   b. Convert random number to legal addresses.

   c. Select unit.

d. Load address.

e. Check for expected address.

f. Check alarm conditions and End of Operation status.

g. Update address.

h. Loop to step c 95 times.

3. Section 3 - Write, Read, Compare

   a. Generate 96 random words and one random address.

   b. Select unit.

   c. Load address, check for expected address, alarm conditions, and End of Operation status.

   d. Write one sector.

   e. Check Not Busy address.

   f. Check alarm conditions and End of Operation status.

   g. Loop to step b if repeat conditions selected.

   h. Select unit.

   i. Load address.

   j. Read one sector.

   k. Check Not Busy address.

   l. Check alarm conditions.

   m. Loop to step n to repeat conditions.

   n. Select unit.

   o. Execute checkword check.

   p. Check alarm conditions and End of Operation status.

   q. Check Not Busy address.

   r. Loop to step n to repeat conditions.

   s. Select unit.

   t. Load address, check for expected address, check alarm conditions and End of Operation status.

   u. Execute Compare function.

   v. Check for Not Compare status.

   w. Check alarm conditions and End of Operation status.

x. Check Not Busy address.

y. Loop to step s to repeat conditions.

z. If no alarm condition or unexpected address occurred, compare input buffer with output buffer area.

aa. Execute read and loop to step Z to repeat condition.

ab. Loop to step a 95 times.

4. Section 4 - Write, Read, Compare Under Interrupt Control Same as Section 3 except interrupts on Alarm and End of Operation are selected prior to performing a Load Address, Read, Write, Checkword Check, and Compare operation. After the interrupt occurs, the status upon interrupt is checked for alarm conditions.

5. Section 5 - Force Address Errors and Check Writing Into Next Cylinder

a. Generate illegal address (00F0).

b. Select unit.

c. Select interrupt on alarm.

d. Load illegal address.

e. Check whether correct interrupt occurred.

f. Check address Error status.

g. Loop to step c to repeat conditions.

h. Select interrupt on alarm.

i. Initiate checkword check.

j. Check whether correct interrupt occurred.

k. Check address Error status.

l. Loop to step h to repeat conditions.

m. Generate an illegal address (FF00).

n. Loop to step b once.

o. Form last sector address of unit (CA9F for 854, 639F for 853).

p. Jump to step v if range of cylinders to be written into is not high enough to include this cylinder.

q. Load address, check alarm conditions.

r. Write 97 words (off end of disk pack).

s. Check whether correct interrupt occurred.

t. Check address Error status.

u. Loop to step q to repeat conditions.

v. Generate legal address.

w. Load address, check alarm conditions.

x. Write 97 words.

y. Load address, check alarm conditions.

z. Add one to second word of buffer area.

aa. Execute Compare function.

ab. Check No Compare status (it should be set).

ac. Loop to step w to repeat conditions.

ad. Generate address of last sector of a cylinder.

ae. Load address, check alarm conditions.

af. Write 97 words (into next cylinder).

ag. Check alarm conditions.

ah. Loop to step ae to repeat conditions.

ai. Load address, check alarm conditions.

aj. Execute Compare function.

ak. Check No Compare status and alarm conditions.

al. Loop to step ai to repeat conditions.

am. Load address, check alarm conditions.

an. Read 97 words.

ao. Check alarm conditions.

ap. Loop to step am to repeat conditions.

aq. If no alarm conditions occurred between steps ae to aq, compare input buffer area with output buffer area.

ar. Loop to step a 95 times.

6. Section 6 - Surface Check

   a. Set up Read and Write routines for a 1536-word buffer (one track) or a 96-word buffer (one sector) depending on available core.

   b. Generate address of first cylinder to be written on.

   c. Generate pattern, 6161 for first pass through section, CECE for second pass.

d. Fill buffer area with pattern, alternate words complemented.

e. Select unit, select interrupts on Alarm and End of Operation.

f. Load address and write under interrupt control.

g. Check for correct interrupts and alarm conditions.

h. Check Not Busy address.

i. Loop to step e to repeat conditions.

j. Increment address.

k. Loop to step f unless address is greater than last cylinder to be written into.

l. Re-initialize address.

m. Select unit, select interrupts on Alarm and End of Operation.

n. Load address and read under interrupt control.

o. Check for correct interrupts and alarm conditions.

p. Check Not Busy address.

q. If not alarm conditions occurred in step m, check whether expected pattern was read.

r. Loop to step m to repeat conditions.

s. Increment address.

t. Loop to step n unless address is greater than address of last cylinder to be written into.

u. Loop to step b once.

7. Section 7 - Check Overlap Seek

a. Generate 96 random numbers.

b. Convert to legal addresses.

c. Select first unit (unit specified in parameter word during initial parameter stop).

d. Load address.

e. Wait for End of Operation status (may still be Busy).

f. Select other unit.

g. Load address.

h. Wait for End of Operation status (may still be Busy).

i. Select first unit.

j. Wait for Not Busy.

k. Check whether address register status equals loaded address.

l. Select other unit.

m. Wait for Not Busy.

n. Check whether address register status equals loaded address.

o. Loop to step c 95 times.

8. Section 8 - Write, Read, Compare under Interrupt Control Same as Section 4 except interrupts on Alarm and Ready, Not Busy are selected

9. Section 9 - Surface Check

   Same as Section 6 except interrupts on Alarm and Ready, Not Busy are selected

10. Section 10 - Write Address Tags

   a. Generate address of first cylinder to be written onto.

   b. Select unit.

   c. Write addresses on track.

   d. Wait Not Busy.

   e. Increment track number.

   f. Loop to step c unless address is greater than address of last cylinder to be written in.

11. Section 11 - Positioning Time Check

   a. Generate 96 random numbers.

   b. Convert random numbers to legal addresses.

   c. Make several of the addresses equal to the lowest and highest possible addresses, alternately.

   d. Initiate load address, initialize ms count.

   e. Wait 1 ms.

   f. Increment ms count.

   g. Check status for Busy.

   h. Loop to step e if Busy.

i. Error if ms count greater than 145_{10}.

j. Loop to step d 95 times.

12. Section 12 - Autoload (Caution: See Restrictions)

a. Move first 1536 (600_{16}) words of core to buffer area.

b. Select unit.

c. Load address, cylinder zero, track zero, sector zero.

d. Wait Not Busy.

e. Write 1536 words.

f. Change one location in low core.

g. Stop and present message to operator.

h. Operator should push AUTOLOAD button.

i. Compare buffer area with low core.

13. Section 13 - Check Recoverable Errors

a. Initial address equals zero.

b. Select unit.

c. Initialize attempt counter.

d. Initiate checkword check.

e. Wait Not Busy.

f. Check status for Checkword, Lost Data, Seek Storage Parity, defective track errors.

g. Jump to step m if none set.

h. Save Error status.

i. Increment attempt counter.

j. Loop to step d unless attempt counter equals 10.

k. Error is not recoverable.

l. Jump to step n.

m. No errors if attempt counter equals initial value, recoverable error if not.

n. Increment track address.

o. Loop to step c unless address is greater than last possible address.

III. PHYSICAL REQUIREMENTS

A. STORAGE REQUIREMENTS

About 2550_{10} memory locations are required. If sufficient core is available, 1440 additional locations will be used.

B. TIMING (Test Running Alone, No Errors)

1. Section 1 = about 1/4 second
2. Section 2 = 8 to 9 seconds
3. Section 3 = 18 to 22 seconds
4. Section 4 = 18 to 22 seconds
5. Section 5 = 36 to 37 seconds
6. Section 6 = about 3 minutes 35 seconds for an 853, probably twice as long for an 854. Sufficient core will enable writing a track at a time. Without sufficient core for a long buffer, the section is not run unless the operator selects it. In this case, one sector is written at a time. The test will then probably take 16 times as long, or 1 hour.
7. Section 7 = 8 to 9 seconds
8. Section 8 = 18 to 22 seconds
9. Section 9 = same as section 6
10. Section 10 = 30 seconds for an 853, 1 minute for an 854
11. Section 11 = 8 to 9 seconds
12. Section 12 = Variable, operator intervention required
13. Section 13 = 35 seconds for an 853, 70 seconds for an 854. Total for sections 1, 2, 3, 4, 5, 8, 9, 11, and 13 (standard run) is about 6 minutes.

C. ACCURACY

Section 11, the positioning timing check, bases the 145 milliseconds on instruction execution time. If the instruction execution time is a few percent less than 1.1 microseconds, error typeouts may occur which are not true. Thus, in a cool room, error code 1C with calculated time = 92_{16} may be ignored.

D. EQUIPMENT CONFIGURATION

1. 17X4 Computer with 8K memory
2. 17X5 Interrupt Data Channel
3. 1738 Disk Storage System
4. One 853 or 854 Disk Storage Drive (two 853's or 854's are required for section 7).

1739 CARTRIDGE DISK DRIVE CONTROLLER
(CDD078 Test No. 78)
(CP = 2F)

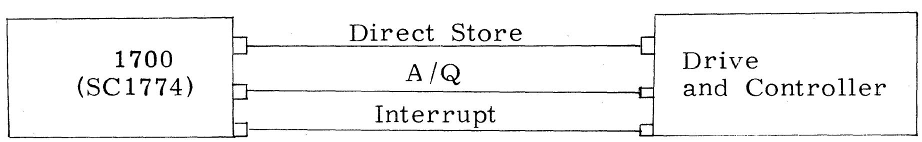
I. INTRODUCTION

The purpose of this test is to verify the operation of the Cartridge Disk Controller and Drive. The test is meant to be an engineering, manufacturing, and field maintenance test. The test will be run in an ascending order, each test becoming progressively more complex.

II. REQUIREMENTS

A. HARDWARE

The test is intended to verify the 1739 Cartridge Disk Controller. The controller is connected to the DSA and to the AQ Channel of the 1704/1705, SC1774/1773/1775, or 1784.



B. SOFTWARE

The test will reside under SMM17 and all rules of SMM17 apply.

NOTE

All references made in this document are to the 1700 System Mainenance Monitor (SMM17) Reference Manual.

C. ACCESSORIES

None

III. OPERATIONAL PROCEDURE

A. RESTRICTIONS

1. Cautions to User

a. The range of cylinders upon which data will be written on disk 0 (cartridge) may be limited during the parameter stop. The low limit must be zero for Section 12 (data is written on cylinder 0 to be autoloaded). Range limits do not apply to fixed disk.

b. A large number of typeouts and/or stops may occur for error codes 14, 1B, and 1D unless bit 11 of the Stop/Jump parameter is set.

c. In Section 12 (Autoload) the diagnostic may be destroyed if the Autoload function is not working properly. Section 12 should not be run on a Maintenance Pack.

d. When using a new pack, it is necessary to ensure that the pack has address tags, correct data, and checkwords. Data may be destroyed in shipment. Sections 7 and 10 should be run to ensure that the pack contains the correct data required for other sections; however, errors may be encountered during the initial pass of Section 7. Ignore these errors and run to completion. Rerun Section 7 for an error-free pass.

e. Bits 2 and 3 of the SMM parameter word must specify the correct machine type.

B. LOADING PROCEDURE

1. The test operates as a sub-program under control of the 1700 System Maintenance Monitor (SMM17).

2. The test mnemonic is CDD, number 78.

3. The calling sequence is that specified by SMM17.

C. PARAMETERS

1. If no parameter stop is made, the following sections will be run.

   a. Section 1
   b. Section 2
   c. Section 3
   d. Section 4
   e. Section 5
   f. Section 6
   g. Section 8
   h. Section 9
   i. Section 13
   j. Section 15

   The test will run on disk 0 (cartridge) and will ignore fixed disk. Cylinder 5 through CA_{16} will be tested. The interrupt line will be line 3.

2. To alter the parameters, follow directions stated in the SMM17 Reference Manual. If bit is set, the corresponding section or condition will be selected. The parameter words to be displayed are as follows:

   a. First Stop: A = 7821, Q = Stop/Jump Parameter.

   b. Second Stop:

      Bit 0 of A = Section 1 - preliminary check.
      Bit 1 of A = Section 2 - register verification test.
      Bit 2 of A = Section 3 - positioner check.
      Bit 3 of A = Section 4 - read, write, and compare.
      Bit 4 of A = Section 5 - same as Section 4 except under control of Alarm and End of Operation interrupts.
      Bit 5 of A = Section 6 - read, write, compare through cylinders.
      Bit 6 of A = Section 7 - surface test.
      Bit 7 of A = Section 8 - worst pattern and checkword generator test.
      Bit 8 of A = Section 9 - same as Section 4 except under Control of Alarm and Ready, Not Busy interrupts.
      Bit 9 of A = Section 10 - write address tags.
      Bit 10 of A = Section 11 - positioning time test.
      Bit 11 of A = Section 12 - autoload check.
      Bit 12 of A = Section 13 - checkword check.
      Bit 13 of A = Section 14 - protect test.
      Bit 14 of A = Section 15 - crosstrack test.
      Bit 15 of A = 0 means cartridge only present.
      Bit 15 of A = 1 means fixed disk also present.
      Q = XXYY
      XX = lowest numbered cylinder to be written on (Section 12 ignores this limit)
      XX = 05 - standard
      YY = highest numbered cylinder to be written on
      YY = CA_{16} - standard

   c. Third Stop:

      A = interrupt line (for example, bit 3 in A set for interrupt line 3)
      Q = interrupt line (for example, bit 3 in Q set for interrupt line 3)

   d. Fourth Stop:

      A = 0 - BAD track address
      Q = N/A
      Enter known bad track addresses in A and run.
      Clear A and run to proceed with test.

e. SELECTIVE SKIP and STOP Settings:

1) STOP - must be set for running of SMM17.

2) SKIP - when set, the Stop/Jump word is displayed in Q.

IV. OPERATOR COMMUNICATIONS

A. MESSAGE FORMATS

1. Normal Program Typeouts

a. Test identification during test initialization:

```
CDD078, Cartridge Disk Controller Test
        CP2F, Ver. 4.0
        IA = XXXX, FC = XX
```

b. During test Section 14 one of the following typeouts will occur:

Set PROTECT switches

Clear PROTECT switches

c. End of Test

A	Q	A	Q
7824	Stop/Jump Parameter	Pass Number	Return Address

2. Error Alarms

All information shown is displayed after General Display Format.

General Display Format:

A	Q	A	Q	etc.
Information Word (7838 for 3 stops) (7848 for 4 stops)	Stop/Jump Parameter	Section/ Error Code	Return Address	**Additional Data**

B. ERROR CODE DICTIONARY

Message Code (Hexadecimal)	Program Tag Name	Message and Description
00	INP OUTPUT	External Reject Q = Contents of Q at Reject A - N/A

Sections 5 and 9 These two tests are similar to test 4 but using interrupt control.

The remaining sections can be run in any order.

B. Explanation of an error and an example of how to repeat an error.

Example of error typeout:

A	Q	A	Q	A	Q	A	Q
7848	0049	041E	017F	0009	C801	0000	0205
(IDENT)	(STOP/JUMP)	(SEC/ERR)	(RET.ADD)	VARIABLE		DATA(either 2 or 4 words)	

The first word of the error typeout is the identifier. The second word is the Stop/Jump parameter. The third word contains the section number and the error code. For example, 041E means Section 4 had an end of operation failure. That is, EOP status bit did not set as expected. The fifth word, according to the error explanation, is the director status. The sixth word is the cylinder address that the error occurred at. The seventh word is the status at the instant of an alarm. (Since no alarm is present, this status is not applicable.) The eighth word contains the function code of the last output that was attempted before the error.

At this point, several options are available to the operator:

1. Check is the error is repetitive. Set repeat condition and check for same error again. If error is the same and operator determines that debug will be attempted at this point, a disable typeout can also be set in Stop/Jump parameter and selective stop removed and test will cycle on error.

2. If operator is not sure of the operation being performed at the time of the error, he may want to look at the test description and determine what was being attempted. The operator should proceed as follows:

Go to Section 4 description and look for error code; if error code is not listed, it indicates that it was not the major test performed in this section. Then the operator should use the error information that tells the last function attempted and look for this function in the Section 4 description. The test description shows that a compare function is executed in Section 4E (0205 indicates compare function). By scanning the entire section description, the operator can determine the sequence of events being attempted and determine how many of these will be repeated when he selects repeat condition. A closer detailed observation of the section can be obtained by looking at the listing for this test.

In some types of errors, the fourth word of the typeout or return jump address can point directly to the section where the error occurred.

C. Suggestions for running test for maintenance of a unit known to have been operating previously.

Load SMM test number 78 Cartridge Disk Drive test (CDD). Set Stop/Jump parameter to 49_{16}. If sectors containing bad surfaces are known, enter in A at the fourth parameter stop. If bad areas are known, test would be initiated as follows:

At first stop, set Q = to Stop/Jump of 49_{16}. Hit run and at second stop leave A set to normally selected sections and check Q for correct range limits. Hit run and at third stop set A and Q to correct interrupt line. Hit run and at fourth stop set A = to track number of bad sector. Hit run and at stop enter next bad track address or clear to zero and run and test will execute. If address of bad sectors are unknown, test will have to be initiated as suggested for a manufacturing operation.

VII. PHYSICAL REQUIREMENTS

A. STORAGE REQUIREMENTS - approximately 8K

B. TIMING - N/A

C. EQUIPMENT CONFIGURATION:

1. 17X4 Computer with 8K memory
2. 1705 Interrupt Data Channel
3. 1 Cartridge Disk Drive (1739/FV227)
4. Device for loading SMM tests into computer

BG504A/H DRUM CONTROLLER DIAGNOSTIC
(DRMP80 Test No. 80)

I. IDENTIFICATION

Test - BG504A/H Drum Controller Test
Number - 80
Mnemonic - DRM

II. RESTRICTIONS

Bit 8 of SMM control word must be set at load time to select MBS.

III. DESCRIPTION AND OPERATION

A. SCOPE

1. This specification describes the BG504A/H Drum Controller diagnostic. It will operate under the control of SMM17 V4.0 or above and has been assigned Test No. 80 in the SMM17 library list. The purpose of this specification is to describe the comprehensive set of test sections for both factory checkout and field maintenance.

B. APPLICABLE DOCUMENTS

1. Software

   a. 1500/VW SMM17 Software Subset of SMM17 V3.0
   b. SMM17 Manual Pub. No. 60182000
   c. MBS subset of SMM17 V3.0 ERS

2. Hardware

   a. 1700 Reference Manual Pub. No. 60153100
   b. SC-1700 Reference Manual Pub. No. 60270600
   c. BG504 Drum Subsystem Pub. No. 39731700

C. DESCRIPTION

1. Communication

   Communication with the diagnostic will be through either console or teletype. Refer to latest SMM17 manual for loading information.

2. General Test Description

a. The following areas will be tested:

1) Functions
2) Status
3) Interrupts
4) Data
5) Alarms

b. The method of testing is to make each succeeding test section more complex, forming a bootstrapping-sequential technique aimed at reducing troubleshooting time. For example:

1) Sector, initial core, and final core address registers will be verified prior to drum transfers.

2) All controller data registers will be verified prior to checking drum transfers.

c. The type of response (reply or reject) to all I/O instructions, except when reading status, will be verified against predicted values. This will include timer information to the nearest millisecond. For example, the controller may be busy, external reject, up to 17 milliseconds after initiating a Write operation. The actual checking is performed in the monitor; the test supplies the data.

d. All four status words are copied after each function, read or write. The only exception is Section 2 where only director and sector address status is copied. Although four status words are copied, only those applicable to the I/O operation will be verified.

e. To verify all eight alarm conditions, it will be necessary to "bug" specific logic areas. To achieve this, a card extender and clip lead are required. Although this procedure is primarily used by QA, it can be helpful both in checkout and in the field.

f. Preset Input Parameters

	A	Q	
Stop 1	8051	020D	ID/Stop/Jump
Stop 2	04DE	0200	Section/Number of Tracks on Drum
Stop 3	4500	0000	Interrupt/Interrupt
Stop 4	0000	0000	Low Track Limit/High Track Limit
Stop 5	5A5A	8060	Data Pattern/Control

1738 DISK QUICK LOOK TEST

(DP5P84 Test No. 84)

I. OPERATING INSTRUCTIONS

A. RESTRICTIONS

1. This is a one section test; therefore, there is no sections parameter.
2. Do not select Read and Write buffers and transfer length that could destroy either the monitor or test(s).
3. Select only EOP interrupts at Stop 5.

B. LOADING PROCEDURE

1. Called as external test under SMM17 V4.0 or above.
2. This test uses the MBS control package in V4.0; therefore, bit 08 must be set in the SMM control word after Quick Look executes.

C. PARAMETERS

If bit 00 of the SMM Stop/Jump parameter is set at the start of the test, a parameter stop occurs.

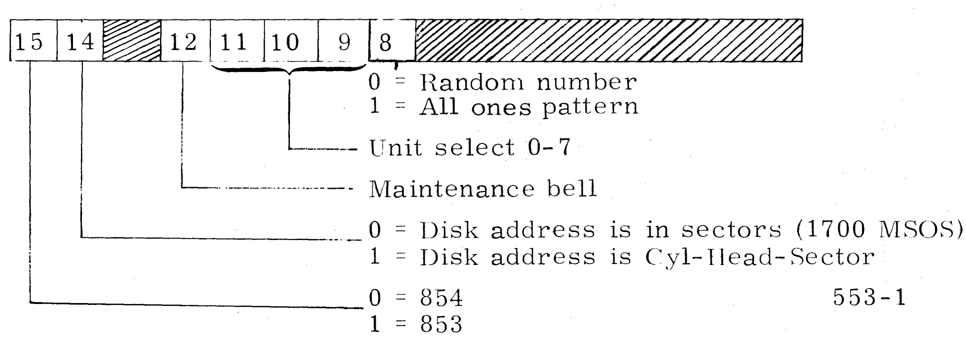
Stops	A	Q
1	8451	SJ
2	P 036E	P 036E
3	P 096F	0600
4	0000	0000
5	4400	0000

1 A = ID
  Q = Stop/Jump

2 A = First available location after test
  Q = FWA-1 Write buffer

3 A = FWA-1 Read buffer
  Q = Maximum transfer length

4 A = First available disk address
  Q =



Stop

5 A = EOP interrupt data - BLBL (status bit-line no., status bit-line no.) See Supplement F, II-D-3 for detailed explanation. A=0 to run without interrupts.

Q = 0

D. MESSAGES

No message will occur if bit 08 of the Stop/Jump word is set.

1. Test title and initial address typeout:

   1738 QUICK LOOK TEST DP5 P84
   CP2F VER 3.1
   IA = XXXX

   XXXX is the initial address of the test.

2. Parameter list type out after last stop:

A1	Q1	A2	Q2	A3	Q3	A4	Q4	A5	Q5
8451	S/J	XXXX	YYYY	ZZZZ	0600	0000	4000	4400	0000

   (See Stops)

3. End of 1738 Test:

A1	Q1	A2	Q2	A3	Q3
8434	S/J	Pass No.	Return Address	Error Count	0000

4. Error Messages

   All error messages are in the format specified by SMM17.

A1	Q1	A2	Q2
84X8	S/J	00YY	Return Address

   X = Number of pairs of words to be typed
   YY = Error code

   Additional information is given depending on the error type.

E. ERROR STOPS

1. The test reports two types of errors.

   a. MBS Detected Errors

      All MBS detected errors must be decoded based on the A3 error stop which will contain a number 0000 - 0004. The most often reported error is 0003 (status error).

A3	Q3	A4	Q4
MBS No.	Last I/O-Response	A-Register	A-Register

A3 = MBS detected error number 0000-0004
Q3 = Last I/O: Response:

10 - Write	10 = Reply
20 - Read	20 = External Reject
30 - Function	30 = Internal Reject

A4 = A register contents for last I/O
Q4 = Q register contents for last I/O

For status errors (A5, Q5, and A6) 06 will contain actual and expected values for director and cylinder address status, respectively.

See Supplement F, II-A-5 for a detailed explanation.

b. Data Errors

Error code 13 is the only data error, all others are MBS detected errors.

DESCRIPTION OF INDIVIDUAL ERROR CODES

Section/ Error Code	Application
0000	Verify director status = ready-on cylinder.
0001	Select unit with or without interrupts.
0002	Verify director status = ready and on cylinder.
0003	Seek to random address.
0004	If selected, wait 1 millisecond for interrupt. Verify ready and busy while waiting.
0005	Wait 200 milliseconds for busy to drop. Verify ready, busy, and EOP while waiting.
0006	No interrupts; verify ready, on cylinder, and EOP after busy drops. Interrupts; verify ready and on cylinder. Verify cylinder address status.
0007	Write random length, random data record.
0008	Wait for interrupt (if selected) 100 milliseconds. Verify ready and busy while waiting.
0009	Wait 100 milliseconds for busy to drop. Verify ready and busy while waiting.

Section/ Error Code	Application
000A	Verify ready, on cylinder, and EOP for no interrupts; ready and on cylinder after interrupt processing. Verify cylinder address status.
000B	Load same address used for write.
000C	If selected, wait 1 millisecond for interrupt. Verify ready and busy while waiting.
000D	Wait 100 milliseconds for busy to drop. Verify ready and busy while waiting.
000E	Interrupts; verify ready and on cylinder. No interrupts; verify ready, on cylinder, and EOP. Verify cylinder address status.
000F	Read random length, random data record.
0010	If selected, wait 200 milliseconds for the interrupt. Verify ready and busy while waiting.
0011	Wait 200 milliseconds for busy to drop. Verify ready and busy while waiting.
0012	Interrupts; verify ready and on cylinder. No interrupts; verify ready, on cylinder, and EOP. Verify cylinder address status.
0013	Data error.

A3	Q3	A4	Q4	A5	Q5
Actual	Expected	Compare Address	Error Address	Transfer Length	Last Address Output

** Interrupt Processor **

0014	Verify status after interrupt. After load address verify ready, interrupt, and EOP. Ignore cylinder address status. After data transfer verify ready, interrupt, on cylinder, and EOP. Verify cylinder address status.
0015	Reselect unit, enable interrupts.
0016	After load address verify ready status only. Ignore cylinder address status. After data transfer verify ready and on cylinder. Verify cylinder address status.

1738, 1733-1/853, 854, and QSE 4730 DISK PACK TEST

(DP3027, Test No. 27)
(CP = 2F)

I. OPERATIONAL PROCEDURE

A. RESTRICTIONS

1. Cautions to User

   a. The range of cylinders upon which data will be written may be limited during the parameter stop. The lower limit is ignored in Section 12 (data is written in cylinder 0 to be autoloaded).

   b. A large number of typeouts and/or stops may occur for error codes 14, 1B, and 1D unless bit 11 of the Stop/Jump parameter is set.

   c. In Section 12 (Autoload) the diagnostic may be destroyed if Autoload function is not working properly. Section 12 should not be run on a Maintenance Pack.

   d. When using a new pack, it is necessary to ensure that the pack has address tags and data on the entire surface before checkword functions are performed. Running Sections 6 and 10 will ensure that the pack contains correct data required for other sections; however, errors may be encountered during the initial pass of Section 6. Ignore these errors and run to completion. Rerun Section 6 for an error-free pass.

   e. Caution should be exercised when running Section 15 if DT193 is installed because it involves core to core transfer from originating computer to computer on other access. The transfer is one for one, so at the end of the section, computer 2 will have the same thing in core as computer 1, except location 0 which must be hand loaded if SMM is to be started from location 0.

   f. Bits 2 and 3 of the SMM parameter word must specify the correct machine type.

B. LOADING PROCEDURE

1. The test operates as a sub-program under control of the 1700 System Maintenance Monitor (SMM17).

2. The test mnemonic is DP3, number 27.

3. The call sequence is that specified by SMM17.

C. PARAMETERS

1. If no parameter stop is made, the test will use prestored parameters as follows:

   a. Sections 1 through 5, 8, 11, and 13.

   b. Range limits: cylinder C_{16}-low limit, cylinder 63_{16}-upper limit.

c. Interrupt line: preset to interrupt line 3

d. Unit number: preset to unit 0

2. To alter parameters, follow directions stated in SMM17. (See SMM/Operator Interface Section V.)

   a. First Stop: A = 2721, Q = Stop/Jump parameter.

   b. Second Stop:

      Bit 0 of A = Section 1 - static status check

      Bit 1 of A = Section 2 - random positioning

      Bit 2 of A = Section 3 - write, read, compare

      Bit 3 of A = Section 4 - write, read, compare using interrupts

      Bit 4 of A = Section 5 - force address errors, check write and read into next cylinder

      Bit 5 of A = Section 6 - surface test, Alarm, and EOP interrupt selected

      Bit 6 of A = Section 7 - check overlapping seek

      Bit 7 of A = Section 8 - variable sector length check

      Bit 8 of A = Section 9 - protect test

      Bit 9 of A = Section 10 - write address tags

      Bit 10 of A = Section 11 - positioning timing check

      Bit 11 of A = Section 12 - autoload check (CAUTION: see restrictions)

      Bit 12 of A = Section 13 - check word check of surface

      Bit 13 of A = Section 14 - 1733-1 extra options check

      Bit 14 of A = Section 15 - core to core transfer and check

      Bit 15 of A = 0, 853 type disk drive

      Bit 15 of A = 1, 854 type disk drive

      Range limits Q = XXYY

      XX = lowest numbered cylinder to be written on (Section 12 ignores this limit)

      XX = $0C_{16}$ - preset value

      YY = highest number cylinder to be written on

      YY = 63_{16} - preset value is for 853

      YY = CA_{16} - value to be entered for 854

c. Third Stop:

A = interrupt line (e.g., bit 3 in A set for interrupt line 3)

Q = set bit X to run unit X. The lowest unit selected will be run in all sections except Section 7, (overlap seek) where all units selected will be run (bit 0 = unit 0, bit 1 = unit 1, etc.)

d. SELECTIVE SKIP and STOP Settings:

1. STOP - should be set for SMM17 running.

2. SKIP - should only be set to display Stop/Jump parameters for purposes of changing same.

II. OPERATOR COMMUNICATIONS

A. MESSAGE FORMATS

1. Normal Program Typeouts

a. Test identification during test initialization:

```
DP 3027, 1700 Disk Subsystem
CP2F, Ver. 4.0
IA - XXXX, FC = XX
```

b. End of Test

A	Q	A	Q
2724	Stop/Jump Parameter	Pass Number	Return Address

2. Error Messages

General format of error display is shown under SMM/Operator Interface Descriptions in Section V of SMM Manual.

General Display Format:

A	Q	A	Q	A Q
Information Word (2738 for three stops and 2748 for four stops)	Stop/Jump Parameter	Section/ Error Code	Return Address	Additional Data

B. ERROR CODE DICTIONARY

Message Code (Hexadecimal)	Program Tag Name	Message and Description
00	INP	External reject
	OUTPUT	A = Director status at reject
		Q = Contents of Q at reject
01	INP	Internal reject of input to A
	IECHK	A = BADD
	IED	Q = Contents of Q upon input to A
		A = Contents of A at last output from A
		Q = Contents of Q at last output from A
02	OUTPUT	Internal reject on output from A
	IEA	A = Director status
		Q = Address register status
		A = Contents of A at last output from A
		Q = Contents of Q at last output from A
03	IEC	Interrupt status bit not set when interrupt occurred
		A = Selected interrupts
		1 - Ready, not busy
		2 - End of operation
		4 - Alarm
		Q = Status at interrupt
		A = Contents of Q at last output
04	IEB	Non-selected interrupt occurred (or interrupt occurred too soon)
		Display same as error code 03
05	IEE	Interrupt status bits not cleared by clear interrupt function
		A = Status at interrupt
		Q = Status after clearing interrupt
		A = Contents of A at last output from A
		Q = Contents of Q at last output from A (other than Clear Interrupt function)

Message Code (Hexadecimal)	Program Tag Name	Message and Description
17	SEC5D SEC5V	An address error was forced but status bit not set A = Loaded address Q = Director status
18	SEC5U	No alarm interrupt occurred when attempting to force address error by initiating checkword check with illegal address Display same as error code 16
19	SEC5I	Address error not present when writing off end of pack Display same as error code 17
1A	BUSYPRES	Controller hung busy (automatic abort if run after error) A = Director status Q = Return address of routine calling busy A = Contents of A during last output Q = Contents of Q during last output
1B	SEC6 ERROR	Surface check detected data error A = Address of sector in error Q = Number of word into sector A = Data expected Q = Data read (Set bit 11 in Stop/Jump parameter to ignore rest of errors in this sector or track.)
1C	SC11B	Maximum positioning time (165 milliseconds) was exceeded A = Time required (milliseconds, hexadecimal) Q = Loaded address.
1D	S12D	Autoload failed to load correct data. Set bit 11 in the Stop/Jump parameter to ignore the rest of the words in error A = BADD Q = Number of word in error A = Word written Q = Word in core after autoload

Message Code (Hexadecimal)	Program Tag Name	Message and Description
1E	CONALARM	End of operation status not present Display same as for error code 06
1F	SEC1B	Status other than Ready, On Cylinder is present (ignoring protect status) during static check Display same as for error code 07
20	SEC5X	Alarm interrupt did not occur when writing off the end of disk pack Display same as for error code 16
21	ADRINTP WRT1 RD1 CW1 CB1	No interrupt occurred when End of Operation or Ready, Not Busy interrupt was selected A = Selected interrupts (see error code 03) Q = Director status A = Contents of A upon last output from A Q = Contents of Q upon last output from A
22	ADW2 SEC8	During a wait for operation to complete busy dropped before expected address was attained A = Director status Q = Cylinder status A = Buffer length Q = Expected address
23	ADW5 SEC8	During a wait for operation to complete expected address was attained; however, busy did not drop Display same as error code 22
24	CONALARM	Alarm status bit set, no alarm condition Display same as error code 06
25	SEC5M	No compare status not set after attempting to force no compare status A = Director status Q = Cylinder register status

1733-2 MULTIPLE CARTRIDGE DISK DRIVE CONTROLLER
(MDC07A Test No. 7A)
(CP = 2C)

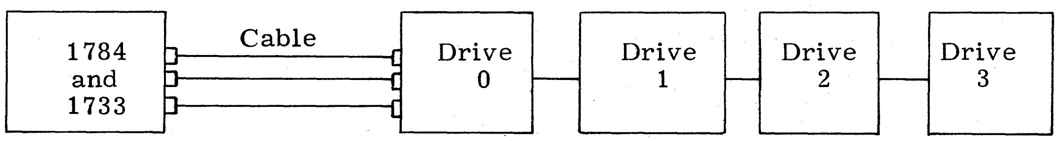
I. INTRODUCTION

The purpose of this test is to verify the operation of the Cartridge Disk Controller and Drives. The test is meant to be an engineering, manufacturing, and field maintenance test. The test will be run in an ascending order, each test becoming progressively more complex.

II. REQUIREMENTS

A. HARDWARE

The test is intended to verify the 1733-2 Cartridge Disk Controller. The controller is connected to the internal DSA and to the AQ Channel of the 1784.



B. SOFTWARE

The test will reside under SMM17 and all rules of SMM17 apply.

NOTE

All references made in this document are to the 1700 System Maintenance Monitor (SMM17) Reference Manual.

C. ACCESSORIES

None

III. OPERATIONAL PROCEDURE

A. RESTRICTIONS

1. Cautions to User

   a. The range of cylinders upon which data will be written on disk 0 (cartridge) may be limited during the parameter stop. The low limit must be zero for Section 12 (data is written on cylinder 0 to be autoloaded).

   b. A large number of typeouts and/or stops may occur for error codes 14, 1B, and 1D unless bit 11 of the Stop/Jump parameter is set.

c. In Section 12 (Autoload) the diagnostic may be destroyed if the Autoload function is not working properly. Section 12 should not be run on a Maintenance Pack.

d. When using a new pack, it is necessary to ensure that the pack has address tags, correct data, and checkwords. Data may be destroyed in shipment. Sections 3 and 7 should be run to ensure that the pack contains the correct data required for other sections; however, errors may be encountered during the initial pass of Section 7. Ignore these errors and run to completion. Rerun Section 7 for an error-free pass.

e. Range limits must be set for single dens drives if there is a mixture of drives on this controller.

B. LOADING PROCEDURE

1. The test operates as a sub-program under control of the 1700 System Maintenance Monitor (SMM17) **Version 3.0 on.**

2. The test mnemonic is MDC number 7A.

3. The calling sequence is that specified by SMM17.

C. PARAMETERS

1. If no parameter stop is made, the following sections will be run.

   a. Section 1
   b. Section 2
   c. Section 4
   d. Section 5
   e. Section 6
   f. Section 7
   g. Section 8
   h. Section 11
   i. Section 13
   j. Section 15

The test will run on disk 0 and the fixed disk. Cylinder O through $CA80_{16}$ will be tested. The interrupt line will be line 3.

Q = Stop/Jump Parameters

Bits 0-6	- Defined by SMM
Bit 7	- Repeat subsection
Bits 8-10	- Defined by SMM
Bit 11	- Report only first data error of this read

12 - Section 2 only - repeat condition with clear controller while doing incremental addressing test only.

13 - Section 2 only - repeat condition with clear controller while doing random addressing only.

14 - Section 4 only - SLS must be set. This forces a stop with
A = Data pattern you want to be used by this section.
Q = Disk address to be used by this section. This condition will repeat until bit 14 is dropped.

2. To alter the parameters, follow directions stated in the SMM17 Reference Manual. If bit is set, the corresponding section or condition will be selected. The parameter words to be displayed are as follows:

a. First Stop: A = 7A41. Q = Special

b. Second Stop:

A =	Bit 15 = Fixed disk will also be tested
Crosstrack Test	Bit 14 = Section 15*
Protect Test	Bit 13 = Section 14
Checkword Check	Bit 12 = Section 13*
Auto Load Check	Bit 11 = Section 12*
Position Time Text	Bit 10 = Section 11*
	Bit 9 = Unused
Head and Sector Address Test	Bit 8 = Section 9
Worst Pattern, Checkword Gen.	Bit 7 = Section 8*
Surface Test	Bit 6 = Section 7*
Status Forcing	Bit 5 = Section 6*
Write, Read, Compare EOP and Alm Int., Random Cylinder	Bit 4 = Section 5*
Write, Read, Compare Test, Random Sector, Same Cylinder	Bit 3 = Section 4*
Write Address Tags	Bit 2 = Section 3*
Positioner Test	Bit 1 = Section 2*
Preliminary Test	Bit 0 = Section 1*

Q = Unit Select (Bit 0 = Unit 0, Bit 1 = Unit 1) etc.

c. Third Stop:

A = OLLL low cylinder address to write on (0000)

LLL = lowest numbered cylinder to be written on (Section 12 ignores this limit)

LLL = 00 - standard

Q = OHHH high cylinder address to write on (195) or (00CA)

HHH = highest numbered cylinder to be written on

HHH = 195_{16} - standard

d. Fourth Stop:

A = IRPT line (Bit 0 = Line 0, etc.)

Q = O = single dens drive (202 cylinders)

$\overline{O}$ = double dens (405 cylinders)

e. Range limits (parameter A3/Q3) affect all selected drives equally; therefore, if there is a mixture of drives, the limits must be set for maximum 100TPI drive.

Internal Test Stop = bad cylinder address file, enter cylinder addresses in A and run terminate list via A = O. This affects all selected drives equally. (Actual entry should be track, head, and surface with sector count equal to zero.)

f. Selective SKIP and STOP Settings:

1) STOP - may be set for running of SMM17

2) SKIP - when set, forces an SMM STOP A = ID Q = MSTJP

IV. OPERATOR COMMUNICATIONS

A. MESSAGE FORMATS

1. Normal Program Typeouts

a. Test identification during test initialization:

```
MDC07A Multiple Drive Cartridge Disk Test
       IA = XXXX, FC = XX VR=4.0 CP=2C
```

b. During test Section 14 one of the following typeouts will occur:

Set PROTECT switches

Clear PROTECT switches

c. End of Test

A	Q	A	Q
7A24	Stop/Jump Parameter	Pass Number	Return Address

2. Error Alarms

All information shown is displayed after General Display Format.

General Display Format:

A	Q	A	Q	etc.
Information Word (7A48 for 3 stops) (7A48 for 4 stops)	Stop/Jump Parameter	Unit Number/Section/ Error Code	Return Address	Additional Data

B. ERROR CODE DICTIONARY

Message Code (Hexadecimal)	Program Tag Name	Message and Description
00	INP	External Reject
	OUTPUT	Q = Contents of Q at Reject
		A = N/A
01	INP	Internal reject on input to A
	CLRCON	A = BADD
	IECHK	Q = Contents of Q when input to A
	IED	A = Contents of A during last output
		Q = Contents of Q during last output
02	OUTPUT	Internal reject on output
	IEA	A = Director status
		Q = Cylinder register status
		A = Contents of A when output attempted
		Q = Contents of Q when output attempted
03	IEC	Interrupt received but interrupt status bit not set
		A = Selected interrupts
		Q = Director status at interrupt
		A = Contents of A during last output
		Q = Contents of Q during last output
04	IEB	Interrupt other than was selected occurred (or interrupt occurred too soon)
		Display same as error code 03
05	IEE	Interrupt status bits not cleared by clear interrupt function
		A = Director status at interrupt
		Q = Director status after clear interrupt function
		A = Contents of A during last output
		Q = Contents of Q during last output
06	CONALARM	Ready status bit not present
		A = Director status
		Q = Cylinder register status
		A = Director status at instant of alarm. (True cylinder status when seek error (code C) is detected.) Contents of A on last output if no alarm detected
		Q = Contents of Q on last output

Message Code (Hexadecimal)	Program Tag Name	Message and Description
07	SECIA	On cylinder status bit not present A = Director status Q = Cylinder register status A = Contents of A at last output Q = Contents of Q at last output
08	BUSYPRES	Busy not present as expected A = Director status Q = N/A
09	CONALARM	Storage parity error Display same as error code 06
0A	CONALARM	Drive fault (non-recoverable) Display same as error code 06
0B	CONALARM	Address error Display same as error code 06
0C	CONALARM	Seek error (controller). This error should recover Display same as error code 06
0D	CONALARM	Lost data Display same as error code 06
0E	CONALARM	Checkword error Display same as error code 06
0F	CONALARM	Protect fault Display same as error code 06
10	CONALARM	Alarm condition present but alarm status bit not set Display same as error code 06
11	ADDRESS	File address status does not equal computed value A = BADD Q = Director status A = Cylinder register status Q = Expected cylinder register

Message Code (Hexadecimal)	Program Tag Name	Message and Description
12	WAIT	Controller hung or busy A = Director status Q = Address of originating routine (BIASED) A = Director status at instant any alarm occurred Q = Contents of Q during last output
13	CONALARM	Seek error (drive) Display same as error code 06
14	COMPARE	Data compare error. Write buffer and read buffer are compared in computer A = Cylinder register status Q = Number of word in sector that is wrong A = Word written Q = Word read (By setting bit 11 in Stop/Jump parameter, multiple errors in the same buffer can be eliminated)
15	COMBUF CB2	No compare status bit set A = Director status Q = Cylinder register status
16	SEC6B	No alarm interrupt occurred when forcing an address error by sending illegal difference A = Illegal difference sent Q = N/A
17	SEC6D	An address error was forced but status bit not set A = Illegal address Q = Interrupt status
18	SEC1N	Cylinder, CWA, Checkword, or True cylinder not clear after clear controller was sent A = Contents of incorrect register Q = Function code for incorrect register
19	SEC6I	Address error status not set when writing off end of file Display same as for error code 17

Message Code (Hexadecimal)	Program Tag Name	Message and Description
1A		Seek complete did not come up at end of seek A = Drive cylinder status (status 5) Q = Unit number expecting seek complete
1B	SEC7 ERROR	Surface check detected error A = Address of sector in error Q = Number of words into sector A = Data written Q = Data read (By setting bit 11 in Stop/Jump parameter, multiple errors in the same buffer can be eliminated)
1C	SEC11B	Maximum positioning time exceeded (96 milliseconds) A = Actual length to position Q = Address positioned to A = Address positioned from Q = N/A (To make this error valid, bits 2 and 3 in SMM parameter must be set for SC1784) 600 or 900 ns
1D	S12D	Auto load failed to load correct data A = BADD Q = Word in error A = Word written Q = Word in core after autoload
1E	CONALARM	End of operation status not present Display same as error code 06
1F	SEC1J-SEC1B	Status other than Ready and On Cylinder after an output function A = Director status Q = Expected status
20	SEC6X	Alarm interrupt did not occur when writing off end of file A = Last address of file Q = N/A
21	ADPRINTP WRT1 RD 1 CW 1 CB 1	No interrupt occurred when EOP, Ready, Not Busy interrupts were selected A = Selected interrupt Q = Director status A = Contents of A during last output Q = Contents of Q during last output

Message Code (Hexadecimal)	Program Tag Name	Message and Description
22	SEC1K	Expected external reject on forced busy did not occur A = 0 - illegal reply; 100-internal reject Q = N/A
23	CWACOMP	Current Word Address register incorrect A = Actual CWA contents Q = Expected CWA contents A = Contents of A during last output Q = Contents of Q during last output
24	CONALARM	Alarm bit set, no alarm conditions set. Display same as error code 06
25	SEC6M	No compare status bit not present A = Director status Q = Cylinder register status
26	CDFA	Cylinder register status does not equal computed cylinder status A = Cylinder register status Q = True cylinder status A = Contents of A during last output Q = Contents of Q during last output
27	CNFE	Cylinder register status incorrect after an operation A = Cylinder register status Q = Expected register contents A = Contents of A during last output Q = Contents of Q during last output
28	SEC1M	Did not get external reject on illegal input director 06 and 07 A = 10 - illegal reply; 0 - internal reject Q = Contents of Q during input
29	SEC14G	Expected protect fault did not occur A = Director status Q = N/A A = Contents of A during last output Q = Contents of Q during last output
2A		Not available
2B		Not available

Message Code (Hexadecimal)	Program Tag Name	Message and Description
2C		Not available
2D		On cylinder status did not drop after doing a seek from zero to maximum limit A = Actual status Q = 0001
2E	SEC1Q	Output buffer length with immediate input of CWA gave incorrect results A = Contents of CWA register Q = Value sent as buffer length
2F		On cylinder status did not drop during RTZS on clear controller function A = Director status Q = Director function on input
30	CHKTRK	Cylinder register not equal to expected value after an operation was executed A = Last output function Q = Director status A = Cylinder register status Q = Expected cylinder status
31	SECTION 13	Recoverable error occurred during checkword check A = Address of track causing error Q = Director status when last error occurred
32	SECTION 13	Non-recoverable error occurred during checkword check. Display same as error code 31
33	SEC2J	Suspected DSA address error (Read/Write must have been verified). In a manufacturing test environment test 2 is necessarily run before test 4 because of degree of difficulty. However, when error 33 occurs, then test 4 must be run before test 2 can be completely verified A = DSA address at failure (THIS IS FWA) Q = N/A A = Data written as determined by software Q = Data read from disk

Message Code (Hexadecimal)	Program Tag Name	Message and Description
34	SEC15	Crosstrack error A = Address of the error detected Q = First of the three tracks that were used
35	STBT SEC7	Table of Bad Track has been exceeded (limit is 10)
36	SEC8E, G, H, etc.	An incorrect checkword was detected A = Checkword status Q = Expected checkword status
37	S11T3	Cylinder to cylinder position time exceeded A = Actual time Q = Specified limit
38		Not used
39		During overlapping operations unit is found not prepared for address A = Director status Q = N/A
3A		Data error during overlapping operations A = N/A Q = Number of word in buffer A = Expected data Q = Actual data
3B		Lost seek complete with address counters A = Unit 0 address count (number of addresses sent this unit) Q = Unit 1 address count (number of addresses sent this unit) A = Unit 2 address count (number of addresses sent this unit) Q = Unit 3 address count (number of addresses sent this unit)
3C		Lost seek complete with address A = Present address unit 0 Q = Present address unit 1 A = Present address unit 2 Q = Present address unit 3
40		Operator error. Interrupt line or equipment address in error. Restart test A = Selected equipment address Q = Selected interrupt line if any

Message Code (Hexadecimal)	Program Tag Name	Message and Description
41		Operator error. No unit selected. Test will restart A = Unit selection Q = N/A
50		Illegal reply to unprotected output instruction and a protected controller A = Data output Q = Equipment address
60		External reject of unprotected output instruction and an unprotected controller A = Last status Q = Contents of Q on last status A = Data output Q = Contents of Q on last output
61		Internal reject - same as error 60
62		On cylinder status did not reset after RTZS on clear controller function A = Director status Q = Director function on input
63		Drive unit not ready A = Director status Q = Director function on input

NON ERROR MESSAGES

A = (ID) 7A1F

Q = Message code

1 = Clear 1784 PROTECT switch

1F = Set 1784 PROTECT switch

V. DESCRIPTION

A. GENERAL DESCRIPTION

1. Cartridge Disk Drive Controller (MDC-7A) test is divided into 15 individually selectable test sections. Sections 1, 2, 4 through 8, 11, 13 and 15 are normally selected tests. Sections 3, 9, 10, 12 and 14 are optional. MDC-7A test sections are divided into subsections and are labeled with program tags such as SEC 8A, B, C, etc. Sec 8 is Section 8 and the letter indicates the subsection.

a. The standard test error messages contain the section currently executing. Each error code defined in the error list contains a program reference tag and each test description contains the applicable error codes. The Return address in error messages (may or may not be biased) gives the listing address the error it came from. It is important to note that the Return address may just give a subroutine area which generated the error. To trace back the error, it may be necessary to go to the beginning of the routine and look in the Return Jump address to get the area in the test you came from. This may have to be done more than once to actually get back to the section that the error indicates caused the error.

b. Sections are structured to run sequentially.

c. If an error is encountered, it may be helpful to run other sections for trouble analysis and to get a more favorable sequence of operation.

d. Normally, the test should run with the entire surface available; however, it may be desirable to restrict the test to certain areas (see parameters).

NOTE

The test may be restricted to as little as one cylinder.

e. Operations performed with a repeat condition are shown in the test description.

f. Section 7 is used to determine defective tracks. However, this section cannot be run until there is a high degree of confidence that the Read, Write, and Compare operations are relatively error free.

g. With a new cartridge or fixed disk, Sections 3 and 7, in that order, must be selected individually to assure address tags and data on entire disk. Failure to do this will cause unrecoverable errors.

B. SECTIONS DESCRIPTION

SECTION 1 PRELIMINARY CHECKS

Error Code	Program Tag Name		Description of Program
U101 U106	SEC1C	*	Clear controller function Input cylinder register status Input director status
U107 U11F	SEC1A		Verify on cylinder present Verify only on cylinder and ready present
U127	SEC1E		Verify cylinder register after CL CONT RC

Error Code	Program Tag Name		Description of Program
U101	SEC1F	*	Clear controller function
U102			Output clear interrupt function
U102			Position forward one cylinder
	SEC1F		Check alarms
U127			Verify cylinder register
			RC
U11F	SEC1J	*	Verify EOP drops on output function
			RC
U122	SEC1K	*	Clear controller function
			Verify busy status give external reject
			RC
			WAIT NOT Busy
	SEC1L		Clear controller function
			Position to cylinder 1
U117	SEC1LA	*	Verify excess negative difference - address error
			Verify address error and alarm
			RC
U128	SEC1M	*	Verify external reject on input director 06 and 07
			Execute illegal input function
			RC
U118	SEC1N	*	Verify all registers zero after clear controller
			Check CWA status
			Check checkword status
			Check true cylinder status
			RC
U12E	SEC1Q	*	Verify all bits operational in CWA register
			RC
			Next iteration - jump to SEC1C
			Repeat section

SECTION 2 POSITIONING TEST

Error Code	Program Tag Name		Description of Program
	SEC2		Position to each legal address on the disk
U327	SEC2X3	*	Position to random address
U326			Write 60 word buffer
			RC
U323			Update for new address. Return to position until done
			Repeat section

SECTION 3 WRITE ADDRESS TAGS

Error Code	Program Tag Name	Description of Program
	SEC3	Initialize section
		Clear controller
	SEC3A	Load address
	SEC3B	Write address tags
		Check alarm
		RC
		Advance track count
		Jump back to SEC3A until first disk complete
		Check for fixed disk - if present, jump to SEC3A
		RC
		Repeat section

SECTION 4 WRITE, READ, COMPARE TEST, RANDOM SECTORS ON SAME CYLINDER

Error Code	Program Tag Name		Description of Program
	SEC4		Set passcount Clear controller
	SEC4A		Generate random data and random first address
	SEC4B	*#	Write 60 word buffer RC
	SEC4C	*	Read 60 word buffer RC
	SEC4D	*	Checkword check of track RC
U415 U430	SEC4E	*	Compare 60 word buffer Check cylinder register advance RC
U414	SEC4F	*	Compare data read against data written RSC RC Next iteration jump to SEC4A Repeat section

SECTION 5 WRITE, READ, COMPARE UNDER INTERRUPT CONTROL ON RANDOM CYLINDERS

Error Code	Program Tag Name		Description of Program
	SEC5		Set section passcount Clear controller
	SEC5Z		Request interrupt
	SEC5D		Generate random data and random address
U521 U530	SEC5A	*#	Write under interrupt control Check cylinder register advance RC
U521 U530	SEC5B	*	Read under interrupt control Check cylinder register advance RC

Sections 5 and 9 These two tests are similar to test 4 but using interrupt control.

The remaining sections can be run in any order.

B. Explanation of an error and an example of how to repeat an error.

Example of error typeout:

A	Q	A	Q	A	Q	A	Q
7A48	0049	041E	017F	0009	C801	0000	0205
(IDENT)	(STOP/JUMP)	(SEC/ERR)	(RET.ADD)	VARIABLE		DATA(either 2 or 4 words)	

The first word of the error typeout is the identifier. The second word is the Stop/Jump parameter. The third word contains the section number and the error code. For example, 041E means Section 4 had an end of operation failure. That is, EOP status bit did not set as expected. The fifth word, according to the error explanation, is the director status. The sixth word is the cylinder address that the error occurred at. The seventh word is the status at the instant of an alarm. (Since no alarm is present, this status is not applicable.) The eighth word contains the function code of the last output that was attempted before the error.

At this point, several options are available to the operator:

1. Check is the error is repetitive. Set repeat condition and check for same error again. If error is the same and operator determines that debug will be attempted at this point, a disable typeout can also be set in Stop/Jump parameter and selective stop removed and test will cycle on error.

2. If operator is not sure of the operation being performed at the time of the error, he may want to look at the test description and determine what was being attempted. The operator should proceed as follows:

Go to Section 4 description and look for error code; if error code is not listed, it indicates that it was not the major test performed in this section. Then the operator should use the error information that tells the last function attempted and look for this function in the Section 4 description. The test description shows that a compare function is executed in Section 4E (0205 indicates compare function). By scanning the entire section description, the operator can determine the sequence of events being attempted and determine how many of these will be repeated when he selects repeat condition. A closer detailed observation of the section can be obtained by looking at the listing for this test.

In some types of errors, the fourth word of the typeout or return jump address can point directly to the section where the error occurred.

C. Suggestions for running test for maintenance of a unit known to have been operating previously.

Load SMM test number 7A Cartridge Disk Drive test (MDC). Set Stop/Jump parameter to 49_{16}. If sectors containing bad surfaces are known, enter in A at the fourth parameter stop. If bad areas are known, test would be initiated as follows:

At the first stop, set Q = to Stop/Jump of 49_{16} and hit RUN. At the second stop, leave A set to normally selected sections, set Q for unit select, and hit RUN. At the third stop, set A for low cylinder limit, set Q for high cylinder limit, and hit RUN. At the fourth stop, set A for interrupt line with Q set for drive density type. Hit RUN and test parameters will be typed out; test will halt with A=0. Set A= to track number of bad sector. Hit RUN, change A to track number of next bad sector at stop or clear to zero, and run for test to execute.

VII. PHYSICAL REQUIREMENTS

A. STORAGE REQUIREMENTS - approximately 8K

B. TIMING - N/A

C. EQUIPMENT CONFIGURATION

1. 1784-X Computer with 12K Memory
2. Interrupt Data Channel
3. 1 Cartridge Disk Drive 1733-2
4. Device for loading SMM tests into computer

1744/274 DIGIGRAPHICS SYSTEM

(DIGA4F Test No. 4F)

The following information contains the procedure for performing each of the Digigraphics test programs. Test program 2 relates to alignment of the 274 Console. This procedure illustrates the method for stepping through each test phase of the console alignment; it does not include the alignment procedure. The user must still refer to the 274 Digigraphics Console Reference/Customer Engineering Manual (Pub. No. 60279100) for specific information on how adjustments are to be performed.

OPERATIONAL PROCEDURE

A. HARDWARE REQUIREMENTS

1. 1704 or 1774 Computer
2. 1744 Digigraphic Controller
3. 274 Display Console
4. 1706 Channel (optional)

B. SOFTWARE REQUIREMENTS

1. Test operates under control of SMM 17.
2. Test is a stand-alone test.
3. Test is approximately $2A70_{16}$ locations in length.
4. Bit 5 of the SMM parameter must be set to run the test (NON-interrupt mode).

C. LOADING PROCEDURE

1. The test must be loaded under SMM 17 as test number 4F.
2. The test may be restarted from Initial Address.

D. PARAMETERS

Once the test has been loaded the following procedure is applicable.

1. Teletype types: Interrupt Line 1 to F.
2. Enter interrupt line; 1 to $F.

3. Depress carriage RETURN key.

4. Teletype types: DATA CHANNEL.

5. Type: 0 (if 1706 BDC not used)

   or

   1 (if 1706 BDC used)

6. Teletype types: EQUIP NO.

7. Enter equipment number; 1 to $F

8. Depress carriage RETURN key.

9. Teletype types: TYPE TEST NUMBER.

10. Check that all computer console lever switches are in center position.

11. Type test number: X where X = 1-9.
    (For test 6 go to step 12 and skip step 11.)

12. Go to test program procedure to be performed.

13. Repeat steps 10 through 12 for each test.

NOTE

If at the completion of any test program, the 274/1744 Maintenance Test is to be exited, return to System Maintenance Monitor Control:

a. Depress and release SELECTIVE SKIP lever switch.

b. Teletype types: TYPE TEST NUMBER.

c. Type: E

d. Depress and release carriage RETURN key.

E. TEST PROGRAMS

1. Test 1: Core Test Program

   a. Phases 1 and 2.

      1) Set SELECTIVE STOP lever switch to up position. (Switch must remain in this position for the normal execution of the Core Test Program.)

      2) Teletype types: ENTER MEMORY SIZE 4 or 8.

      3) Type: 4 (if 1744 core memory = 4K)

         or

         8 (if 1744 core memory = 8K)

4) Depress carriage RETURN key.

5) Teletype types: 1744 CONTROLLER MEMORY
MODULE ADDRESS ACTUAL DESIRED

NOTE

Phase 1 and phase 2 of core test are now in progress (test requires 1 to 2 minutes for execution). If both phases are performed without error, teletype will print message indicated in Phase 3, step 1). This signifies entry into phase 3 of core test. If test fails, an error type-out will be printed conforming to the format above.

b. Phase 3.

1) Teletype has typed: ENTER TEST PATTERN IN A REG-RUN.

2) Depress REGISTER SELECT button.

3) Depress display register CLEAR button.

4) Using the display register buttons, enter the test pattern to be written into 1744 core (this pattern will also be read and verified).

5) Momentarily set RUN/STEP lever switch to RUN position and release.

6) Teletype types: XXXX HEX TEST PATTERN SELECTED.
(XXXX = test pattern selected, in hexadecimal).

7) If you previously designated that the 1744 has an 8K memory, perform steps a) through c); with a 4K memory, omit these steps.

   a) Teletype types: TYPE 0 OR 1 TO SELECT MODULE.

   b) Type: 0 (if you desire Module 0 to be exercised)
   or
   1 (if you desire Module 1 to be exercised)

   c) Depress and release carriage RETURN.

NOTE

Module 1 or 2 is currently being exercised. It takes approximately 1 minute to complete the Read, Write and Verify operation. If no errors occur, the operation will continually be recycled. If an error is detected, the teletype will print out the error information.

8) To exit phase 3, press and release teletype MANUAL INTERRUPT button.

c. Phase 4.

1) Teletype has typed: R or W.

2) Type: W (if you want a continuous write operation performed)

or

R (if you want a single write operation followed by a continuous read)

3) Teletype types: ENTER TEST PATTERN IN A REG-RUN

4) Press REGISTER SELECT button.

5) Press display register CLEAR button.

6) Set the display register buttons to reflect the pattern to be used for the continuous read or write operation.

7) Momentarily set RUN/STEP lever switch to RUN position and release.

8) Teletype types: XXXX HEX TEST PATTERN SELECTED (XXXX = test pattern selected, in hexadecimal).

9) If you previously designated that the 1744 has an 8K memory, perform steps a) through c); with a 4K memory, omit these steps.

   a) Teletype types: TYPE 0 or 1 TO SELECT MODULE.

   b) Type: 0 (if you wish the continuous read or write operation performed with Module 0)

   or

   1 (if you wish the continuous read or write operation performed with Module 1)

   c) Depress and release carriage RETURN key.

NOTE

The continuous read or write operation is now in progress. There is no verification during this phase. The program will continually loop until user desires to manually exit test.

10) To exit from Core Test Program:

   a) Set SELECTIVE STOP lever switch to center position.

   b) Press REGISTER SELECT button.

   c) Press and release SELECTIVE SKIP lever switch.

   d) Teletype types: TYPE TEST NUMBER

   e) Go to next test program.

2. Test 2: 274 Console Test Program

NOTE

The following procedure enables the user to step through all the phases of the console test program. It is intended to supplement the current console alignment procedure in the Digigraphics console customer engineering manual. The user must still refer to the alignment procedure for complete and accurate guidance.

a. Teletype types: NUMBER

b. Choose one of the following:

If user desires only to step through the high voltage on checks (phases 15-18, see Table 1), perform the following:

1) In reply to the teletype message, NUMBER, type: 15

2) Press carriage RETURN. (Test phase is now in progress; 274 Console displays square type pattern).

3) Omit steps c through f. and go directly to step g.

OR

If user desires to step through each test phase, see Table 1, and proceed to step c.

c. Turn off the 274 Console high-voltage power supply.

CAUTION

Console test phases 1 through 14 should be performed with the console high voltage turned off. Failure to turn off high voltage may cause burn spots on the Console CRT screen.

NOTE

If user attempts to enter console test phases 1 through 14 with high voltage on, teletype types: TURN OFF HIGH VOLTAGE. The proper response to this message is:

1) Turn off 274 Console high-voltage power supply.

2) Wait until type-out stops.

3) Depress and release teletype MANUAL INTERRUPT pushbutton.

4) Teletype types: NUMBER

5) Go to step h.

Remove the 274 Console preamplifier cards at locations J43 and J66. (Turn console off while cards are being removed or inserted).

CAUTION

Console test phases 1 through 12 should be performed with the console preamplifier cards at jack locations J43 and J66 removed. Failure to remove cards will cause the console deflection amplifiers to overheat. Make certain that preamplifier cards are replaced before turning high voltage back on.

d. In reply to the teletype message, NUMBER, type: 1.

e. Press carriage RETURN.

NOTE

Phase 1 of console test is now in progress.

TABLE 1. CONSOLE TESTS

CAUTIONS

High voltage off for phases 1-14.
Do not turn high voltage back on until phase 15 is executed.
Preamplifier cards out for phases 1-12, replace after entering phase 13.
Never turn high voltage on while preamplifier cards out.
Turn console off when cards are being removed or inserted.
Refer to Digigraphics console customer engineering manual for exact sequencing of items above.

Phase	Console Test
1	Receiver check
2	Bit 2 D/A Alignment
3	Bit 3 Alignment
4	Bit 4 Alignment
5	Bit 5 Alignment
6	Bit 6 Alignment
7	Bit 7 Alignment
8	Bit 8 Alignment
9	Bit 9 Alignment
10	Bit 10 Alignment
11	Bit 11 Alignment
12	S&H Delay and Time Constant
13	Preamplifier and Deflection Ampl. Alignment

TABLE 1. CONSOLE TESTS (Cont'd)

Phase	Console Test
14	XY Velocity and Vector Sum Adj.
15	Test Square Displayed
16	Three Test Squares Displayed
17	Test Square Displayed
18	Five Dot Pattern Displayed

f. To progress through remainder of console test, choose one of the following procedures:

1) Teletype Advance Procedure. (Procedure enables user to advance through test sequentially or to jump to any desired test phase.)

   a) Depress teletype MANUAL INTERRUPT button.

   b) Teletype types: NUMBER

   c) Type in number in PHASE column (see Table 1) corresponding to specific console test you wish to perform.

   d) Press carriage RETURN key. (Selected console test phase is now in progress.)

   e) Repeat steps a through d to advance test.

2) Light Pen Switch Advance. (Procedure enables user to sequentially advance through test phases 1-15).

   a) Press and release light pen switch.

   b) Teletype types: N = XX
   (XX = console test phase initiated; see Table 1.)

   c) Repeat steps a and b to advance test.

3) Maintenance Switch Card Advance. (Procedure enables user to sequentially advance through test phases 1-18. Test phase 18 advances to phase 1.)

   a) Press and release switch on maintenance card (location J16) in the 274 Console logic rack.

   b) Teletype types: N = XX
   (XX = console test phase initiated; see Table 1.)

   c) Repeat steps a and b to advance test.

4) Light Pen Strike Advance. (May be used to advance program sequentially only when light is present on screen; i.e., phases 15-18. Test phase 18 advances to phase 1.)

a) Press Light Pen switch and pick light from the 274 Console display.

b) Teletype types: N = XX
(XX = console test phase initiated; see Table 1.)

c) Repeat steps a and b to advance test.

h. To exit 274 Console Test Program:

a) Press and release SELECTIVE SKIP lever switch.

b) Teletype types: TYPE TEST NUMBER

c) Go to next test program.

3. Test 3: X, Y and S Transfer and ID Read Test Program

a. Internal/Computer Display Check

NOTE

If test 3 is in progress and any interrupt other than Priority or Light Pen occurs, the teletype will print out an error message (Ghost Interrupt):

GI
HHHH*

1) Observe that:

a) Teletype does not print error message.

b) The display on the 274 Console conforms to the following illustration (Dots are internally displayed; cross is computer-displayed.)

*HHHH = Status of 1744 in hexadecimal

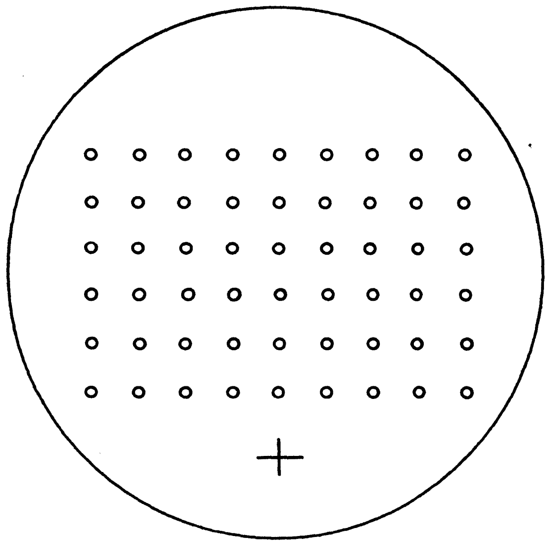


Figure 1. Dot-Cross Display

b. ID Error Check.

1) Using the light pen, choose one of the displayed dots. Observe that:

a) Next dot in sequence disappears while choice is being made. (Dot sequence: left to right, starting at bottom row)

b) There is no teletype ID error (IDERR) message printout.

NOTE

An ID error printout (in hexadecimal) will resemble the following format:

IDERR

$X_4X_3X_2X_1$ $Y_4Y_3Y_2Y_1$ $S_4S_3S_2S_1$

$00X_4X_3$ $00X_2X_1$ $00Y_4Y_3$ $00Y_2Y_1$ $00S_4S_3$ $00S_2S_1$ 00VR* 00HR**

* Vertical row number of dot chosen.

**Horizontal row number of dot chosen.

Top row of numbers reflects actual X, Y and S register status at time of light pen strike. Bottom row reflects ID bytes associated with chosen dot. Two low-order characters of each ID byte identify dot parameters.

c. Forced Printout Feature.

1) Using the light pen, choose one of the displayed dots (next dot in sequence disappears when choice is made).

2) Using the light pen, choose the cross.

3) Observe that the teletype prints a message conforming to the following format (information relates to chosen dot, not cross):

CROSS

$X_4X_3X_2X_1$ $Y_4Y_3Y_2Y_1$ $S_4S_3S_2S_1$

$00X_4X_3$ $00X_2X_1$ $00Y_4Y_3$ $00Y_2Y_1$ $00S_4S_3$ $00S_2S_1$ OOVR OOHR

d. Intensity Levels Check.

1) Set SELECTIVE STOP lever switch to up position.

2) Depress REGISTER SELECT button.

3) Depress the display register CLEAR button.

4) Enter $OF77_{16}$ (0000111101110111_2) into the display register.

5) Set SELECTIVE STOP lever switch to center position.

6) Momentarily set the RUN/STEP lever switch to RUN position and release.

7) Observe that:

a) Each previously displayed dot has been replaced with a 45-degree line, approximately 1 inch in length.

b) The lines at the left third of the display are of a dim intensity; center third, medium intensity; and right third, bright intensity.

e. Increment Byte Entry Feature.

1) Set SELECTIVE STOP lever switch to up position.

2) Depress REGISTER SELECT-A button.

3) Depress display register CLEAR button.

4) Enter desired increment byte into display register. Use the following guide.

Display Register	15 14 13 12	11	10 9 8	7	6 5 4	3	2 1 0
Increment Byte	Set to 0's	1 = Beam on 0 = Beam off	Scale Factor 010, 011, 100, 101, 110 or 111 only	Sign X 0 = + 1 = -	X enter in complement form if sign neg.	Sign Y 0 = + 1 = -	Y enter in complement form if sign neg.

5) Set SELECTIVE STOP lever switch to center position.

6) Momentarily set RUN/STEP lever switch to RUN position and release.

7) Observe that 274 Console displays the new increment byte.

NOTE

To enter another increment byte, repeat previous seven steps.

f. To exit from X, Y and S Transfer and ID Read Test Program:

1) Depress REGISTER SELECT- P button.

2) Depress and release SELECTIVE SKIP lever switch.

3) Teletype types: TYPE TEST NUMBER

4) Go to next test program.

4. Test 4: Command Test Program.

a. Observe that 274 Console displays the following:

SSSSSSSSSSMMMMMMMMMMPPPPPPPPPPRRRRRRRRRRE

NOTE

S's signify successful execution of an S Jump command; M's, Macro Call; P's, P Jump: R's, Return to Main; E's - decoding of an End of Display byte.

b. To Exit Command Test Program:

1) Depress and release SELECTIVE SKIP lever switch.

2) Teletype types: TYPE TEST NUMBER

3) Go to next test program.

5. Test 5: Memory Dump Program.

   a. Teletype types: FWA

   b. If only one dump is desired and the dump program is to be exited at the completion of that dump, set and leave the SELECTIVE SKIP lever switch in the up position. To remain in dump program, check that switch is in the center position.

   c. In reply to teletype message "FWA", type, in hexadecimal, the First Word Address of memory dump (0 to FFF in 4K system; 0 to 1FFF in 8K system).

   d. Depress and release carriage RETURN key.

   e. Teletype types: NWDS

   f. Type, in decimal, the number of words desired in dump. (Maximum: 100_{10}).

   g. Depress and release carriage RETURN key.

   h. Observe that teletype prints out the memory dump requested (typeout is in hexadecimal).

   i. Choose one of the following:

      1) If SELECTIVE SKIP lever switch is in the center position:

         a) At the completion of the dump, teletype types: FWA

         b) Repeat steps 5b through 5h to obtain another dump.

      2) If SELECTIVE SKIP lever switch is in the up position:

         a) At the completion of the dump, the teletype types: TYPE TEST NUMBER.

         b) Set SELECTIVE SKIP lever switch to center position.

         c) Go to next test program.

6. Test 6: Variable Function and Alphanumeric Keyboards Test Program.

   a. Check that all computer console lever switches are in the center position.

   b. Perform the appropriate keyboard checkout procedures: 1) Variable Function Keyboard Checkout and/or 2) Alphanumeric Keyboard Checkout.

      1) Variable Function Keyboard Checkout:

         a) Prior to initiating Test 6, depress and release Keyboard ON/OFF pushbutton several times. Observe that the pushbutton illuminates and extinguishes. Leave pushbutton in extinguished condition.

NOTE

Keyboard ON/OFF lamp extinguished indicates deactivated keyboard.

b) Teletype has previously typed: TYPE TEST NUMBER

c) Type: 6

d) Depress carriage RETURN.

e) Observe that keyboard ON/OFF pushbutton illuminates.

f) Check that all pushbuttons, except ON/OFF, are extinguished or can be extinguished by depressing pushbuttons.

g) With all keyboard pushbuttons, except ON/OFF, extinguished, observe that the 274 Console display surface is blank.

h) Depress and hold keyboard Reject (red) button. Observe that the button is illuminated and "00" is displayed on the 274 Console.

i) Release Reject button.

j) Depress and hold keyboard Accept (green) button. Observe that the button is illuminated and "01" is displayed on the 274 Console.

k) Release Accept button.

l) Depress and latch each latching button (those other than Accept, Reject, and ON/OFF). Observe that as each button is latched, the bit position associated with the button is displayed.

m) Depress and release the On/OFF button.

n) Note that all keyboard button lamps extinguish and the 274 Console screen is blank.

o) To exit from Variable Function Keyboard portion of test program:

    (1) Depress and release SELECTIVE SKIP lever switch.

    (2) Teletype types: TYPE TEST NUMBER

    (3) Choose one of the following:

        Go to Alphanumeric Keyboard Checkout

        or

        Go to any other 274/1744 Maintenance Test programs to be performed

        or

        Exit 274/1744 Maintenance Test and return to SMM 17 control by:

(a) In reply to teletype message TYPE TEST NUMBER, type: E

(b) Depress and release carriage RETURN key.

2) Alphanumeric Keyboard Checkout.

a) Prior to initiating Test 6, depress and release keyboard ON/OFF button several times. Observe that the button illuminates and extinguishes. Leave button in illiminated condition.

NOTE

Keyboard ON/OFF lamp illuminated indicates keyboard activated.

b) Teletype has previously typed: TYPE TEST NUMBER

c) Type: 6

d) Depress and release carriage RETURN.

e) Observe that keyboard ON/OFF pushbutton extinguishes.

f) Depress and release keyboard on/off pushbutton and observe that it illuminates.

g) Using Table 2 as a guide, depress and release keyboard key and observe that the 274 Console displays the data indicated.

NOTE

Certain key characters are uppercase symbols and require that the SHIFT or CTRL keys be depressed (dep) while selection is being made.

NOTE

The 274 Console will display any portion of "07 06 05 04 03 02 01 00" depending on which key is depressed. A "07 03 00" would indicate that the 1744 Controller is sending a logical 1 in bit positions 07, 03, and 00 to the computer. The 06, 05, 04, 02, and 01 bit positions would be logical 0's.

h) To exit from Alphanumeric Keyboard portion of test program:

(1) Depress and release SELECTIVE SKIP lever switch.

(2) Teletype types: TYPE TEST NUMBER.

(3) Choose one of the following:

Go to any other 274/1744 Maintenance Test programs to be performed

or

Exit 274/1744 Maintenance Test and return to SMM 17 control by:

(a) In reply to teletype message TYPE TEST NUMBER, type: E

(b) Depress and release carriage RETURN key.

7. Test 7: S Address Register Jump Command Test

a. This test exercises the S Address Register by executing S Jumps and checking the results.

1) Teletype has typed: TYPE TEST NUMBER.
TYPE TEST NUMBER.

2) Type:
7

3) Depress Carriage Return.

b. Upon completion of test 7:

1) Go to next test program or exit.

2) Type:
E

3) Depress and release Carriage Return.

8. Test 8: Scissoring Test

a. Observe that the 274 Console displays the form described under Test 8 in the TEST PROGRAMS DESCRIPTION section.

b. To exit the scissoring test program:

1) Depress and release SELECTIVE SKIP lever switch.

2) Teletype types TYPE TEST NUMBER.

3) Go to next test program.

9. Test 9: Velocity Compensation Test

Same as above, except for the display. See the discussion under TEST PROGRAM DESCRIPTIONS.

TEST PROGRAMS DESCRIPTION

TEST 1: CORE TEST PROGRAM

PURPOSE

The core test program checks the ability of the 1744 Controller to have data written into and read out of its buffer memory, and it ensures that the transfer is unaffected by cross talk. The worst test patterns are used to thoroughly exercise the logic circuitry.

PROCEDURAL DESCRIPTION

General

Test 1 is subdivided into four test phases. Phases 1 and 2 are executed sequentially without operator intervention. Pre-selected test patterns using varied combinations of $FFFF_{16}$, 0000_{16}, 5555_{16} and $AAAA_{16}$ bytes are used. Phase 3 enables the user to exercise buffer memory with any 16-bit word combination so desired. In phases 1, 2 and 3, the selected bytes are written into core, read out and verified. If the test phase fails, the teletype will print out a message defining the failure. The fourth phase is a continuous read/write feature, whereby the user specifies a 16-bit word pattern and calls for a read or write operation.

Phases 1 and 2

Upon entering test 1 the teletype prints out ENTER MEMORY SIZE 4 or 8. This is a request for the user to enter, via the teletype, the current size of the 1744 buffer memory, 4 or 8, as applicable for a 4K or 8K system. When the core size information is entered, the teletype prints:

1744 CONTROLLER MEMORY

MODULE ADDRESS ACTUAL DESIRED

This typeout signifies that phase 1 of the core test has been initiated. Phase 2 will automatically be entered at the successful completion of phase 1. Should either test phase fail, the teletype will print out an error message in hexadecimal conforming to the format heading above. The typeout in the MODULE column will be either 1 or 0, indicating the memory module in which the failure occurred. The ADDRESS column will contain the 1744 S-Register count at which the error occurred. The ACTUAL column specifies the byte that was read back to the computer (i.e., the byte that is in error). DESIRED column indicates the true byte being exercised by the test program. The successful completion of phases 1 and 2 is signaled by: no error message typeout; and teletype message, ENTER TEST PATTERN IN A REG-RUN.

Phase 3

The last typeout signified entry into phase 3 of the core test; it is also a request for the user to enter a test pattern in the A register of the computer, via the computer console display register pushbuttons. The program will stop at this point only if the SELECTIVE STOP lever switch had previously been set to the up position. After the pattern is entered, the teletype will print XXXX HEX TEST PATTERN SELECTED; XXXX is the test pattern entered in the A register.

If operator previously designated that the 1744 had an 8K memory, the teletype will request that the number of the module to be exercised is entered with the message, TYPE 0 OR 1 TO SELECT MODULE. Type 0 or 1 to make this selection. This typeout will not occur if a 4K memory had previously been indicated.

Phase 3 test will continually be repeated until: an error occurs and the teletype prints out that error message; or the test is to be manually exited.

Phase 4

Depressing the teletype MANUAL INTERRUPT pushbutton while phase 3 is in progress will cause the test program to advance to phase 4.

Entry into phase 4 is indicated by the teletype message R OR W. Type R if a continuous read operation is to be performed or W if a continuous write operation is to be performed. The teletype will print ENTER TEST PATTERN IN A REG RUN. This is a request for the user to enter the test pattern to be used for the operation into the A register operation of the computer. After the pattern is entered, the teletype will print XXXX TEST PATTERN SELECTED; XXXX is the test pattern selected in hexadecimal.

If an 8K memory had previously been indicated, the teletype will print TYPE 0 OR 1 TO SELECT MODULE. The user replies by typing 0 or 1, depending on the module to be exercised. The request for module selection will not be printed out if a 4K buffer memory had previously been indicated.

Phase 4 execution will begin with the input of the data above. It will continually be repeated until the user desires to exit the core test program by depressing the SELECTIVE SKIP lever switch.

TECHNICAL DESCRIPTION

General

Figure 3 illustrates, on a basic block level, the data transfer path used during the core write operation. Each interconnecting line represents a 16-bit transfer path.

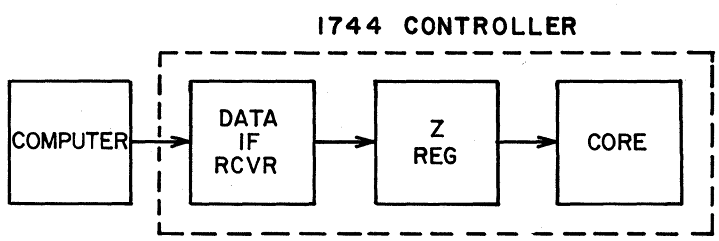


Figure 3. Core Write-Data Transfer for Path

Figure 4 is an example of the data transfer logic used during a core write operation. The logic unique to the transfer of bit 03 is illustrated.

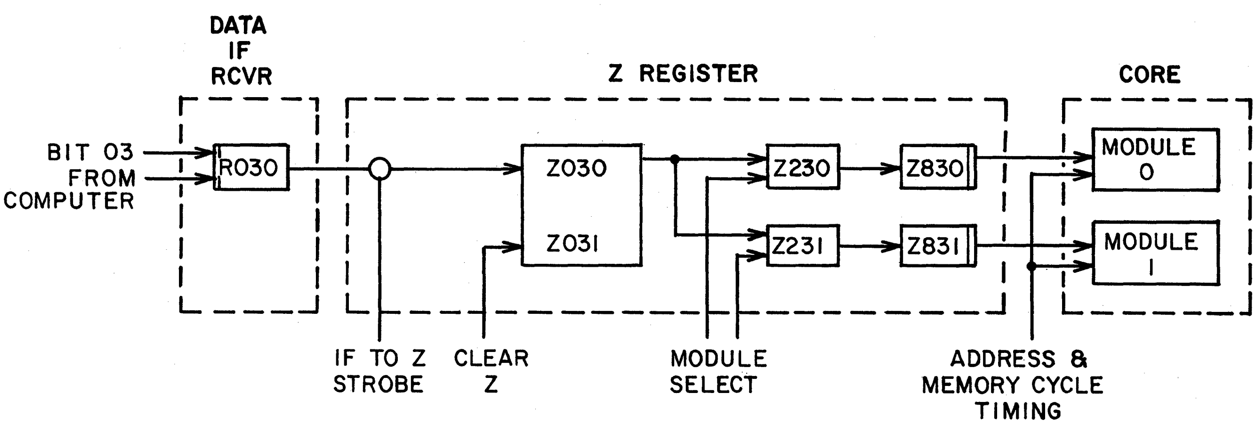


Figure 4. Core Write - Bit 03 Logic Circuit

Additional inhibited gates and loads are not shown in the figure; they are not used for data transfer during core write. Though they are not used, they may be a probable trouble area for this operation.

The basic block diagram of the core read data transfer path is illustrated in Figure 5.

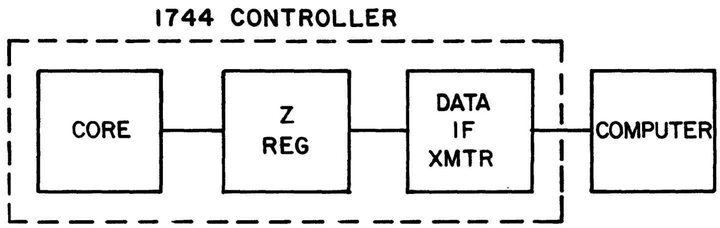


Figure 5. Core Read - Data Transfer Path

Figure 6 illustrates the data path associated with transferring a bit during the core read operation on a logic circuit level. Bit 03 is used as an example.

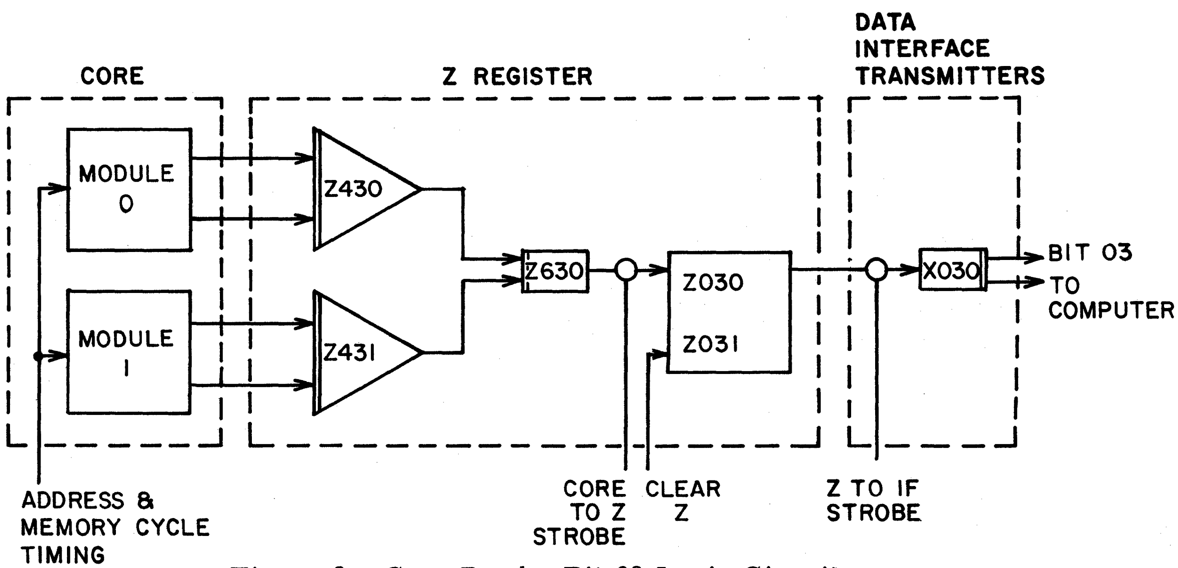


Figure 6. Core Read - Bit 03 Logic Circuit

Although the Z-register flip-flops shown in Figures 4 and 6 illustrate only two of the Z-register set inputs, the 13 low-order flip-flops have additional set inputs from the status selector circuits. These inputs are inhibited during a buffer memory read or write operation, but would present problems if the input gate was enabled due to a malfunction. This also applies to an additional OR input to transmitter X030 in Figure 6.

Phase 1: During phase 1, the 1744 core read/write logic is exercised with 16-bit $FFFF_{16}$ and 0000_{16} bytes. The exact sequencing is described below:

1) $FFFF_{16}$ bytes written into every location in Module 0; read and verified.
2) Alternate 0000 and $FFFF_{16}$ bytes written into every location in Module 0; read and verified.

If 1744 has an 8K memory, steps 3 and 4 are performed:

3) $FFFF_{16}$ bytes written into every location in Module 1; read and verified.
4) Alternate 0000 and $FFFF_{16}$ bytes written into every core location in Module 1; read and verified.
5) Steps 1 through 4 (1 and 2 in 4K system) repeated ten times.

The test patterns may be expressed in hexadecimal, octal or binary form:

Hexadecimal	$FFFF_{16}$	0000_{16}
Octal	177777_8	000000_8
Binary	$1111\ 1111\ 1111\ 1111_2$	$0000\ 0000\ 0000\ 0000_2$

Phase 1, therefore, exercises buffer memory with 16-bit words containing either all logical 1's or all logical 0's. This test checks the ability of the core read/write logic to process both '1s and 0's and to switch between the two at 600 kc rate. It is also a good check of all the strobing terms used during the buffer memory operations. (See Figures 4 and 6.)

Phase 2: Phase 2 is entered without operator intervention at the completion of phase 1. The test phase exercises the buffer memory Read/Write circuits with 16-bit $AAAA_{16}$ and 5555_{16} bytes. The test sequence is described below:

1) A 64-word block of alternate 5555_{16} and $AAAA_{16}$ bytes written into Module 0.
2) A 64-word block of alternate $AAAA_{16}$ and 5555_{16} bytes written into Module 0.
3) Steps 1 and 2 repeated until Module 0 filled.
4) Contents of Module 0 read and verified.
5) A 64-word block of alternate $AAAA_{16}$ and 5555_{16} bytes written into Module 0.
6) A 64-word block of alternate 5555_{16} and $AAAA_{16}$ bytes written into Module 0.
7) Steps 5 and 6 repeated until Module 0 filled.
8) Contents of Module 0 read and verified.
9) Steps 1 through 8 re-cycled ten times.
10) Steps 1 through 9 repeated for Module 1 if 1744 has an 8K memory.

The test patterns may be expressed in hexadecimal, octal or binary form:

Hexadecimal	5555_{16}	$AAAA_{16}$
Octal	052525_8	125252_8
Binary	$0101\ 0101\ 0101\ 0101_2$	$1010\ 1010\ 1010\ 1010_2$

Phase 2 exercises the core Read/Write circuits with 16-bit words consisting of alternate logical 1's and 0's, with the 1's and 0's being shifted in successive words. In terms of crosstalk problems, this presents a worst-case test pattern for the memory module and transmission lines. If a crosstalk problem is likely to occur, this test phase will provide every opportunity.

Phase 3: Entry into phase 3 of the core test program (i.e., successful completion of phase 1 and 2) is signaled by the teletype message, ENTER TEST PATTERN IN A REG RUN. This is a request for the user to enter, via the teletype, the test pattern to be exercised.

The selected test pattern is written into every location in buffer memory, read and verified. A failure is indicated by a teletype message defining the error.

Phase 4: Phase 4 is normally entered by depressing the teletype MANUAL INTERRUPT pushbutton while phase 3 is in progress.

The test aids in troubleshooting because it enables the user to select a 16-bit test pattern and have this pattern either continually written into buffer memory or continually read out after a single write operation.

TEST 2: 274 CONSOLE TEST PROGRAM

PURPOSE

Test program 2 generates all the different byte streams necessary to enable the customer engineer to align the 274 Console.

PROCEDURAL DESCRIPTION

The program consists of 18 test phases. The test phases may be advanced using either the teletype or the light pen or a maintenance card located in the 274 Console logic rack. Each technique has its advantages and limitations.

Using the teletype, the operator depresses the MANUAL INTERRUPT pushbutton whenever one test phase is to be changed to another. The teletype types NUMBER, to which the user responds by typing in the new test phase number. With this procedure the user may jump to any test phase so desired; the disadvantage is that the user must leave the console and approach the teletype whenever a test phase is to be changed. The teletype may or may not be in close proximity to the console.

The test phases may be advanced sequentially with the light pen by either of two methods. Depressing the Light Pen switch will advance tests 1 through 14 (tests with high voltage off). Depressing the light pen switch and picking light from the 274 console screen will advance tests 15 through 18 (tests with high voltage on). These are quick and convenient methods for advancing the console tests; the only minor limitation is that tests can only be advanced sequentially.

Each console test phase may be advanced from the rear of the console through use of the maintenance card at location J16. Depressing the momentary switch on the card will sequentially advance the test. The teletype will print out the new phase test number.

The user must determine which of the possible ways of advancing the 274 Console test program is most advantageous to use under a given set of circumstances.

To exit test 2, the SELECTIVE SKIP lever switch is depressed.

The procedure for performing all adjustments associated with each test phase is described in the 274 Digigraphic Console Reference/Customer Engineering Manual, Pub. No. 60279100.

TEST 3: X, Y and S TRANSFERS and ID READ

PURPOSE

The X, Y and S Transfers and ID Read test checks the ability of the 274/1744 to perform computer and internal display, and to time-share between both in one display frame. The test checks the ability of the hardware to respond to and process Read S, Read X, Read Y and Search for ID Byte function code commands. It also checks the ability of the hardware to detect and process the following command bytes: End of Display, Reset, Increment, and ID.

PROCEDURAL DESCRIPTION

Test 3 consists of five major checks. Upon entering the test program, the user performs the Internal/Computer Display check. A dot-cross pattern display on the 274 Console is examined to determine whether it is correct.

The second check is the ID Error check. Several of the displayed dots are chosen with the light pen and the user observes that the teletype does not print an ID error message.

The Forced Printout check is next. A displayed dot is chosen with the light pen. It is immediately followed by a cross choice. A teletype message is printed out defining location parameters associated with the chosen dot. This printout is examined.

To perform the Intensity Levels check, the user enters a preselected Increment byte into the A register of the computer. He then observes the 274 Console for a given display pattern with several intensity levels.

The last check is the Increment Byte Entry feature. The operator enters an Increment Byte of his own choosing into the A register of the computer and observes that the 274 Console displays the byte.

Return to the control program may be accomplished by depressing the SELECTIVE SKIP lever switch on the computer console.

Internal/Computer Display Check

Upon entering test 3 the console will display the dot-cross pattern illustrated in Figure 7 below.

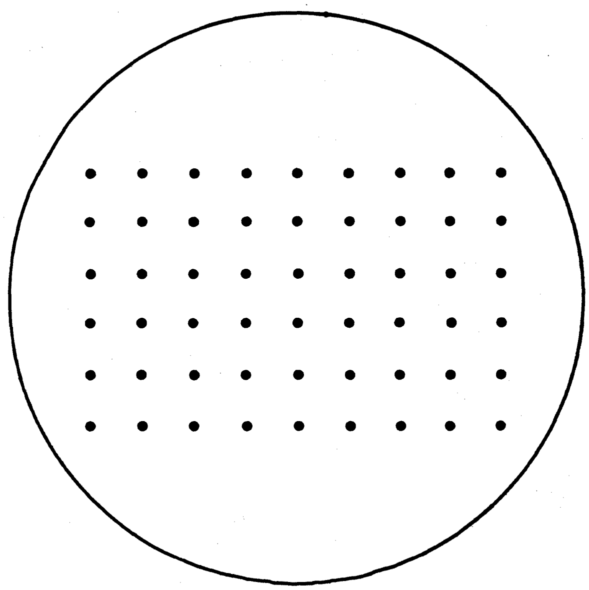


Figure 7. Dot-Cross Pattern Display

All dots are displayed from buffer memory, and the cross is computer displayed. Internal display is initiated by a Function Code 0 (i.e., Command Field = 0), Write command with bit 12 (Start Internal Display Bit) set to 1. Dots are sequentially displayed, left to right, starting at the bottom row.

It is necessary that the user know what command bytes are used to generate the display to better understand what aspects of the hardware are checked during this test. The following describes the byte stream used to generate two consecutive dots. Specific dots are identified by the S register count associated with the Increment byte producing the dot (see Figure 8). As an example, the dot at the bottom left of the display would be identified as Dot 00E. Illustrated below is the byte stream used to produce Dot 01D and Dot 02C.

TABLE 1. BYTE STREAM-DOT 01D AND DOT 02C

Hexadecimal Character	Byte Type	Purpose
841	RESET	Key 1744 logic that next two bytes are new X and Y coordinates; enable light pen sense; and set dim intensity.
C54	X COORDINATE	Horizontal position for dot 01D.
AFF	Y COORDINATE	Vertical position for dot 01D.
FB 1B	ID ID	Contain X position data for dot 00E.
FA FF	ID ID	Contain Y position data for dot 00E.
0 0E	ID ID	Contain S register count of increment byte producing dot 00E.
0	ID	Contains vertical row count for dot 00E.
0	ID	Contains horizontal row count of dot 00E.
C00	NOP - BEAM ON	Displays dot 01D.
200	NOP	No operation byte, turns beam off.
200	NOP	No operation byte (beam off).
200	NOP	No operation byte (beam off).
841	RESET	Key 1744 logic that next two bytes are new X and Y coordinates; enable light pen sense; and set dim intensity.
D94	X COORDINATE	Horizontal position for dot 02C.
AFF	Y COORDINATE	Vertical position for dot 02C.
FC 5B	ID ID	Contain X position data for dot 01D.
FA FF	ID ID	Contain Y position data for dot 01D.
0 ID	ID ID	Contain S register count of increment byte producing dot 01D.

TABLE 1. BYTE STREAM-DOT 01D AND DOT 02C

Hexadecimal Character	Byte Type	Purpose
1	ID	Contains vertical row count of dot 01D.
0	ID	Contains horizontal row count of dot 01D.
C00	NOP - BEAM ON	Display dot 02C
200	NOP	No operation byte, turns beam off
200	NOP	No operation byte, (beam off)
200	NOP	No operation byte, (beam off)

The last byte in the internal display byte stream is an End of Display byte. When decoded, it will set the Priority Interrupt FF, causing the Interrupt line to come up. Sensing an interrupt, the computer will initiate a Function Code 0 Read command to read 1744 status. Having determined that the Priority Interrupt was enabled, the computer will initiate a Function Code 4 Write (computer display) command. The byte stream for the cross is now sent over from the computer and the cross is displayed. This sequence of events is repeated every 25 ms, providing for a 40 frame per second display rate.

ID Error Check

One of the capabilities of test 3 enables the user to check the light pen light detection and interrupt circuitry, X, Y, and S register transfer circuitry, and ID byte detection. When the user choses a dot with the light pen, the following sequence of events occur:

a. User chooses dot with light pen.

b. Light pen amplifier/power supply detect the light, changing it to a logic level.

c. Light Pen strike logic level transmitted from console to controller where it sets Light Pen (LP) Interrupt FF.

d. LP Interrupt FF causes 1744 interrupt line to come up. X, Y, S registers frozen.

e. Computer detects interrupt, comes back with a Function Code 0 Read to determine which interrupt FF was set.

f. Computer detects light pen has caused interrupt.

g. Computer initiates a Function Code 4 Read command (Read X). The X register contents represent the X coordinate of the light pen strike.

h. Computer initiates a Function Code 5 Read command (Read Y). The Y register contents represent the Y coordinates of the light pen strike.

i. Computer initiates a Function Code 2 Read command (Read S). The S register contents represent core address at time of the light pen strike.

j. Computer initiates a Function Code 6 Read (Search for ID bytes). The controller starts sequentially addressing and reading core locations, starting from the freeze location. The data bytes read from each core location are placed on the controller data interface transmitter lines. A non-ID byte is accompanied by a Reject signal; ID byte, Reply signal. The ID byte carries the identification parameters associated with the dot that was struck. These parameters include: true X and Y dot location coordinates; true S register count of Increment byte producing dot; and true horizontal and vertical row count.

k. Computer goes through a verify routine. It compares the X, Y and S register contents associated with the light pen strike to the X, Y and S dot location parameters in the ID byte. If the values differ by a given amount, the teletype will print out an ID error message. The typeout is in hexadecimal.

1 2 3 4

IDERR

$X_4X_3X_2X_1$ $Y_4Y_3Y_2Y_1$ $S_4S_3S_2S_1$

$00X_4X_3$ $00X_2X_1$ $00Y_4Y_3$ $00Y_2Y_1$ $00S_4S_3$ $00S_2S_1$ 00VR 00HR

5 6 7 8 9

1 Indicates typeout is result of ID error.

2 Contents of X register at time of freeze.

3 Contents of Y register at time of freeze.

4 Contents of S register at time of freeze.

5 Two ID bytes; two low-order characters of each, when combined, identify true X coordinate of dot chosen; should be equal to 2 .

6 Two ID bytes; two low-order characters of each, when combined, identify true Y coordinate of dot chosen; should be equal to 3 .

7 Two ID bytes; two low-order characters of each, when combined, define true S register count (Core address) of increment byte generating chosen dot; should be within three counts of 4 .

8 ID byte, two low-order characters identify vertical row count of chosen dot.

9 ID byte, two low-order characters identify horizontal row count of chosen dot.

NOTE

X_4 and/or Y_4 in the ID bytes will be "F" characters (-0) if chosen dot is in negative quadrant.

When an ID error printout occurs, it may have been caused by an error relating to the X, Y or S transfers or by an error unique to ID byte processing or both. To aid in isolating a trouble to a given area, refer to Figure 8. It illustrates all the dots displayed on the CRT and their X and Y coordinates, and S register count. By relating the ID error printout to the figure, the user can more easily categorize a trouble.

Forced Printout Check

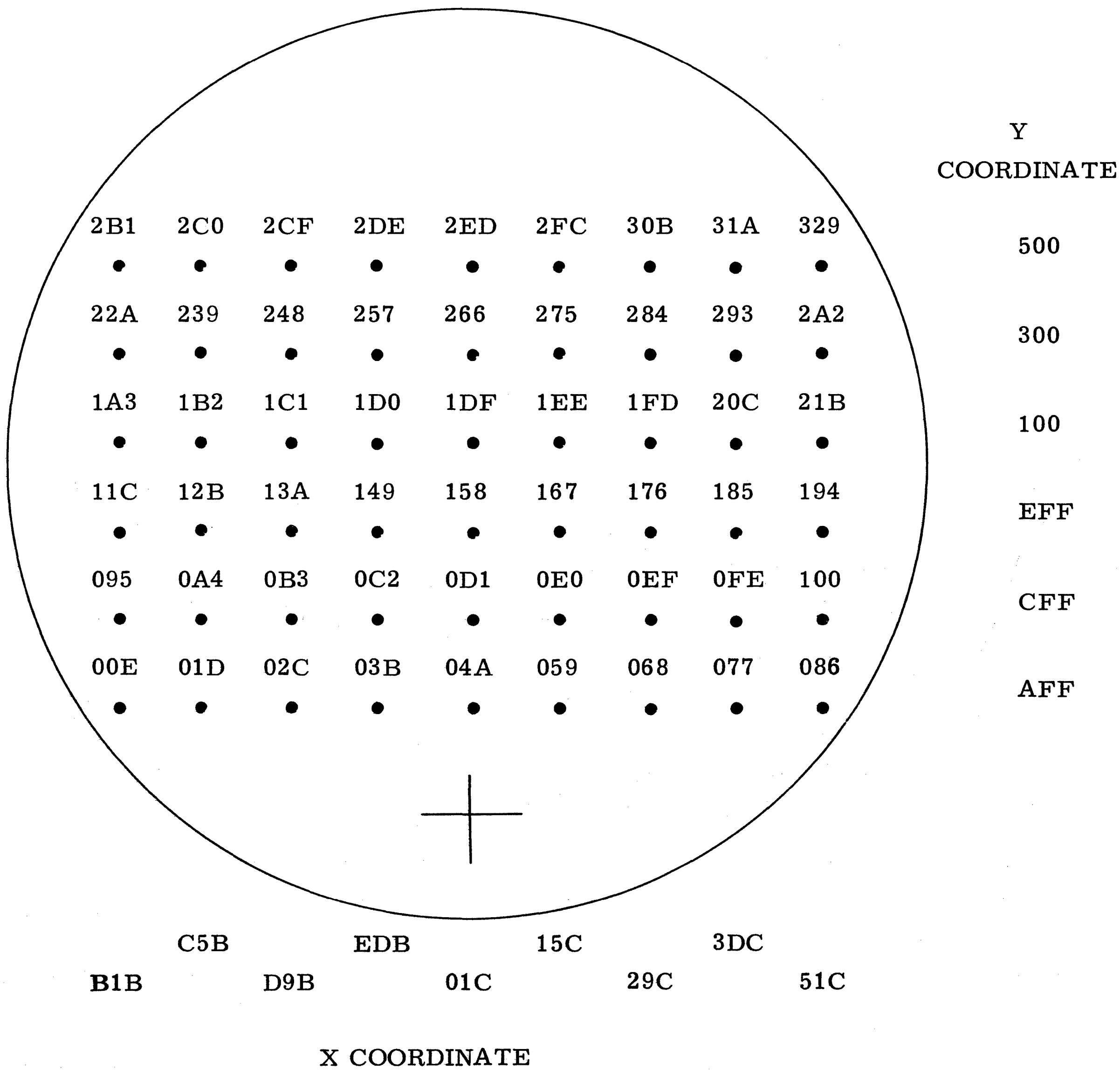
The forced printout check enables the user to have the identification parameters associated with any selected dot printed out on the teletype. To exercise the test, the user picks one of the displayed dots. It is important to note that the next dot in sequence goes out. This verifies that the choice has been made. The user then chooses the cross. Upon choosing the cross, the teletype will print out the following message:

C R O S S

$X_4X_3X_2X_1$ $Y_4Y_3Y_2Y_1$ $S_4S_3S_2S_1$

$00X_4X_3$ $00X_2X_1$ $00Y_4Y_3$ $00Y_2Y_1$ $00S_4S_3$ $00S_2S_1$ 00VR 00HR

The term "CROSS" signifies this printout was a result of a dot-cross choice. The remainder of the printout format is described in the ID Error Check. The Figure 9 typeout was obtained by choosing each dot in the bottom row.



1. All numbers in hexagon.
2. Numbers above dots represent S register counts of byte producing dot.

Figure 8. Dot Location Diagram

```
CROSS
0B1B  0AFF  000E
00FB  001B  00FA  00FF  0000  000E  0000  0000
CROSS
0C5B  0AFF  001D
00FC  005B  00FA  00FF  0000  001D  0001  0000
CROSS
0D9B  0AFF  002C
00FD  009B  00FA  00FF  0000  002C  0002  0000
CROSS
0EDB  0AFF  003B
00FE  00DE  00FA  00FF  0000  003B  0003  0000
CROSS
001C  0AFF  0049
0000  001C  00FA  00FF  0000  004A  0004  0000
CROSS
015C  0AFF  0059
0001  005C  00FA  00FF  0000  0059  0005  0000
CROSS
029C  0AFF  0068
0002  009C  00FA  00FF  0000  0068  0006  0000
CROSS
030C  0AFF  0076
0003  00DC  00FA  00FF  0000  0077  0007  0000
CROSS
051C  0AFF  0086
0005  001C  00FA  00FF  0000  0086  0008  0000
```

Figure 9. Dot-Cross Typeout - Bottom Dot Row

Note that whenever a dot lies in a negative quadrant, the ID bytes defining that coordinate parameter are prefixed with an F character, rather than a 0.

Intensity Levels Check

The intensity levels check enables the user to check the ability of the 1744 and 274 to detect, decode, and process dim, medium and bright intensity commands. The byte stream producing the dots in test 3 contained the three intensity levels, but with only dots displayed, it is difficult to distinguish different intensity levels. With the intensity levels check, the user enters an increment byte in the computer A register with a scale factor of 7, and delta X and delta Y equal to +7. This produces a series of 45 degree lines on the console display, replacing the dots. The lines at the left one-third of the display are of a dim intensity, center one-third, medium intensity, and right one-third, bright intensity.

Increment Byte Entry Feature

Test 3 has an option which enables the user to enter any desired increment byte into the A register of the computer. The increment will then be displayed at each previous dot location. This feature is a useful tool to the customer engineer because all the logic circuitry associated with processing of varied increment bytes can be checked. The 274/1744 logic associated with processing the following byte characteristics can be checked:

a. Beam on/off.

b. Scale factors 2 through 7.

c. All combination of positive and negative delta X and delta Y values.

TEST 4: COMMAND TEST PROGRAM

PURPOSE

The command test program checks the ability of the hardware to execute all 1744 jump commands (i.e., S Jump, Macro Call, P Jump and Return to Main). It checks that the hardware can detect and process the following bytes: End of Display, Reset, and Increment.

PROCEDURAL DESCRIPTION

There is only one test phase in the command test program. When the test is entered, the user observes the 274 Console for a given display. A correct display indicates successful execution of test 4.

TECHNICAL DESCRIPTION

Upon entering the test program, the appropriate commands are sent from the computer to the controller to enable the sorting of all bytes used in this test into buffer memory. An execute internal display command is initiated and the console presentation is controlled by the jump commands. The display conforms to the following pattern:

SSSSSSSSSSMMMMMMMMMMPPPPPPPPPPRRRRRRRRRRE

The letters in proper number and sequence convey the following information:

10	S's	successful execution of S Jump
10	M's	successful execution of Macro Call
10	P's	successful execution of P Jump
10	R's	successful execution of Return to Main
1	E	detection of End of Display byte (10 E's indicate failure to detect byte)

To better understand how the display is generated, refer to Chronological Description, Command Test. The chart at the left represents buffer memory locations of Module 0 (location 0 through 4096_{10} or 0 through 1000_{16}). Data in the chart identifies the bytes or byte streams used; hexadecimal characters defining the byte structure are also shown.

CHRONOLOGICAL DESCRIPTION, COMMAND TEST

1. Reset beam to coordinate DA7 in X and 258 in Y; set medium intensity level.
2. S JUMP CMD detected; S register incremented by 1.
3. S JUMP ADDRESS read out of core; strobed to Z register, to S buffer, to S register and addresses core.
4. S JUMP location; contains the byte stream for displaying the letter S; S byte stream repeated ten times.
5. MACRO CALL CMD detected; S register incremented by 1.
6. MACRO ADDRESS read out of core; strobed to Z register, to S buffer, to S register and addresses core; core location of MACRO ADDRESS stored in P register.
7. MACRO Location; contains the byte stream for displaying the letter M; M byte stream repeated ten times.
8. P JUMP CMD detected; location stored in P register, i.e., 6 incremented by 1 and strobed into the S register addressing core at this location.
9. P JUMP ADDRESS read out of core; strobed to Z register, to S buffer, to S register, and addresses core at this location, core location of P JUMP ADDRESS stored in P register.
10. P JUMP location; contains the byte stream for displaying the letter P; P byte stream repeated ten times.
11. RETURN TO MAIN CMD detected; location stored in P, i.e. 9 incremented by 1 and strobed into the S register addressing core at this location.
12. Location contains byte stream for displaying the letter R; R byte stream repeated ten times.
13. S JUMP CMD detected; S register incremented by 1.
14. S JUMP ADDRESS read out of core; strobed to Z register, to S buffer, to S register and addresses core.

	MODULE 0 CONTENTS	Location (Hex)
1	RESET (802) X COORDINATE (DA7) Y COORDINATE (258)	0
2	S JUMP CMD (1C8)	
3	S JUMP ADDRESS (300)	
*	END OF DISPLAY (1F8's) (many)	
7	M's (10 times)	0100
8	P JUMP CMD (1D8)	
*	END OF DISPLAY (1F8's) (many	
10	P's (10 times)	0200
11	RETURN TO MAIN CMD (1FA)	
*	END OF DISPLAY (1F8's) (many)	
4	S's (10 times)	0300
5	MACRO CALL CMD (1E8)	
6	MACRO ADDRESS (100)	
9	P JUMP ADDRESS (200)	
12	R's (10 times)	037B
13	S JUMP CMD (1C8)	
14	S JUMP ADDRESS (D00)	
*	END OF DISPLAY (1F8's) (many)	
15	E -	0D00
16	END OF DISPLAY (1F8)	
**	E's (9 times)	
*	END OF DISPLAY (many) (1F8's)	1000

15. Locations contain the byte stream for displaying the letter E, once.
16. END OF DISPLAY byte detected, display is terminated, will be repeated once every 25 ms.

*Each * represents many locations. End of Display bytes fill all of these locations. If one of them is addressed due to a malfunction, display will be terminated for the remainder of the display frame.

**Locations contain the byte stream for displaying the letter E; E byte stream repeated nine times. If the END OF DISPLAY byte at 16 is not decoded these will be displayed.

The byte stream used for generating a single letter M is illustrated below. It is typical of the byte streams used to display the other letters because it consists only of beam on and off Increment bytes of varying magnitudes.

BYTE STREAM FOR LETTER M

Hexadecimal Character	Type
D04	Increment byte with beam on
D02	Increment byte with beam on
D39	Increment byte with beam on
4C4	Increment byte with beam off
D34	Increment byte with beam on
4CB	Increment byte with beam off
D0B	Increment byte with beam on
D0D	Increment byte with beam on
522	Increment byte with beam off
4D0	Increment byte with beam off

To determine how test 4 would respond to different troubles, the Set and Clear outputs of each command flip-flop were alternately grounded (simulating a logical 0 at the ground point) and the display recorded. These are the results:

TROUBLE	CONSOLE DISPLAY
Set Output Grounded:	
S Jump - B710/711	•
Macro Call - B750/751	SSSSSSSSSSRRRRRRRRRRE
P Jump - B730/731	SSSSSSSSSSMMMMMMMMMM
Return to Main - B770/771	SSSSSSSSSSMMMMMMMMMM PPPPPPPPPP
Term Internal Display - B772/773	SSSSSSSSSSMMMMMMMMMM PPPPPPPPPPRRRRRRRRRR EEEEEEEEEE
Clear Output Grounded:	
Any above flip-flop	Console screen blank

An analysis of the contents of buffer memory during test 4 will illustrate why specific results were obtained. The only result that is not readily obvious by examing core contents is the blank display obtained when any one of the Clear outputs of the flip-flops was grounded. Under these conditions, the Set output is forced to a logical 1. The Set outputs of all jump command flip-flops are applied to inverter B405.

The B405 term is needed to enable the Set input AND gate at E200/201 in the Byte Processing Timing Circuits. Under these conditions, the gate is inhibited by B405 and consequently, the console screen is blank.

TEST 5: MEMORY DUMP PROGRAM

PURPOSE

The memory dump program enables the user to have the contents of the 1744 Controller memory printed out on the teletype. He has the option of selecting the first word address and the number of words in the dump. Hardware must be capable of processing S register Write and Read Core commands before test 5 can be executed.

PROCEDURAL DESCRIPTION

There is only one test phase in the memory dump program: the dump itself. When the program is entered, the teletype prints FWA. This is a request for the operator to enter, via the teletype, the first word address of the transfer. He replies by entering this information in hexadecimal. The teletype will then request the number of words desired in the transfer, with the message, NWDS. This information should be entered in decimal. With the last input, the program takes over and executes the dump, printing out the information, in hexadecimal, on the teletype.

TECHNICAL DESCRIPTION

With the input of the necessary information to perform a dump, the hardware executes an S register Write command (Function Code 2, Write). This command enables 13 bits to be transferred from the computer A register to the 1744 data interface receivers through the S buffer to the S register. The address entered into the S register is the one the user specified by his reply to the teletype message, FWA. The computer next performs a Read Core operation (Function Code 1, Read). Bytes are sequentially read out of 1744 core, routed through the Z register, to the data interface transmitters to the computer. A new core location is read and outputted every 1.67 μsec. A reply accompanies each byte transfer.

The computer outputs the received data to the teletype where it is recorded.

TEST 6: KEYBOARDS TEST PROGRAM

PURPOSE

The Variable Function and/or Alphanumeric keyboards are checked out during test 6. The ability of the keyboards to be activated or deactivated under program and manual control is checked along with the ability of the computer to recognize which of the keyboard keys have been depressed.

PROCEDURAL DESCRIPTION

Test 6 contains a separate checkout procedure for the Variable Function and Alphanumeric keyboards. Assuming both are to be checked, begin with the Variable Function keyboard.

Prior to entering the test, activate and deactivate the keyboard manually. Leaving the keyboard deactivated, enter test 6 and observe that the test program could activate it. Depress the keyboard keys and observe that the keys illuminate and that the 274 Console displays the bit number associated with the key. After completing the above checks, manually deactivate the keyboard and exit test 6.

To check out the Alphanumeric keyboard, manually activate and deactivate the keyboard prior to re-entering test 6. Leaving the keyboard in the activated state, enter test 6 and observe that the program deactivates the keyboard. At present, the program has the ability of activating only the Variable Function keyboard. Manually activating the Alphanumeric keyboard, systematically depress each key and observe that the 274 Console displayed the proper bit numbers associated with the keyboard 8-bit ASCII code.

Depressing the SELECTIVE SKIP lever switch exits test 6.

TECHNICAL DESCRIPTION

When either keyboard is manually activated, a logical 0 is generated by the ON/OFF. The activate command is routed through the 274 Console to the 1744 Controller, where it is processed. In the controller, there is logic circuitry that is unique to the ON/OFF status of each keyboard. This circuitry will be affected by the momentary signal generated by the switch, and it will change the signal to an activate hold signal for the activated keyboard and a deactivate signal for the other. The outputs are transmitted to the 274 Console to light driver cards in the keyboard logic. The light driver cards associated with the activated keyboard will generate a ground to that keyboard. This ground will activate the keyboard, illuminating the ON/OFF lamp. During manual activation, this is the only way that the lamp can be illuminated. The ON/OFF lamp on the non-selected keyboard will either become extinguished or remain extinguished depending on its previous state.

With the current program, only the Variable Function keyboard can be activated by the test program. This is accomplished by a Function Code 7, Write Command.

After a keyboard has been activated, any key that is depressed will generate a delta keyboard signal. This signal will be directed through the 274 Console to the controller. Upon receipt of this input, the controller will generate an interrupt. The computer, in turn, will read controller status (Function Code 0, Read). Having determined that a keyboard interrupt has occurred, the computer will read keyboard status (Function Code 7, Read). The status of the activated keyboard will be placed on the A register lines. The computer will examine the bit positions associated with the keyboard status input. If it detects a logical 1 in a specific bit position, it will send a byte stream over to the digigraphics to display the bit position character(s). The display will be all or part of: 07 06 05 04 03 02 01 00.

On the Variable Function keyboard, the Accept and Reject (green and red) keys are momentary switches and must be held in the down position to display their respective bit position. The remaining keys, associated with bits 02 through 15, are latching switches, and need only be latched in the down position.

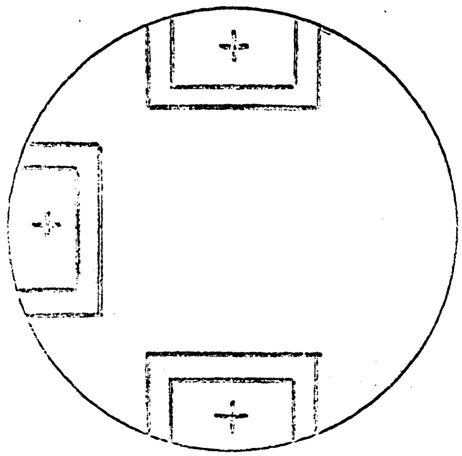
The Alphanumeric keyboard utilizes an 8-bit ASCII code to identify a depressed key. The high-order bit is an Even Parity bit. All the keys activate momentary switches. Unlike the Variable Function, the key does not have to be held in the depressed position to obtain a display, because the outputs are strobed into eight flip-flops in the console keyboard logic. The ASCII code of the last depressed key is stored at these flip-flops. The contents are changed whenever a new key is depressed.

It is significant that the keyboard and 274 Console outputs reflect the negated version of the bit or bits associated with the depressed key.

TEST 7: EXECUTES A SERIES OF S JUMP COMMANDS

TEST 8: SCISSORING TEST PROGRAM

Improper scissoring will result in the deformation of the display, which takes the following form:



TEST 9: VELOCITY COMPENSATION TEST PROGRAM

PURPOSE

The velocity test pattern permits adjustments of the 274 console for improved velocity compensation when W09, Rev D and W07, Rev G are inserted in the console. This test is for use on the 1744/274, both old and new resets, and on the 3344/274.

DESCRIPTION

Three groups of diagonal lines are displayed, each group representing one of the three available intensity levels. All three groups have the same byte structure, except for the intensity bit in the increment bytes.

Each diagonal line is made up of repeated vectors of a single scale factor and increment size, representing one of the 42 possible combinations available (6 scale factors X 7 increment factors).

A brief review of the structure of the increment byte is useful here. It has the format.

b f f f (ΔX) (ΔY)

where:

b = intensity
fff = scale factor = 2, 3, 4, 5, 6, or 7
(ΔX) = X-increment (4 bits, with sign)
(ΔY) = Y-increment (4 bits, with sign)

Whenever an increment byte is encountered, the contents of the X and Y interface registers are incremented as follows:

$$X^1 = X + (\Delta X) \cdot 2^{fff - 2}$$

$$Y^1 = Y + (\Delta Y) \cdot 2^{fff - 2}$$

The multipliers are 2^0, 2^1, 2^2, 2^3, 2^4, and 2^5; i.e., 1, 2, 4, 8, 16, and 32. Since ΔX and ΔY are four signed bits, then the total number of distinct (positive) increments is 6 X 7 = 42. The maximum change in either interface register is therefore 0111_2 X 32 = 7 X 32 = 224.

Each set of 42 lines is generated by 42 separate reset bytes, followed by calls to the same basic set of macros. (Recall that beam intensity is established by the reset sequence.) Each line macro consists of a single type of increment byte (with positive and equal ΔX and ΔY), repeated enough times to give a line approximately 2 inches long, on the diagonal.

The length of lines can be computed from the increment bytes, using the beam-lag factor which is built into the 274 Console; i.e., whenever one of the interface registers is incremented, the corresponding beam coordinate is inhibited from changing by more than half of the difference between the new register value and the old beam coordinate, during the remainder of the current clock cycle (1.67 microseconds).

For example, consider the case of maximum ΔX and ΔY, obtained by using scale factor 7 (multiplier 32) and increments of 32 in both X and Y. The increment byte for this would be:

1 1 1 1	0 1 1 1	0 1 1 1
b f f f	ΔX	ΔY

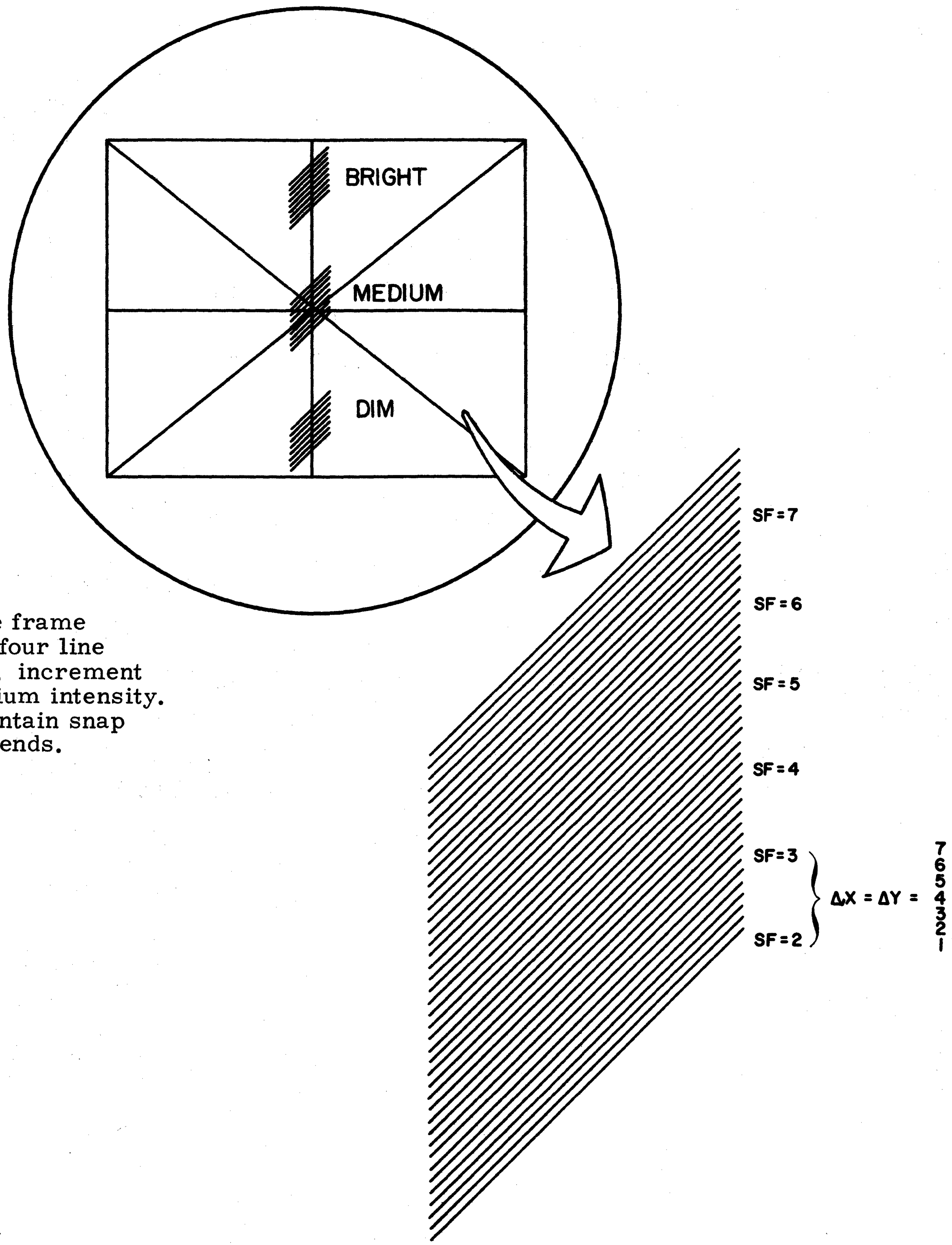
This increment byte causes the X and Y interface register to be increased by 224, each time the byte is processed. If several such bytes are processed in succession, starting with $X_0 = Y_0 = 0$ in the registers, the register values and follow-up beam coordinates can be represented as follows:

Cycle	Register Values	Beam Coordinates at End of Cycle	Change in Beam Coor. (ΔH & ΔV)
0	0	0	0
1	224	112	112
2	448	(448-112)/2 + 112 = 280	168
3	672	(672-280)/2 + 280 = 476	196
4	896	686	210
5	1120	903	217

.
.
.

It can be seen that ΔH and ΔV will approach the maximum of 224 display grid units, which is the maximum change in the interface registers. Therefore, the upper limit on beam movement for a single increment byte is approximately (224/200) X 1.4 inches = 1.57 inches on the diagonal. For this case (fff = 7 and $\Delta X = \Delta Y = 32$), two increment bytes are used, giving a line (280/200) X 1.4 = 1.96 $\cong$ 2 inches.

The display pattern is illustrated in the figure below. A line of medium intensity surrounds the three patterns, as shown:



NOTE: The frame consists of four line segments 7, increment 7, and medium intensity. All lines contain snap back at the ends.

TABLE 2. ALPHA NUMERIC KEYBOARD CHART

KEY	Upper Case Keys SHIFT	CTRL	274 CONSOLE DISPLAY							
1			07		05	04				00
2			07		05	04			01	
3					05	04			01	00
4			07		05	04		02		
5					05	04		02		00
6					05	04		02	01	
7			07		05	04		02	01	00
8			07		05	04	03			
9					05	04	03			00
0					05	04				
:					05	04	03		01	
-					05		03	02		00
Q			07	06		04				00
W			07	06		04		02	01	00
E			07	06				02		00
R			07	06		04			01	
T			07	06		04		02		
Y				06		04	03			00
U				06		04		02		00
I			07	06			03			00
O			07	06			03	02	01	00
P				06		04				
LINE FEED							03		01	
RE-TURN			07				03	02		00
A				06						00
S				06		04			01	00
D				06				02		
F			07	06				02	01	
G				06				02	01	00
H				06			03			
J			07	06			03		01	
K				06			03		01	00
L			07	06			03	02		
;			07		05	04	03		01	00
RUB OUT			07	06	05	04	03	02	01	00
Z				06		04	03		01	
X			07	06		04	03			
C			07	06					01	00
V				06		04		02	01	
B				06					01	
N				06			03	02	01	
M							03	02		00
,			07		05		03	02		
.					05		03	02	01	
/			07		05		03	02	01	00
!	dep				05					00
,,	dep				05				01	
#	dep		07		05				01	00
$	dep				05			02		
%	dep		07		05			02		00
&	dep		07		05			02	01	
,	dep				05			02	01	00
(	dep				05		03			
)	dep		07		05		03			00
*	dep		07		05		03		01	
=	dep		07		05	04	03	02		00
WRU		dep						02		00
TAPE		dep				04			01	
TAPE		dep				04		02		
TAB		dep					03			00
←	dep			06		04	03	02	01	00
@	dep		07	06			-			
X OFF		dep	07			04			01	00
EOT		dep	07					02		
RU		dep						02	01	
BELL		dep	07					02	01	00
VT		dep	07				03		01	00
FORM		dep					03	02		
+	dep				05		03		01	00
↑	dep		07	06		04	03	02	01	
<	dep				05	04	03	02		
>	dep		07		05	04	03	02	01	
?	dep				05	04	03	02	01	00

1744/274 DIGIGRAPHICS DISPLAY SYSTEM
(DG406F Test No. 6F)

I. INTRODUCTION

A. IDENTIFICATION

1. Type of Program - Diagnostic test under 1700 System Maintenance Monitor (SMM17)
2. Computer - CONTROL DATA 1700/SC17

B. PURPOSE

The digigraphics display system test operates under the control of the 1700 System Maintenance Monitor to verify all of the operating features and graphics display capabilities of the 1744 Digigraphics Controller and the 274 Digigraphics Display Console. It also provides graphic patterns for alignment. The test consists of 8 sections (0-7) selected by corresponding bits set in test parameter. Sections are executed sequentially beginning with the lowest number selected.

C. RESTRICTIONS

1. Minimum core requirements - 12K.
2. The test is designed for compatibility with either the 1700 or SC17 processor. Bit 2 of SMM parameter must be set if running on an SC17 processor.
3. Operator intervention is required in the following sections:
   a. Section 05 - Pattern Alignment Test (PALTST)
      (if alignment is necessary)
   b. Section 06 - Scale Factor Test (SCLTST)
      (when scale factors are maladjusted)
   c. Section 07 - Keyboard Test (KYBTST)
      (to check correct functioning of AN/KB and /or VFKB, keys must be depressed by operator)

D. SPECIAL FEATURES

The following special features are implemented by selectable parameters in test parameter word 1:

1. Test may run either buffered (1706 BDC) or unbuffered.
2. Flexible running time - long or short test implies cycling through 5 times (45 sec) for short or 15 times (1 min. 45 sec) for long (Memory test).
3. The current section being run may be terminated and the next selected section started by light pen picking of the displayed word "NEXT" located at lower center of CRT (coordinates X = $F69, Y = $900).
4. Display of error message on 274 console. This feature provides for display of the first 9 words of the error message on the console, in addition to the normal error reporting, via A/Q or Teletypewriter.
5. Optional short error message feature terminates error message after 5 stops. Long error message provides 10 stops to include applicable register contents.

II. REQUIREMENTS

A. HARDWARE

1. Minimum Configuration

   17X4 Mainframe
   17XX Storage Increment
   17X5 Interrupt Data Channel
   1744 Digigraphic Controller (4K)
   274 Digigraphic Display Console

2. Target Configuration

   The minimum configuration expanded to include:

   1706 Buffered Data Channel
   274 Digigraphic Display Console with optional:

      Alphanumeric Keyboard
      Variable Function Keyboard

   1711/12/13 Teletypewriter

3. Maximum Configuration

The target configuration expanded to include:
An additional 4K memory module for the 1744 Digigraphic Controller

III. OPERATIONAL PROCEDURE

A. LOADING PROCEDURE

The test must be loaded under the standard SMM17 loading procedures as test number 6F.

B. PARAMETERS

1. Stop 1

A	Q
6F31	Stop/Jump

A = Test Number, Number of Stops, Type of Stop
Q = Stop /Jump

Bit 0 = Stop to Enter Parameters
Bit 1 = Stop at End of Test Section
Bit 2 = Stop at End of Test
Bit 3 = Stop on Error
Bit 4 = Repeat Condition
Bit 5 = Repeat Section
Bit 6 = Repeat Test
Bit 7 = Not Used
Bit 8 = Omit Typeouts
Bit 9 = Bias Return Address Display
Bit 10 = Reenter Parameters
Bit 11-15 = Not Used

2. Stop 2

A	Q
Testing Modes	Interrupt Line No.

A = Testing modes in following format:

Bit 0 = Long Test
Bit 1 = Buffered Data Control
Bit 2 = 274 Console Section Selection
Bit 3 = 274 Console Error Message Display
Bit 4 = Variable Function Keyboard (VFKB)
Bit 5 = Alphanumeric Keyboard (AN/KB)
Bit 6 = Short Error Message
Bit 7 = Run in Memory Stack 1
Bit 8-15 = Not Used

Q = Interrupt Line

The interrupt line is selected by setting the bit corresponding to interrupt line number desired, e.g.: Bit 7 set, interrupt line 7 is selected. This parameter should not be changed after the initial parameter stop.

3. Stop 3

A	Q
Test Sections	OPR. SEL. Test Pattern

A = Test Sections

The desired test sections to be executed will be selected by setting bits corresponding to the section numbers, e.g.: Bit 0 = Section 0. An optional method may be used to select the next section using light pen picking from the word "NEXT" displayed on the console.

Q = Operator Selected Test Pattern

The operator may select a bit configuration of his choice as the final memory test pattern. If no selection is made, the final memory test pattern will be $01F8.

C. MESSAGES

Message typeout will not occur if bit 8 of Stop/Jump word is set.

1. Test title and initial address typeout:

DG406F 1744/274 Digigraphic Test.
IA = XXX, FC = XX

XXX is the initial address of the test.

XX is the frequency count.

2. Section running typeout:

Running Section X

X is section number.

3. End of Section.

A	Q	A	Q
6F22	Stop/Jump Word	Section/ Number	Return Address

4. End of Test.

A	Q	A	Q
6F24	Stop/Jump	Pass Count	Return Address

D. ERROR MESSAGES

All errors are in SMM17 format. The return address indicates the origin of the error reported. The error code is divided into two hexadecimal digits, the lower order digit indicates the error condition while the next significant digit indicates the error type. The uppermost two hexadecimal digits will be the section number (XXYZ).

Where XX = Section Number
Y = Type of Error
Z = Error Condition Code

For specific error code and maintenance aids, see Appendix A.

1. Definition of error types:

Type	Definition
0	Buffered data channel input
1	Buffered data channel output
2	Direct A/Q channel input

Type	Definition
3	Direct A/Q channel output
4	Controller status data (0-7)
5	Controller status data (8-15)
6	Not used
7	Input and output command/function
8	Data compare
9	Register content
A	Not used
B	Interrupt

2. Error conditions defined by types:

Type 0 - Buffered Data Channel Input

Code	Condition
0	Not used
1	External reject on status input (1706)
2	Internal reject on status input (1706)
3	Not used
4	External reject on buffered data input
5	Internal reject on buffered data input
6-9	Not used
A	Un-terminated buffer transfer
B	External reject on 1706 function
C	Internal reject on 1706 function
D	Buffered data channel input failure

Type 1 - Buffered Data Channel Output

Code	Condition
0	Not used
1	Buffered data channel output failure
2	Probable memory failure (RUN MEMTSX)
3	Not used
4	External reject on buffered data output
5	Internal reject on buffered data output

Type 2 - Direct A/Q Channel Input

Code	Condition
0	External reject on controller status input
1	Internal reject on controller status input
2	External reject on direct data input
3	Internal reject on direct data input
4	External reject on S-reg input
5	Internal reject on S-reg input
6	External reject on P-reg input
7	Internal reject on P-reg input
8	External reject on X-reg input
9	Internal reject on X-reg input
A	External reject on Y-reg input
B	Internal reject on Y-reg input
C	External reject on ID byte search input
D	Internal reject on ID byte search input
E	External reject on KYBD status input
F	Internal reject on KYBD status input

Type 3 - Direct A/Q Channel Output

Code	Condition
0	External reject on controller function output
1	Internal reject on controller function output
2	External reject on direct data output
3	Internal reject on direct data output
4	External reject on S-reg address output
5	Internal reject on S-reg address output
6	External reject on terminate computer display
7	Internal reject on terminate computer display
8	External reject on computer display
9	Internal reject on computer display
A	External reject on KYBD function output
B	Internal reject on KYBD function output

Type 4 - Controller Status Data 0-7

Code	Condition
0	Unexpected status
1	Console power off (disabled)
2	KYBD interrupt did not enable

Type 5 - Controller Status Data (Keyboard)

Code	Condition
0	Variable function keyboard did not activate
1	Variable function keyboard did not deactivate
2	Alphanumeric keyboard did not activate
3	Alphanumeric keyboard did not deactivate

Type 6 - Not Used

Type 7 - Input/Output Command/Function

Code	Condition
0	Status data input not functioning
1	Input data command not functioning
2	S-Reg input not functioning
3	P-Reg input not functioning
4	X-Reg input not functioning
5	Y-Reg input not functioning
6	Search ID byte not functioning
7	Keyboard status data input not functioning
8	Reject on clear controller function
9	Output data command not functioning
A	Starting I/O address output not functioning

Type 8 - Data Compare

Code	Condition
0	Memory address error - content incorrect
1	Incorrect storage word content
2	Not used
3	Parity plane test storage error

Type 9 - Register Content

Code	Condition
0	S-register content error
1	P-register content error
2	X-register content error
3	Y-register content error

Type A - Not used

Type B - Interrupt Errors

Code	Condition
0	Not used
1	Internal reject status input
2	External reject status input
3	Internal reject KB status input
4	External reject KB status input
5	Internal reject CLR INTRPT output
6	External reject CLR INTRPT output
7	Internal reject CLR KB INTRPT output
8	External reject CLR KB INTRPT output
9	Interrupt failed to CLR
A	Internal reject - status input after CLR
B	External reject - status input after CLR
C	Unexpected interrupt
X	Reject code stored here for register input
E	PRI failed to occur
F	PRI FF failed to enable

3. Error Message Formats

Parameter entry permits the operator to select long or short error message formats. All console displayed errors will be short format. Error display will not appear on console for sections 2, 3, and 4. Short message format:

Stops 1		2		3		4		5	
A	Q	A	Q	A	Q	A	Q	A	Q
6F58	S/J	SS/XY	RTA	ACT	FUNCT	EXP	DASTA	KBSTA	MEMADR

Long Message format:

Stops 1		2		3		4		5	
A	Q	A	Q	A	Q	A	Q	A	Q
6FA8	S/J	SS/XY	RTA	ACT	FUNCT	EXP	DASTA	KBSTA	MEMADR
Stops 6		7		8		9		10	
A	Q	A	Q	A	Q	A	Q	A	Q
S-EXP	S-ACT	PEXP	P-ACT	X-EXP	X-ACT	Y-EXP	Y-ACT	ID-EXP	ID-ACT

For reject codes stop 3 is the contents of A and Q register.

Glossary:

S/J	=	Stop/Jump word
SS/XY	=	
		SS = Section
		X = Error type
		Y = Error condition
RTA	=	Return address
ACT	=	Actual word received
FUNCT	=	Function code to be performed
EXP	=	Expected word
DASTA	=	Data status word
KBSTA	=	KYBD status word
MEMADR	=	Memory address (1744) or incorrect status bits for status errors
S-EXP	=	Expected S-register contents, if applicable
S-ACT	=	Actual S-register contents, if applicable
P-EXP	=	Expected P-register contents, if applicable
P-ACT	=	Actual P-register contents, if applicable
X-EXP	=	Expected X-register contents, if applicable
X-ACT	=	Actual X-register contents, if applicable
Y-EXP	=	Expected Y-register contents, if applicable
Y-ACT	=	Actual Y-register contents, if applicable
ID-EXP	=	Expected ID byte
ID-ACT	=	Actual ID byte

E. SECTION DESCRIPTION INDEX

The following is an index of section descriptions:

IV. DESCRIPTION

A. GENERAL

1. The diagnostic test consists of 8 individually selectable test sections, designed to test the controller and its associated display console for proper operating condition. Hardware failures and malfunctions will be reported as errors using the previously described error message formats. Error message display on the console is an optional parameter selection, except for Sections 2, 3, and 4.

2. The selection of 1744 controller memory stack is determined by memory test section selected (Sections 2 and 3) as follows:

Memory Test	Testing Stack
MEMTS0 (Sec 02)	Stack 0
MEMTS1 (Sec 03)	Stack 1

The memory stacks will be tested by writing predetermined patterns in the selected stacks, reading each location and comparing its contents for correct pattern.

3. Graphic patterns will be displayed on the console for visual checking of definition and error triangles. Graphic patterns will also be used for alignments.

4. Common subroutines are provided to satisfy SMM requirements and for use by test sections as required.

5. Special features are included that provide console display of the number of the test section running, except for memory tests which are displayed on the typewriter. The word "NEXT" is displayed at the lower center of the display screen which allows the operator to select the next sequential test section previously selected to be executed.

B. SECTION DESCRIPTION

Each section except 2 and 3 will store alphanumeric macros in upper memory locations of running stack unless previously stored. The stack is selected by bit 7, testing mode parameter.

1. Test Section 00 - Command Test (CMDTST).

   Commands and functions of the 1744 Controller except internal jumps, are executed in this section. Responses, storage or register contents are checked to determine if properly executed. Incorrect responses, register contents or malfunctions will result in an error being reported. The test pass frequency is determined by parameter selection for long or short (long - 10 passes; short - 5 passes). A group of clear/disable functions are performed to clear the controller, clear and disable all Interrupt flip-flops (FF), and deactivate all keyboards. Store each memory location with its own address. The capability of setting a starting address in the S register is checked by setting the S register to each value 000 to FFF and reading its contents subsequent to each setting for accurate comparison to its own value. Data transfer commands are exercised by transferring data pattern $AAAA to the controller and reading same from controller memory, and comparing for accuracy. Numerous status inputs are done and bits checked throughout the section. Reset functions are performed to provide known X and Y values which permit X and Y registers input and comparison. Keyboard activation, interrupt FF, enabling, and start display functions are also accomplished by this section.

Any malfunction, incorrect data, or status during the performance of the above commands/functions will cause an appropriate error code to be reported.

2. Test Section 01 - Buffered Data Channel Test (BDCTST)

   This section verifies the proper functioning of the I/O channels. If the Buffered Data Channel (BDC) is used, data is transferred via BDC to the 1744 Controller, and read back via BDC and compared. If an error occurs, the same data is read back via A/Q channel and compared. If this comparison is error free, a BDC input error is reported. In the event it is not error free, the data is again transferred to the 1744 via A/Q channel and read back via A/Q channel and compared. If this comparison is error free, a BDC out error is reported. However, if an error still exists, a memory malfunction error will be reported. Therefore, the memory test should be selected and executed.

   When test Section 01 is selected and it is determined that the BDC is not in the system, control passes to the end of section.

3. Test Section 02 - Memory Stack 0 Test (MEMTS0)

   This section exercises the 1744 Memory Stack 0, utilizing the following patterns:

   Pattern 0 - Zeros
   Pattern 1 - Ones
   Pattern 2 - Address Test
   Pattern 3 - A-5, Pattern Test
   Pattern 4 - Worst Pattern Test
   Pattern 5 - Parity Plane Test
   Pattern 6 - Operator Selectable Pattern
   (Contents of Q register at last test parameter Stop 4)

   The patterns will be sequentially selected and stored in the memory stack under test, the stack will be read and the contents of each cell compared for accuracy. Any unexpected variation of the patterns will be reported as an error to include the address of the failing cell in Q of Error Stop 5. The long/short test parameter selection will cause the section to be repeated 5 times for short or 15 times for long test.

a. Pattern 0 - This pattern ensures that the stack will successfully hold zeros ($0000) in each location. Each location is read and compared for accuracy.

b. Pattern 1 - This pattern ensures that the stack will successfully hold ones ($FFFF) in each location. This is verified by reading and comparing each location.

c. Pattern 2 - This pattern determines if the stack under test will hold its own address and additionally ensures that the 1744 S register can be successfully incremented.

   1) Beginning with the first location of the stack each location is filled with its own address, e.g. (stack 0 = $0000 - $0FFF) (stack 1 = $1000 - $1FFF).

   2) Verification is assured by reading and comparing each location's contents with its address.

d. Pattern 3 - The A-5 pattern test ensures that the stack is capable of holding a pattern of $AAAA and $5555 in adjacent memory locations. This is accomplished by filling the stack with alternate $AAAA and $5555, reading and comparing each location's contents for accuracy.

e. Pattern 4 - This pattern determines if the memory stack will hold the worst pattern which is defined as: $AAAA, $0000, $5555, $FFFF in 64 adjacent locations and $FFFF, $5555, $0000, $AAAA in the next 64 adjacent locations, and continuing this sequence through the last location of the stack.

   1) The pattern is developed by filling 4 locations with $AAAA, $0000, $5555, $FFFF and repeating this pattern sequence until 64 locations are filled.

   2) Fill the next 4 locations with $FFFF, $5555, $0000, $AAAA and repeat this pattern sequence until 64 locations are filled.

   3) Repeat 1) and 2) above until the entire memory stack is filled.

   4) After reading and comparing each location, repeat 1) through 3) above except use the complement of indicated patterns.

f. Pattern 5 - Parity Plane test ensures that the parity plane of the stack will hold zero and one while the rest of the plane holds the worst pattern.

   1) Fill the stack with the complement of the worst pattern, except for plane zero which is masked to zeros. This causes worst pattern to be generated in the parity plane.

   2) Each location is read and compared for accuracy.

   3) Fill the stack with the worst pattern, except for plane zero which is masked to zeros. This causes the complement worst pattern to be generated in the parity plane.

   4) Repeat step 2) above.

g. Pattern 6 - This pattern is pre-stored as $01F8 and may be changed by the operator during parameter entry. To change the pattern the operator will enter the desired pattern in Q - register at parameter stop 4.

4. Test Section 03 - Memory Test Stack 1 (MEMTS1)

   This section is identical to test Section 02, except the 1744 Memory Stack 1 will be tested.

5. Test Section 04 - Jump Test (JMPTST)

   This section ensures the proper performance of the S - Jump, P - Jump, Macro Call, and Return to Main functions.

   The S - Jump is checked by storing the S - Jump byte ($1C8) followed by the Jump address, with all other locations filled with $1F8 end of display byte. Upon executing the jump, an end of display will be detected causing the generation of a priority interrupt. Input S register and compare to determine if S register is equivalent to jump address. Execute for 11 addresses, $0800, $0400, $0200, $0100, $0080, $0040, $0020, $0010, $0008, $0004, $0002.

   The P - Jump, Macro Call, and Return to Main is checked by restoring macros in 1744 memory and executing macro calls to display "S - Jump, P - Jump, and M - Jump. The value of the P register will be checked for errors. Visual check should be made on display console.

   The number of repetitions may be varied by the long/short parameter selection (long - 10 times; short - 5 times).

6. Test Section 5 - Pattern Alignment Test (PALTST)

This section generates and displays graphic patterns for visual scrutiny by the operator to determine display quality and correct alignment.

a. The following three graphic pattern, byte stream groups are sequentially generated in the 1700 processor and transferred to the 1744 controller memory for display on the 274 console:

   1) 5 Dot Pattern

   2) D/A Bit Switching Pattern

   3) Composite Graphics Pattern (boxes, circles, crosses, diagonals, alphanumerics, intensity variations, blinking, and non-blinking functions)

b. The patterns are displayed sequentially as listed above. However, the operator may terminate a pattern and cause the next sequential pattern to be displayed by depressing the light pen switch. To extend the period of pattern display, the repeat section (bit 5) of the Stop/Jump parameter should be set.

c. Pattern Description

   1) The 5 - Dot Pattern (Figure 1) consists of 5 small dots displayed. A hardware adjustment has been made on most 1744 digigraphics systems to cause the outer dots to be just visible. This adjustment causes graphic dimensions on the console to be slightly less than the binary equivalence. For example, binary representation of a 14 inch line is graphically displayed as approximately 13 inches. This adjustment was made to satisfy the standard software package design.

CAUTION

If only the center dot is visible, determine whether the hardware has been adjusted to display inch for inch; if so, visibility of the center dot only is correct.

   2) D/A Switching Pattern (Figure 2) is a diagonal line from lower left to upper right with X and Y bit switching markers beside the line. The line adjacent to the markers should be straight. A marked variation appearing on the line opposite the markers indicates maladjustment of the associated D/A amplifier. To correct this condition, adjust D/A amplifiers until the line adjacent to the markers is straight.

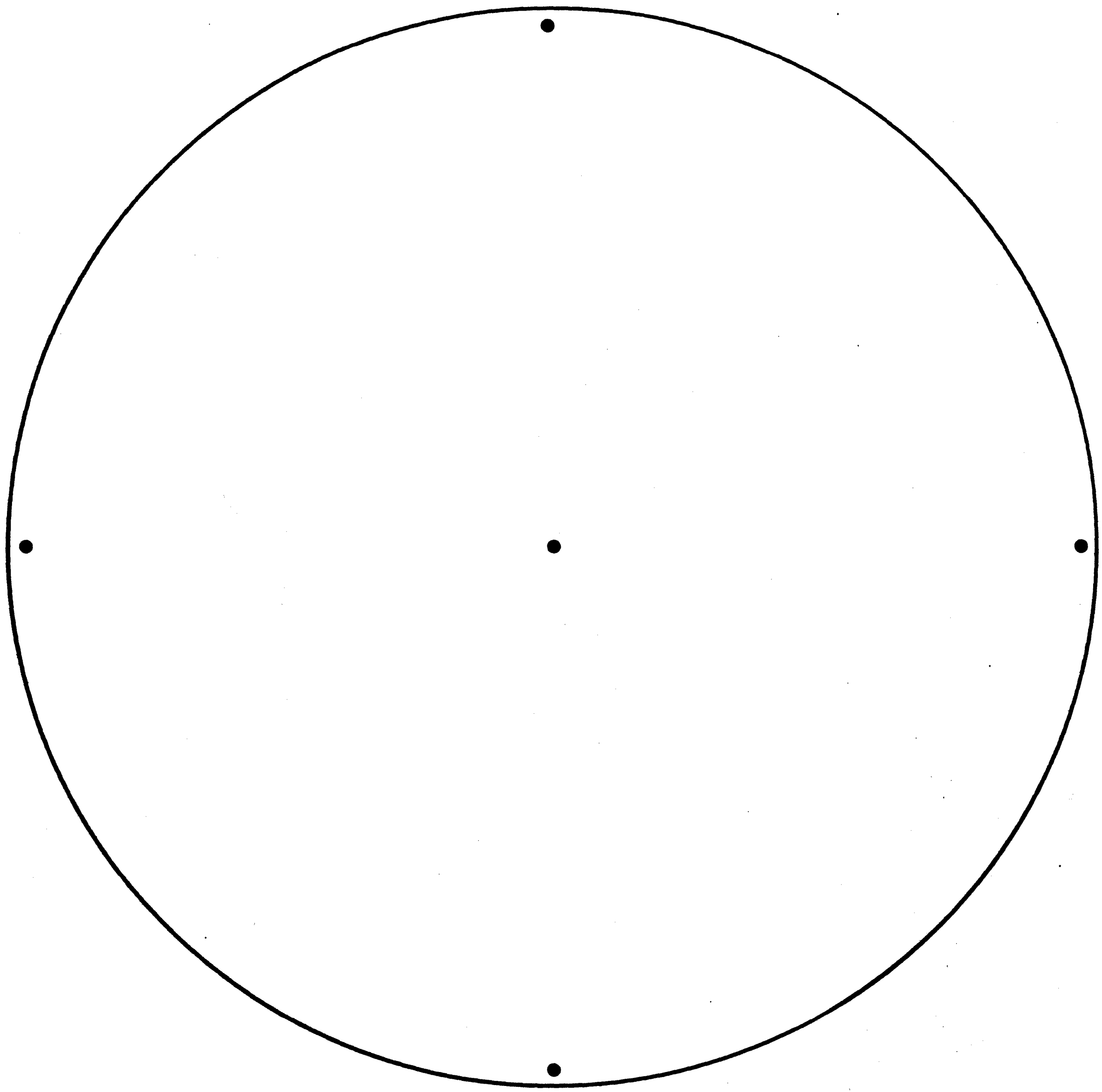


Figure 1. 5 Dot Pattern

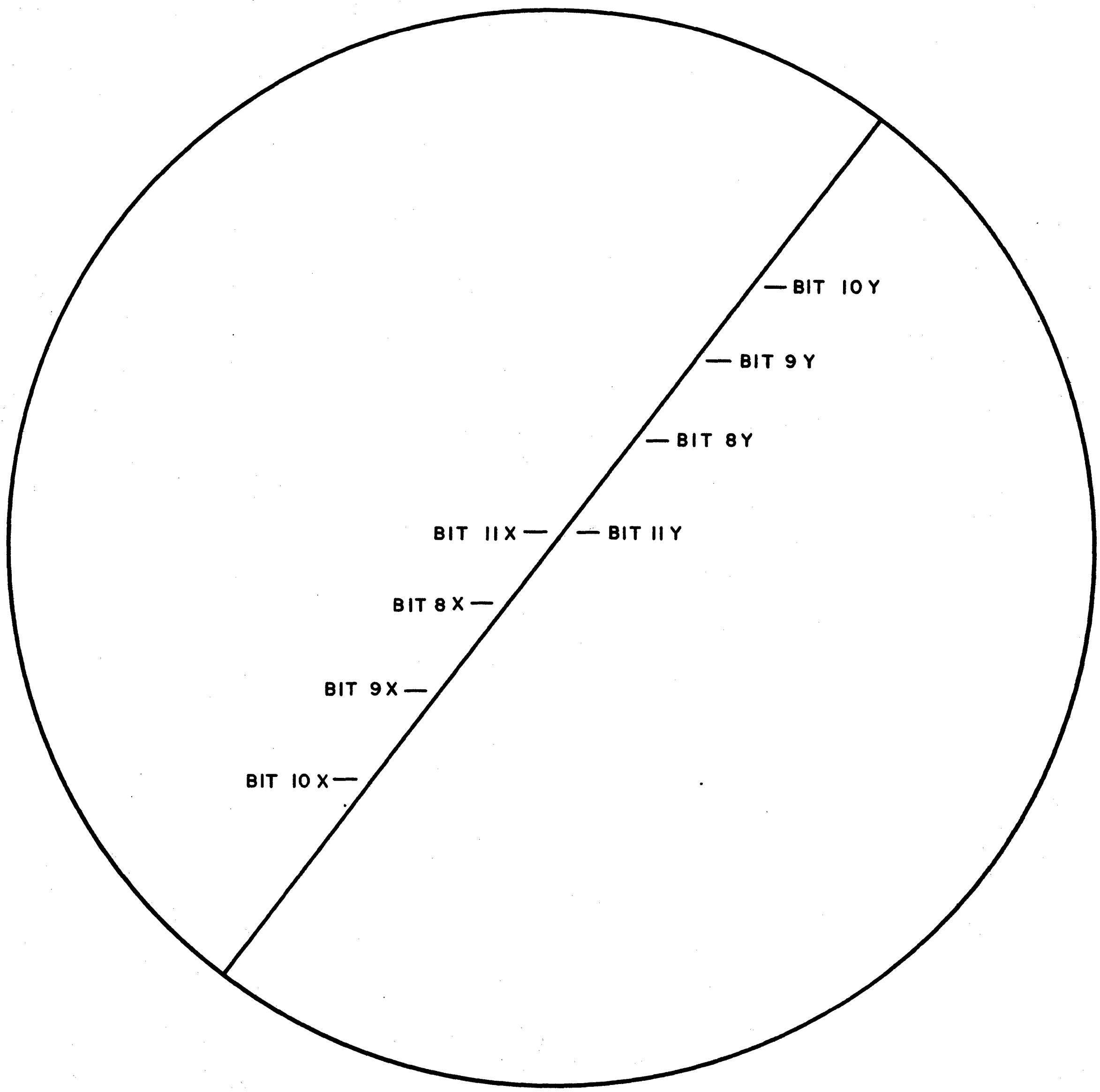


Figure 2. D/A Switching Pattern

3) The Composite Graphics Pattern (Figure 3) consists of three square boxes (14 x 14, 12 x 12 and 7 x 7 inches), four circles 1/2 inch diameter, four circles 2-1/2 inches diameter, two diagonal lines intersecting at the center and with the corners of the two inner boxes and terminating at the four corners of the 14 inch box, two perpendicular lines terminating at the edges of the 14 inch box and forming four right angles at the center, intensity, blinking and nonblinking functions indicated in upper half of pattern, and with alphanumeric characters on both sides. Some incorrect patterns are shown in Figure 4 which indicates malalignment.

7. Test Section 6 - Scale Factor Test (SCLTST)

This test section ensures that each scale factor (2 - 7) will provide the proper unit variation (Figure 5). A horizontal line will be drawn for each scale factor using the same number of incremental byte of equal value. A visual examination should determine if correct variation is attained.

8. Test Section 7 - Keyboard Test (KYBTST)

This test section consists of two subsection described below, each of which requires operator intervention to be effectively completed. The subsections desired must be selected in the test parameter by setting bit 4 for VFKB or bit 5 for AN/KB, or both for dual keyboard configuration. The section, however, will exit after a time out period in the event no further action is taken by the operator.

a. Alphanumeric Keyboard Subsection

The subsection displays as follows:

"HIT RANDOM KEY"

At this time the operator activates a key at random, causing the corresponding character to be displayed. This character should be visually checked against the selected key for match. Continue in this manner until all 64 ASCII subset characters are checked. Upon completion of this subsection, it advances to the variable function keyboard subsection after time out period. If variable function keyboard is not in the system, it advances to the end of section.

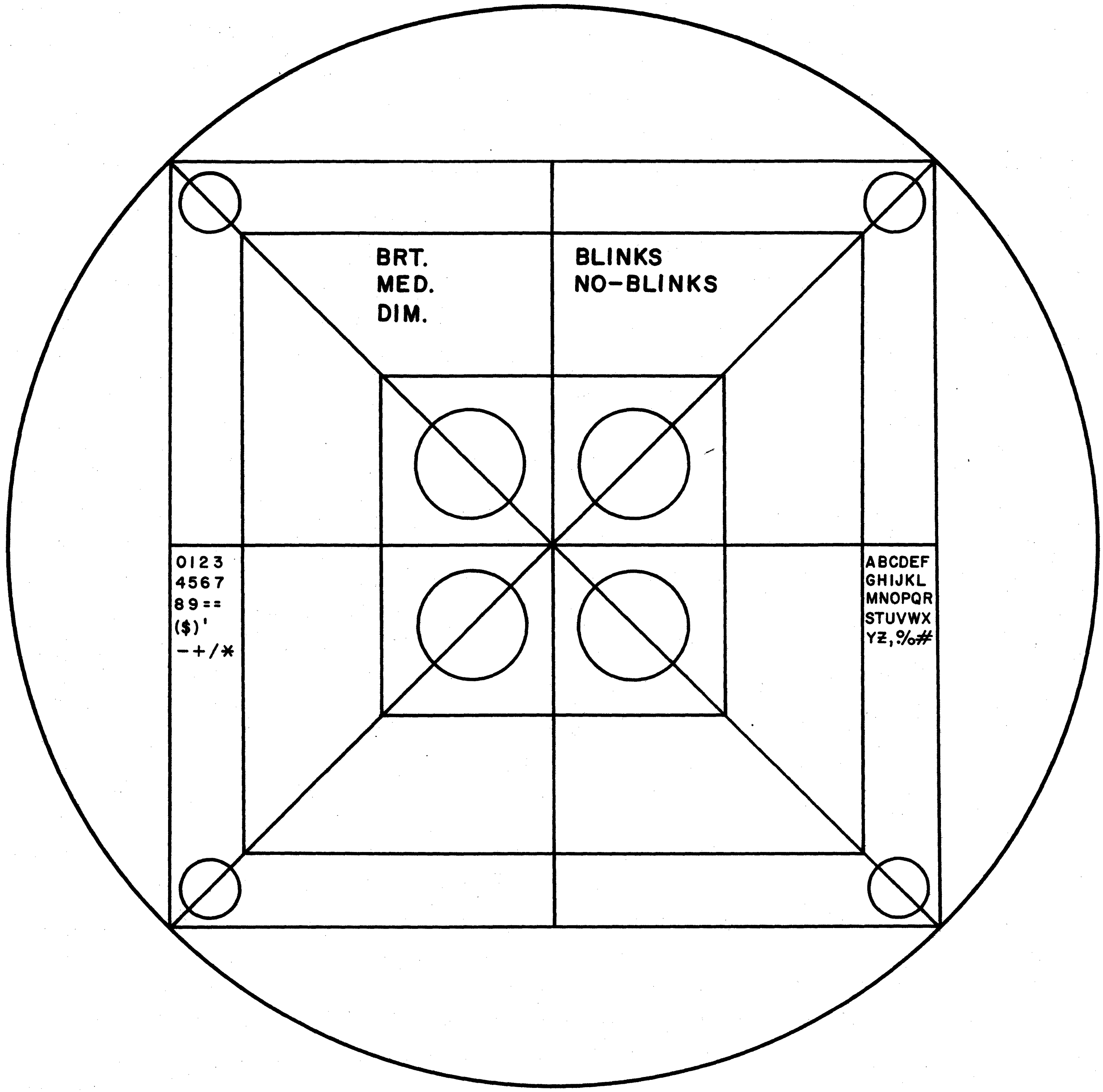


Figure 3. Composite Graphics Pattern

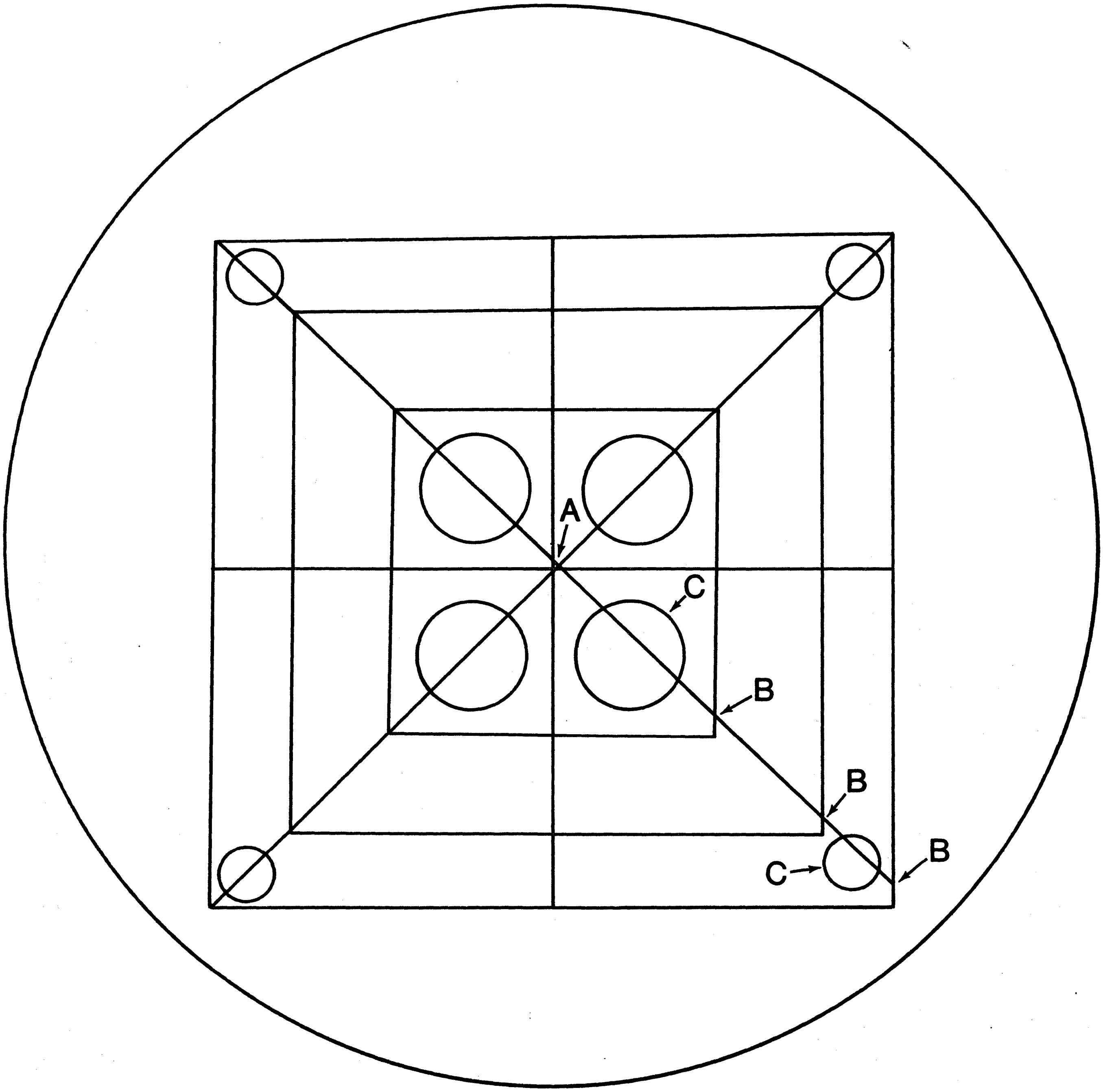


Figure 4. Malaligned Composite Pattern

A. Error Triangle
B. Diagonal not through Corner
C. Diagonal not through Center of Circles

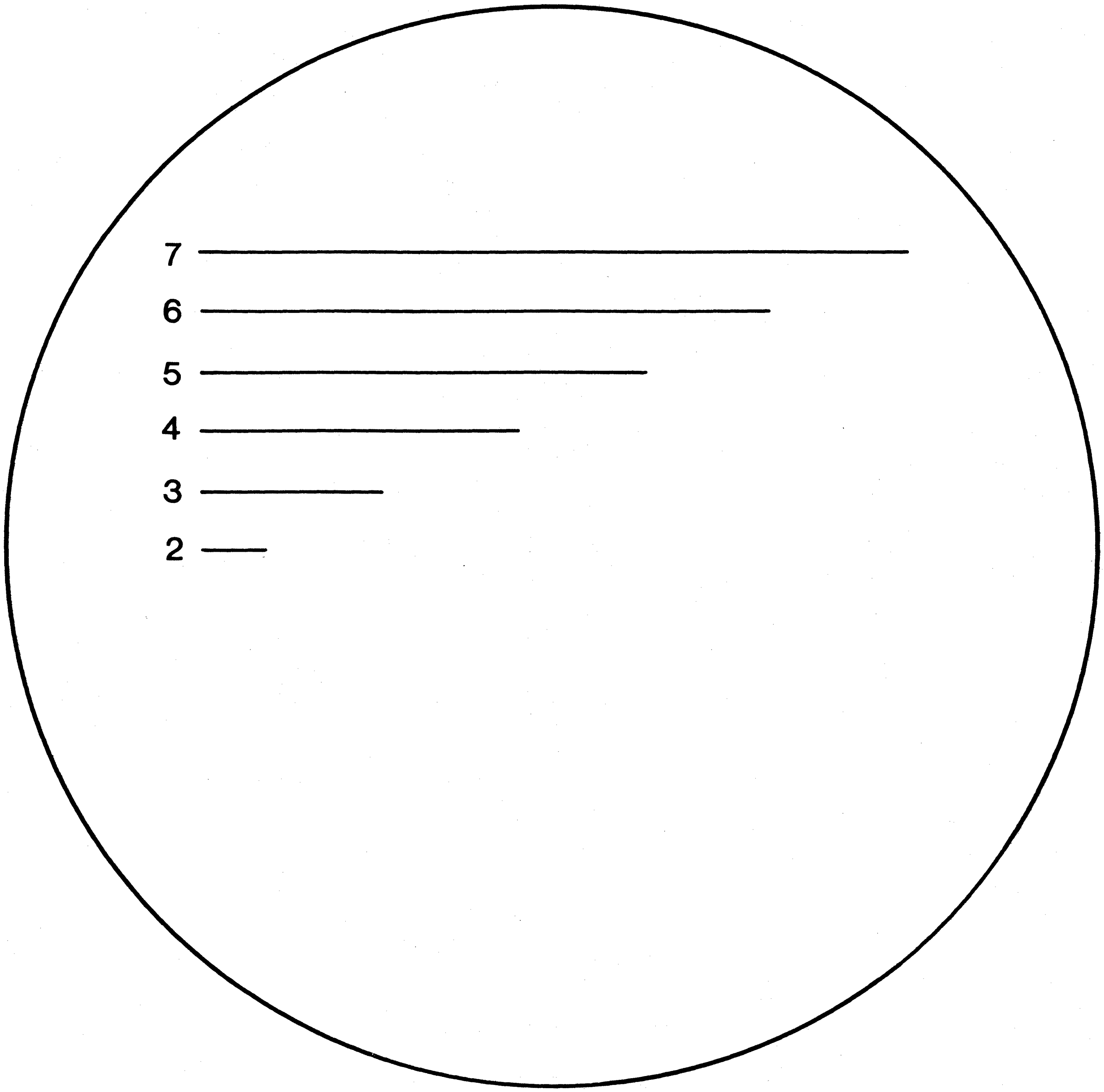


Figure 5. Scale Factor Pattern

b. Variable Function Keyboard Subsection

The keyboard activation is accomplished by the section. After keyboard is activated, the keyboard interrupt is enabled which allows the operator to randomly select one or more keys.

Upon key selection, depress the Accept key (keyboard interrupt is generated) which will cause the keyboard pattern (Figure 6) to be displayed with a blinking "X" appearing in the corresponding key position, including the Activate key. All keys other than the Accept and Reject keys are latching type and will remain activated until released. The release of latching keys followed by depressing the Accept/Reject key will cause the removal of the blinking "X" in the next pattern display for all released keys. Non-selection by operator will cause exit to next section after time out.

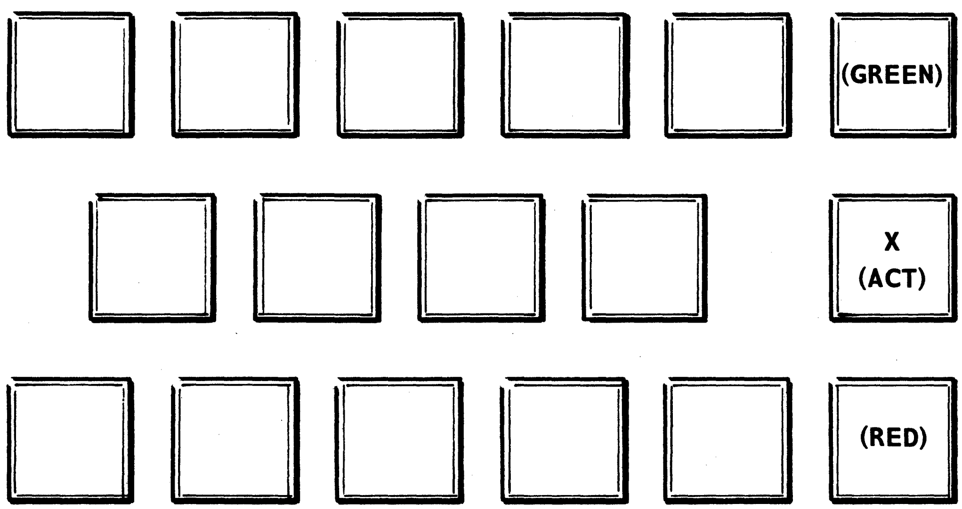


Figure 6. Variable Function Keyboard Display Pattern
(blinking "X" indicates keys activated)

APPENDIX A

I. MAINTENANCE ROUTINES

A. 1744 DIGIGRAPHIC CONTROLLER MEMORY DUMP

This routine reads the contents of the 1744 Memory Stack (2048) and stores it in the buffer area. It also passes control to the line printer or teletypewriter dump routine for printout.

1. Call - Set P register to IA + $10,

   Set A register bit 15 = 1, for teletypewriter, or bit 15 = 0 for line printer output. Set bit 12 = 0 for stack 0 or bit 12 = 1 for stack 1.

   Set Q register to $0 for memory location 0-2047, or set Q register to $800 for memory locations 2048-4096.

2. Execute - RUN/STEP Switch to Run

To dump the complete stack 0 two runs must be made, one for each Q register setting. To dump the complete stack 1 (same as above) with bit 12 of A register set.

B. TELETYPEWRITER DUMP

This routine prints the contents of the computer memory on the teletypewriter from the address specified in the A register to the address specified in the Q register.

1. Call - Set P register to IA + 9.
   Set A register to FWA.
   Set Q register to RUN.
2. Execute - RUN/STEP Switch to Run.

C. LINE PRINTER DUMP

This maintenance routine prints the computer memory contents specified by A and Q registers on the line printer.

1. Call - Set P register to IA + $E.
   Set A register to FWA.
   Set Q register to LWA.
2. Execute - RUN/STEP Switch to Run.

II. ERROR CODES

Error Code is prefixed with section number (XX) when displayed.

Code	Definition
XX01	Ext. Reject - Status Input (BDC)
XX02	Int. Reject - Status Input (BDC)
XX04	Ext. Reject - Data Input (BDC)
XX05	Int. Reject - Data Input (BDC)
XX0A	Un-Terminated BFR Transfer
XX0B	Ext. Reject - BDC Function
XX0C	Int. Reject - BDC Function
XX0D	Input Failure (BDC)
XX10	Input Data Error (BDC)
XX11	Output Failure (BDC)
XX12	Probable Memory Failure (Suggest running memory test)
XX14	Ext. Reject - Data Output (BDC)
XX15	Int. Reject - Data Output (BDC)
XX20	Ext. Reject - Controller Status Input (1744)
XX21	Int. Reject - Controller Status Input (1744)
XX22	Ext. Reject - Direct Data Input
XX23	Int. Reject - Direct Data Input
XX24	Ext. Reject - S Register Input
XX25	Int. Reject - S Register Input
XX26	Ext. Reject - P Register Input
XX27	Int. Reject - P Register Input
XX28	Ext. Reject - X Register Input
XX29	Int. Reject - X Register Input
XX24	Ext. Reject - Y Register Input
XX2B	Int. Reject - Y Register Input
XX2C	Ext. Reject - ID Byte Input
XX2D	Int. Reject - ID Byte Input
XX2E	Ext. Reject - Keyboard Status Input
XX2F	Int. Reject - Keyboard Status Input
XX30	Ext. Reject - 1744 Function Output
XX31	Int. Reject - 1744 Function Output
XX32	Ext. Reject - Direct Data Output
XX33	Int. Reject - Direct Data Output

Code	Definition
XX34	Ext. Reject - S Register Output (ADDR)
XX35	Int. Reject - S Register Output (ADDR)
XX36	Ext. Reject - Terminate Computer Display
XX37	Int. Reject - Terminate Computer Display
XX38	Ext. Reject - Computer Display
XX39	Int. Reject - Computer Display
XX3A	Ext. Reject - Keyboard Function Output
XX3B	Int. Reject - Keyboard Function Output
XX40	Unexpected Status
XX41	Console Power Off
XX42	KB Interrupt FF Did Not Enable
XX50	VFKB Did Not Activate
XX51	VFKB Failed to De-activate
XX52	AN/KB Did Not Activate
XX53	AN/KB Failed to De-activate
XX70	Controller Status Data Incorrect
XX71	Input Data Command Failed
XX72	S Register Input Failed
XX73	P Register Input Failed
XX74	X Register Input Failed
XX75	Y Register Input Failed
XX76	Search ID Byte Failed
XX77	Keyboard Status Input Failed
XX78	Reject on Clear Controller Function
XX79	Output Data Command Failed
XX7A	S - Register Output Failed
XX80	Memory Location - Wrong Address/Bad Compare
XX81	Memory Error - Incorrect Compare
XX83	Parity Plane Test - Storage Error
XX90	S Register Content Error
XX91	P Register Content Error
XX92	X Register Content Error
XX93	Y Register Content Error
XXB1	Int. Reject - Status Input (Interrupt processor)
XXB2	Ext. Reject - Status Input (Interrupt processor)
XXB3	Int. Reject - Keyboard Status Input (Interrupt processor)
XXB4	Ext. Reject - Keyboard Status Input (Interrupt processor)

Code	Definition
XXB5	Int. Reject - Clear Interrupt
XXB6	Ext. Reject - Clear Interrupt
XXB7	Int. Reject - Clear KB Interrupt
XXB8	Ext. Reject - Clear KB Interrupt
XXB9	Interrupt Failed to Clear
XXBA	Int. Reject - Status Input (after clear interrupt)
XXBB	Ext. Reject - Status Input (after clear interrupt)
XXBC	Unexpected Interrupt
XXBE	PRI Int. Failed to Occur
XXBF	PRI Int. FF Failed to Enable

CYBERDATA KEY ENTRY STATION TEST

(Key 060 Test No. 60)

I. INTRODUCTION

This diagnostic will test the CYBERDATA unique components.

II. REQUIREMENTS

A. HARDWARE TESTED

970-8	Key Entry Station Controller
970-8	Key Entry Distribution Unit
970-32	Key Entry Station (CRMT)
970-480	Key Entry Station (CRVT) with 029 Keyboard
970-481	Key Entry Station (CRVT) with TTY Keyboard
FC701	Remote Multiplexer (CMRC)
FC602	Local Controller (CMLC)
CK115	Receive Only Printer

B. SOFTWARE

This diagnostic is designed to operate under control of the SMM17 Monitor.

III. OPERATIONAL PROCEDURE

A. LOADING PROCEDURE

This diagnostic is loaded using the standard SMM17 monitor test loading procedure.

NOTE

The equipment code used must be the address of the controller supplying the interrupt.

B. PARAMETERS

This diagnostic is set to run with a prestored set of parameters. No parameter changes are required if the prestored list of parameters are valid for the stations to be tested. To alter the prestored parameters, follow the directions stated in SMM17 Reference Manual.

The parameter stops are as follows:

First stop (overflow light on)

(A) = 6031 - test ID stop

(Q) = Stop/Jump parameter

Second stop

(A) = Sections to run (prestored as 0027)

(Q) = Interrupt line - interrupt line 7 = bit 7, etc. (prestored as 0100)

Third stop

(A) = Number of controllers to be tested (prestored as 0001) (maximum of 8)

(Q) = Number of lines to print in Section 6 (prestored as 0028)

The number of remaining stops is dependent on the number of controllers to be tested. The format of the remaining stops is as follows:

(A) Bits 8 through 15 = stations to be tested, where:
Bit 8 = Station 0, etc.

(A) Bits 0 through 7 = stations containing 480 character terminals.

Example: If station 5 is a 480 character terminal, set bit 5 in the A register.

(Q) = Equipment code of the controller to be tested.

The previous stop will continue until all controllers have been entered.

If section 6 is selected upon entry and before execution, the following printout will occur:

Enter Printer Equipment Number in A Register. A stop will occur to allow this entry.

C. SECTION DESCRIPTION INDEX

Section 0	Controller Test
Section 1	Output Worst Pattern
Section 2	Output All Characters and Character Positioning
Section 3	Input from Keyboard and Display
Section 4	Input from One Station Output to Another
Section 5	Plasma Matrix Check
Section 6	Receive ONLY Printer Test
Section 7	Input from Keyboard and Display with Code Conversion for 970-481
Section 8	Input from One Station Output to Another with Code Conversion for 970-481

IV OPERATION COMMUNICATION

A. MESSAGE FORMATS

1. Error Messages

All error message displays use the standard SMM17 error message format:

A	Q	A	Q	AQ......AQ
60X8	Stop/Jump Parameter	Section/ Error	Return Address	(See Individual Error Message)

B. MESSAGE DICTIONARY

Error Code	Program Tag Name	Message
Entry Error		
01	PARENT	Parameter entry error, retry A3 = Sections Q3 = Interrupt line A4 = Stations to test Q4 = Stations containing 480 character displays
Reject Error		
02	INTPRO IO	Internal reject on input A3 = A register contents Q3 = Q register contents A4 = Address of calling program Q4 = Not used
Reject Error		
03	INTPRO IO	External reject on input A3 = A register contents Q3 = Q register contents A4 = Address of calling program Q4 = Retry count
Reject Error		
04	INTPRO IO	Internal reject on output Same as 02
Reject Error		
05	INTPRO IO	External reject on output Same as 03
Status Error		
06	SEC0	Status error A3 = Actual status Q3 = Expected status
Status Error		
07	SEC0	Clock status did not clear when clear controller was executed

Error Code	Program Tag Name	Message
Data Error		
08	INPCHK	Input word not equal to expected word A3 = Actual data Q3 = Expected data A4 = Not used Q4 = Equipment number
Parity Error		
09	IO	Parity error A3 = Input word Q3 = Equipment Address A4 = Line address Q4 = Character address
Character Lost		
0A	IO	Character lost A3 = Input word Q3 = Equipment address A4 = Line address
Break		
0B	IO	Break condition detected A3 = Input word Q3 = Equipment address A4 = Line address Q4 = Character address
Status Error		
0C	INTPRO	Interrupt received, clock status not set
Status Error		
0D	INTPRO	Clock status did not clear with clear interrupt
False Interrupt		
0E	INTPRO	Clock interrupt occurred when disabled
Time Out		
0F	SEC0	Controller time out. No clock status
Status Error		
10	IO SEC2	No character request status A3 = Input word Q3 = Equipment address

Error Code	Program Tag Name	Message
11	PARENT	Character ready did not clear on input A3 = N/A Q3 = Equipment address

V DESCRIPTIONS

A. GENERAL

The diagnostic performs various tests on the CYBERDATA Key Entry Controller and Stations. The test sections to be run are selected via the parameter entry routine. Common subroutines include: parameter entry, error reporting, interrupt processing, and the input/output driver.

B. SECTION DESCRIPTIONS

1. Section 0 - Controller Test

This section checks the operation, status, and functions of the controller. Controller status is read and the protect status is checked. A message is printed on console teletype and all selected stations if protected.

The clock status is then checked. If it is not set, program waits 40 milliseconds for clock status to set. If clock does set in the prescribed time, ERROR "F" is generated. When clock status is detected, a clear controller is attempted (no rejects expected). ERROR "7" is generated if clock status does not clear when clear controller is attempted. ERROR "6" is generated if any status other than protected or clock is received.

NOTE

If clock status does not set in the prescribed time, the test is terminated.

2. Section 1 - Output Worst Pattern

This section outputs the U*U* pattern as a worst condition test. The operator must observe the pattern displayed to determine proper operation. One page is sent to all selected stations using character positioning. A 480-character buffer is built at INIT. The clear command is issued to all selected stations and the I/O driver is scheduled.

Re-entry is performed after completion of buffer and repeat section is tested.

3. Section 2 - Output All Characters and Character Positioning

This section will transmit the alphanumeric repertoire. The first page consisting of every other character of the repertorie is written. The second page uses the character positioning mode of operation to fill in the blanks. The erase line feature is used to clear the screen upon completion (bottom to top). It will be necessary for the operator to monitor the display to determine proper operation. Repeat conditions are checked between pages.

A 480-character buffer is built at INIT. The clear command is issued to all selected stations, and the I/O driver is scheduled for each page and the erase line functions, bottom to top.

4. Section 3 - Input from Keyboard and Display

This section requires the operator to exercise the keyboard. Characters received will be returned and displayed. The operator must determine proper operation. Operating the "INT" key will terminate the section.

The "Input" message buffer is scheduled for the I/O driver. Upon completion, the input word table is monitored for data received. When data is received it is checked to determine code type. The alphanumeric repertoire is saved in a single character buffer. Special key codes will generate the appropriate message buffer. The "INT" key will terminate the section and schedule the I/O driver.

5. Section 4 - Input from One Station Output to Another

This section receives data from any station and will display the data on any other station. The first two characters received will determine the station to which the data will be sent. Operating the "INT" key will terminate this section.

The message "THIS IS XX OUTPUT TO" is scheduled for the I/O driver. Upon completion, the input word table is monitored for data received. The first two characters received will be saved in the routing table which will be used as the destination station for data received from this station. When data is received, it is checked to determine code type (same as Section 3). The "INT" key will terminate the section. All buffers, when generated, will schedule the I/O driver.

6. Section 5 - Plasma Matrix Check

This section will print characters which will use all matrix positions of the plasma display. One page each of the characters H, I, and number sign will be printed. Each page is terminated by the "INT" key.

A 480-character buffer is built at INIT. The clear command is issued to every selected station. The I/O driver is scheduled with the first page. When the "INT" character is received, the next page is scheduled until the three pages are complete. Repeat condition is checked after each page.

7. Section 6 - Remote Printer Test

This section performs various functions on the remote printer to verify its operation.

Upon entry, the following message will be printed on the console writer:

RESET PRINTER AND
ENTER PRINTER EQUIPMENT CODE IN A REGISTER

Only one printer may be tested at a time. If it is desirable to test another printer, the parameter stop must be re-entered.

After the entry of the equipment code, the test will set tabs and print a message using the TAB function. The tabs are then cleared,and the TAB function is used to print a message. An alphanumeric pattern is printed and shifted to verify all characters are printable. The number of lines to be printed is selected in the initial parameter entry (Q4).

During all character outputs, the echo check is made and the character is verified. If an error should occur, Error 8 is reported.

Other errors reported by this section include the Reject errors (2, 3, 4, and 5), Parity (9), Character Lost (A), Break (B), and Modem error (12).

8. Section 7 - Input from Keyboard and Display

This section is the same as Section 5 except a code conversion takes place between the input and output routines.

9. Section 8 - Input from One Station Output to Another

This section is the same as Section 4 except a code conversion takes place between the input and output routines.

C. SUBPROGRAM DESCRIPTION

The subprograms used by this diagnostic, with the exception of the I/O driver, are used primarily for interface to SMM17.

1. PARENT

   The parameter entry routine allows the operator to select the tests which are applicable to his system and situation. Failure to select at least one section, an interrupt line, and at least one controller will result in error code 1 being reported. After the error is reported, the routine will initialize and return for a retry.

2. SECSEL

   The section select routine will transfer control to the selected sections, one at a time, until all sections have been completed. After completion of all sections, control is given to the end test routine.

3. ENDTES

   The end of test routine will check the stop at end of test parameter. If bit 2 of the Stop/Jump word is set, a stop will occur in accordance with SMM17 requirements. After the stop, bit 6 will be tested to determine if repeat test is desired.

4. REPTES

   The repeat test routine will reinitialize the section select routine and check the Stop/Jump word for re-enter parameters (bit 10) and stop to enter parameters (bit 0). If both are set, a parameter stop will occur.

5. REPSEC

   The repeat section routine will stop at the end of a section if bit 1 of the Stop/Jump word is set. If not set, control is given to the next section via the section select routine.

6. REPCON

   The repeat conditions routine will check bit 4 of Stop/Jump word. If set, the previous conditions will be repeated.

7. ERRRPT

   The error reporting routine reports all errors detected by the diagnostic. Errors are reported in accordance with SMM17 procedures. This routine also contains the error data table (ERRDAT).

8. INTPRO

The interrupt processor will read and save controller status. The clock enable flag is checked, and ERROR E is reported if clock was not enabled when the interrupt occurred. The I/O driver is entered via the return address (IA+5). The exit from this routine will be to the exit interrupt handler located in SUMMIT.

9. IO

The input/output driver is completely interrupt driven and performs all data transfers in the character positioning mode. This routine is scheduled by the various sections via the enable interrupt routine and is entered when the interrupt is received by the interrupt processor (INTPRO).

The driver reads station status from all selected stations. The status word is saved in the status word table, and character ready status is checked. If character ready is set, parity error, character lost, and break status are examined. These errors are then reported, if present, as ERROR 9, ERROR A, and ERROR B, respectively. The output word table is checked for activity. If the output buffer is active, the driver will send the line address from LAD, the character address from CAD, and one word from the data buffer. The line address, character, and buffer addresses are updated. First word and last word addresses are compared. If addresses are equal, OUTWD is cleared (not active). Exit is accomplished by enabling interrupts and returning to the monitor.

VI APPLICATIONS

A. HUNG CONDITIONS

This diagnostic is entirely interrupt driven, therefore, interrupt failure will cause a hung condition waiting for I/O to complete.

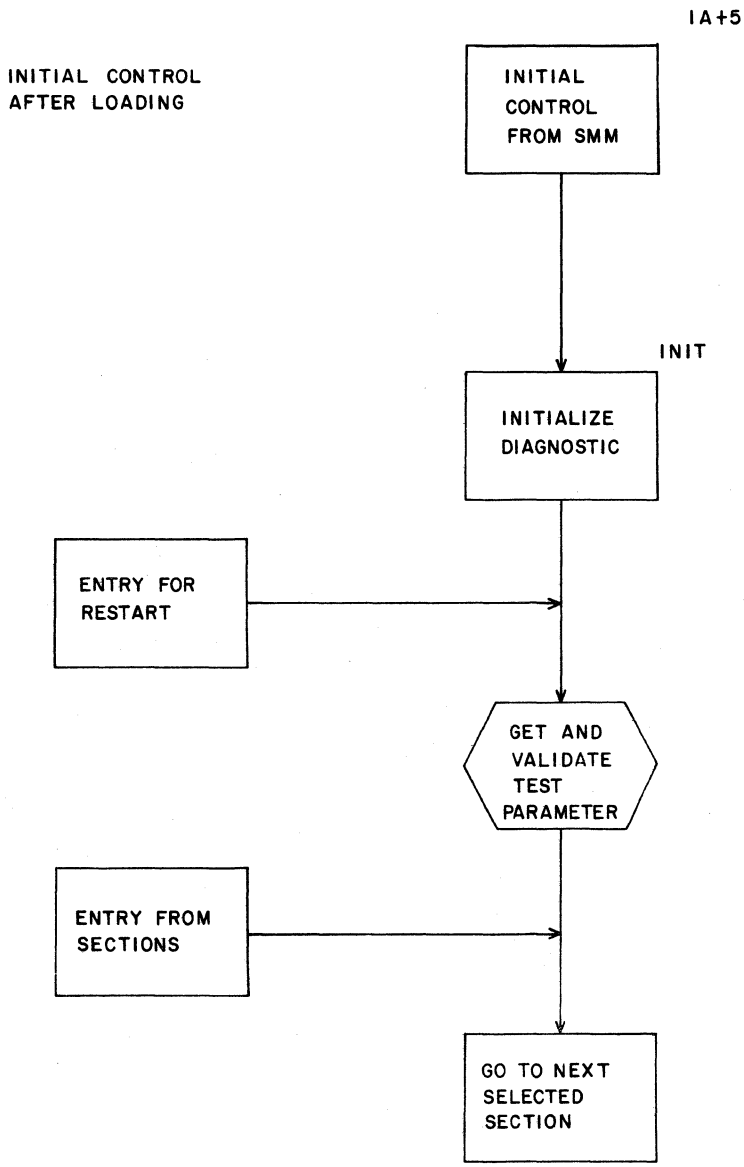
Failure of the character ready status to clear will cause a hung condition at program tag DUMIN. A dummy input is performed to clear character ready status. If this status does not clear, the diagnostic continues to try.

B. NO OUTPUT

If the diagnostic appears to be operating normally but nothing is displayed, the probable cause is the interrupt speed. The clock period cannot be less than one character time (that is, at 1200 baud, the clock period cannot be less than 9.1 microseconds). In a checkout environment, the jumper options may not be selected properly.

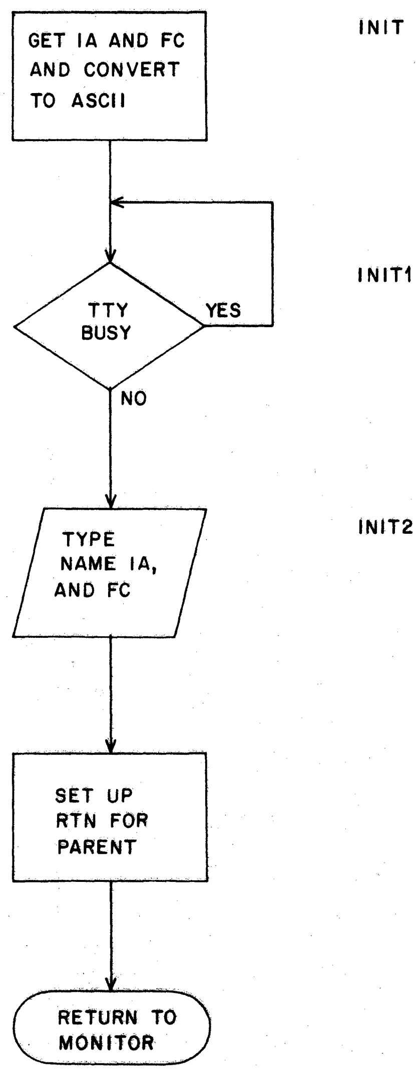
```
S       E       T       _       T       A       B       S
S       E       T       _       T       A       B       S
S       E       T       _       T       A       B       S
S       E       T       _       T       A       B       S
S       E       T       _       T       A       B       S
```

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_qacsuuvwhijklmnopqrstuvwxyz{|}~
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ 
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !
#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"
$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#
%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$
&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%
'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&
()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'
)*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'(
*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()
+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*
,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+
-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,
./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-
/0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-.
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./
123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0
23456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./01
3456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./012
456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123
56789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./01234
6789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./012345
789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456
89:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./01234567
9:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./012345678
:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789
;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:
<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;
=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<
>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=
?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@
BCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@A
CDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@AB
DEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABC
EFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCD
FGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDE
GHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEF
HIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFG
IJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGH
```

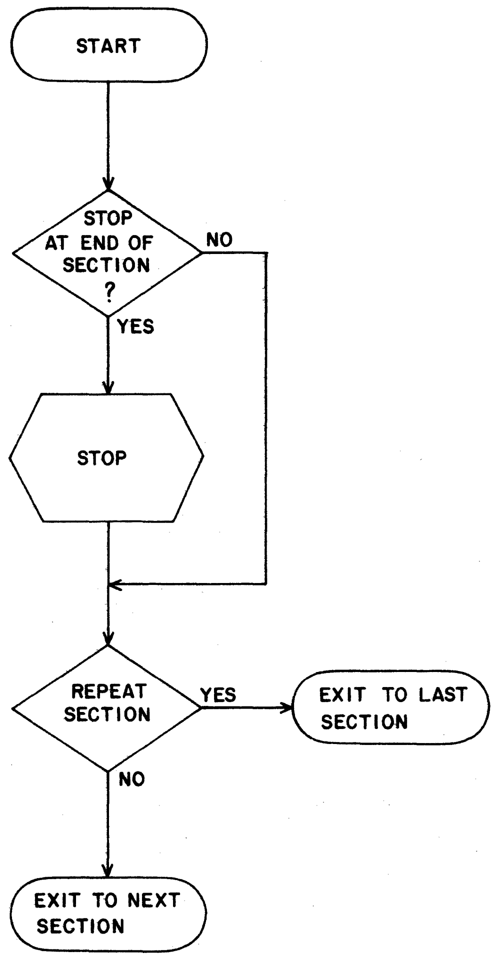


INITIAL CONTROL
AFTER LOADING
IA+5
INITIAL
CONTROL
FROM SMM
INIT
INITIALIZE
DIAGNOSTIC
ENTRY FOR
RESTART
GET AND
VALIDATE
TEST
PARAMETER
ENTRY FROM
SECTIONS
GO TO NEXT
SELECTED
SECTION

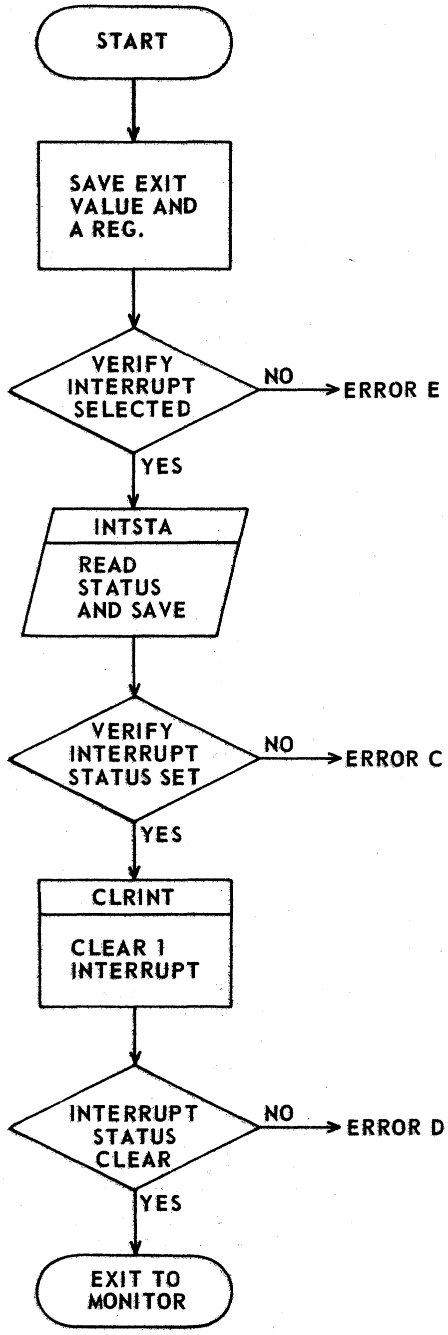
INITIALIZE ROUTINE (INIT)



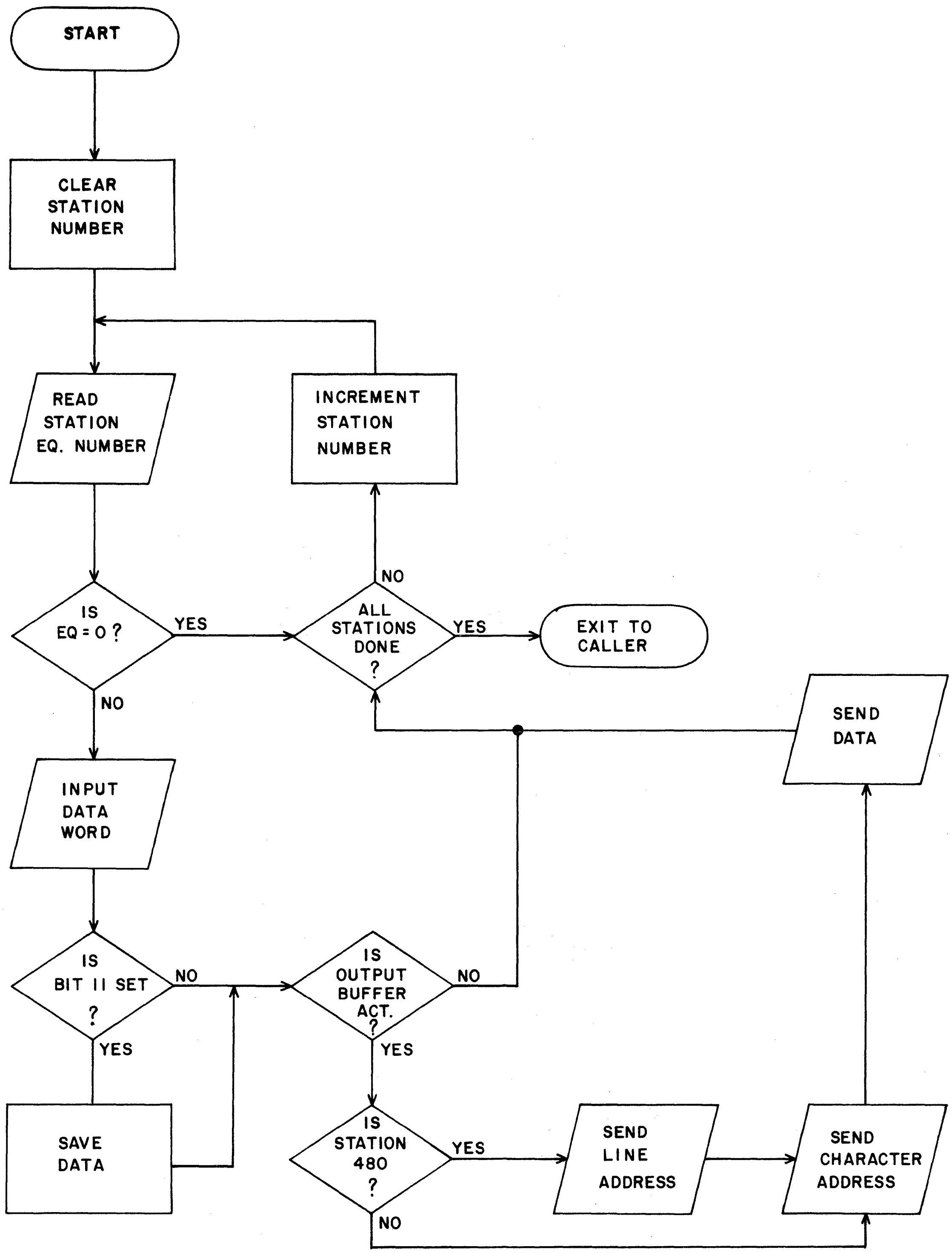
REPEAT SECTIONS ROUTINE (REPSEC)



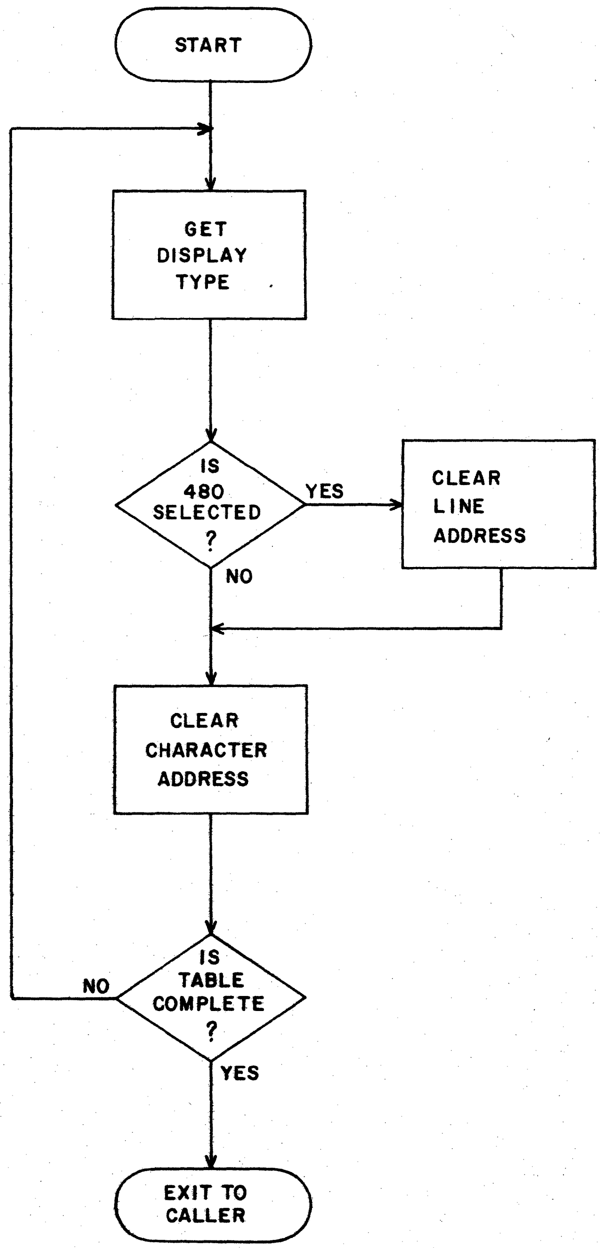
INTERRUPT PROCESSOR (INTPRO)



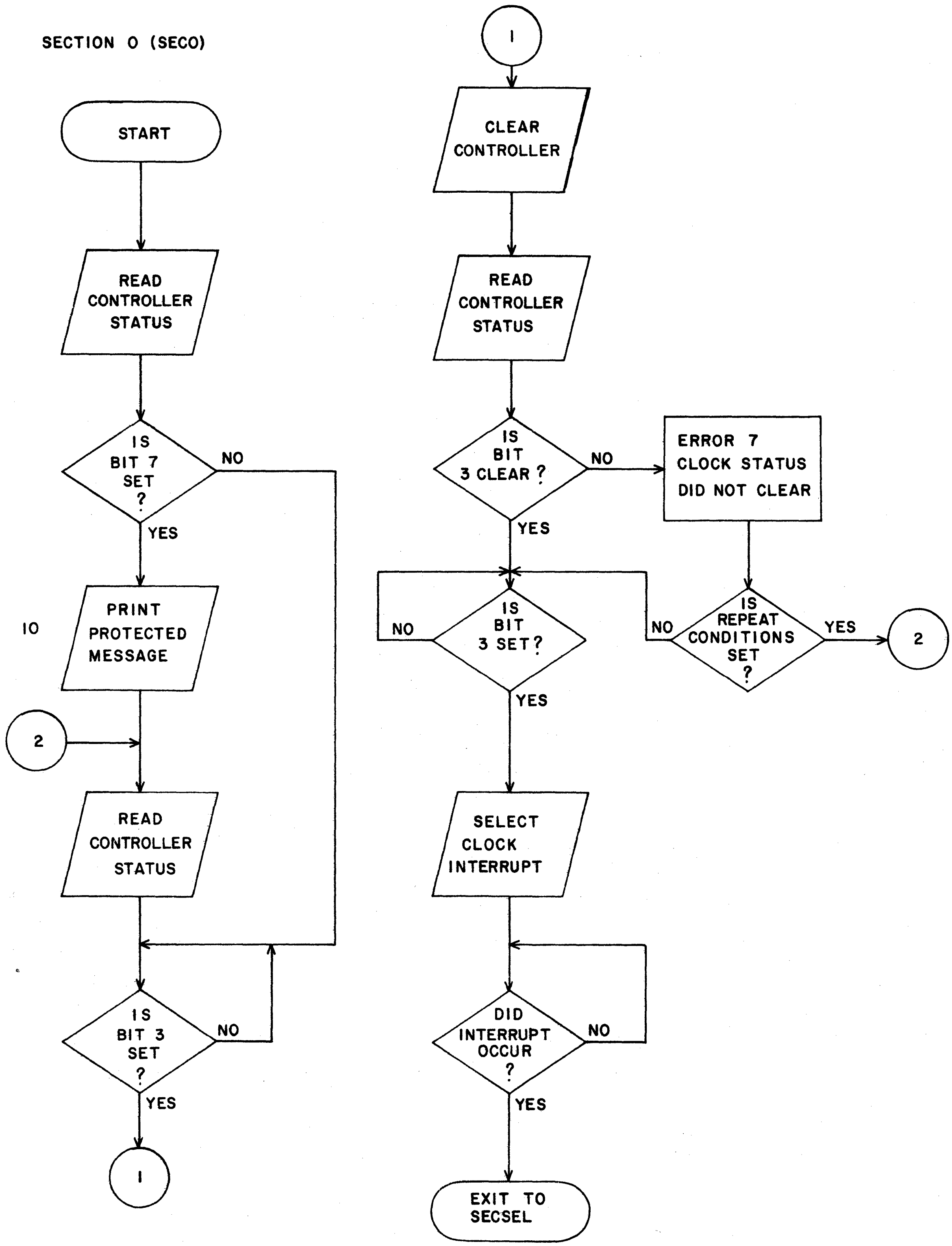
INPUT/OUTPUT DRIVER (IO)



CLEAR TABLE ROUTINE (TABCLR)



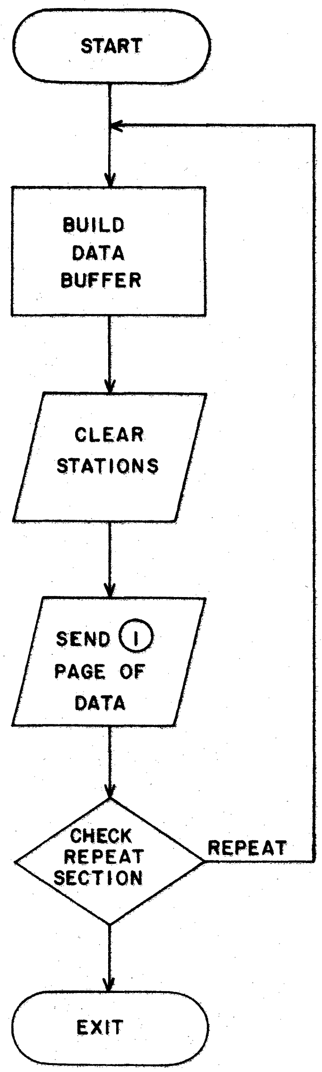
SECTION 0 (SECO)



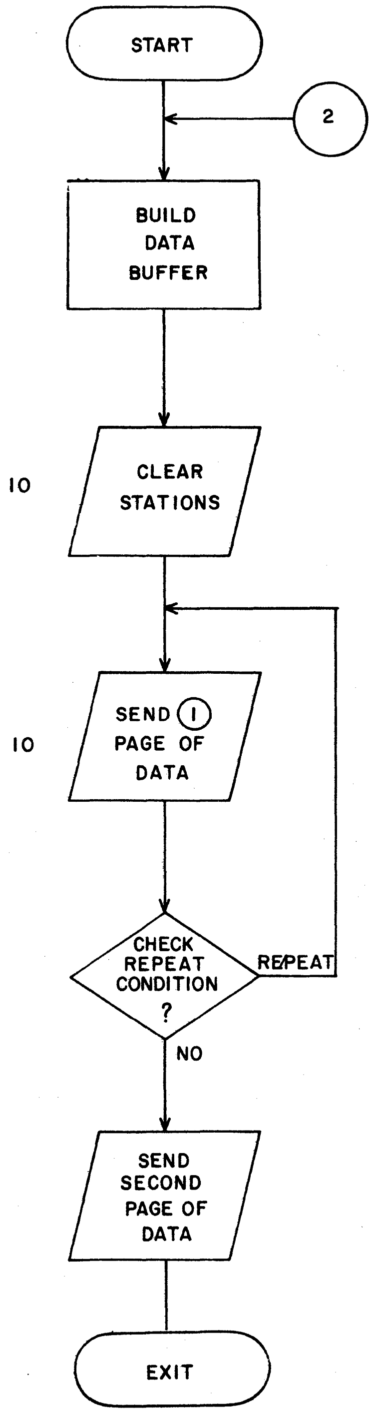
SECTION I (SECI)

10

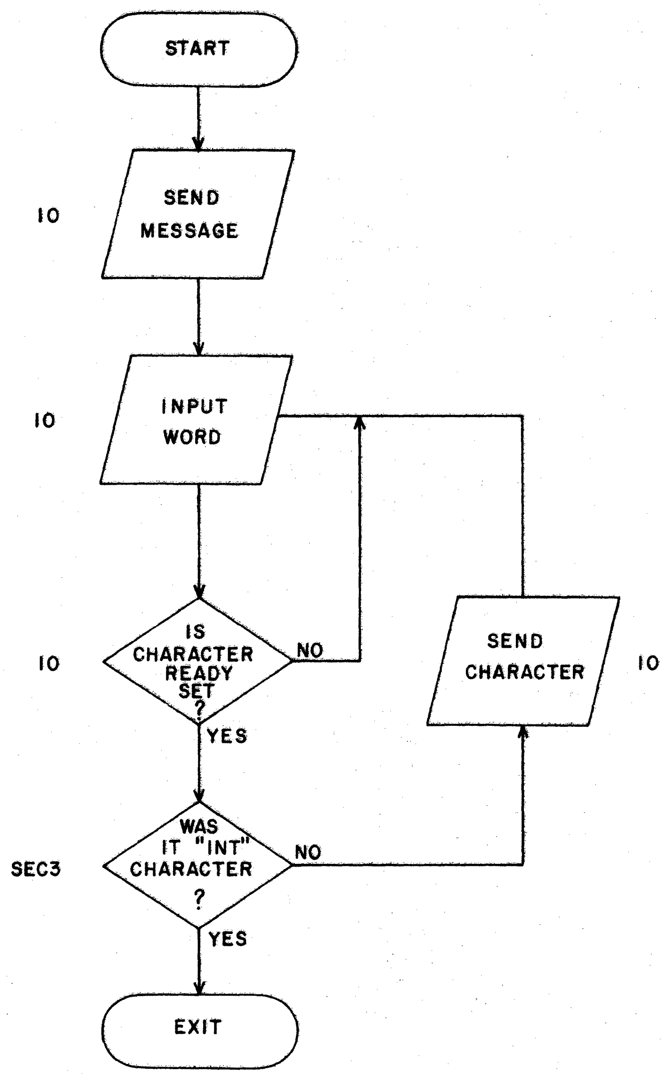
10



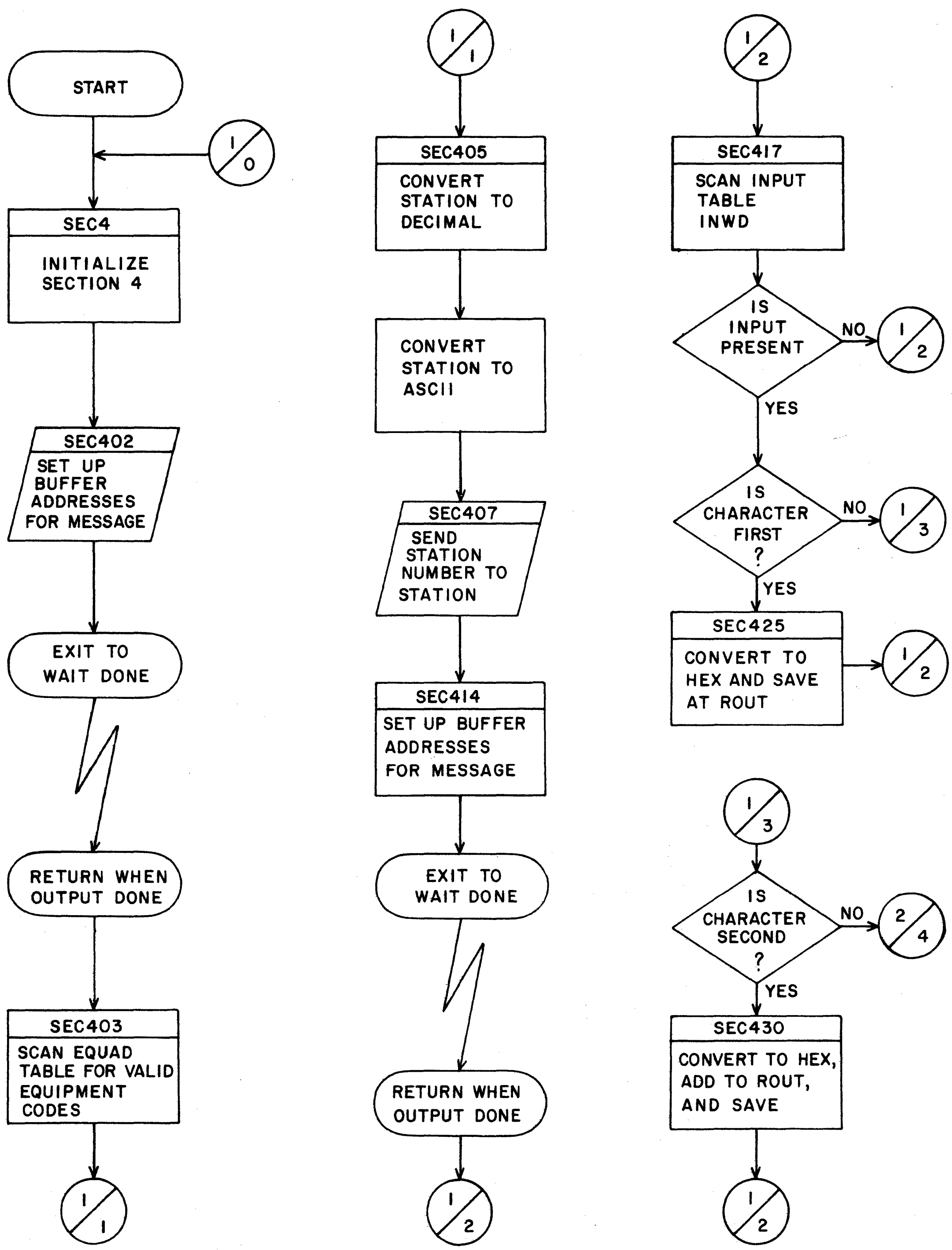
SECTION 2 (SEC2)



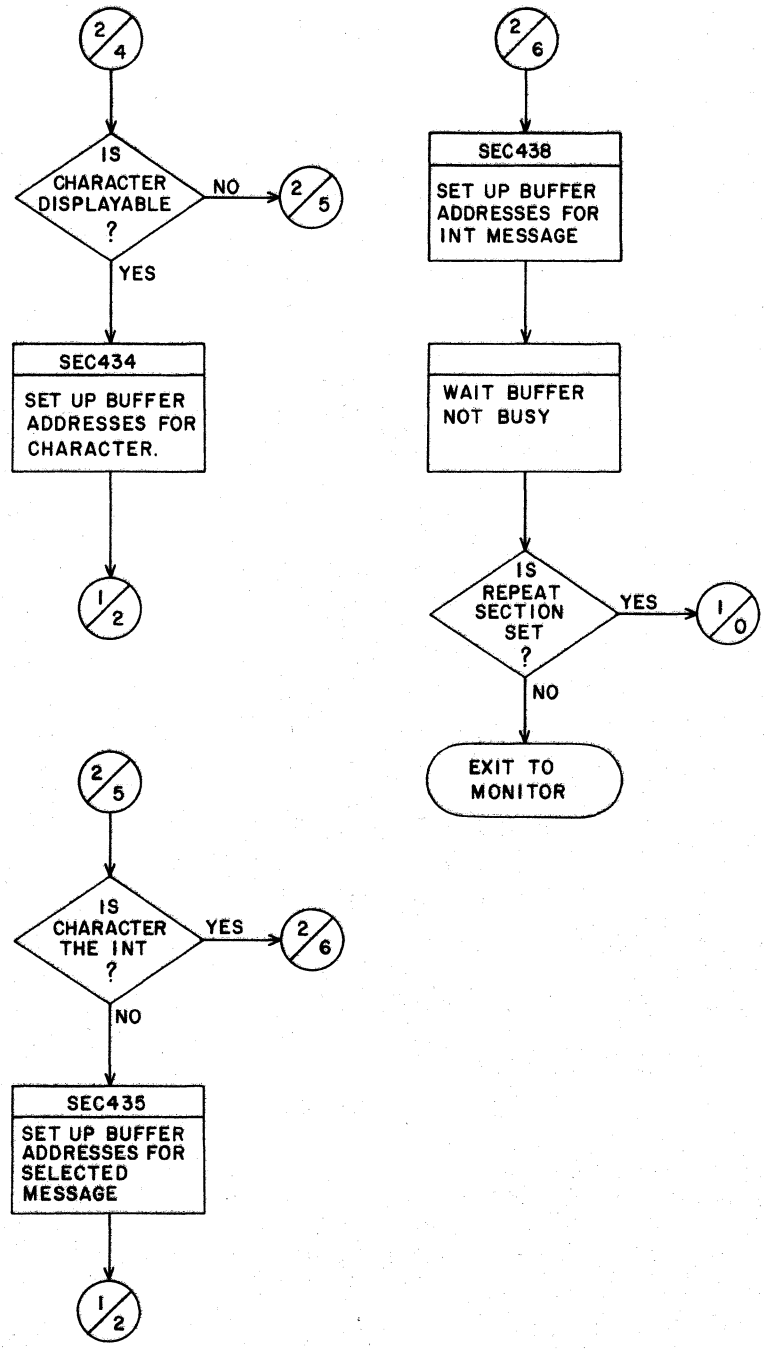
SECTION 3 (SEC3)

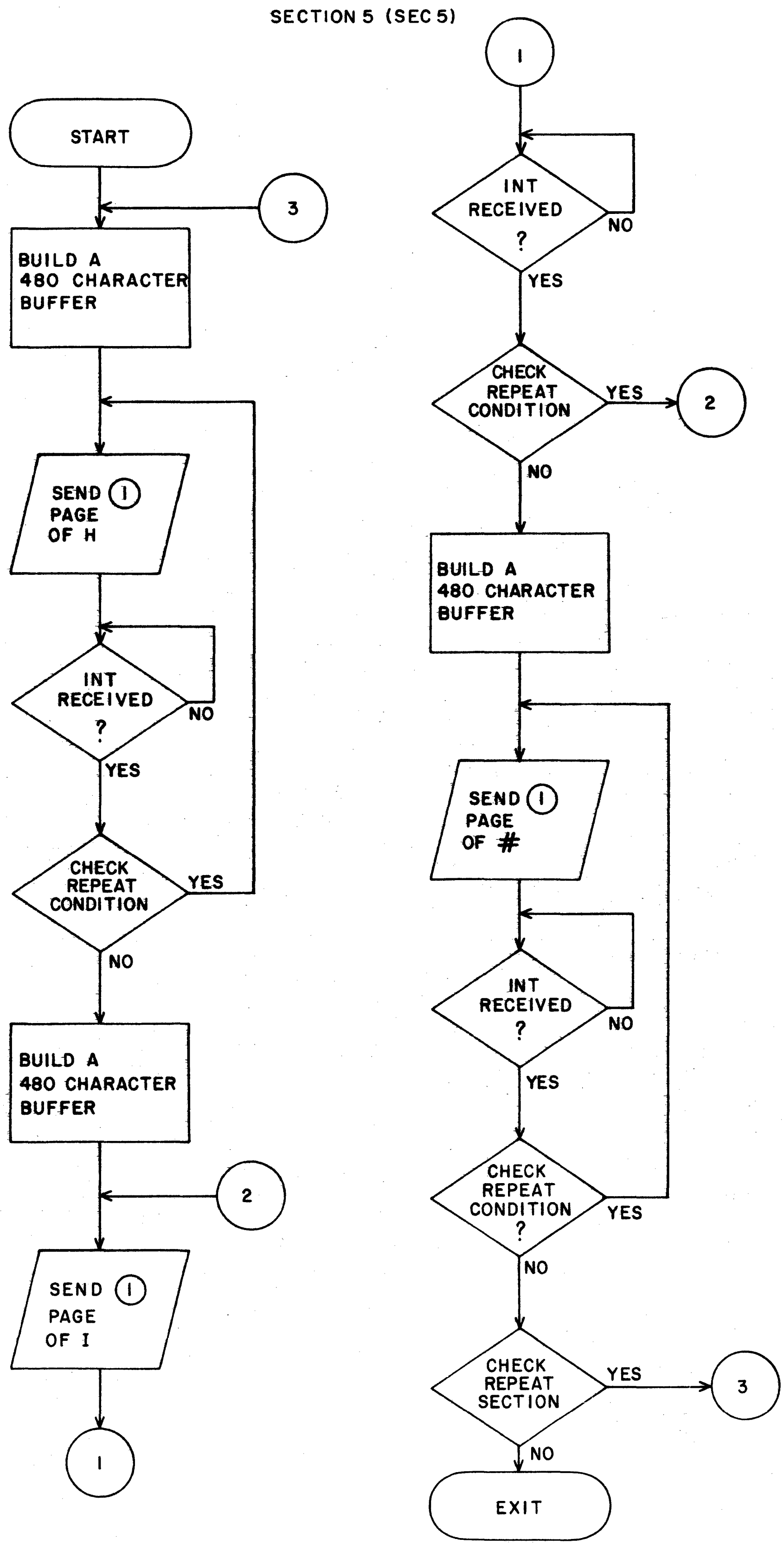


SECTION 4 (SEC 4)



SECTION 4 (SEC4)




SECTION 5 (SEC 5)
START
3
BUILD A 480 CHARACTER BUFFER
SEND 1 PAGE OF H
INT RECEIVED ?
NO
YES
CHECK REPEAT CONDITION
YES
NO
BUILD A 480 CHARACTER BUFFER
2
SEND 1 PAGE OF I
1
1
INT RECEIVED ?
NO
YES
CHECK REPEAT CONDITION
YES
2
NO
BUILD A 480 CHARACTER BUFFER
SEND 1 PAGE OF #
INT RECEIVED ?
NO
YES
CHECK REPEAT CONDITION ?
YES
NO
CHECK REPEAT SECTION
YES
3
NO
EXIT

DIGIGRAPHICS IV CONSOLE (GPGT)

I. INSTRUCTION MACROS

The macros described in this section are used to generate the GPGT Display Code Interpreter (DCI) instructions in tests GT0, GT1, GT2, GT3, and GT6. Some of the macros appear in a different form from one test to the next. The macro definition in the front of each test designates which form of a macro is used by that test. All changes made to the tests mentioned above must use these macro instructions to generate DCI instructions. Macros designated with an asterisk (*) to the left should not be used. Their macro definitions are to be deleted from the tests in a future revision.

A. GPGT DISPLAY FILE

1. Null Instruction

   NULL   No parameters required

2. Relative Jump

   JMPR   A (where A is the relative address tag)

3. Indirect Jump

   JMPI   A (where A is the indirect address tag)

4. Direct Subroutine Entry

   SRED   A (where A is the direct address tag)

5. Indirect Subroutine Entry

   SREI   A (where A is the indirect address tag)

6. Relative Subroutine Exit

   SRXR   A (where A is the relative address tag)

7. Indirect Subroutine Exit

   SRXI   A (where A is the indirect address tag)

8. Execute Instruction

   EXCI   A (where A is the indirect address tag)

9. Control Word

   CW   A, B, S, W

   where A is the relative address tag
   B is the blink bit (0 or 1)
   S is the enable scissor bit (0 or 1)
   W is the execute scissor bit (0 or 1)

10. Move Beam Delta X

MBX X (where X is the number of raster units)

11. Move Beam Delta Y

MBY Y (where Y is the number of raster units)

12. Draw Vector Delta X

DVX X (where X is the number of raster units)

13. Draw Vector Delta Y

DVY Y (where Y is the number of raster units)

14. Draw Vector Delta X, Delta Y

DVXY X, Y

where X is the number of raster units on X
Y is the number of raster units on Y

The type bit and the delta intensity are forced to zero.

* DVXY X, Y, I3

where X is the number of raster units on X
Y is the number of raster units on Y
I3 is the delta intensity value

The type bit is forced to zero.

DVXYT X, Y, I3

where X is the number of raster units in X
Y is the number of raster units in Y
I3 is the delta intensity value

The type bit is forced to one.

DVXYI X, Y, I3

where X is the number of raster units on X
Y is the number of raster units on Y
I3 is the delta intensity value

The type bit is forced to zero.

DVXYIT X, Y, I3, T

where X is the number of raster units on X
Y is the number of raster units on Y
I3 is the delta intensity value
T is the type bit

15. Short Vector Mode

* DVSM S, I4, T

where S is the scale field
I4 is the delta intensity value
T is the type field

* XY X, Y, I1, I0

where X is the number of raster units in X
Y is the number of raster units in Y
I1 is the upper bit of the delta intensity
I0 is the lower bit of the delta intensity

DIGIGRAPHICS IV CONSOLE (GPGT) TROUBLESHOOTING PROGRAM
(GT0 Test No. 70)

I. INTRODUCTION

The purpose of this program is to aid the customer engineer and checkout technician in generation and execution of his own display file for the GPGT. To accomplish this, the operator must type the hexadecimal codes for the GPGT instructions at the GPGT keyboard. This program also includes a core dump to the display console.

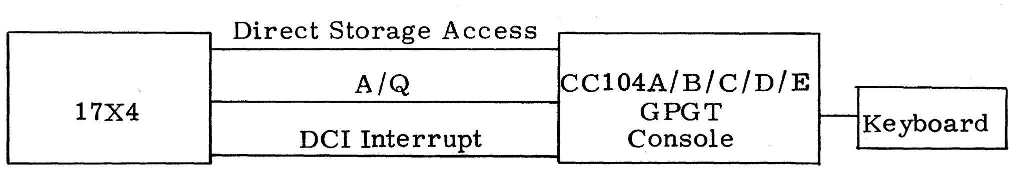
II. REQUIREMENTS

A. HARDWARE

1. Minimum Configuration
   1704/1714/1774/1784 Computer
   CC104A/B/C/D/E GPGT Console
   Keyboard
   Input device for SMM17

2. Core Requirements
   The minimum amount of core required is 4K.

3. Equipment Configuration



B. SOFTWARE

The program operates under control of the SMM17 monitor.

C. ACCESSORIES

None.

III. OPERATIONAL PROCEDURE

A. LOADING PROCEDURE

The program is loaded as test number 70 using standard SMM17 loading procedure.

B. PARAMETERS

1. Parameter Stops

First Stop (overflow light on)
(A) = 7021 - test ID stop
(Q) = Stop/Jump parameter
Second Stop
(A) = Interrupt line for display code interpreter
(Prestored as 0004-bit 2 designating interrupt line 2)
This parameter must not be changed after the initial parameter stop.
(Q) = Not Used

2. DCI Switch Setting

DCI instruction/clock control switches must be UP.
The DCI PROTECT switch must be in UNPROTECTED.
The DCI SENSE REFRESH FAULT switch must be UP.

3. Stop/Jump Parameter Word

Bit 0 - Stop to enter parameters
1 - Not sensed by this program
2 - Not sensed by this program
3 - Not sensed by this program
4 - Not sensed by this program
5 - Not sensed by this program
6 - Not sensed by this program
7 - Not used
8 - Omit typeout
9 - Bias return address display
10 - Not sensed by this program
11 - Not sensed by this program
12 - Not sensed by this program
13 - Not sensed by this program
14 - Not sensed by this program
15 - Run this program alone
(This bit should be set when two or more tests in the test list use the same display code interpreter equipment number. This allows the tests to be run consecutively, since they cannot be multiplexed.)

C. SECTION DESCRIPTION INDEX

Not applicable

IV. OPERATOR COMMUNICATIONS

A. MESSAGE FORMATS

1. Normal Teletype Message

Program identification during test initialization.

GT0 (No. 70) GPGT TROUBLESHOOTING TEST
IA = XXXX

DIGIGRAPHICS IV CONSOLE (GPGT) DISPLAY CODE
INTERPRETER COMMAND TEST
(GT1 Test No. 71)

I. INTRODUCTION

The purpose of this test is to verify the operation of the Display Code Interpreter (DCI). This test checks the A/Q channel functions, interrupts, and clock/instruction stepping of DCI instructions. During clock stepping after each clock pulse, the entire Register Display (TV) monitor is read and compared against a table of expected changes. After the instruction has been completed, the parameter registers are also read and compared against a table of expected changes. After an instruction step, both the Register Display (TV) monitor and the parameter registers are read and compared against a table of expected changes.

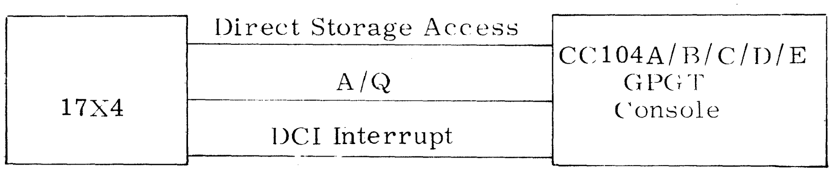
II. REQUIREMENTS

A. HARDWARE

1. Minimum Configuration
   1704/1714/1774/1784 Computer
   CC104A/B/C/D/E GPGT Console*
   Input Device for SMM17

2. Core Requirements
   The minimum amount of core required is 12K.

3. Equipment Configuration



B. SOFTWARE

The test operates under control of SMM17 monitor.

C. ACCESSORIES

None.

*FCO CD10271 must be installed to run Sections E and F, and FCO CD11569 must be installed to run Sections 1, 4, 5, 12, and 13.

III. OPERATIONAL PROCEDURE

A. LOADING PROCEDURE

The test is loaded as test number 71 using standard SMM17 loading procedure.

B. PARAMETERS

1. Parameter Stops

First stop (overflow light on)
(A) = 7131 test ID stop
(Q) = Stop/Jump parameter

Second stop
(A) = First group of section selection bits
(prestored as $FFFE_{16}$)

Bit 0 = Not used
Bit 1 = Section 1 - A/Q functions
Bit 2 = Section 2 - Load/unload instructions (clock step)
Bit 3 = Section 3 - Load/unload instructions (instruction step)
Bit 4 = Section 4 - Jump instructions (clock step)
Bit 5 = Section 5 - Jump instructions (instruction step)
Bit 6 = Section 6 - Parameter word instructions (clock step)
Bit 7 = Section 7 - Parameter word instructions (instruction step)
Bit 8 = Section 8 - Move beam instructions (clock step)
Bit 9 = Section 9 - Move beam instructions (instruction step)
Bit 10 = Section A - Conditional control instructions (clock step)
Bit 11 = Section B - Conditional control instructions (instruction step)
Bit 12 = Section C - Draw vector instructions (clock step)
Bit 13 = Section D - Draw vector instructions (instruction step)
Bit 14 = Section E - Control word instructions (clock step)
Bit 15 = Section F - Control word instructions (instruction step)

(Q) = Second group of section selection bits
(prestored as $002F_{16}$)

Bit 0 = Section 10 - Character mode instructions (clock step)
Bit 1 = Section 11 - Character mode instructions (instruction step)
Bit 2 = Section 12 - Execute instruction (clock step)
Bit 3 = Section 13 - Execute instruction (instruction step)
Bit 4 = Not used
Bit 5 = Section 15 - Start/stop and interrupt

Third stop
(A) = Interrupt line for display code interpreter
(prestored as 0004_{16} - bit 2 designating interrupt line 2)
This parameter must not be changed after the initial parameter stop.

(Q) = Power line frequency
(prestored as 0060_{16})

For 60-cycle input power, set to 0060_{16}.

For 50-cycle input power, set to 0050_{16}.

2. DCI and Display Console Switch Setting

The DCI instruction/clock control switches must be up.
The DCI PROTECT switch must be in the UNPROTECTED position.
The DCI SENSE REFRESH FAULT switch must be DOWN.

NOTE

To avoid burning the CRT, ensure that the BEAM DEFOCUS switch on the display console is set.

3. Stop/Jump Parameter Word

Bit 0 - Stop to enter parameters
Bit 1 - Stop at end of section
Bit 2 - Stop at end of test
Bit 3 - Stop on error
Bit 4 - Repeat condition
Bit 5 - Repeat section
Bit 6 - Repeat test
Bit 7 - Not used
Bit 8 - Omit typeouts
Bit 9 - Bias return address display
Bit 10 - Re-enter parameters
Bit 11 - Set audible alarm on error
Bit 12 - Not sensed by this test
Bit 13 - Not sensed by this test
Bit 14 - Not sensed by this test
Bit 15 - Run this test alone
(This bit should be set when two or more tests in the test list use the same display code interpreter equipment number. This allows the tests to be run consecutively, since they cannot be multiplexed.)

C. SECTION DESCRIPTION INDEX

Number	Name	Run Time (Seconds)
0	Not Used	
1	A/Q Functions	2
2	Load/Unload Instructions (clock step)	41
3	Load/Unload Instructions (instruction step)	4
4	Jump Instructions (clock step)	3
5	Jump Instructions (instruction step)	1
6	Parameter Word Instructions (clock step)	3
7	Parameter Word Instructions (instruction step)	1
8	Move Beam Instructions (clock step)	22
9	Move Beam Instructions (instruction step)	2
A	Conditional Control Instructions (clock step)	21
B	Conditional Control Instructions (instruction step)	4
C	Draw Vector Instruction (clock step)	40
D	Draw Vector Instruction (instruction step)	2
E	Control Word Instructions (clock step)	2
F	Control Word Instructions (instruction step)	1
10	Character Mode Instruction (clock step)	100
11	Character Mode Instruction (instruction step)	8
12	Execute Instruction (clock step)	1
13	Execute Instruction (instruction step)	1
14	Not Used	
15	Start/Stop and Interrupt	1
	Total run time	260

IV. OPERATOR COMMUNICATIONS

A. MESSAGE FORMATS

1. Normal Teletype Message

   Program identification during test initialization

   GT1 (No. 71) GPGT DCI TEST
   IA=XXXX

2. Stop at End of Section

   First stop (overflow light on)
   (A) = 7122 - test ID stop
   (Q) = Stop/Jump parameter

   Second Stop
   (A) = Section number
   (Q) = Return address

3. Stop at End of Test

   First Stop (overflow light on)
   (A) = 7124 - test ID stop
   (Q) = Stop/Jump parameter

   Second Stop
   (A) = Pass number
   (Q) = Return address

4. Stop on Error

   All error message displays use basically the standard SMM17 error message format. The format of the first two stops is the same for all types of errors. The format of the third, fourth, and fifth stops is determined by the type of error. The format for the first and second stops is as follows:

   First Stop (overflow light on)
   (A) = 71X8 - test ID stop
   where X is the number of stops
   (Q) = Stop/Jump parameter

   Second Stop
   (A) = XXYZ where XX = Section number
   Y = Condition (or subsection)
   Z = Error type
   (Q) = Address pointer to where within a condition the error occurred.

   This pointer is not the same as the return address found in other SMM17 tests. The address points to where execution stopped when the error occurred, but not to where execution will continue after the error. Where execution continues after the error is determined by the repeat condition bit of the Stop/Jump parameter. If the repeat condition bit is set, execution will continue at a backward marker (a recovery point to repeat the condition designated in (A) of this second stop). If the repeat condition bit is not set, execution will continue at a forward marker (a recovery point to skip around the remainder of the condition designated in (A) of this second stop).

B. MESSAGE DICTIONARY

The upper hexadecimal digit of the two-digit error message code designates the condition (or subsection) that failed. The lower digit is the error type. This message dictionary describes the error types.

Code	Subroutine Name	Subroutine Tag Name	Message and Description
1	FNRP STRP	FNI110 STI100	RESPONSE, expect reply, receive internal reject A3 = I/O type* Q3 = Q register function code
2	FNRP STRP	FNI110 STI100	RESPONSE, expect reply, receive external reject A3 = I/O type* Q3 = Q register function code
3	FNER STER	FNI230 STI220	RESPONSE, expect external reject, receive internal reject A3 = I/O type* Q3 = Q register function code
4	FNER STER	FNI200 STI200	RESPONSE, expect external reject, receive reply A3 = I/O type* Q3 = Q register function code
5	CMPALL	CMI030	TV monitor has unexpected display A3 = First word of DCI instruction being stepped Q3 = XYYY Where X is the current DCI word number (0, 1, or 2) and YYY is the clock pulse number. A pseudo word number of 4 is used to designate when start draw has occurred. The clock pulse number then refers to LDU clocks. When the instruction is completed Q is $FFFF_{16}$. A4 = Actual TV display Q4 = Expected TV display A5 = Failing TV word number Q5 = Previous TV display
6	CMPALL	CMI030	REGISTER, parameter register has unexpected contents A3 = First word of DCI instruction being stepped Q3 = FFFF A4 = Actual register contents Q4 = Expected register contents A5 = Failing register number Q5 = Previous register contents

*Input = 0200, output = 0300.

Code	Subroutine Name	Subroutine Tag Name	Message and Description
7	CKCORE	CKI020	STORAGE, core location has unexpected contents A3 = First word of DCI instruction being stepped Q3 = $FFFF_{16}$ A4 = Actual location contents Q4 = Expected location contents A5 = Failing location address (Biasing is determined by bit 9 of Stop/Jump parameter) Q5 = Not used
8	WAIT	WAI050 WAI060	TIME, interrupt did not occur within expected time limits A3 = First word of DCI instruction being stepped Q3 = $FFFF_{16}$ A4 = Lower limit (milliseconds) Q4 = Upper limit (milliseconds) A5 = Actual time (milliseconds) Q5 = Expected interrupt (bit corresponding to register 20_{16})
9	DCIPRO	DCI002	INTERRUPT, internal reject during interrupt state A3 = I/O type* Q3 = Q register function code
A	DCIPRO	DCI002	INTERRUPT, external reject during interrupt state A3 = I/O type* Q3 = Q register function code
B	RINT	RIT010	INTERRUPT, missing A3 = First word of DCI instruction being stepped Q3 = $FFFF_{16}$ A4 = Actual interrupts (bits corresponding to register 20_{16}) Q4 = Expected interrupts (bits corresponding to register 20_{16})
C	DCIPRO	DCI020	INTERRUPT, no interrupt status bit set when an interrupt occurred A3 = First word of DCI instruction being stepped Q3 = XYYY Where X is the current DCI word number (0, 1, or 2) and YYY is the clock pulse number. When the instruction is completed Q is $FFFF_{16}$. A4 = 0000 (actual status) Q4 = Expected interrupts (bits corresponding to register 20_{16})

*Input = 0200, output = 0300.

Code	Subroutine Name	Subroutine Tag Name	Message and Description
D	DCIPRO	DCI030	INTERRUPT, unexpected A3= First word of DCI instruction being stepped Q3= XYYY Where X is the current DCI word number (0, 1, or 2) and YYY is the clock pulse number. When the instruction is completed Q is $FFFF_{16}$. A4= Actual interrupts (bits corresponding to register 20_{16}) Q4= Expected interrupts (bits corresponding to register 20_{16})
E	DCIPRO	DCI060	INTERRUPT, unable to clear interrupt status A3= First word of DCI instruction being stepped Q3= XYYY Where X is the current DCI word number (0, 1, or 2) and YYY is the clock pulse number. When the instruction is completed, Q is $FFFF_{16}$. A4= Actual interrupt status after attempted clear (bits corresponding to register 20_{16}) Q4= Expected interrupt status after attempted clear (bits corresponding to register 20_{16}) A5= Function used to attempt clear interrupt status 00 = Cleared when interrupt status or keyboard register unloaded 1A = Load interrupt enable register 1B = Load interrupt disable register 30 = Reset Q5= Not used

Register 20

15	14	13	12	11	10	9	8	7	6
LP	EOF	PG	RTC	LSW	K	PF1	PF2	HF	CF

V. DESCRIPTION

A. GENERAL

Sections which step DCI instructions are arranged in section pairs. The even numbered section clock steps the instruction and the odd numbered section instruction steps the instruction. Both sections of a section pair use the same routine, but the routine is entered with a different parameter in the Q register (0, even or 1, odd).

Unexpected interrupts are enabled in Sections 4-15.

B. SECTION DESCRIPTIONS

1. Section 1 - A/Q Functions

Error Code	Program Tag Name	Program Description
	CYCAQ	Condition 0 - scratchpad, all ones
0101 0102	P1I010	Reset. Expect reply.
0105		Read TV interrupt enable. Expect 0000.
0101 0102		Load all scratchpad registers with FFFF. Expect reply.
0101 0102		Unload all scratchpad registers. Expect reply.
0106		Verify that scratchpad registers contain FFFF.
		Check repeat condition stop/jump bit. Do 16 times.
	P0I000	Condition 1 - scratchpad, all zeros
0111 0112	P0I010	Reset. Expect reply.
0115		Read TV interrupt enable. Expect 0000.
0111 0112		Load all scratchpad registers with 0000. Expect reply.
0111 0112		Unload all scratchpad registers. Expect reply.
0116		Verify that scratchpad registers contain 0000.
		Check repeat condition stop/jump bit. Do 16 times.
	S1I000	Condition 2 - scratchpad, shifted one
0121 0122	S1I010	Reset. Expect reply.
0125		Read TV interrupt enable. Expect 0000.
0121 0122		Load all scratchpad registers with one bit (start with 0001 and shift one bit position left each pass). Expect reply.
0121 0122		Unload all scratchpad registers. Expect reply.
0126		Verify that scratch registers contain the value loaded.
		Check repeat condition stop/jump bit. Do for each bit position.
	S0I000	Condition 3 - scratchpad, shifted zero

Error Code	Program Tag Name	Program Description
0247/0347		Verify that the register number was written into core by the unload instruction.
		Check for repeat condition stop/jump bit. Do for each scratchpad register except P.
	VZI000	Condition 5 - zoom level
0251/0351 0252/0352 0255/0355	VZI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0251/0351 0252/0352 0256/0356		Load and unload P register. Expect reply.
0251/0351 0252/0352 0255/0355 0256/0356	VZI020	Clock/instruction step a load zoom level instruction (use 7, 0 . . . . 6).
		Check repeat condition stop/jump bit. Do for eight values.
	VWI000	Condition 6 - window limits
0261/0361 0262/0362 0265/0365	VWI010	Reset. Expect reply Read TV interrupt enable. Expect 0000.
0261/0361 0262/0362 0266/0366		Load and unload P register. Expect reply.
0261/0361 0262/0362 0265/0365 0266/0366	VWI020	Clock/instruction step a load window limits instruction (use FFFF, 0000, AAAA, 5555).
		Check repeat condition stop/jump bit. Do for four values.
	VEI000	Condition 7 - interrupt enable
0271/0371 0272/0372 0275/0375	VEI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0271/0371 0272/0372 0276/0376		Load and unload P register. Expect reply.
0271/0371 0272/0372 0275/0375	VEI020	Clock/instruction step a load interrupt enable instruction (use EF9F, 0000, AA8A, 4515).
		Check repeat condition stop/jump bit. Do for four values.

Error Code	Program Tag Name	Program Description
	VII000	Condition 8 - interrupt disable
0281/0381 0282/0382	VII010	Reset. Expect reply.
0285/0385		Read TV interrupt enable. Expect 0000.
0281/0381 0282/0382 0286/0386		Load and unload P register. Expect reply.
0281/0381 0282/0382	VII016	Load interrupt enable register with EF9F. Expect reply.
0281/0381 0282/0382		Read TV interrupt enable. Expect reply.
0285/0385		Verify that interrupt enable register contains EF9F.
0281/0381 0282/0382 0285/0385 0286/0386		Clock/instruction step a load interrupt disable instruction (use 0000, EF9F, 4515, AA8A).
		Check repeat condition stop/jump bit. Do for four values.

3. Section 4 and 5 - Jump Instructions

Error Code	Program Tag Name	Program Description
	CYCBR	Condition 0 - relative jump
0401/0501 0402/0502	JRI010	Reset. Expect reply.
0405/0505		Read TV interrupt enable. Expect 0000.
0401/0501 0402/0502 0405/0505		Load interrupt enable register with EECF. Read TV interrupt enable. Expect EECF.
0401/0501 0402/0502 0406/0506		Load and unload P register. Expect reply.
0401/0501 0402/0502 0405/0505 0406/0506	JRI020	Clock/instruction step a relative jump instruction (use 0AAA, 0555).
		Check repeat condition stop/jump bit. Do for two jump addresses.

Error Code	Program Tag Name	Program Description
	J1I000	Condition 1 - indirect jump (one word)
0411/0511 0412/0512 0415/0515	J1K010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0411/0511 0412/0512 0415/0515		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0411/0511 0412/0512 0416/0516		Load and unload P register. Expect reply.
0411/0511 0412/0512 0416/0516		Load and unload DATUM register (address of start of section). Expect reply.
0411/0511 0412/0512 0415/0515 0416/0516	J1I020	Clock/instruction step a one-word indirect jump instruction (use indirect addresses AAAA, 5555).
		Check repeat condition stop/jump bit. Do for two indirect addresses.
	J1I000	Condition 2 - indirect jump (two-word)
0421/0521 0422/0522 0425/0525	J2I010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0421/0521 0422/0522 0425/0525		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0421/0521 0422/0522 0426/0526		Load and unload P register. Expect reply.
0421/0521 0422/0522 0426/0526		Load and unload DATUM register (address of start of section). Expect reply.
0421/0521 0422/0522 0425/0525 0426/0526	J2I020	Clock/instruction step a two-word indirect jump instruction (use indirect addresses AAAA, 5555).
		Check repeat condition stop/jump bit. Do for two indirect addresses.

Error Code	Program Tag Name	Program Description
	XRI000	Condition 3 - relative subroutine exit
0431/0531 0432/0532 0435/0535	XRI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0431/0531 0432/0532 0435/0535		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0431/0531 0432/0532 0436/0536		Load and unload P register. Expect reply.
0431/0531 0432/0532 0436/0536		Load and unload DATUM register (address of start of section). Expect reply.
0431/0531 0432/0532 0435/0535 0436/0536	XRI020	Clock/instruction step a relative subroutine exit instruction (use link addresses 2AAA, 5555).
		Check repeat condition stop/jump bit. Do for two direct addresses.
	X1I000	Condition 4 - indirect subroutine exit (one word)
0441/0541 0442/0542 0445/0545	X1I010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0441/0541 0442/0542 0445/0545		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0441/0541 0442/0542 0446/0546		Load and unload P register. Expect reply.
0441/0541 0442/0542 0446/0546		Load and unload DATUM register (address of start of section). Expect reply.
0441/0541 0442/0542 0445/0545 0446/0546		Clock/instruction step a one-word indirect subroutine exit instruction (use link addresses 2AAA, 5555).
		Check repeat condition stop/jump bit. Do for two link addresses.

Error Code	Program Tag Name	Program Description
	X2I000	Condition 5 - indirect subroutine exit (two word)
0451/0551 0452/0552 0455/0555	X2I010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0451/0551 0452/0552 0455/0555		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0451/0551 0452/0552 0456/0556		Load and unload P register. Expect reply.
0451/0551 0452/0552 0456/0556		Load and unload DATUM register (address of start of section). Expect reply.
0451/0551 0452/0552 0455/0555 0456/0556	X2I020	Clock/instruction step a two-word indirect subroutine exit instruction (use link addresses 2AAA and 5555).
		Check repeat condition stop/jump bit. Do for two link addresses.
	D1I000	Condition 6 - direct subroutine (one-word)
0461/0561 0462/0562 0465/0565	D1I010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0461/0561 0462/0562 0465/0565		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0461/0561 0462/0562 0466/0566		Load and unload P register. Expect reply.
0461/0561 0462/0562 0466/0566		Load and unload DATUM register (address of start of section). Expect reply.
0461/0561 0462/0562 0465/0565		Load Write Limits register so that the location to be written by the direct subroutine entry instruction is within limits. Set all protect bits within the write limits except the location to be written by the direct subroutine.
0461/0561 0462/0562 0465/0565 0466/0566	D1I020	Clock/instruction step a one-word direct subroutine entry instruction.

Error Code	Program Tag Name	Program Description
0467/0567	D1I021	Verify that the core location written by the subroutine entry instruction contains the correct link address.
		Check repeat condition stop/jump bit.
	D2I000	Condition 7 - direct subroutine entry (two-word)
0471/0571	D2I010	Reset. Expect reply.
0472/0572		
0475/0575		Read TV interrupt enable. Expect 0000.
0471/0571 0472/0572 0475/0575		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0471/0571 0472/0572 0476/0576		Load and unload P register. Expect reply.
0471/0571 0472/0572 0476/0576		Load and unload DATUM register (address of start of section). Expect reply.
0471/0571 0472/0572 0475/0575		Load Write Limits register so that the location to be written by the direct subroutine entry instruction is within limits. Set all protect bits within the write limits except the location to be written by the direct subroutine entry.
0471/0571 0472/0572 0475/0575 0476/0576	D2I020	Clock/instruction step a two-word direct subroutine entry instruction.
0477/0577	D2T021	Verify that the core location written by the subroutine entry instruction contains the correct link address.
		Check repeat conditions stop/jump bit.
	I1I000	Condition 8 - indirect subroutine entry (one-word)
0481/0581	I1I010	Reset. Expect reply.
0482/0582		
0485/0585		Read TV interrupt enable. Expect 0000.
0481/0581 0482/0582 0485/0585		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0481/0581 0482/0582 0486/0586		Load and unload P register. Expect reply.

Error Code	Program Tag Name	Program Description
0481/0581 0482/0582 0486/0586		Load and unload DATUM register (address of start of section). Expect reply.
0481/0581 0482/0582 0485/0585		Load Write Limits register so that the location to be written by the indirect subroutine entry instruction is within limits.
		Set all protect bits within the write limits except the location to be written by the indirect subroutine entry.
0481/0581 0482/0582 0485/0585 0486/0586	I1I020	Clock/instruction step a one-word indirect subroutine entry instruction.
0487/0587	I1I021	Verify that the core location written by the subroutine entry instruction contains the correct link address.
		Check repeat condition stop/jump bit.
	I2I000	Condition 9 - indirect subroutine entry (two-word)
0491/0591 0492/0592 0495/0595	I2I010	Reset. Expect reply. Read TV interrupt enable. Expect reply.
0491/0591 0492/0592 0495/0595		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0491/0591 0492/0592 0496/0596		Load and unload P register. Expect reply.
0491/0591 0492/0592 0496/0596		Load and unload DATUM register (address of start of section). Expect reply.
0491/0591 0492/0592 0495/0595		Load Write Limits register so that the location to be written by the indirect subroutine entry instruction is within limits. Set all protect bits within the write limits except the location to be written by the indirect subroutine entry.
0491/0591 0492/0592 0495/0595 0496/0596	I2I020	Clock/instruction step a two-word indirect subroutine entry instruction.
0497/0597	I2I021	Verify that the core location written by the subroutine entry instruction contains the correct link address.
		Check repeat condition stop/jump bit.

4. Section 6 and 7 - Parameter Word Instructions

Error Code	Program Tag Name	Program Description
	CYCPW	Condition 0 - parameter word 1 - set intensity
0601/0701 0602/0702 0605/0705	I4I010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0601/0701 0602/0702 0605/0705		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0601/0701 0602/0702 0606/0706		Load and unload P register. Reply.
0601/0701 0602/0702 0605/0705 0606/0706	I4I020	Clock/instruction step a parameter word 1 instruction (use absolute intensity of F, 0.... E).
		Check repeat condition stop/jump bit. Do for each absolute intensity value.
	PXI000	Condition 1 - parameter word 1 - change zoom ability
0611/0711 0612/0712 0615/0715	PZI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0611/0711 0612/0712 0615/0715		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0611/0711 0612/0712 0616/0716		Load and unload P register. Expect reply.
0611/0711 0612/0712 0615/0715	PXI020	Clock/instruction step a parameter word 1 instruction (use zoomable and nonzoomable).
		Check repeat condition stop/jump bit. Do for zoomable and nonzoomable.
	BWI000	Condition 2 - 11/12-bit window
0621/0721 0622/0722 0625/0725	BWI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0621/0721 0622/0722 0625/0725		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0621/0721 0622/0722 0626/0726		Load and unload P register. Expect reply.

Error Code	Program Tag Name	Program Description
0621/0721 0622/0722 0625/0725 0626/0726	BWI020	Clock/instruction step a parameter word 2 instruction (select 12-bit window).
0621/0721 0622/0722 0625/0725 0626/0726	BWI030	Clock/instruction step a parameter word 2 instruction (select 11-bit window).
		Check repeat condition stop/jump bit. Do two times.
	PII000	Condition 3 - program interrupt
0631/0731 0632/0732 0635/0735	PII010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0631/0731 0632/0732 0635/0735		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0631/0731 0632/0732 0636/0736		Load and unload P register. Expect reply.
0631/0731 0632/0732 0635/0735 0636/0736 0639/0739 063A/073A 063C/073C 063D/073D 063E/073E	PII020	Clock/instruction step a parameter word 2 instruction (program interrupt).
063B/073B		Verify that program interrupt occurred.
		Check repeat condition stop/jump bit. Do two times.

5. Section 8 and 9 - Move Beam Instructions

Error Code	Program Tag Name	Program Description
	CYCMB	Condition 0 - absolute beam movement (nonzoomable)
0801/0901 0802/0902 0805/0905	BNI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.

Error Code	Program Tag Name	Program Description
0801/0901 0802/0902 0805/0905		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0801/0901 0802/0902 0806/0906		Load and unload P register. Expect reply.
0801/0901 0802/0902 0806/0906		Load and unload window location X with 7FFF. Expect reply.
0801/0901 0802/0902 0806/0906		Load and unload window location Y with 7FFF. Expect reply.
0801/0901 0802/0902 0805/0905		Load zoom level register with 7. Expect reply. Read TV zoom level. Expect reply.
0801/0901 0802/0902 0805/0905 0806/0906	BNI016	Clock/instruction step a parameter word 1 instruction (disable zoomability).
0801/0901 0802/0902 0805/0905 0806/0906	BNI020	Clock/instruction step an absolute beam movement instruction (use positions AAAA, 5555, AAAA, 5555, and 1 random position for both X and Y).
		Check repeat condition stop/jump bit. Do for each of the five sets of operands.
	BZI000	Condition 1 - absolute beam movement (zoomable)
0811/0911 0812/0912 0815/0915	BZI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0811/0911 0812/0912 0815/0915		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0811/0911 0812/0912 0816/0916		Load and unload P register. Expect reply.
0811/0911 0812/0912 0816/0916		Load and unload window location X and Y (use locations FFFF, 0000, 0000, FFFF, AAAA, 5555, 5555, AAAA, and 1 random location for both X and Y).

Error Code	Program Tag Name	Program Description
0811/0911 0812/0912 0815/0915		Load zoom level register with a random zoom level. Expect reply. Read TV zoom level. Expect reply.
0811/0911 0812/0912 0815/0915 0816/0916	BZI016	Clock/instruction step a parameter word 1 instruction (enable zoomability).
0811/0911 0812/0912 0815/0915 0816/0916	BZI020	Clock/instruction step an absolute beam movement instruction (use positions FFFF, 0000, FFFF, 0000, AAAA, 5555, AAAA, 5555, and 1 random position for both X and Y).
		Check repeat condition stop/jump bit. Do for each of the nine sets of operands.
	RZI000	Condition 2 - negative relative beam movement
0821/0921 0822/0922 0825/0925	RZI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0821/0921 0822/0922 0825/0925		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect reply.
0821/0921 0822/0922 0826/0926		Load and unload P register. Expect reply.
0821/0921 0822/0922 0825/0925 0826/0926	RZI014	Clock/instruction step a parameter word 1 instruction (disable zoomability).
0821/0921 0822/0922 0825/0925 0826/0926	RZI016	Clock/instruction step an absolute beam movement instruction (use position 0000 for both X and Y).
0821/0921 0822/0922 0825/0925 0826/0926	RZI020	Clock/instruction step a negative relative beam movement instruction (use deltas AAAA and 5555 for both X and Y).
		Check repeat condition stop/jump bit. Do for each of the two operands.
	XZI000	Condition 3 - move beam delta X
0831/0931 0832/0932 0835/0935	XZI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.

Error Code	Program Tag Name	Program Description
0831/0931 0832/0932 0835/0935		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0831/0931 0832/0932 0836/0936		Load and unload P register. Expect reply.
0831/0931 0832/0932 0835/0935 0836/0936	XZI016	Clock/instruction step a parameter word 1 instruction (disable zoomability).
0831/0931 0832/0932 0835/0935 0836/0936	XZI018	Clock/instruction step an absolute beam movement instruction (use positions FFFF, 0000, FFFF, 0000, AAAA, 5555, AAAA, 5555, and 1 random position for both X and Y).
0831/0931 0832/0932 0835/0935 0836/0936	XZI020	Clock/instruction step a move beam delta X instruction (use deltas FFFF, 0000, 0000, FFFF, FAAA, 0555, 0555, FAAA, and 1 random delta for X).
		Check repeat condition stop/jump bit. Do for each of the nine sets of operands.
	YZI000	Condition 4 - move beam delta Y
0841/0941 0842/0942 0845/0945	YZI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0841/0941 0842/0942 0845/0945		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0841/0941 0842/0942 0846/0946		Load and unload P register. Expect reply.
0841/0941 0842/0942 0845/0945 0846/0946	YZI016	Clock/instruction step a parameter word 1 instruction (disable zoomability).
0841/0941 0842/0942 0845/0945 0846/0946	YZI018	Clock/instruction step an absolute beam movement instruction (use positions FFFF, 0000, FFFF, 0000, AAAA, 5555, AAAA, 5555, and 1 random position for X and Y).
0841/0941 0842/0942 0845/0945 0846/0946	YZI020	Clock/instruction step a move beam delta Y instruction (use deltas FFFF, 0000, 0000, FFFF, FAAA, 0555, 0555, FAAA, and 1 random delta for Y).
		Check repeat condition stop/jump bit. Do for each of the nine sets of operands.

6. Section A and B - Conditional Control Instructions

Error Code	Program Tag Name	Program Description
	CYCCC	Condition 0 - jump on zoom level (true)
0A01/0B01 0A02/0B02 0A05/0B05	ZTI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0A01/0B01 0A02/0B02 0A05/0B05		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0A01/0B01 0A02/0B02 0A06/0B06		Load and unload P register. Expect reply.
0A01/0B01 0A02/0B02 0A05/0B05		Load zoom level register with 7. Expect reply. Read TV zoom level. Expect reply.
0A01/0B01 0A02/0B02 0A05/0B05 0A06/0B06		Instruction step a parameter word 1 instruction (enable zoomability).
0A01/0B01 0A02/0B02 0A05/0B05 0A06/0B06	ZTI020	Clock/instruction step a conditional control instruction (jump over 1 word if the zoom level is equal to or greater than the operand - use operands 7, 0 .... 6) expect jump. Check repeat condition stop/jump bit. Do for each zoom level as operand.
	ZFI000	Condition 1 - jump on zoom level (false)
0A11/0B11 0A12/0B12 0A15/0B15	ZFI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0A11/0B11 0A12/0B12 0A15/0B15		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0A11/0B11 0A12/0B12 0A16/0B16		Load and unload P register. Expect reply.
0A11/0B11 0A12/0B12 0A15/0B15 0A16/0B16		Instruction step a parameter word 1 instruction (enable zoomability).

Error Code	Program Tag Name	Program Description
0A11/0B11 0A12/0B12 0A15/0B15 0A16/0B16	ZFI020	Clock/instruction step a conditional control instruction (jump to start of item if the zoom level is equal to or greater than the operand, use operands 7-1). Expect no jump (zoom level equal 0 from reset).
		Check repeat condition stop/jump bit. Do for zoom levels 7-6 as operands.
	CTI000	Condition 2 - jump on CCR (true)
0A21/0B21 0A22/0B22 0A25/0B25	CTI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0A21/0B21 0A22/0B22 0A25/0B25		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0A21/0B21 0A22/0B22 0A26/0B26		Load and unload P register. Expect reply.
0A21/0B21 0A22/0B22 0A26/0B26	CTI016	Load and unload condition control register with a single one bit (use 8000, 0001....4000). Expect reply.
0A21/0B21 0A22/0B22 0A25/0B25 0A26/0B26	CTI020	Clock/instruction step a conditional control instruction (jump to end of item if the designated CCR bit is not set. Use operands F, 0....E). Expect no jump.
		Check repeat condition stop/jump bit. Do for each bit position in conditional control register.
	CFI000	Condition 3 - jump on CCR (false)
0A31/0B31 0A32/0B32 0A35/0B35	CFI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0A31/0B31 0A32/0B32 0A35/0B35		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0A31/0B31 0A32/0B32 0A36/0B36		Load and unload P register. Expect reply.
0A31/0B31 0A32/0B32 0A36/0B36		Load and unload conditional control register with all bits set except one (use 7FFF, FFFE... BFFF). Expect reply.

Error Code	Program Tag Name	Program Description
0A31/0B31 0A32/0B32 0A35/0B35 0A36/0B36	CFI020	Clock/instruction step a conditional control instruction (jump over two words if the designated CCR bit is not set. Use operands F, O. . . . E). Expect jump.
		Check repeat condition stop/jump bit. Do for each bit position in conditional control register.
	HFI000	Condition 4 - jump on light pen hit (false)
0A41/0B41 0A42/0B42 0A45/0B45	HFI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0A41/0B41 0A42/0B42 0A45/0B45		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0A41/0B41 0A42/0B42 0A46/0B46		Load and unload P register. Expect reply.
0A41/0B41 0A42/0B42 0A45/0B45 0A46/0B46	HFI020	Clock/instruction step a conditional control instruction (jump over 2 words if a light pen occurred). Expect no jump.
		Check repeat condition stop/jump bit. Do two times.
	SFI010	Condition 5 - jump on light pen switch (false)
0A51/0B51 0A52/0B52 0A55/0B55	SFI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0A51/0B51 0A52/0B52 0A55/0B55		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0A51/0B51 0A52/0B52 0A56/0B56		Load and unload P register. Expect reply.
0A51/0B51 0A52/0B52 0A55/0B55 0A56/0B56	SFI020	Clock/instruction step a conditional control instruction (jump over 1 word if the light pen switch is not set). Expect jump.
		Check repeat condition stop/jump bit. Do two times.

Error Code	Program Tag Name	Program Description
	ETI000	Condition 6 - jump if outside 11-bit window (true)
0A61/0B61 0A62/0B62 0A65/0B65	ETI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0A61/0B61 0A62/0B62 0A65/0B65		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0A61/0B61 0A62/0B62 0A66/0B66		Load and unload P register. Expect reply.
0A61/0B61 0A62/0B62 0A65/0B65 0A66/0B66	ETI017	Instruction step a parameter word 1 instruction (disable zoomability).
0A61/0B61 0A62/0B62 0A65/0B65 0A66/0B66		Instruction step an absolute beam movement instruction with a shifting single bit set in the positions (use 0400....8000 first in X position and then in Y position).
0A61/0B61 0A62/0B62 0A65/0B65 0A66/0B66	ETI020	Clock/instruction step a conditional control instruction (jump over two words if the beam is not inside the 11-bit window). Expect jump. Check repeat condition stop/jump bit. Do for each single bit position outside the 11-bit window in X and then in Y position.
	EFI000	Condition 7 - jump if outside 11-bit window (false)
0A71/0B71 0A72/0B72 0A75/0B75	EFI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0A71/0B71 0A72/0B72 0A75/0B75		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0A71/0B71 0A72/0B72 0A76/0B76		Load and unload P register. Expect reply.
0A71/0B71 0A72/0B72 0A75/0B75 0A76/0B76		Instruction step a parameter word 1 instruction (disable zoomability).

Error Code	Program Tag Name	Program Description
0A71/0B71 0A72/0B72 0A75/0B75 0A76/0B76		Instruction step an absolute beam movement instruction (X and Y positions 0000).
0A71/0B71 0A72/0B72 0A75/0B75 0A76/0B76	EFI020	Clock/instruction step a conditional control instruction (jump to end of item if the beam is not inside the 11-bit window). Expect no jump.
		Check repeat condition stop/jump bit. Do two times.
	TTI000	Condition 8 - jump if outside 12-bit window (true)
0A81/0B81 0A82/0B82 0A85/0B85	TTI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0A81/0B81 0A82/0B82 0A85/0B85		Load interrupt enable with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0A81/0B81 0A82/0B82 0A86/0B86		Load and unload P register. Expect reply.
0A81/0B81 0A82/0B82 0A85/0B85 0A86/0B86	ETI017	Instruction step a parameter word 1 instruction (disable zoomability).
0A81/0B81 0A82/0B82 0A85/0B85 0A86/0B86		Instruction step an absolute beam movement instruction with a shifting single bit set in the positions (use 0800....8000 first in X position and then in Y position).
0A81/0B81 0A82/0B82 0A85/0B85 0A86/0B86	ETI020	Clock/instruction step a conditional control instruction (jump over two words if the beam is not inside the 12-bit window). Expect jump.
		Check repeat condition stop/jump bit. Do for each single bit position outside the 12-bit window in X and then in Y position.
	TFI000	Condition 9 - jump if outside 12-bit window (false)
0A91/0B91 0A92/0B92 0A95/0B95	TFI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0A91/0B91 0A92/0B92 0A95/0B95		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.

Error Code	Program Tag Name	Program Description
0A91/0B91 0A92/0B92 0A96/0B96		Load and unload P register. Expect reply.
0A91/0B91 0A92/0B92 0A96/0B96		Load and unload control word address register with the address of a control word instruction. Expect reply.
0A91/0B91 0A92/0B92 0A95/0B95 0A96/0B96		Instruction step a parameter word 1 instruction (disable zoomability).
0A91/0B91 0A92/0B92 0A95/0B95 0A96/0B96		Instruction step an absolute beam movement instruction (X and Y positions 0).
0A91/0B91 0A92/0B92 0A95/0B95 0A96/0B96	TFI020	Clock/instruction step a conditional control instruction (jump to end of item if beam is inside 12-bit window). Expect jump.
		Check repeat condition stop/jump bit. Do two times.
	YTI000	Condition A - cyclic jump (true)
0AA1/0BA1 0AA2/0BA2 0AA5/0BA5	YTI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0AA1/0BA1 0AA2/0BA2 0AA5/0BA5		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0AA1/0BA1 0AA2/0BA2 0AA6/0BA6		Load and unload P register. Expect reply.
0AA1/0BA1 0AA2/0BA2 0AA6/0BA6		Load and unload control word address register with the address of a control word instruction. Expect reply.
0AA1/0BA1 0AA2/0BA2 0AA5/0BA5		Load write limits register so that the location to be written by the conditional control instruction is within limits.
		Set all protect bits within the write limits except the location to be written by the conditional control instruction.
0AA1/0BA1 0AA2/0BA2 0AA5/0BA5 0AA6/0BA6	YTI020	Clock/instruction step a conditional control instruction (jump to start of item if the operand is equal to count. Use operands 1-F with counts O-E). Expect jump.

Error Code	Program Tag Name	Program Description
0AA7/0BA7		Verify that the core location written by the conditional control instruction contains 0000.
		Check repeat condition stop/jump bit. Do for operands 1-F with counts O-E.
	YFI000	Condition B - cyclic jump (false)
0AB1/0BB1 0AB2/0BB2 0AB5/0BB5	YFI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0AB1/0BB1 0AB2/0BB2 0AB5/0BB5		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0AB1/0BB1 0AB2/0BB2 0AB6/0BB6		Load and unload P register. Expect reply.
0AB1/0BB1 0AB2/0BB2 0AB5/0BB5		Load write limits register so that the location to be written by the conditional control instruction is within limits.
		Set all protect bits within the write limits except the location to be written by the conditional control instruction.
0AB1/0BB1 0AB2/0BB2 0AB5/0BB5 0AB6/0BB6	YFI020	Clock/instruction step a conditional control instruction (jump over one word if the operand is equal to the count). Use operands E, E, O-D with counts F, O, 1-E. Expect no jump.
0AB7/0BB7		Verify that the core location written by the conditional control instruction contains the starting count incremented by one.
		Check repeat condition stop/jump bit. Do for operands E, E, O-D with counts F, O, 1-E.

7. Section C and D - Draw Vector Instructions

Error Code	Program Tag Name	Program Description
	CYCDV	Condition 0 - draw vector X (from off window to on window)
0C01/0D01 0C02/0D02 0C05/0D05	AXI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.

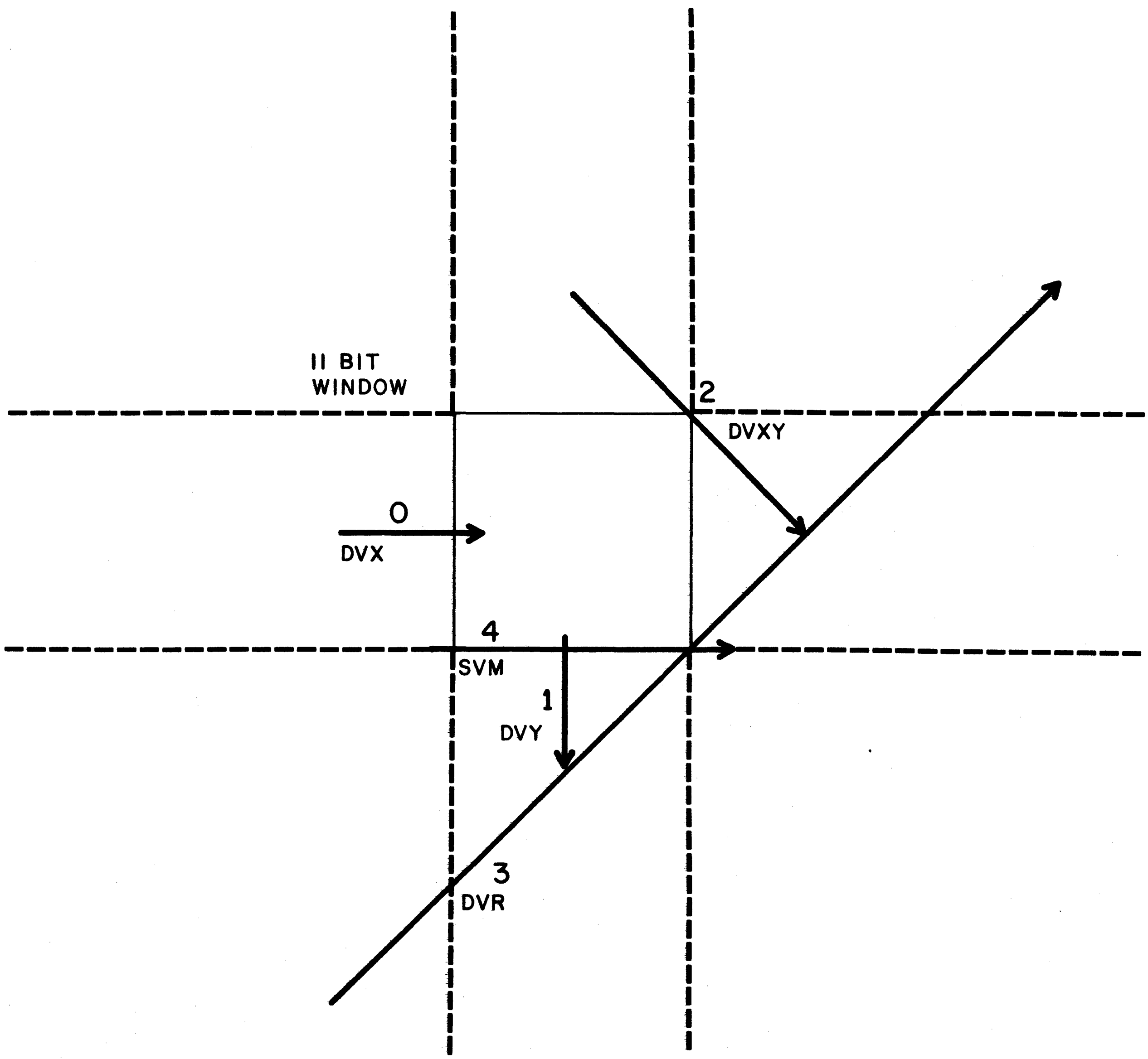
Error Code	Program Tag Name	Program Description
0C01/0D01 0C02/0D02 0C05/0D05		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0C01/0D01 0C02/0D02 0C06/0D06		Load and unload P register. Expect reply.
0C01/0D01 0C02/0D02 0C05/0D05 0C06/0D06	AXI014	Clock/instruction step a parameter word 1 instruction (disable zoomability).
0C01/0D01 0C02/0D02 0C05/0D05 0C06/0D06	AXI016	Clock/instruction step an absolute beam movement instruction (use position FA00 for X and 0000 for Y).
0C01/0D01 0C02/0D02 0C05/0D05 0C06/0D06	AXI020	Clock/instruction step a draw vector X instruction (use delta X of 0240_{16}).
		Check repeat condition stop/jump bit. Repeat five times.
	AYI000	Condition 1 - draw vector Y (from on window to off window)
0C11/0D11 0C12/0D12 0C15/0D15	AYI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0C11/0D11 0C12/0D12 0C15/0D15		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect reply.
0C11/0D11 0C12/0D12 0C16/0D16		Load and unload P register. Expect reply.
0C11/0D11 0C12/0D12 0C15/0D15 0C16/0D16	AYI014	Clock/instruction step a parameter word 1 instruction (disable zoomability).
0C11/0D11 0C12/0D12 0C15/0D15 0C16/0D16	AYI016	Clock/instruction step an absolute beam movement instruction (use position 0000 for X and FC40 for Y).
0C11/0D11 0C12/0D12 0C15/0D15 0C16/0D16	AYI020	Clock/instruction step a draw vector Y instruction (use delta Y of FDBF).
		Check repeat condition stop/jump bit. Repeat five times.

Error Code	Program Tag Name	Program Description
	ABI000	Condition 2 - draw vector XY (from off Y window to off X window)
0C21/0D21 0C22/0D22 0C25/0D25	ABI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0C21/0D21 0C22/0D22 0C25/0D25		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0C21/0D21 0C22/0D22 0C26/0D26		Load and unload P register. Expect reply.
0C21/0D21 0C22/0D22 0C25/0D25 0C26/0D26	ABI016	Clock/instruction step a parameter word 1 instruction (disable zoomability).
0C21/0D21 0C22/0D22 0C25/0D25 0C26/0D26	ABI018	Clock/instruction step an absolute beam movement instruction (use position 0000 for X and 07FE for Y).
0C21/0D21 0C22/0D22 0C25/0D25 0C26/0D26	ABI020	Clock/instruction step a draw vector XY instruction (use delta X of 07FE and delta Y of F801). Check repeat condition stop/jump bit. Repeat five times.
	ARI000	Condition 3 - relative vector (from off X and Y windows, across X and Y window limits, to off X and Y windows)
0C31/0D31 0C32/0D32 0C35/0D35	ARI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0C31/0D31 0C32/0D32 0C35/0D35		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0C31/0D31 0C32/0D32 0C36/0D36		Load and unload P register. Expect reply.
0C31/0D31 0C32/0D32 0C35/0D35 0C36/0D36	ARI014	Clock/instruction step a parameter word 1 instruction (disable zoomability).

Error Code	Program Tag Name	Program Description
0C31/0D31 0C32/0D32 0C35/0D35 0C36/0D36	ARI016	Clock/instruction step an absolute beam movement instruction (use position F801 for X and F003 for Y).
0C31/0D31 0C32/0D32 0C35/0D35 0C36/0D36	ARI020	Clock/instruction step a relative vector instruction (use a delta X of 17FA and a delta Y of 17FA). Check repeat condition stop/jump bit. Repeat five times.
	ASI000	Condition 4 - short vector mode (from off X window, across entire X window, to off X window)
0C41/0D41 0C42/0D42 0C45/0D45	ASI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0C41/0D41 0C42/0D42 0C45/0D45		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0C41/0D41 0C42/0D42 0C46/0D46		Load and unload P register. Expect reply.
0C41/0D41 0C42/0D42 0C45/0D45 0C46/0D46	ASI014	Clock/instruction step a parameter word 1 instruction (disable zoomability).
0C41/0D41 0C42/0D42 0C45/0D45 0C46/0D46	ASI016	Clock/instruction step an absolute beam movement instruction (use position FBC0 for X and FC00 for Y).
0C41/0D41 0C42/0D42 0C45/0D45 0C46/0D46	ASI020	Clock/instruction step a short vector mode instruction (use a scale factor of 7 with a delta X of 0011_{16} and a delta Y of 0000). Check for repeat condition stop/jump bit. Repeat five times.

8. Section E and F - Control Word Instructions

Error Code	Program Tag Name	Program Description
	CYCCW	Condition 0 - skip, no automatic scissoring to window enabled



VECTORS DRAWN IN CONDITIONS
0-4 OF SECTIONS C/D

Error Code	Program Tag Name	Program Description
0E01/0F01 0E02/0F02 0E05/0F05	SAI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0E01/0F01 0E02/0F02 0E05/0F05		Load interrupt enable register with EEC7. Expect reply. Read TV interrupt enable. Expect EEC7.
0E01/0F01 0E02/0F02 0E06/0F06		Load and unload P register. Expect reply.
0E01/0F01 0E02/0F02 0E05/0F05 0E06/0F06	SAI020	Clock/instruction step a control word instruction (S and W bits set). Expect skip item. Check repeat condition stop/jump bit. Do two times.
	SMI000	Condition 1 - no skip, no S/W bit
0E11/0F11 0E12/0F12 0E15/0F15	SBI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0E11/0F11 0E12/0F12 0E15/0F15		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0E11/0F11 0E12/0F12 0E16/0F16		Load and unload P register. Expect reply.
0E11/0F11 0E12/0F12 0E15/0F15 0E16/0F16	SBI020	Clock/instruction step a control word instruction (use S bit not set/W bit set and S bit set/W bit not set). Expect not draw item and not skip item. Check repeat condition stop/jump bit. Do for S bit not set/W bit set and S bit set/W bit not set.
	SCI000	Condition 2 - skip
0E21/0F21 0E22/0F22 0E25/0F25	SCI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0E21/0F21 0E22/0F22 0E25/0F25		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.

Error Code	Program Tag Name	Program Description
0E21/0F21 0E22/0F22 0E26/0F26		Load and unload P register. Expect reply.
0E21/0F21 0E22/0F22 0E26/0F26	SCI020	Clock/instruction step a control word instruction (S and W bits set). Expect not draw item and skip item.
		Check repeat condition stop/jump bit. Do two times.
	CNI000	Condition 3 - draw item, W clear/not correct
0E31/0F31 0E32/0F32 0E35/0F35	CNI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0E31/0F31 0E32/0F32 0E25/0F25		Load interrupt enable with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
0E31/0F31 0E32/0F32 0E36/0F36		Load and unload P register. Expect reply.
0E31/0F31 0E32/0F32 0E35/0F35 0E36/0F36	CNI020	Clock/instruction step a control word instruction (W bit not set and S bit set). Expect not draw item and not skip item.
0E31/0F31 0E32/0F32 0E36/0F36		Load and unload P register with the address of the previously stepped control word instruction. Expect reply.
0E31/0F31 0E32/0F32 0E35/0F35		Load write limits register so that the location to be written by the control word instruction is within limits.
		Set all protect bits within the write limits except the location to be written by the control word instruction.
0E31/0F31 0E32/0F32 0E35/0F35 0E36/0F36	CNI030	Clock/instruction step the same control word instruction previously stepped (W bit not set and S bit set). Expect draw item and W bit clear/not correct (store bit 15 into control word).
0E31/0F31 0E32/0F32 0E35/0F35 0E36/0F36	CNI040	Clock/instruction step the rest of the control word instruction. P decremented during draw item (W bit now set and S bit set). Expect not draw item and skip item.
0E37/0F37		Verify that the W bit is set in the control word instruction.
		Check repeat condition stop/jump bit. Do two times.

9. Section 10 and 11 - Character Mode Instructions

Error Code	Program Tag Name	Program Description
	CYCCM	Condition 0 - character mode fixed spacing
1001/1101 1002/1102	SHI010	Reset. Expect reply.
1005/1105		Read TV interrupt enable. Expect 0000.
1001/1101 1002/1102 1005/1105		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
1001/1101 1002/1102 1006/1106		Load and unload P register. Expect reply.
1001/1101 1002/1102 1005/1105 1006/1106	SHI014	Clock/instruction step a parameter word 1 instruction (disable zoomability).
1001/1101 1002/1102 1005/1105 1006/1106	SHI016	Clock/instruction step an absolute beam movement instruction (use position F800 for X and 07FF for Y).
1001/1101 1002/1102 1005/1105 1006/1106	SHI020	Clock/instruction step a character mode fixed spacing instruction (an exit symbol and one other character is used at sizes A and B alternately).
		Check repeat condition stop/jump bit. Repeat, in reverse order, for all characters between ASCII code 20_{16} and $7E_{16}$.
	SZI000	Condition 1 - character mode variable spacing
1011/1111 1012/1112	SZI010	Reset. Expect reply.
1015/1115		Read TV interrupt enable. Expect 0000.
1011/1111 1012/1112 1015/1115		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
1011/1111 1012/1112 1016/1116		Load and unload P register. Expect reply.
1011/1111 1012/1112 1015/1115 1016/1116	SZI014	Clock/instruction step a parameter word 1 instruction (disable zoomability).

Error Code	Program Tag Name	Program Description
1011/1111 1012/1112 1015/1115 1016/1116	SZI016	Clock/instruction step an absolute beam movement instruction (use position F800 for X and 07FF for Y).
1011/1111 1012/1112 1015/1115 1016/1116	SZI020	Clock/instruction step a character mode variable spacing instruction (an exit symbol and two other characters are used at size A with spacing 0F on X and F0 on Y).
		Check repeat condition stop/jump bit. Repeat, in reverse order, for all character pairs between ASCII codes A0B0 and AFBF.
	LRI010	Condition 2 - enter plot character mode
1021/1121 1022/1122 1025/1125	LRI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
1021/1121 1022/1122 1025/1125		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
1021/1121 1022/1122 1026/1126		Load and unload P register. Expect reply.
1021/1121 1022/1122 1025/1125 1026/1126	ERI014	Clock/instruction step a parameter word 1 instruction (disable zoomability).
1021/1121 1022/1122 1025/1125 1026/1126	LRI016	Clock/instruction step an absolute beam movement instruction (use position F800 for X and 07FF for Y).
1021/1121 1022/1122 1025/1125 1026/1126	LRI020	Clock/instruction step an enter plot character mode instruction (a backspace symbol at size A is used).
		Check repeat condition stop/jump bit.

10. Section 12 and 13 - Execute Instruction

Error Code	Program Tag Name	Program Description
	CYCEXC	Condition 0 - execute control word
1201/1301 1202/1302 1205/1305	CWI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.

Error Code	Program Tag Name	Program Description
1201/1301 1202/1302 1205/1305		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
1201/1301 1202/1302 1206/1306		Load and unload P register. Expect reply.
1201/1301 1202/1302 1206/1306	CWI014	Load and unload DATUM register (address of start of section). Expect reply.
1201/1301 1202/1302 1205/1305 1206/1306	CWI020	Clock/instruction step an execute instruction (indirect address points to a control word instruction).
1201/1301 1202/1302 1205/1305 1206/1306	CWI030	Clock/instruction step a control word instruction in execute mode. Expect immediate exit.
		Check repeat condition stop/jump bit.

11. Section 15 - Start/Stop

Error Code	Program Tag Name	Program Description
	CYCRUN	Condition 0 - start/reset
1501 1502 1505	ESI010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
1501 1502 1505		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
1501 1502 1506		Load and unload P register (address of a load P register instruction - loading its own address). Expect reply.
1501 1502		Start DCI at address in P register. Expect reply.
1503 1504		Attempt to load one scratchpad register (use registers 0F - 01). Expect external reject.
1503 1504		Attempt to unload one scratchpad register (use registers 0F-01). Expect external reject.
1501 1502	ESI020	Reset. Expect reply.

Error Code	Program Tag Name	Program Description
1501 1502	ESI030	Unload one scratchpad register (use registers 0F-01). Expect reply.
		Check repeat condition stop/jump bit. Do for scratch register 0F-01.
	INI000	Condition 1 - start/finish
1511 1512	INI010	Reset. Expect reply.
1515		Read TV interrupt enable. Expect 0000.
1511 1512 1515		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
1511 1512 1516		Load and unload P register (address of a load P instruction, loading its own address). Expect reply.
1511 1512		Start DCI at address in P register. Expect reply.
1513 1514		Attempt to load interrupt enable register. Expect external reject.
1513 1514		Attempt to load interrupt disable register. Expect external reject.
1511 1512		Finish current instruction and stop. Expect reply.
1511 1512		Load interrupt enable register with EECF. Expect reply.
		Check repeat condition stop/jump bit. Do two times.
	OFI000	Condition 2 - Start/end of frame interrupt
1521 1522	OFI010	Reset. Expect reply.
1525		Read TV interrupt enable. Expect 0000.
1521 1522 1525		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
1521 1522 1526		Load and unload P register (address of display file containing an end of frame instruction and a load P register instruction, loading its own address). Expect reply.

Error Code	Program Tag Name	Program Description
1521 1522		Start DCI at address in P register. Expect reply.
1528 1529 152A 152C 152D 152E	OFI020	Verify that the end of frame interrupt occurs in 19-21 milliseconds. No interrupt time error (type 8) will occur if the interrupt is timed to be less than 19 milliseconds and this test is being multiplexed.
152B		Report missing interrupt if end of frame interrupt has not occurred after waiting 100 milliseconds.
1521 1522		Load zoom level register. Expect reply.
		Check repeat condition stop/jump bit. Do for each method of clearing the interrupt (re-enable, disable, and reset).
	RGI000	Condition 3 - start/program interrupt
1531 1532	RGI010	Reset. Expect reply.
1535		Read TV interrupt enable. Expect 0000.
1531 1532 1535		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
1531 1532 1536		Load and unload P register (address of a display file containing a program interrupt instruction and load P register instruction, loading its own address). Expect reply.
1531 1532 1539 153A 153C 153D 153E		Start DCI at address in P register. Expect reply and program interrupt.
153B		Verify that the program interrupt occurred.
1531 1532		Load write limits register. Expect reply.
		Check repeat condition stop/jump bit. Do for each method of clearing the interrupt (re-enable, disable, and reset).

Error Code	Program Tag Name	Program Description
	L1I000	Condition 4 - start/program failure 1 interrupt (write limits)
1541 1542 1545	L1I010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
1541 1542 1545		Load interrupt enable register EECF. Expect reply. Read TV interrupt enable. Expect EECF.
1541 1542 1546		Load and unload P register (address of a display file containing an unload P register and a load P register instruction). Expect reply.
1541 1542 1545	L1I030	Load write limits register (use limits above/below the location to be written by the unload P register instruction). Expect reply. Clear the protect bit for the location to be written by the unload P register instruction.
1541 1542 1549 154A 154C 154D 154E		Start DCI at address in P register. Expect reply and program failure 1 interrupt (attempted write outside write limits).
154B		Verify that program failure 1 interrupt occurred.
1547		Verify that the location of the attempted write remained unchanged.
1541 1542 1545		Load write limits register. Expect reply.
		Check repeat condition stop/jump bit. Do two times.
	B1I000	Condition 5 - Start/program failure 1 interrupt (protect bit)
1551 1552 1555	B1I010	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
1551 1552 1555		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
1551 1552 1556		Load and unload P register (address of a display file containing an unload P register instruction and a load P register instruction, loading its own address). Expect reply.

Error Code	Program Tag Name	Program Description
1551 1552 1555		Load write limits register so that the location to be written by the unload P register instruction is within limits. Expect reply.
		Set the protect bit for the location to be written by the unload P register instruction.
1551 1552 1559 155A 155C 155D 155E		Start DCI at address in P register. Expect reply and program failure 1 interrupt (attempted write into a protected location).
155B		Verify that the program failure 1 interrupt occurred.
1557		Verify that the location of the attempted write remained unchanged.
1551 1552		Unload all the unload only registers. Expect reply.
		Check repeat condition stop/jump bit. Do two times.
	TCI000	Condition 6 - real time clock interrupt
1561	TCI010	Reset. Expect reply.
1562 1565		Read interrupt enable. Expect 0000.
1561 1562 1565		Load interrupt enable register with EECF. Expect reply. Read TV interrupt enable. Expect EECF.
1568 1569 156A 156C 156D 156E	TCI020	Verify that first real time clock interrupt occurs in 0-17 milliseconds if line frequency is 50 cycle. No interrupt time error (type 8) will occur if the interrupt is timed to be less than the lower limit and this test is being multiplexed.
156B		Report missing interrupt if the real time clock interrupt has not occurred after waiting 100 milliseconds.
1568 1569 156A 156C 156D 156E	TCI030	Verify that second real time clock interrupt occurs either in 16-17 milliseconds if line frequency is 60 cycle or in 19-21 milliseconds if line frequency is 50 cycle. No interrupt time error (type 8) will occur if the interrupt is timed to be less than the lower limit and this test is being multiplexed. This second interrupt is cleared with a reset.

C. CONTINUATION AIDS

When writing a new section for GT1, the most difficult task is to generate the change table for clock and instruction stepping. Generation of a preliminary change table may be simplified by using the build change table routine (BUILD). To execute this routine, do the following:

1. Master clear.
2. Set P to the biased address BUILD.
3. Set A to the listing address of the condition to be executed.
4. Set Q to the number of calls the selected condition makes to STEPER and hit RUN.

The routine will execute the condition up to a call to STEPER. It will then extract all prestored change table word control words and come to a parameter stop. New word control words may be entered into A until the parameter stop is terminated by entering F000 into A. The routine will build a change table beginning at location CHNGTB with the number of entries stored at location BUT060. The table is dumped to a teletype. This preliminary change table will have to be modified somewhat by using modifiers to handle multiple sets of operands. See subprogram GETRCT description for change table format.

DIGIGRAPHICS IV CONSOLE (GPGT) DISPLAY QUALITY TEST

{GT2 Test No. 72}

I. INTRODUCTION

The purpose of this test is to verify the operation and alignment of the GPGT display console. This test checks intensity levels, contrast, trace width, drift, stability, distortion, vector end point accuracy, character size, and variable spacing. Patterns are selected on the keyboard. The parameters are as follows: window location, zoom level, mask, conditional control register parameter bits, and 11/12-bit window selection.

II. REQUIREMENTS

A. HARDWARE

1. Minimum Configuration

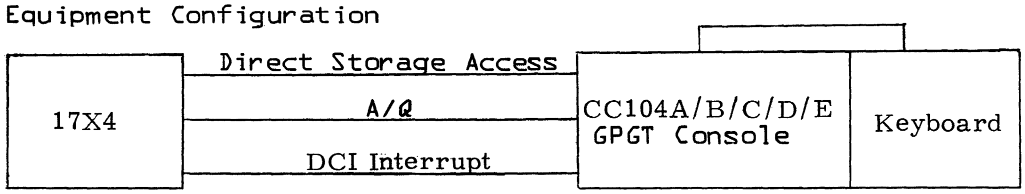
1704/1714/1774/1784 Computer

CC104A/B/C/D/E GPGT Console
Keyboard
Input device for SMM17

2. Core Requirements

The minimum amount of core required is 12K.

3. Equipment Configuration



B. SOFTWARE

The test operates under control of SMM17 monitor.

C. ACCESSORIES

None.

III. OPERATIONAL PROCEDURE

A. LOADING PROCEDURE

The test is loaded as test number 72 using standard SMM17 loading procedure.

B. PARAMETERS

1. Parameter Stops

First stop (overflow light on)

(A) = 7221 test ID stop
(Q) = Stop/Jump parameter

Second stop

(A) = Interrupt line for Display Code Interpreter
(Prestored as 0004-bit 2 designating interrupt line 2)
This parameter must not be changed after the initial parameter stop.
(Q) = Not used

2. DCI Switch Setting

DCI instruction/clock control switches must be UP.
The DCI PROTECT switch must be in UNPROTECTED.
The DCI REFRESH FAULT switch must be UP.

3. Stop/Jump Parameter Word

Bit 0 - Stop to enter parameters
1 - Not sensed by this test
2 - Not sensed by this test
3 - Stop on error
4 - Not sensed by this test
5 - Not sensed by this test
6 - Not sensed by this test
7 - Not used
8 - Omit typeouts
9 - Bias return address display
10 - Re-enter parameters
11 - Not sensed by this test
12 - Not sensed by this test
13 - Not sensed by this test
14 - Not sensed by this test
15 - Run this test alone
(This bit should be set when two or more tests in the test list use the same display code interpreter equipment number. This allows the tests to be run consecutively since they cannot be multiplexed.)

C. PATTERN DESCRIPTION INDEX

Since the patterns in this test are used in the alignment procedure for the display console, a detailed description of the patterns is located in the GPGT On-Site Maintenance Manual (Publication Number 82165000).

Number	Name
1	Quick Look
2	Focus (Vectors)
3	Pincushion
4	Text
5	Drift
6	Intensity
7	Focus (Dots)

IV. OPERATOR COMMUNICATIONS

A. MESSAGE FORMATS

1. Normal Teletype Message

Program identification during test initialization.

```
GT2 (No. 72) GPGT DISPLAY QUALITY TEST
IA = XXXX
```

2. Normal Display Console Message

Displayed at the console after the teletype message, during pattern selection, and during pattern manipulation.

```
PATTERN NUMBERS  1 = QUICKLOOK  2 = FOCUS....
TO SELECT PATTERN, TYPE PTN/pattern number ETX
FUNCT __
```

3. Stop on Error

All error message displays use basically the standard SMM17 error message format. The format of the first two stops is the same for all types of errors. The format of the third and fourth stops is determined by the type of error. The format for the first and second stops is as follows:

First stop (overflow light on)

```
(A) = 72X8 test ID stop
      where X is the number of stops
(Q) = Stop/Jump parameter
```

Second stop

```
(A) = XX0Z where XX = Pattern number
                  Z = Error type
(Q) = Address pointer to where within the
      pattern setup the error occurred

      This pointer is not the same as the return address
```

found in other SMM17 tests. The address points to where execution stopped when the error occurred, but not to where execution will continue after the error. Execution after the error continues from the beginning of the pattern setup.

B. MESSAGE DICTIONARY

Code	Subroutine Name	Subroutine Tag Name	Message and Description
01	FNRP STRP	FNI110 STI100	RESPONSE, expect reply, receive internal reject A3 = I/O type* Q3 = Q register function code
02	FNRP STRP	FNI110 STI100	RESPONSE, expect reply, receive external reject A3 = I/O type* Q3 = Q register function code
05	CMPALL	CMI030	TV monitor has unexpected contents A3 = Actual TV display Q3 = Expected TV display A4 = Failing TV word number Q4 = Previous TV display
06	CMPALL	CMI030	REGISTER, parameter register has unexpected contents A3 = Actual contents Q3 = Expected contents A4 = Failing register number Q4 = Previous contents
09	DCIPRO	DCI002	INTERRUPT, internal reject during interrupt state A3 = I/O type* Q3 = Q register function code
0A	DCIPRO	DCI002	INTERRUPT, external reject during interrupt state A3 = I/O type* Q3 = Q register function code
0B	RINT	RII010	INTERRUPT, missing A3 = Actual interrupts (bits corresponding to register 20_{16}) Q3 = Expected interrupts (bits corresponding to register 20_{16})

*Input = 0200, output = 0300.

Code	Subroutine Name	Subroutine Tag Name	Message and Description
0C	DCIPRO	DCI020	INTERRUPT, no interrupt status bit set when an interrupt occurred A3 = 0000 (actual status) Q3 = Expected interrupts (bits corresponding to register 20_{16})
0D	DCIPRO	DCI030	INTERRUPT, unexpected A3 = Actual interrupts (bits corresponding to register 20_{16}) Q3 = Expected interrupts (bits corresponding to register 20_{16})
0E	DCIPRO	DCI060	INTERRUPT, unable to clear interrupt status A3 = Actual interrupt status after attempted clear (bits corresponding to register 20_{16}) Q3 = Expected interrupt status after attempted clear (bits corresponding to register 20_{16}) A4 = Function used to attempt clear interrupt status 00 = Cleared when interrupt status or keyboard register unloaded 1A = Load interrupt enable register 1B = Load interrupt disable register 30 = Reset Q4 = Not used

Register	15	14	13	12	11	10	9	8	7	6
20	LP	EOF	PG	RTC	LSW	K	PF1	PF2	HF	CF

V. DESCRIPTION

A. GENERAL

This test allows the selection and manipulation of alignment patterns. These patterns are called and controlled by typing functions on the display console keyboard. Initially the display is as follows:

```
PATTERN NUMBERS  1 = QUICKLOOK  2 = FOCUS....
TO SELECT PATTERN, TYPE PTN/pattern number ETX
FUNCT __
```

NOTE

Lower case on the keyboard must be selected.

Depressing the first key of a function type-in causes any previous pattern to stop being displayed and the function display with cursor to be displayed instead. That first symbol is displayed following the FUNCT and the cursor is advanced one space. Each symbol of the type-in is displayed and the cursor advanced until an ETX terminates the type-in. If you make an error while typing the function, depress BACKSPACE and correct your error. Illegal keys are ignored. Illegal functions are discarded and the cursor replaced following the FUNCT.

1. Display a Pattern (PTN/)

   Type: PTN/n (ETX)
   where n is the pattern number

   The selected pattern is displayed using prestored parameters for window limits, zoom level, mask, conditional control register bits, and 11/12-bit window selection. Since each pattern has its own set of parameters, it is necessary to select a pattern before any pattern parameters are typed.

   NOTE

   The test ignores pattern parameters that are typed before a pattern number has been selected.

2. Change Window Location (8/ or 9/)

   Type: 8/nnnn (ETX) for window location X
   or 9/nnnn (ETX) for window location Y
   where nnnn is the window location (leading zeros need not be typed)

3. Change Zoom Level (18/)

   Type: 18/n (ETX)
   where n is the zoom level

4. Change Window Limits (19/)

   Type: 19/wxyz (ETX)
   where w is x upper limit
   x is y upper limit
   y is x lower limit
   z is y lower limit

5. Change 11/12-Bit Window {PAR/}

Type: PAR/nn (ETX)
where nn is 11 for an 11-bit window
or 12 for a 12-bit window

6. Change CCR {B/}

Type: B/nnnn (ETX)
where nnnn is the value to be placed in the conditional control register

NOTE

The conditional control register bits are not sensed by all patterns. When the CCR bits are sensed, they may have different meaning from one pattern to the next.

7. Terminate the Test {END/}

Type: END/ (ETX)

B. PATTERN PARAMETER DESCRIPTION

1. Quick Look

Parameter	Prestored
Window location X {8}	0000
Window location Y {9}	0000
Zoom level {18}	0
Window limits {19}	0000
11/12-bit window	12
Conditional control {B}	Not Used

2. Focus {vectors}

Parameter	Prestored
Window location X {8}	0000
Window location Y {9}	0000
Zoom level {18}	0
Window limits {19}	0000
11/12-bit window	12
Conditional control {B}	Not Used

3. Pincushion

Parameter	Prestored
Window location X {8}	0000
Window location Y {9}	0000
Zoom level {18}	0
Window limits {19}	0000
11/12-bit window	12
Conditional control {B}	Not Used

4. Text

Parameter	Prestored
Window location X {8}	6000
Window location Y {9}	9FFF
Zoom level {18}	3
Window limits {19}	0000
11/12-bit window	12
Conditional control {B}	0001

The Conditional Control register is used to select 1 or 16 paragraphs of text. If bit 0 of the CCR is set, one paragraph is displayed. If bit 0 is clear, 16 paragraphs are displayed.

5. Drift

Parameter	Prestored
Window location X {8}	0000
Window location Y {9}	0000
Zoom level {18}	4
Window limits {19}	0000
11/12-bit window	12
Conditional control	0101

The Conditional Control register is used to select either the vertical or horizontal drift test and also the wait time at each edge of the CRT. The CCR bits are assigned as follows:

Drift Test Selection

Bit 8 - Horizontal drift test
Bit 9 - Vertical drift test

Wait Time

Bit 0 - 0 milliseconds
Bit 1 - 20 milliseconds
Bit 2 - 40 milliseconds
Bit 3 - 80 milliseconds
Bit 4 - 160 milliseconds
Bit 5 - 320 milliseconds
Bit 6 - 640 milliseconds
Bit 7 - 640 milliseconds

6. Intensity

Parameter	Prestored
Window location X {8}	0000
Window location Y {9}	0000
Zoom level {18}	4
Window limits {19}	0000
11/12-bit window	12
Conditional control {B}	0001

The Conditional Control register is used to select quadrants of the intensity pattern. The CCR bits are assigned as follows:

Bit 0 - All quadrants
Bit 1 - Quadrant 1
Bit 2 - Quadrant 2
Bit 3 - Quadrant 3
Bit 4 - Quadrant 4

7. Focus (Dots)

Parameter	Prestored
Window location X (8)	0000
Window location Y (9)	0000
Zoom level (18)	4
Window limits (19)	0000
11/12-bit window	12
Conditional control (B)	0001

The Conditional Control register is used to select the displayed symbol. The CCR bits are assigned as follows:

Bit 0 - Points
Bit 1 - H's
Bit 2 - No symbol displayed (beam movements only)

C. PATTERN SETUP DESCRIPTION

Error Code	Program Tag Name	Program Description
XX01 XX02	KEI001	Finish current instruction and stop. Expect reply.
XX01 XX02	KEI002 KEI003	Read TV DCI stopped bit. Expect reply. Return control to SMM. Wait for DCI stopped.
XX01 XX02 XX05	KEI004	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
XX01 XX02 XX05		Load write limits register. Expect reply.
XX01 XX02 XX06		Load and unload P register. Expect reply.
XX01 XX02 XX06		Load interrupt enable register with AFDF. Expect reply. Read TV interrupt enable. Expect AFDF.
XX01 XX02	KEI008	Start display. Expect reply (selected pattern or function display).

Error Code	Program Tag Name	Program Description
XX09 XX0A XX0C XX0D XX0E	KEI020	Return control to SMM. Wait for keyboard interrupt.
XX0B	KEI030	Verify that keyboard interrupt occurred. Store symbol into display file and update cursor position. If symbol is an ETX, do the designated function. If END ETX has been typed, exit test.

DIGIGRAPHICS IV CONSOLE LIGHT PEN AND KEYBOARD TEST

(GT3 Test No. 73)

I. INTRODUCTION

The purpose of this test is to verify the operation of the GFGT light pen and keyboard. The two modes of light pen operation, picking and tracking, are checked. Light pen picking is checked using vectors, points, symbols and combinations of vectors, points, and symbols. Light pen tracking is checked using basically the same tracking routine as used by the GPGT software system. The keyboard is checked by depressing keys in a random sequence and visually checking the resultant display. A symbol key results in displaying that symbol; a control key results in the indicated function or displaying the character sequence shown on that key.

II. REQUIREMENTS

A. HARDWARE

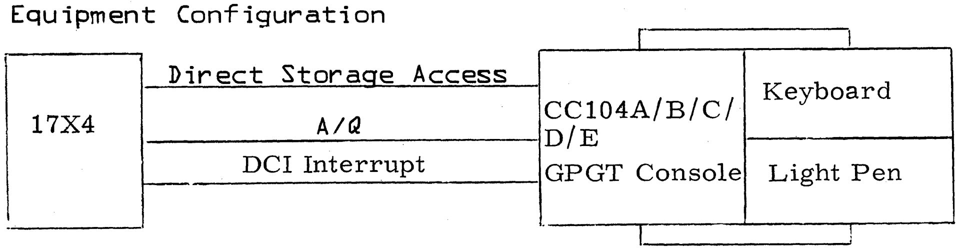
1. Minimum Configuration

   1704/1714/1774/1784 Computer
   CC104 A/B/C/D/E Console
   Keyboard
   Light Pen
   Input device for SMM17

2. Core Requirements

   The minimum amount of core required is 8K.

3. Equipment Configuration



B. SOFTWARE

The test operates under control of the SMM17 monitor.

C. ACCESSORIES

None.

III. OPERATIONAL PROCEDURE

A. LOADING PROCEDURE

The test is loaded as test number 73 using standard SMM17 loading procedure.

B. PARAMETERS

1. Parameter Stops

First stop (overflow light on)

```
(A) = 7321 test ID stop
(Q) = Stop/Jump parameter
```

Second stop

```
(A) = Section selection bits (prestored as 0007)
      Bit 0 = Section 0 - Light pen picking check
      Bit 1 = Section 1 - Light pen tracking check
      Bit 2 = Section 2 - Keyboard check
(Q) = Interrupt line for display code interpreter
      (prestored as 0004-bit 2 designating interrupt line 2)
      This parameter must not be changed after the initial
      parameter stop.
```

2. DCI Switch Setting

DCI instruction/clock control switches must be UP.
The DCI PROTECT switch must be in UNPROTECTED.
The DCI SENSE REFRESH FAULT switch must be UP.

3. Stop/Jump Parameter Word

```
Bit 0 - Stop to enter parameters
    1 - Stop at end of test section
    2 - Stop at end of test
    3 - Stop on error
    4 - Repeat condition
    5 - Repeat section
    6 - Repeat test
    7 - Not used
    8 - Omit typeouts
    9 - Bias return address display
   10 - Re-enter parameters
   11 - Not sensed by this test
   12 - Not sensed by this test
   13 - Not sensed by this test
   14 - Not sensed by this test
   15 - Run this test alone
        (This bit should be set when two or more tests in the
        test list use the same display code interpreter equipment
        number. This allows the tests to be run consecutively,
        since they cannot be multiplexed.)
```

C. SECTION DESCRIPTION INDEX

Number	Name
0	Light pen picking
1	Light pen tracking
2	Keyboard

IV. OPERATOR COMMUNICATIONS

A. MESSAGE FORMATS

1. Normal Teletype Message

Program identification during test initialization.

```
GT3 (NO. 73) GPGT LIGHT PEN/KEYBOARD TEST
IA = XXXX
```

2. Normal Display Console Message

Displayed at the console during the keyboard check section.

```
KEYBOARD TEST-TERMINATE WITH RESET, E, N, D, ETX
```

3. Stop at End of Test Section

First stop (overflow light on)

```
(A) = 7322 - test ID stop
(Q) = Stop/Jump parameter
```

Second stop

```
(A) = Section number
(Q) = Return address
```

4. Stop at End of Test

First stop (overflow light on)

```
(A) = 7324 - test ID stop
(Q) = Stop/Jump parameter
```

Second stop

```
(A) = Pass number
(Q) = Return address
```

5. Stop on Error

All error message displays use basically the standard SMM17 error message format. The format of the first two stops is the same for all types of errors. The format of the third and fourth stops is determined by the type of error. The format for the first and second stops is as follows:

First stop (overflow light on)

(A) = 73X8 - test ID stop
where X is the number of stops
(Q) = Stop/Jump parameter

Second stop

(A) = XXYZ where XX = Section number
Y = Condition (or subsection)
Z = Error type
(Q) = Address pointer to where within a condition the error occurred.

This pointer is not the same as the return address found in other SMM17 tests. The address points to where execution stopped when the error occurred, but not to where execution will continue after the error. Where execution continues after the error is determined by the repeat conditions bit of the Stop/Jump parameter. If the repeat condition bit is set, execution will continue at a backward marker, a recovery point to repeat the condition designated in (A) of this second stop. If the repeat condition bit is not set, execution will continue at a forward marker, a recovery point to skip around the remainder of the condition designated in (A) of this second stop.

B. MESSAGE DICTIONARY

The upper hexadecimal digit of the two-digit error message code designates the condition (or subsection) that failed. The lower digit is the error type. This message dictionary describes the error types.

Code	Subroutine Name	Subroutine Tag Name	Message and Description
1	FNRP STRP	FNI110 STI100	RESPONSE, expect reply, receive internal reject A3 = Input (0200), Output (0300) Q3 = Q register function code

Code	Subroutine Name	Subroutine Tag Name	Message and Description
2	FNRP STRP	FNI110 STI100	RESPONSE, expect reply, receive external reject A3 = I/O Type* Q3 = Q register function code
5	CMPALL	CMI030	TV monitor has unexpected display A3 = Actual TV display Q3 = Expected TV display A4 = Failing TV word number Q4 = Previous TV display
6	CMPALL	CMI030	REGISTER, parameter register has unexpected contents A3 = Actual register contents Q3 = Expected register contents A4 = Failing register number Q4 = Previous register contents
8	WAIT	WAI050 WAI060	TIME, interrupt did not occur within expected time limits A3 = Lower limit (in milliseconds) Q3 = Upper limit (in milliseconds) A4 = Actual time (in milliseconds) Q4 = Not used
9	DCIPRO	DCI002	INTERRUPT, internal reject during interrupt state A3 = I/O Type* Q3 = Q register function code
A	DCIPRO	DCI002	INTERRUPT, external reject during interrupt state A3 = I/O Type* Q3 = Q register function code
B	RINT	RII010	INTERRUPT, missing A3 = Actual interrupts (bits corresponding to register 20_{16}) Q3 = Expected interrupts (bits corresponding to register 20_{16})
C	DCIPRO	DCI020	INTERRUPT, no interrupt status bit set when an interrupt occurred A3 = 0000 (actual status) Q3 = Expected interrupts (bits corresponding to register 20_{16})

*Input = 0200, output = 0300.

Code	Subroutine Name	Subroutine Tag Name	Message and Description
D	DCIPRO	DCI030	INTERRUPT, unexpected A3 = Actual interrupts (bits corresponding to register 20_{16}) Q3 = Expected interrupts (bits corresponding to register 20_{16})
E	DCIPRO	DCI060	INTERRUPT, unable to clear interrupt status A3 = Actual interrupt status after attempted clear (bits corresponding to register 20_{16}) Q3 = Expected interrupt status after attempted clear (bits corresponding to register 20_{16}) A4 = Function used to attempt clear interrupt status 00 = Cleared when interrupt status or keyboard register unloaded 1A = Load interrupt enable register 1B = Load interrupt disable register 30 = Reset Q4 = Not used

Register 20

15	14	13	12	11	10	9	8	7	6
LP	EOF	PG	RTC	LSW	K	PF1	PF2	HF	CF

V. DESCRIPTION

A. GENERAL

Since Section 0 requires the operator to execute conditions in a sequential manner, standard SMM17 error messages are provided when an unexpected result occurs. Sections 1 and 2 have no required sequence and thus, expected results must be verified visually.

B. SECTION DESCRIPTIONS

1. Section 0 - Light Pen Picking

Each condition in Section 0 follows the same sequence of operations. Two DCI drawing instructions (vector and/or symbol) are executed in each condition. Light pen hits are enabled on unless the repeat condition or repeat section stop/jump bits are set.

Error Code	Program Tag Name	Program Description
0201 0202 0205	Key	Reset. Expect reply. Read TV interrupt enable. Expect 0000.
0201 0202 0206		Load and unload P register. Expect reply.
0201 0202 0205		Load interrupt enable register. Expect reply. Read TV interrupt enable. Expect BE8F.
0201 0202		Start display. Expect reply.
0209 020A 020C 020D 020E	KEI020	Return control to SMM. Wait for keyboard interrupt.
020B	KEI030	Verify that keyboard interrupt occurred. Store symbol(s) into display file and update cursor position. If RESET END ETX has not been typed, go back and wait for another keyboard interrupt. If RESET END ETX has been typed, check repeat condition stop/jump bit.

IV. APPLICATIONS

A. GENERAL

The only way to check that a light pen hit can transfer bit 2^{15} to the light pen hit address register (05) is to run this test at an address above 7FFF. This can be accomplished by indicating a forced load address at Build Test List time. Just prior to the test number / equipment address stop A should be entered with FF00, and Q should be entered with the desired load address.

B. HUNG CONDITIONS

If the test hangs or seems to be lost, the system controller and the display code interpreter should be stepped to halt all action. The computer registers, TV monitor, and certain program locations should be observed to help define the problem.

NOTE

Do not master clear the computer. If the computer is master cleared, much of the TV monitor information will also be cleared. Memory locations may be observed without master clearing. This is done by clearing P with the register clear button, setting P to the desired address, placing ENTER/SWEEP switch to SWEEP, stepping the RUN/STEP switch once, and observing the X register.

DIGIGRAPHICS IV CONSOLE (GPGT)
COMMUNICATIONS TEST (12-BIT INTERFACE)
(GT5 Test No. 75)

I INTRODUCTION

The purpose of this test is to verify the operation of the GPGT communications interface. The test operates in link around mode in which the receiver is connected to the output of the transmitter. Since this mode of operation is selected by a software function, no hardware alteration is necessary. The modem interface drivers and receivers are not included in the link around data path. An echo mode may also be selected. In this mode, data is turned around after the modem. On the 358-3 modem, this is accomplished by reversing the loop test connector J2. Also, bit 12 of the Stop/Jump parameter must be set to enable echo mode.

II REQUIREMENTS

A. HARDWARE

1. Minimum Configuration

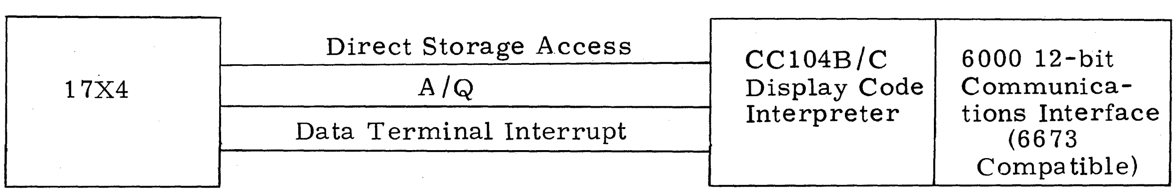
   1704/1714/1774/1784 Computer

   CC104B/C GPGT Console
   Input device for SMM17

2. Core Requirements

   The minimum amount of core required is 4K.

3. Equipment Configuration



B. SOFTWARE

The test operates under control of the SMM17 monitor.

C. ACCESSORIES

None

III OPERATIONAL PROCEDURE

A. LOADING PROCEDURE

The test is loaded as test number 75 using standard SMM17 loading procedure.

B. PARAMETERS

1. Parameter Stops

First stop (overflow light on)
(A) = 7521 test ID stop
(Q) = Stop/Jump parameter
Second stop
(A) = Section selection bits (prestored as 003F)
Bit 0 = Section 0 - Zeros
1 = Section 1 - Ones
2 = Section 2 - Shifting one
3 = Section 3 - Shifting zero
4 = Section 4 - Complements
5 = Section 5 - Random
6 = Section 6 - Protect/CRC character check
7 = Section 7 - Terminate buffer
8 = Section 8 - Test mode
(Q) = Interrupt line for communications interface (prestored as 0008)

2. Data Terminal Switch Setting

The DATA TERMINAL IN switch must be UP.
The PROTECT switch must be DOWN (except during portions of Section 6).
The PRIORITY switch must be DOWN.
The DATA TERMINAL INTERFACE BOARD 16/12 BIT SELECT switch must be DOWN to select 12-bit.

3. Stop/Jump Parameter Word

Bit 0 - Stop to enter parameters
1 - Stop at end of test section
2 - Stop at end of test
3 - Stop on error
4 - Repeat condition (buffer)
5 - Repeat section
6 - Repeat test

Bit 7 - Not used

8 - Omit typeouts

9 - Bias return address display

10 - Re-enter parameters

11 - Communicate with 1700 host

12 - Echo through modem

13 - Bypass the remainder of the data errors for this buffer

14 - Start transmitter only

15 -

Bits 11 and 12 must not be set at the same time. Bits 13 and 14 apply only to Sections 0 through 5.

C. SECTION DESCRIPTION INDEX

Section Number	Name	Run Time
0	Zeros	Less than 1 second
1	Ones	Less than 1 second
2	Shifting one	Less than 1 second
3	Shifting zero	Less than 1 second
4	Complements	Less than 1 second
5	Random	Less than 1 second
6	Protect	Less than 1 second
7	Terminate buffer	Less than 1 second
8	Test mode	Less than 1 second

IV OPERATOR COMMUNICATIONS

A. MESSAGE FORMATS

1. Normal Teletype Messages

Program identification during test initialization.

GT5 (No. 75) GPGT COMMUNICATIONS TEST

IA = XXXX

Section 6 Instructions Typeout

Stop Q = 61, Set 1700 PROTECT switch

Stop Q = 62, Set EQUIPMENT PROTECT switch

Stop Q = 63, Clear PROTECT switches

Stop Q = 6E, Clear PROTECT switches to report error

Section 8 Instructions Typeout

Set test mode switches

Clear test mode switches

2. Operator Intervention Stops

An operator intervention stop is identified by an ID word of 751F in the A register. The Q register contains a code to designate what operation the operator must perform.

(A) = 751F - Test ID word

(Q) = 0061 - Operator must place the 1700 PROTECT switch to the PROTECT position

(A) = 751F - Test ID word

(Q) = 0062 - Operator must place the PROTECT switch on the communications interface to the PROTECT position

(A) = 751F - Test ID word

(Q) = 0063 - Operator must place the 1700/communications PROTECT switches to the NON-PROTECT positions

(A) = 751F - Test ID word

(Q) = 006E - Operator must clear the 1700/communications PROTECT switches and hit RUN. An error stop, if selected, will follow this stop

(A) = 751F - Test ID word

(Q) = 0081 - Operator must place both TEST MODE switches on the communications interface to a position other than OFF

(A) = 751F - Test ID word

(Q) = 0082 - Operator must place both TEST MODE switches on the communications interface to the OFF position

3. Stop at End of Test Section

First stop (overflow light on)

(A) = 7522 - Test ID stop

(Q) = Stop/Jump parameter

Second stop

(A) = Section number

(Q) = Return address

4. Stop at End of Test

First stop (overflow light on)

(A) = 7524 - Test ID stop

(Q) = Stop/Jump parameter

Second Stop

(A) = Pass number

(Q) = Return address

5. Stop On Error

All error message displays use basically the standard SMM17 error message format. The format of the first two stops is the same for all types of errors. The format of the third and fourth stops is determined by the type of error. The format for the first and second stops is as follows:

First stop (overflow light on)

(A) = 75X8 - Test ID stop

Where X is the number of stops

(Q) = Stop/Jump parameter

Second stop

(A) = XXYZ where XX = Section number

Y = Buffer number (Sections 0-5)

Z = Error type

The buffer designated in Y is actually the same buffer repeated 16 times in Sections 0-5. In Sections 6-8, Y is always zero except for several special cases of error type 6 and 7.

(Q) = Address pointer to where within the communications driver the error occured.

This pointer is not the same as the return address found in other SMM17 tests. The address points to where execution stopped when the error occurred, but not to where execution will continue after the error. Where execution continues after the error is determined by the repeat condition bit of the Stop/Jump parameter. If the repeat condition bit is set, execution will continue at a backward marker, a recovery point to repeat the buffer designated in (A) of this second stop. If the repeat condition bit is not set, execution will continue at a forward marker, a recovery point to ignore the remainder of the current buffer sequence and to advance to the next buffer.

B. MESSAGE DICTIONARY

The upper hexadecimal digit of the two-digit error message code designates the buffer number that failed in sections 0-5. (Sections 0-5 transfer 16 buffers numbered 0-F.) In Sections 6-8, the upper hexadecimal digit is always zero except for several special cases of error type 6 and 7. The lower digit of the error message code is the error type. This message dictionary describes the error types including the special cases of error type 6 and 7.

Code	Subroutine Name	Subroutine Tag Name	Message and Description
1	FNRP STRP	FNI110 STI100	RESPONSE, expect reply, receive internal reject A3 = I/O type* Q3 = Q register equipment address
2	FNRP STRP	FNI110 STI100	RESPONSE, expect reply, receive external reject A3 = I/O type* Q3 = Q register equipment address
3	FNRP STRP	FNI230 STI220	RESPONSE, expect external reject, receive internal reject A3 = I/O type* Q3 = Q register equipment address
4	FNRP STRP	FNI200 STI200	RESPONSE, expect external reject, receive reply A3 = I/O type* Q3 = Q register equipment address
5	CMPST	CMI010	STATUS, word has unexpected contents A3 = Actual status Q3 = Expected status A4 = Q register equipment address Q4 = Previous status
6	CMPST	CMI010	CWA, current word address register has unexpected contents A3 = Actual address Q3 = Expected address A4 = Q register equipment address Q4 = Previous address
Special case of error type 6 in Section 7.			
0716	S7I150 S7I 170	S7I005	CWA register out of expected range after terminate buffer A3 = Actual address Q3 = Q register station and director bits A4 = Starting address of buffer Q4 = Last word address plus one of buffer
7	CKCORE	CKI130	DATA does not match expected data A3 = Actual data Q3 = Expected data A4 = Word number in buffer (words numbered from 1) Q4 = Not used

*Input=0200, output=0300.

Code	Subroutine Name	Subroutine Tag Name	Message and Description
Special cases of error type 7 in Section 6.			
0617	PPI220	PPFAIL	PROTECTED location altered by receive operation when 1700 PROTECT switch is on and command is not protected A3 = Actual data Q3 = Expected data (OBAD) A4 = Word number in buffer Q4 = Not used
0627	PPI250	PPFAIL	CRC received incorrect A3 = Actual CRC Q3 = Expected CRC A4 = Word number in buffer (0065) Q4 = Not used
8	CKCORE	CKI140	DATA stored beyond receive buffer LWA A3 = Data stored in location following the end of the receive buffer Q3 = Address of buffer overflow
9	DCIPRO	DCI002	INTERRUPT, internal reject during interrupt state A3 = I/O test* Q3 = Q register function code
A	DCIPRO	DCI002	INTERRUPT, external reject during interrupt state A3 = I/O type* Q3 = Q register function code A4 = Attempted function (output only)
B	RINT	RII010	INTERRUPT, missing A3 = Actual receiver interrupts (bits corresponding to receiver status bits) Q3 = Expected receiver interrupts (bits corresponding to receiver status bits) A4 = Actual transmitter interrupts (bits corresponding to transmitter status bits) Q4 = Expected transmitter interrupts (bits corresponding to transmitter status bits)

*Input=0200, output=0300.

Code	Subroutine Name	Subroutine Tag Name	Message and Description
C	DCIPRO	DCI020	INTERRUPT, no interrupt status bit set when an interrupt occurred A3 = Actual receiver status when interrupt occurred Q3 = Expected receiver interrupts (bits corresponding to receiver status bits) A4 = Actual transmitter status when interrupt occurred Q4 = Expected transmitter interrupts (bits corresponding to transmitter status bits)
D	DCIPRO	DCI030	INTERRUPT, unexpected A3 = Actual receiver status when interrupted Q3 = Expected receiver interrupts (bits corresponding to receiver status bits) A4 = Actual transmitter status when interrupt occurred Q4 = Expected transmitter interrupts (bits corresponding to transmitter status bits)
E	DCIPRO	DCI069	INTERRUPT, unable to clear interrupt status A3 = Actual receiver status after attempted clear interrupts Q3 = 0000 (expected interrupts after attempted clear interrupts) A4 = Actual transmitter status after attempted clear interrupts Q4 = 0000 (expected interrupts after attempted clear interrupts)

Interrupt bits corresponding to status: Bit 04 = EOP, bit 05 = Alarm.

A. GENERAL

Sections 0-5 of this test transmit and receive 16 buffers (numbered 0-F) in link around mode or echo mode. Sections 0-5 use a common driver, but the routine is entered with different patterns prestored. Both receiver and transmitter end of operation interrupts are enabled.

DIGIGRAPHICS IV CONSOLE (GPGT)
DESIGN SPECIFICATION VERIFICATION TEST
(GT6 Test No. 76)

I. INTRODUCTION

The purpose of this test is to verify that the GPGT meets certain design specifications. This test checks vector volume, character volume, light pen field of view, and light pen tracking rate. The volume counts generated by this test do not indicate minimum, maximum, or average display rates. The counts are meant to be used only as a guideline for comparison from one day to the next. *

II. REQUIREMENTS

A. HARDWARE

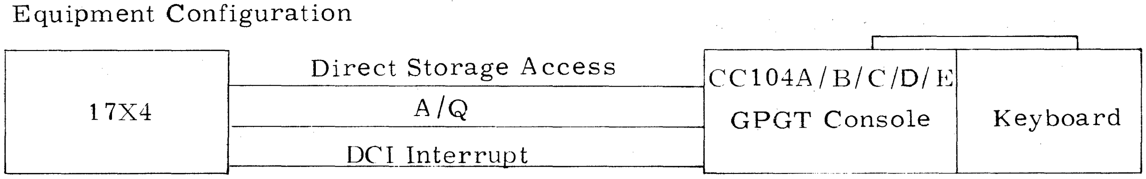
1. Minimum Configuration

1704/1714/1774/1784 Computer
CC104A/B/C/D/E GPGT Console
Keyboard
Input device for SMM17

2. Core Requirements

The minimum amount of core required is 8K.

3. Equipment Configuration



B. SOFTWARE

The test operates under control of SMM17 monitor.

C. ACCESSORIES

None

III OPERATIONAL PROCEDURE

A. LOADING PROCEDURE

The test is loaded as test number 76 using standard SMM17 loading procedure.

*On 50-Hz units, unusually low vector volume counts may occur randomly; these are erroneous and should be ignored.

B. PARAMETERS

1. Parameter Stops

Parameters cannot be changed after the initial parameter stop.

First stop (overflow light on)

(A) = 7621 test ID stop

(Q) = Stop/Jump parameter

Second stop

(A) = Interrupt line for display code interpreter (prestored as 0004-bit 2 designating interrupt line 2)

(Q) = Power line frequency (prestored as 0060_{16}) For 60-cycle input power, set to 0060_{16}. For 50-cycle input power, set to 0050_{16}.

2. Switch Settings

DCI instruction/clock control switches must be UP. The DCI PROTECT switch must be in UNPROTECTED. The DCI SENSE REFRESH FAULT switch must be DOWN. The DCI SCANNER switch must be set to ONE and all other scanner switches must be set to OUT. The switch on the DSA board must be UP if the GPGT is cabled to a 1784. This switch must be DOWN for all other 17X4 mainframes.

3. Stop/Jump Parameter Word

Bit 0 - Stop to enter parameters
 8 - Omit typeouts

C. PATTERN DESCRIPTION INDEX

Number	Name
1	Short Vector Mode 1/2 Inch Vector Volume

Number	Name
2	Short Vector Mode 2 Inch Vector Volume
3	Short Vector Mode 8 Inch Vector Volume
4	Two Word 1/2 Inch Vector Volume
5	Two Word 2 Inch Vector Volume
6	Two Word 8 Inch Vector Volume
7	Three Word 1/2 Inch Vector Volume
8	Three Word 2 Inch Vector Volume
9	Three Word 8 Inch Vector Volume
10	Symbol Volume
11	Light Pen Field of View
12	Light Pen Tracking Rate

IV OPERATOR COMMUNICATIONS

A. MESSAGE FORMATS

1. Normal Teletype Message

Program identification during test initialization.

GT6 (No. 76) GPGT SPEC VERIFICATION TEST
IA = XXXX

2. Normal Display Console Message

Displayed at the console after the teletype message and during pattern selection.

PATTERN NUMBERS 1 = SVM HALF INCH VECTORS,
2 = SVM TWO INCH VECTORS.....
TO SELECT PATTERN, TYPE PTN/pattern number ETX FUNCT____

3. Error Messages

No error messages are used. Displays must be visually checked.

B. MESSAGE DICTIONARY

Not applicable.

V DESCRIPTION

A. GENERAL

This test allows the selection of specification verification patterns. These patterns are called by typing pattern numbers on the display console keyboard. Initially the display is as follows:

PATTERN NUMBERS 1 = SVM HALF INCH VECTORS, 2 = SVM TWO INCH VECTORS.......

TO SELECT PATTERN, TYPE PTN/pattern number ETX FUNCT—— LOWER CASE ON KEYBOARD MUST BE SELECTED.

Upper case codes from the keyboard are ignored.

Depressing the first key of a pattern selection type-in causes any previous pattern to stop being displayed and the pattern selection display with cursor to be displayed instead. That first symbol is displayed following the FUNCT and the cursor is advanced one space. Each symbol of the type-in is displayed and the cursor advanced until an ETX terminates the type-in. If an error is made while typing the function, depress BACKSPACE and correct the error. Illegal keys are ignored. Illegal pattern selections are discarded and the cursor replaced following the FUNCT.

B. DISPLAY A PATTERN (PTN/)

Type: PTN/n ETX
Where n is the pattern number

C. SELECT A NEW SYMBOL FOR PATTERN 10 (SYM/)

Type: SYM/s ETX
Where s is the desired symbol

D. TERMINATE THE TEST (END/)

Type: END/ETX

CAUTION

This termination procedure is necessary to ensure the proper execution of other GPGT tests to be run. Locations changed in SMM are restored to their proper values.

E. PATTERN DESCRIPTIONS

1. Short Vector Mode 1/2 Inch Vector Volume

   This pattern is used to calculate the number of 1/2 inch vectors that can be drawn in one refresh time using short vector mode draw instructions. The result is displayed to the left of the vector pattern.

2. Short Vector Mode 2 Inch Vector Volume

   This pattern is used to calculate the number of 2 inch vectors that can be drawn in one refresh time using short vector mode draw instructions. The result is displayed to the left of the vector pattern.

3. Short Vector Mode 8 Inch Vector Volume

   This pattern is used to calculate the number of 8 inch vectors that can be drawn in one refresh time using short vector mode draw instructions. The result is displayed to the left of the vector pattern.

4. Two-Word 1/2 Inch Vector Volume

   This pattern is used to calculate the number of 1/2 inch vectors that can be drawn in one refresh time using two-word (DVXY) draw instructions. The result is displayed to the left of the vector pattern.

5. Two-Word 2 Inch Vector Volume

   This pattern is used to calculate the number of 2 inch vectors that can be drawn in one refresh time using two-word (DVXY) draw instructions. The result is displayed to the left of the vector pattern.

6. Two-Word 8 Inch Vector Volume

   This pattern is used to calculate the number of 8 inch vectors that can be drawn in one refresh time using two-word (DVXY) draw instructions. The result is displayed to the left of the vector pattern.

7. Three-Word 1/2 Inch Vector Volume

   This pattern is used to calculate the number of 1/2 inch vectors that can be drawn in one refresh time using three-word (DVR) draw instructions. The result is displayed to the left of the vector pattern.

8. Three-word 2 Inch Vector Volume

   This pattern is used to calculate the number of 2 inch vectors that can be drawn in one refresh time using three-word (DVR) draw instructions. The result is displayed to the left of the vector pattern.

9. Three-Word 8 Inch Vector Volume

   This pattern is used to calculate the number of 8 inch vectors that can be drawn in one refresh time using three-word (DVR) draw instructions. The result is displayed to the left of the vector pattern.

10. Symbol Volume

    This pattern is used to calculate the number of symbols that can be drawn in one refresh time. The result is displayed to the left of the symbol pattern. The prestored symbol pattern contains the symbol A (code 41).

11. Light Pen Field of View

This pattern is used to examine the field of view of the light pen. The pattern consists of two small squares. On the left the larger square is formed by hundreds of short vectors illuminating its entire area. On the right the smaller square is formed by four .1287-inch perimeter vectors. To examine the field of view, the light pen is brought near the larger square. Each vector sensed by the light pen is also drawn at the right near the smaller square. Thus, an exact image of what the light pen sees appears over the smaller square. When the field of view is correct, the image should fit within the smaller square.

12. Light Pen Tracking Rate

This pattern is used to calculate the ligh pen tracking rate at which the light pen is lost. After selecting this pattern from the keyboard, the light pen switch must be depressed to activate light pen tracking. To force a tracking rate calculation, the light pen must first be lost. The light pen is considered lost when the tracking routine enters into a full screen raster search. Speedy light pen motions with sudden changes in direction are necessary to lose the light pen. When the light pen is lost, the rate at which it was moving is displayed near the top of the screen. If the light pen switch was released during the loss of the light pen, the switch must be depressed to again activate tracking and to display the rate at which the light pen was lost.

CAUTION

Tracking rates displayed as a result of a released light pen switch should be considered inaccurate.

Due to the large number of variables in this tracking rate test, the tracking rate should be considered adequate when most of the displayed rates are large. A tracking rate of 00 IN/SEC should always be ignored.

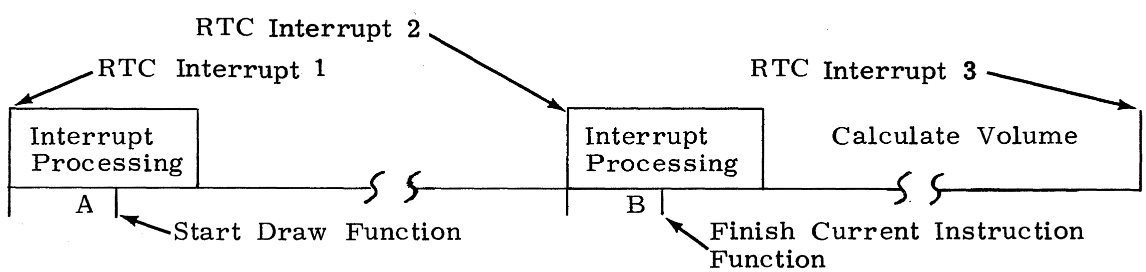
VI. APPLICATIONS

A. GENERAL

The volume counts generated by this test indicate the display rate for one specific set of conditions. Any variance from this set of conditions will result in volume counts which differ from the counts in the tables at the end of this section. The set of conditions used to calculate the volume counts are not to be considered best, worst, or typical case. The conditions were chosen only for the ease of programming. However, under this set of conditions, a console that is functioning properly should display volume counts equal or greater than given in the tables.

B. CONDITIONS USED FOR CALCULATIONS

The volume calculations are based on the accuracy of the real-time clock (RTC). This accuracy should be checked on an oscilloscope. The testing of the real-time clock in test GT1 is accurate to only 5 percent. The volume count patterns are drawn every other real-time clock period. Alternate real-time clock periods are used to do the actual calculations, and also to do most of the program housekeeping. However, some housekeeping is required during the real-time clock period in which the volume pattern is being drawn. This housekeeping is program overhead since nothing is being drawn at that time. Consider the following example:



A is the time period between the receipt of interrupt 1 and the execution of the start draw function. B is the time period between the receipt of interrupt 2 and the execution of the finish current instruction function. Since period A is greater than period B, the housekeeping overhead is equal to A-B.

Another form of overhead is processor cycle stealing overhead. This overhead occurs when the DCI must wait for a memory reference because the 17X4 processor is referencing memory. This overhead occurs during the entire drawing period, but is decreased by entering a loop of long left-shift instructions while waiting for the next interrupt. The amount of this overhead depends upon which 1700 series processor is being used. Therefore, the appropriate table (1704, 1714, 1774, 1784-900, 1784-600) must be used to compare against the generated volume counts.

The counts in the tables are based on 30-foot cable lengths. If a site uses cable lengths greater than 30 feet, the volume counts generated by this test will be less than listed in the tables. Quality assurance should use 30-foot cables when running this test.

C. VOLUME COUNT TABLES

PTN	1704	1714	1774	1784-900	1784-600
1			7756	6844	8152
2			5155	5068	5385
3			1919	1919	2020
4			3667	3009	3487
5			3206	2854	3143
6			1567	1476	1584
7			2784	2194	2570
8			2464	2139	2390
9			1366	1254	1366
10 (Space)			12554	10488	10500
(Point)			10199	9744	10000
(Dash)			9287	9012	9514
(Slash)			8473	8216	8713
(L)			7821	7561	8060
(Y)			7270	7042	7485
(F)			6778	6585	7004
(M)			6356	6198	6552
(K)			5997	5803	6176
(A)			5639	5514	5805
(R)			5313	5217	5529
(Q)			5053	4955	5252
(S)			4830	4727	5012
(g)			4023	4520	4772
(8)			3918	3831	4052

1735/915 OPTICAL CHARACTER READER TEST

(OCR035 Test No 35)

I. OPERATING INSTRUCTIONS

A. RESTRICTIONS

1. Bit 2 of SMM Parameter must be set if running on an SC1700.

2. Due to timing differences between computer mainframes, any message indicating a 1735/915 timing problem may be a mainframe fault. In cases where timing is critical the test does not attempt to interpret the error. Rather an informative message is displayed.

3. All sections of the test except Section 6 will run with only the system interrupt line connected. To run Section 6, both the system interrupt line and the manual interrupt line must be connected.

4. Sections 4 and 6 require manual intervention and are not normally selected.

5. In Section 6, change the reader from Ready to Not Ready by alternately pressing the Start and Stop switches with a document at the Document Ready operation.

6. In Section 4, two stops will occur after typeouts. After setting or clearing the proper switches the computer must be placed in RUN to continue testing.

7. Test requires minimum of 8K to run.

B. LOADING PROCEDURE

1. Call as external test number 35 under SMM17.

2. The following documents are required to run the test:

   a. Section 0. One document of any type is required.

   b. Section 1. Ten documents of any type are required.

   c. Section 2. Thirty documents of any type are required.

   d. Section 3. One document of any type is required.

   e. Section 4. One document of any type is required.

   f. Section 5. Six documents, Pub. No. 60217516, are required. These documents are of nominal stroke width, pitch and skew. Spacing is six lines per inch.

g. Section 6. One document of any type is required.

h. Section 7. One document of any type is required.

i. Section 8. This is the general read routine. The machine should be capable of reading any of the following documents.

Pub. No.

1) 60217502

2) 60217503

3) 60217504

4) 60217505

5) 60217506

6) 60217507

7) 60217508

8) 60217509

9) 60217510

10) 60217511

11) 60217512

12) 60217513

13) 60217514

14) 60217515

See the General Specifications of test documents (Pub. No. 60217500) for a description of the above documents. Eighteen documents are required for one pass of Section 8.

j. Section 9. Seventeen documents of Pub. No. 60217511 are required.

k. Section A. Three documents having Line Locate bars along the left margin are required.

l. Section B. Three documents having Line Locate bars are required.

m. Section C. Twenty-one documents of Pub. No. 91564000 are required. Set EUROPEAN MODE switch to NORMAL in the controller (non European).

C. PARAMETERS

If bit 0 of the SMM Stop/Jump parameter is set at the start of the test, a parameter stop occurs. If bits 10 and 0 are set, parameters may be re-entered at the end of each section and at the end of a pass through the test.

1. First Stop, A = 3541, Q = Stop/Jump parameter.

   The Stop/Jump parameter may be changed if desired.

2. Second Stop, A = $079F_{16}$, Q = 21_{16}. The bits in the A register specify the pre-selected sections to run; bit 0 implies section 0, bit 1 implies section 1, bit 10 implies section A, etc. The sections selected may be changed as desired.

   The bits in Q are a word count parameter prestored as 21_{16}.

3. Third Stop A = 0040, Q = 0080. The bit in the A register specifies the system interrupt line (data, end-of-operation, and alarm). The bit in the Q register specifies the manual interrupt line. Both the system and manual interrupt lines must be connected to run Section 6. All other sections will run with only the system interrupt line connected. These interrupt line bits may be changed if desired.

4. Fourth Stop A = $BA29_{16}$, Q = 0000. The A register contains the read coordinates used by the test. This has no meaning for Section C.

5. Fifth Stop, A = 3521, Q = Stop/Jump Parameter.

6. Sixth Stop, A = 8300, Q = 0014 Document Count.

   The A register contains the Mode parameter as follows:

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
A				B				C				D			

   (A) Font

   0001 = Alpha numeric
   0010 = Alpha
   0011 = Numeric
   0100 = Mark sense
   *1000 = Handprint test document
   1001 = Handprint, numeric, and LVM.
   1010 = A/N degraded
   1011 = Handprint, numeric, X, and LVM.
   1100 = Gothic
   1111 = Handprint test document with seventh through tenth stops.

*Omit seventh through tenth stops.

(B) Scan Control Limit

0000 No rescans (one scan)
0001 Black fill (one rescan)
0010 Quantize 2 (two rescans)
0011 Black fill and quantize 2 (three rescans)

(C) Scan Lock (Selective Quantize)

0000 No significance
0001 Black fill only (first rescan)
0010 Quantize 2 only (second rescan)
0011 Black fill, quantize 2 (third rescan)

(D) Buffer Build, Dump to TTY, Scan Height

*1XXX Buffer build (data correction up to scan limit (B))
X1XX Dump to teletype (X0XX = compare mode)
XXX1 Scan 2
XXX0 Scan 3

7. Seventh Stop, A = 3541, Q = Stop Jump Parameter.

8. Eighth Stop, A = Read Coordinates.

Automatic parameters are C045 handprint or E820 nonhandprint.

Q = Line locate coordinate

0035 handprint

0014 nonhandprint

9. Ninth Stop, A = Number of Characters

Automatic parameters are 001A handprint or 0044 nonhandprint.

Q = Last line to be read

001C handprint

0022 nonhandprint

10. Tenth Stop, A = Document Ready Page Advance, Line Locate, Spacing (See Table 5.)

Automatic parameters are 0203 handprint or 8200 nonhandprint.

Q = Single line scan, OLCC. (See Table 6.)

0000 handprint

0000 nonhandprint

*To be used with handprint test document only.

TABLE 5 (A REGISTER)

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00

Bit 15:
0 = Line Locate
1 = No Line Locate

Bits 11–08: Spacing
0000 Double Space
0001 Single Space
0010 Double Space
0011 Triple Space

Bits 03–00: Document Ready Page Advance (Number of Lines to be Skipped)

F_{16} = Maximum Allowable
F_{16} = 15 Lines at Three Per Inch
F_{16} = 30 Lines at Six Per Inch

TABLE 6 (Q REGISTER

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00

Bit 15:
1 = Drive OLCC
0 = No OLCC

Bits 14–00: Single Line Scan Count
Q0 (Normal Quantize) Unless Scan Lock = 1, 10_2, or 11_2 (I.C.6.C.)

D. MESSAGES

No typeouts occur if bit 8 of the Stop/Jump parameter is set.

1. Test title and initial address of the test.

   1700/SC - 1735/915 OCR035 TEST

   IA = XXXX

   XXXX is the starting address where the test is loaded in memory.

2. Section 1 XXXX MINI-STEPS LL TO LL

   Actual number of mini-steps performed from one line locate bar to the next line locate bar; 16 or 17 mini-steps is the correct number. Any other count will result in the above message. A count below 16 indicates that the distance taken by a mini-step is too great; above 17 indicates that the distance taken by a mini-step is too small.

   X MINI-STEPS IN XXX.X MS

   Mini-step time is out of tolerance. XXX.X is the time in milliseconds taken by the 915 for X mini-steps.

The proper times are:

Mini-steps	Expected Time	Time Allowed*
1	4.4 milliseconds	3.9 - 4.8 milliseconds
2	9.0 milliseconds	8.1 - 9.9 milliseconds
4	14.0 milliseconds	12.6 - 15.4 milliseconds
8	22.0 milliseconds	19.8 - 24.2 milliseconds

3. Low-Speed Mirror Timing is typed out in Section 3 as follows:

MIRROR FWD TIMING
AVERAGE = 0316, MAXIMUM = 0320, MINIMUM = 0305
* MIRROR REVR TIMING**
AVERAGE = 0083, MAXIMUM = 0086, MINIMUM = 0081

Given times are in decimal. The average forward time should be 316_{10} milliseconds ±4% (acceptable limits: $304_{10} \leq$ FWRD Time $\leq$ 330 MS).

The average reverse time should be 81_{10} MS ±4% (Acceptable limits: 77_{10} MS $\leq$ REVRS Time 85_{10} MS). Forward time is computed based on $F0_{16}$ is started with the mirror already moving.

WARNING

The 1700 and SC1700 do not have internal clocks and, therefore, all computed times are based on instruction cycle times. A "slow" 1700 will shorten the above times; a "fast" 1700 will lengthen the above times. All average times outside the above limits should be investigated. (The test takes into account the longer cycle times of an SC1700.)

*Time allowed is expected time ± 10 percent. If time(s) is out of tolerance check and adjust the following delays:

In controller - Y021 at B41B
Y020 at B41A

In 915 - Y470
Y471
Y472
Y474

4. Actual data and expected data typeouts in case of data compare errors. This typeout may be omitted by setting bit 7 of the Stop/Jump parameter. This typeout may occur in Sections 5, 8, 9 or C.

A. D* yyyyyyyyyyyy . . . . Qx

NOTE

Quantize level if handprint:

X=0 First scan
=1 Backfill (first rescan)
=2 Quantize 2 (second rescan)
=3 Quantize 2 and backfill (third rescan)
=B Buffer build

Where yyyy . . . . is the actual data read in error

NOTE

Characters compared successfully will appear as spaces, lost data will appear as ?, and space substitution as ←.

E. D* zzzzzzzzzzzz . . . . xxx . . . . zzz \\ss \

Where zzzz . . . . zzz is the expected data pattern. xxxx specifies those cases where expected data cannot be predicted; e. g., when reading the entire character set in Alpha mode, the numeric characters may be read as rejects or as some alpha character.

\\ is current printer character for a field mark (DC_{16}). Where SS indicates space codes. (Spaces in A. D* line are actual spaces.)

5. Section 4. These typeouts instruct the operator to Set or Clear the Protect switches.

SET PROTECT SWITCH ON 1735
SET 1704 PROTECT SWITCH - RUN
CLEAR 1704 AND 1735 PROTECT SWITCHES - RUN

6. Section 6. These typeouts are used when checking the End-of-File status, manual interrupt and alarm interrupt.

SET AND CLEAR EOF SWITCH 10 TIMES.

Sets EOF status and causes manual interrupt.

PRESS START, THEN STOP SWITCH 10 TIMES.

Sets alarm status and causes alarm interrupt.

7. Section C. Set Mode to European in Controller Run

Instructs operator to select European font for next ten documents to be read.

L,XXXXXXXX C,YYYYYYYY S,AAAAAAAA R,BBBBBBBB QZ

- L = Lines read
- C = Characters read
- S = Substitutions
- R = Rejects
- Z = Quantize level
  - 0 = first scan
  - 1 = black fill
  - 2 = quantize 2
  - 3 = black fill and quantize 2

Section C should be executed separately. The test is parameterized to read the first ten documents, lines 4 through 1A (Hex), and the last ten documents, lines 1 through 3 (European).

Each line is read and compared against predetermined data. Any error will force a rescan (up to three rescans). The number of rescans may be limited by selecting the desired scan control limit (I.C.6.B). Selective quantizing (that is, reading at black fill quantize only) is accomplished by selecting the appropriate scan lock (I.C.6.C.). Data is read only at the selected quantize.

A buffer build feature allows errors to be corrected by cumulative rescan data correction (up to third rescan). Uncorrected data (that is, bad on all rescans) is reported after last rescan. Buffer build is to be used only when reading the handprint test documentation, the handprint test document mode.

Selective line control is accomplished by setting last line to be read (I.C.9) and number of lines to be skipped (document ready page advance) (I.C.10, Table 5).

This allows a line, or a sequential series of lines to be read and compared or dumped at desired quantize level(s).

Single line scan allows up to 32,767 reads on any single line of a document.

In the nontest document mode, the first line will be typed for examination. Operator depresses carriage return if line is acceptable; rubout if unacceptable. The reference line is not included in error total lines. Reference document is counted in document count.

In the reference mode, rescans will occur only if characters are read in error.

In dump to TTY mode, rescans will occur up to desired scan control limit (I. C. 6. B).

Special Characters:

@ = Reject
# = Super reject
\ = Field separator
[= Fill character (assembly mode)
? = Lost data (00_{16})
← = Space substitution

If document count parameter is changed in H. P. test document mode and count is greater than 10_{10}, the last 10_{10} documents will be European mode. If count is less than 11_{10}, all documents will be read in non-European mode.

8. End of Test Typeout

A	Q	A	Q
35X4	S/J Parameter	Pass Number	Return Address

X = Number of stops

9. Error Messages

a. All error messages are in the format specified by SMM17.

A	Q	A	Q
35X8	S/J Parameter	0yzz	Return Address

x = Number of stops (if any) or number of pairs of words typed (if any)
y = Section number
zz = Error code

Additional information is given, depending on the type of error, if X (number of stops) is greater than 2. See description of error codes below.

b. Error Codes

An error code is displayed in the lower two digits of the A register on the second stop of all error stop sequences. A description of the error codes used and the additional information displayed on each error is described below.

Error Code (Hex.)	Description
01	Ready status not set A = Equipment status Q = 0000
02	Busy status not set A = Equipment status Q = 0000
03	An interrupt occurred but the interrupt status bit is not set A = Equipment status Q = 0000

Error Code (Hex.)	Description
04	The time required to sort one document exceeded 1800 ms. A = Sort time in ms Hex. Q = 0000
05	Incorrect equipment status A = Actual status Q = Expected status
06	Incorrect mirror status A = Actual status Q = Expected status
07	An interrupt occurred. Interrupt status bit was set but none of the following were set - data, end of operation, alarm or manual interrupt. A = Equipment status Q = 0000
08	An interrupt occurred which had not been selected. A = Equipment status Q = Interrupt select bits for selected interrupts
09	A clear interrupt function did not clear the interrupt status bit. A = Equipment status Q = 0000
0A	Line Locate did not occur within 300 ms A = Actual status Q = Expected
0B	The character read was "out of mode." Example: Reading in alpha mode and a numeric character is read. A = Number of "out of mode" characters in the line just read Q = 0000

Error Code (Hex.).	Description
1B	End of File status did not set when End of File switch was pressed. A = Equipment status Q = 0000
1D	Mechanical counter Busy status did not set after a counter function. A = Counter function Q = 0000
1E	Page advance error and/or mirror coordinate error occurred after executing a page advance function. Could not find the expected character or could not find line after page advance. (Note: Odd page advance functions are executed twice.) A = 000X Where X is the number of lines the page was advanced prior to the error (1FX is odd 2X). Q = 00YY Where YY as the coordinate at which it expected to find a character.

E. ERROR STOPS

Stops occur upon errors if bit 3 of the Stop/Jump parameter is set. At least two stops occur. Additional stops may occur depending upon the type of error.

II. DESCRIPTION

A. INITIALIZATION

1. Calculate and store bias value
2. Type test title
3. Store last address of test in SMM
4. Enter parameters if selected in Stop/Jump word
5. Bias address of interrupt processing routine

6. Request interrupt lines from SMM

7. Go to control routine and start test

Section 0 (S0). Check for a reply to 1735/915 functions. Status must be Ready and Not Busy. Error if internal or external reject.

B. OPERATING MODE FUNCTION (D = 1)

1. Clear controller
2. Clear interrupts
3. Data interrupt request
4. End of operation interrupt request
5. Alarm interrupt request
6. Stop read
7. Manual interrupt request
8. Increment mechanical counter No. 1
9. Increment mechanical counter No. 2
10. Increment mechanical counter No. 3
11. Clear mechanical counter No. 1
12. Clear mechanical counter No. 2
13. Clear mechanical counter No. 3
    Repeat from (B) 100 times

C. DATA MODE FUNCTIONS (D = 2)

1. Clear controller
2. Clear interrupt
3. Data interrupt request
4. End of operation interrupt request
5. Alarm interrupt request
6. Manual interrupt request
7. Assembly mode
8. Scan mode
9. Read mode
   (Repeat from C 1,000 times

D. POSITIONING FUNCTIONS (D = 3)

1. Page advance
2. Page advance - small step
3. Position mirror forward.
4. Position mirror reverse.
   Repeat from (D. 1) 24 times.

E. MECHANICAL ACTION FUNCTIONS - Except Mechanical Action Code (D = 4)

1. Clear interrupt.
2. End of operation interrupt request.
3. Alarm interrupt request.
   Repeat from (D. 1) 1,000 times.

F. READ MODE FUNCION (D = 5)

1. Read function.
2. Zero mirror.
   Repeat from (F. 1) 24 times.

Section 1. Check Page Advance (normal and mini-step) and End of Operation Interrupt After Page Advance.

A. PAGE ADVANCE - Normal and Mini-step.

1. Sort to primary hopper
2. Advance page the specified increment. Normal step.
3. Repeat A. 2 until increment equals $0F_{16}$.
4. Repeat from A. 1 if Repeat Conditions is selected.
5. Repeat from A. 1 for mini-step.

B. END OF OPERATION INTERRUPT AFTER PAGE ADVANCE

1. Sort to primary hopper.
2. Advance page the specified increment. Normal step.
3. Select End of Operation interrupt.
4. Check for interrupt. Error if interrupt did not occur.
5. Repeat from B. 2 until page advance increment equals $0F_{16}$.
6. Repeat from B. 1 if repeat conditions is selected.
7. Repeat from B. 1 for mini-step.
8. Repeat from B. 1 if Repeat Conditions is selected.

9. End of section. Repeat from A. 1 if Repeat Section is selected.

C. MINI-STEP - DISTANCE

1. Sort document.
2. Double space document.
3. Clear repeat.
4. Step document till it reads first white data.
5. Step document till it reads first black data.
6. Save white mini-steps.
7. Step document till it reads first white data.
8. Add white steps to black.
9. Go to 11 if total mini-steps = 16 or 17.
10. Type error message XX MINI-STEPS LL TO LL.
11. Add 1 to repeat.
12. Go to 14 if repeat = 10.
13. Go to 4.
14. Go to 1 if repeat condition.

D. MINI-STEP - TIME-MEASURE TIME FOR 1, 2, 4, 8 MINI-STEPS

1. Sort document.
2. Double space document.
3. Set mini-step increment to 1 (1 mini-step.). Clear repeat.
4. Request end of operation interrupt.
5. Mini-step (increment).
6. Count time till interrupt.
7. Report missing interrupt if overflow.
8. Go to 6.
9. Go to 18 if time for mini-step increment was not within ±10 percent of specification. *

*Mini-steps	Expected Time	Time Allowed
1	4.4 milliseconds	3.9 - 4.8 milliseconds
2	9.0 milliseconds	8.1 - 9.9 milliseconds
4	14.0 milliseconds	12.6 - 15.4 milliseconds
8	22.0 milliseconds	19.8 - 24.2 milliseconds

10. Go to 13 if last increment was performed.

11. Set mini-step increment to next increment.

12. Go to 4.

13. Add 1 to repeat.

14. Go to 16 if repeat is 10.

15. Go to 3.

16. Go to 1 if repeat condition.

17. Go to end of section.

18. Type error message X MINI-STEPS IN XXX.X MS.

19. Go to 10.

Section 2 (S2). Check Document Sorting, Sort Timing and End of Operation Interrupt After Sorting.

A. SORT TO ALTERNATE HOPPERS

1. Set counter.
2. Wait Not Busy.
3. Sort to primary hopper.
4. Sort to secondary hopper.
5. Repeat from A. 3 four times.
6. Control to SMM
7. Repeat from A. 1 if Repeat Conditions is selected.

B. SORT TIMING

1. Set counter
2. Wait Not Busy.
3. Advance document to end of page.
4. Sort to primary.
5. Compute the time in ms that Busy status remains set during sort operation.
6. Error stop if sort time exceeds 1800 ms.
7. Repeat from B. 2 nine times.
8. Control to SMM
9. Repeat from B. 1 if Repeat Conditions is selected.

C. END OF OPERATION INTERRUPT AFTER SORT

1. Set counter.
2. Sort to primary hopper and select End of Operation interrupt.
3. Wait Not Busy.
4. Check for E. O. P. interrupt. Error if interrupt did not occur.
5. Repeat from C. 2 if Repeat Conditions is selected.
6. Sort to secondary hopper.
7. Select End of Operation interrupt.
8. Check for interrupt. Error if it did not occur.
9. Repeat from C. 6 if Repeat Conditions is selected.
10. Repeat from C. 2 four times.
11. End of Section stop. Repeat from A. 1 if Repeat Section is selected.

Section 3 (S3). Check Mirror Motion, Status, Coordinates, Timing and Interrupts.

A. MIRROR MOTION TO FAR FORWARD AND FAR REVERSE AND CORRECT STATUS.

1. Set counter.
2. Zero mirror.
3. Check for Ready and Mirror Far Reverse status.
   Error if status not correct.
4. Move mirror to Far Forward position. Check Equipment status for End of Operation, Ready and Mirror Far Forward status.
   Error if status not correct.
5. Check Mirror status for Mirror Far Forward and Compare.
   Error if status is not correct.
6. Move mirror to Far Reverse position.
7. Check Equipment status for End of Operation, Ready and Mirror Far Reverse.
   Error if status is not correct.
8. Check Mirror status for Mirror Far Reverse and Compare.
   Error if status not correct.
9. Repeat from A. 2 twenty-four times.
10. Repeat from A. 1 if Repeat Conditions is selected.

B. COMPARE AND COORDINATE STATUS AT EACH COORDINATE FROM ZERO TO FAR FORWARD. COMPARE BUT NOT COORDINATE STATUS FROM MIRROR FAR FORWARD TO MIRROR FAR REVERSE.

1. Set coordinate flag to one.
2. Zero mirror.
3. Move mirror forward to coordinate selected.
4. Check Mirror status for Compare and correct Coordinate.
   Error if status not correct.
5. Update coordinate by one and repeat from B. 2 until coordinate reaches FF_{16}.
6. Decrease coordinate flag by one.
7. Move mirror reverse to selected coordinate.
8. Check Mirror status for Compare only. Error if status not correct.
9. Move mirror to Far Forward position.
10. Repeat from B. 6 until coordinate reaches zero.
11. Repeat from B. 1 if Repeat Conditions is selected.
12. Clear controller

C. END OF OPERATION INTERRUPT AFTER FORWARD AND REVERSE MIRROR MOTION CHECK

1. Set counter
2. Zero mirror
3. Move mirror forward to coordinate 40_{16}.
4. Select End of Operation interrupt.
5. Check for interrupt. Error if interrupt did not occur.
6. Repeat from C. 2 if Repeat Conditions is selected.
7. Move mirror to coordinate $F0_{16}$.
8. Select EOP interrupt.
9. Check for interrupt error if it did not occur.
10. Zero mirror
11. Select End of Operation interrupt.
12. Check for interrupt. Error if it did not occur.
13. Repeat from C. 7 if Repeat Conditions is selected.
14. Repeat from C. 2 twenty-four times.

D. END OF OPERATION INTERRUPT ON MIRROR FAR REVERSE AFTER A CLEAR CONTROLLER FUNCTION

1. Set counter
2. Zero mirror
3. Move mirror to Far Forward position.
4. Clear controller
5. Wait Not Busy
6. Check for Mirror Far Reverse status. Error if not set.
7. Select End of Operation interrupt.

C. REJECT TO NONPROTECTED 1735/915 FUNCTIONS CHECK

1. Set counter.
2. Clear Protect bits in core.
3. Output all function bits, one at a time, from 0 through 15. Expect a reject. Error if a reply is received.
4. Repeat from C. 3 nineteen times.
5. Type message: CLEAR 1704 AND 1735 PROTECT SWITCHES - RUN.
6. Clear all Protect bits in core.
7. End of section. Repeat from A. 1 if Repeat Section is selected.
8. Restore original SMM Parameter.

Section 5. Check Window Operation and Space Code Field Mark Generation

A. READ NOMINAL TEST DOCUMENTS IN ALPHANUMERIC MODE - SCAN 2

1. Set document count.
2. Set up alphanumeric pattern for data checking.
3. Sort to primary hopper.
4. Set line count.
5. Advance page two lines.
6. Jump to A. 8.
7. Advance page one line.
8. Clear buffer.
9. Zero mirror.
10. Clear error counters.
11. Select Scan 2 mode.
12. Read one line.
13. Check actual data against expected data. Update error count if not the same.
14. Error stop if any Data Compare errors occurred in this line.
15. Check End of Data Line for seven spaces, two field marks (DC) and a fill character (DB).
16. Error stop if any space code - field mark errors.
17. Print actual and expected data.

18. Repeat from A. 7 fifty-five times.

19. Repeat from A. 3 four times.

20. Repeat from A. 1 if Repeat Conditions is selected.

21. Wait Not Busy.

22. Sort to primary.

23. End of Section 5. Repeat from A. 1 if Repeat Section is selected.

Section 6. Check End of File Status, Manual Interrupt and Alarm Interrupt.

A. CHECK END OF FILE STATUS AND MANUAL INTERRUPT, LOAD A DOCUMENT TO THE DOCUMENT READY POSITION, BUT DO NOT PRESS THE START SWITCH TO BEGIN THIS SECTION.

1. Check Equipment status for Not Ready. Error if Ready status is set.
2. Type message: SET AND CLEAR END OF FILE SWITCH 10 TIMES.
3. Set counter.
4. Select manual interrupt.
5. Check for interrupt. Error if interrupt did not occur.
6. Check for End of File status. Error if not set.
7. Repeat from A. 4 nine times.
8. Repeat from A. 3 if Repeat Conditions is selected.

B. CHECK ALARM INTERRUPT WHEN GOING FROM READY TO NOT READY

1. Type message: PRESS START THEN STOP SWITCH 10 TIMES.
2. Set counter.
3. Select alarm interrupt.
4. Check for interrupt. Error if interrupt did not occur.
5. Repeat from B. 3 nine times.
6. Repeat from B. 2 if Repeat conditions is selected.
7. End of Section 6. Repeat from A. 1 if Repeat Section is selected.

Section 7. Check Mechanical Counters

A. CLEAR AND INCREMENT COUNTERS INDIVIDUALLY

1. Clear each counter separately.
2. Increment counter No. 1 fifty times.

C. READ HANDPRINT TEST DOCUMENT OR GENERAL READ OF ANY DOCUMENT

1. Set document count.
2. Sort primary.
3. Zero mirror.
4. Advance to first line.
5. Zero input buffer.
6. Line locate.
7. Read.
8. Go to 21 if dump to teletype.
9. Go to 11 if handprint test document.
10. Go to 40 if first line read.
11. Go to 44 if any errors.
12. Go to 54 if single line read
13. Go to 18 if repeat condition.
14. Go to 27 if last line.
15. Go to 25 if Single Line Read mode.
16. Advance to next line.
17. Increment line count.
18. Reverse mirror, line locate.
19. Zero input buffer.
20. Go to 7.
21. Type out data.
22. Go to 25 if repeat condition.
23. Go to 14 if Scan Lock mode.
24. Go to 14 if last scan (last quantize level).
25. Reverse mirror.
26. Go to 19.
27. Go to 31 if handprint test document.
28. Go to 37 if 20th document.
29. Increment document count.
30. Go to 2.

31. Go to 33 if 10th document
32. Go to 28.
33. Type SET MODE TO EUROPEAN message.
34. Halt.
35. Set parameters for next ten documents.
36. Go to 29.
37. Go to 39 if Dump to Teletype mode.
38. Type error totals.
39. Go to end of test.
40. Type the reference line.
41. Go to 15 if carriage return from teletype.
42. Go to 2 if rubout from teletype.
43. Go to 41.
44. Go to 51 if Single Line Read mode.
45. Go to 56 if Scan Lock mode.
46. Go to 59 if Buffer Build mode.
47. Type expected data (reference). Type actual data.
48. Drive OLCC if selected.
49. Go to 13 if last scan (last quantize level).
50. Go to 25.
51. Type expected data.
52. Type actual data.
53. Drive OLCC if selected.
54. Go to 38 if last single line read scan.
55. Go to 13.
56. Type expected data.
57. Type actual data.
58. Go to 13.
59. Go to 13 if buffer build has built correctly.
60. Go to 56 if last scan (last quantize level).
61. Reverse mirror.
62. Go to 7.

1700 / FF104 / 955 SYSTEM TEST

(RX1A30 Test No. 30)

I. OPERATING PROCEDURES

A. RESTRICTIONS

1. Requires a minimum of 8K 1700 with a 608 or 609, and a teletype.
2. The diagnostic interfaces to SMM17 only for loading.
3. Test parameters are accepted only from the teletype.
4. Complete control is given to the RX-1 monitor.
5. All entries are in hexadecimal.
6. The standard "A,Q,A,Q," error messages are not used. All errors are typed on the teletype or line printer.

B. LOADING PROCEDURE

1. The standard SMM17 call for 8K is test number 30.

C. PARAMETERS

1. Automatic

   a. A standard I/O table is used by the RX-1 Monitor. All I/O parameters are defined in the Standard I/O Table (Table 1).

2. Manual

   a. The Manual Interrupt button can be depressed at any time. All operations are stopped and control is transferred to the RX-1 Monitor. The monitor will type:

      NEXT JOB
      I

      Entry by teletype can be accomplished only after the monitor has typed "Next Job", "I", and rings a bell. The monitor will wait for an input to be typed and then a carriage return. It is not necessary to type spaces. All entries are right justified.

      To repeat the last entry, type carriage return.

      To cancel an entry in progress, type RUBOUT.

Teletype input formats are:

1) W
2) A, B or
   A(Z), B or
   A, B(Z) or
   A(Z), B(Z)
3) C, D(X)=Y

where:

W = E = Output error totals (reference line not included).

A = MTx = Mag tape unit x (in).
    OCR = 995 Page Reader.

B = TTY = Teletype (out).
    MTx = Mag tape unit x (out).
    LPR = Line printer.
    ABC = Autoload buffer controller

C = C = Change standard I/O table.

D = MTI = Mag tape input.
    MTO = Mag tape output.
    LPR = Line printer.
    OCR = 955 Page Reader.

X = EQ = Equipment number.
    INT = Interrupt line number.
    MOD = Data handling mode.
    FIL = Mag tape file number.
    TFM = Mag tape format for each 16 bit 1700 word.
    FCT = Tape copy file count.
    MRD = Mark document.
    CV = Converter number.
    CCC = Line printer carriage control characters.
    OLC = Drive on-line character correction option.
    DPA = Document ready page advance.
    BSC = Buffer scan control.
    POS = Mirror position.
    ADV = Line stepping.
    LCT = Line count/page.

EOL = Line terminate symbol.
ESP = Line terminate space count.
BLC = Blank line coordinate.
RSC = Line rescan count (on rejects).
CC = Cancel character.
DL = Delete character.
QL = Quantizing level.
SN2 = Scan mode.
KRL = Keep reference line.
IOT = Inhibit output.
SLL = Suppress line locate.
STK = Stock forms parameter.
SND = Serial numbering device.
FNO = Field number parameter.
HD = Handprint definition.
CMP = Comparison mode.
DCC = De-select cancel character.
DDL = De-select delete line character.
CPV = Character peak voltage.
HLT = Horizontal line thickening.
VLT = Vertical line thickening.
IMC = Initial mirror coordinate.
TMC = Terminal mirror coordinate.
FF$\underline{w}$ = Field/font word w = 0 → 7.*
IC$\underline{w}$ = Initial field coord. w = 0 → 7.*
TC$\underline{w}$ = Terminal field coord. w = 0 → 7.*

Y = ____ = A value for X. See I.C.2.c. for acceptable values.

Z = One of the temporary modes in the table below.

b. The following is an option association table that goes with the format A(Z),B(Z). Any input device "A" in its allowable temporary mode (Z) can be output to any output device "B" in its temporary mode (Z).

* $\underline{w}$ represents the field number; up to eight fields may be specified per line.

A	(Z)		B (Z)
OCR	PDM	Packed data mode	MTx BCD, BIN, ASC
	UCD	Unpacked chtr data	TTY BCD, BIN, ASC
	SDM	Servo data mode	PTP BCD, BIN, ASC
	CPV	Chtr peak voltage	LPR BCD, BIN, ASC
MTx	BCD, BIN, ASC		ABC -------------

c. The following is an association table that goes with format C,D(X)=Y; where C indicates a change in the standard I/O table is requested, D = the device to change, (X) = the unit to change, and Y = the actual change.

D	X	Y	Range	INIT.
OCR	EQ	Equipment no.	0 → F	A
	INT	Interrupt line no.	1 → F	7
	LCT	Lines/page	0 → FF	21
	ADV	Stepping increment/line	TABLE 2	2
	DPA	Units of .008" after doc. ready	TABLE 11	~~2A~~ 20
	POS	Mirror retrace position	00 → FF	10
	IMC	First coor. where read can start	00 → FF	28 (min. 20)
	TMC	Terminating mirror coordinate	00 → FF	C0 (" B6)
	FFw	Font selection for field w.	TABLE 4	0
	ICw	Initial read coord. for field w.	00 → FF	0
	TCw	Terminal read coord for field w.	00 → FF*	0
	RSC	Rescan count/line (on reject)	0 → 7	0
	EOL	Line terminate symbol	ASCII chtr. in HEX	0 **
	ESP	Line terminate space count	0 → 7	2

*If a third digit , =8, is added here, end of field codes are added on data transfers.
Example: To enable end of field codes on field 2 with a terminal coordinate of 5A, perform C,OCR(TC2)=5A8 entry.
**0 indicates an end of line character is not used.

D	X	Y	Range	INIT.
OCR	BLC	Blank line coord.	00 → FF	50
	CC	Cancel character	ASCII chtr. in HEX	00
	DL	Delete line symbol	ASCII chtr. in HEX	00
	QL	Quantizing level	00 → FF	80
	SN2	Scan mode	0 = Scan3, 1 = Scan2	0
	CMP	Compare mode	D = Print all, disable err. ck. E = Print all, enable err. ch. A = Print all errors only. R = Print all errors when rej. only. S = Print all errors when sub. only.	A
	DCC	De-select cancel chtr. selection		
	IOT	Inhibit output	Y = Yes, N = No	N
	SLL	Suppress Line Locate	Y = Yes, N = No	N
	KRL	Keep reference line	Y = Yes, N = No	N
	DDL	De-select delete line chtr. selection		
	CPV	Adjust chtr. peak reference	0 → F	A
	HLT	Adjust horizontal line thickening	00 → 3F	30
	VLT	Adjust vertical line thickening	0 → 1	0
	MRD	Mark document on chtr. reject.	0 = No Mark, 1 = Mark	0
	BSC	Buffer scan control	TABLE 8	0
	OLC	Drive OLCC option	Y = Yes, N = No	N
	STK		Y = Yes, N = No	N
	SND		Y = Yes, N = No	N
	FNO		1 → 8	1
	HD		TABLE 10 000 FFF	FFF
LPR	EQ	Equipment no.	0 → F	F
	CCC	Carriage control characters	Y = Yes, N = No	N
MTI				
MTO	EQ	Equipment no.	0 → F	7
	INT	Interrupt line no.	1 → F	3
	CV	Converter no.	0 → F	0
	MOD	Mag. tape mode, ASCII, Binary, BCD	ASC, BIN, BCD	ASC
	FIL	Mag. tape file no.	0 = 8/8 FMT	1
	TFM	Mag. tape format/1 1700 word	1 = 4/6/6 FMT	0
	FCT	Mag. tape (input) file count used when copying tapes	00 → FF	0

D. OPERATING INSTRUCTIONS

1. Set up the parameters for the desired operation via the format in (I. 0. 2. 1. 1). (See I. D. 5. for std. par.)

   EXAMPLE 1: C, OCR(EOL)=4B

   This would change the existing EOL symbol from a + to a K.

   EXAMPLE 2: C, MTO(MOD)=BIN

   This will change the output mag. tape mode to binary.

   EXAMPLE 3: C, MTI(EQ)=3

   This will change the input mag. tape equipment number to 3.

2. Execute the operation via the A(Z), B(Z) format in I. 0. 2. a. 2)

   EXAMPLE 1: OCR(CPV), LPR

   This will cause the 955 to read according to preset parameters and direct the output to go to the line printer. Character peak voltages will also be output.

   EXAMPLE 2: MT1, LPR

   This will cause the contents of mag. tape unit 1 to dump to the line printer.

3. The Reference Line

   When operating the OCR in a reference mode (CMP = A, E, R, or S), a reference line will be read from the first line in the optics and output to the teletype for examination. To request that this line not be accepted, depress the rubout on the TTY and another attempt will be made to get a reference line from the 955. If the reference line is acceptable, a carriage return will put that line in the reference buffer as is. If corrections to that line are desirable, the following rules apply.

   a. Space to the undesired character and type in an * to delete checking that character or, type a character to substitute for it.

   b. When all correcting has been completed, a carriage return will cause the acceptance of the remainder of the reference line as is.

   c. When correcting hand print characters, the character input via TTY, determines the type of character to read. For example, if an alpha character is typed in, that character will always compare against the alpha extraction from the data read and the alpha portion of the read line will be output from now on for that character.

d. Upon completion of the reference line, it will be output to the teletype in its corrected form and the requested operation will begin.

NOTE

In an error output only mode, the reference line will be output for every fifth error line.

A blank (space) character substitution error will appear as an underscore in the teletype error message.

4. Autoloading the FF104

   a. MT$\underline{x}$, ABC (x = magnetic tape unit number)

5. Standard (Preset) Parameters.

   a. The parameters are initially set to allow execution of autoload from MT$\underline{x}$ and running using the standard series of USASI test documents.

   b. To review the standard parameters, see the column marked INIT of the table at I. C. 2. c.

6. Character Peak/Servo Data

   a. Character peak is a number representing the peak voltage at character. recognition time. It's value ranges from 0 through F. Ideally it should always = F. It's output format is the same as that for servo data.

   b. Servo data represents the number of shifts in a vertical plane required to shift the character upward to the point of recognition. It is sent to the 1700 as a complemented value and has a range of 0 through 37 hex. The 1700 divides this number by 4, complements and outputs it following the character data in the following manner.

   ABCDEFGHIJKLMNOP------------------------Z
   77776666555444443333------------------------1*

   The above values were used to illustrate the method of output and show the servo data in a possible skew situation. The right hand side would be higher in the optics than the left.

---

* A false indication is given when the character is rejected; as, a value is given where none was generated, i. e., the register is not cleared.
The above values were used to illustrate the method of output and show the servo data in a possible skew situation. The right hand side would be higher in the optics than the left.

c. In the FF104, servo data is used to determine topless and bottomless data and as a guide to the degree and direction of servo necessary to line locate. Zone 5 (see chart) is ideal positioning for the FF104. This falls into zones 3 and 4 of the RX1 output.

7. Hand Print

a. In RX1, a code is used to determine the data for extraction on each hand-print character. It is initially set for all numeric data and can be changed when building a reference line. The basic hand-print data to the 1700 is as follows:

$2^{15}2^{14}2^{13}2^{12}2^{11}2^{10}2^{09}2^{08}2^{07}2^{06}2^{05}2^{04}2^{03}2^{02}2^{01}2^{00}$

1	0	0	CODE	NUMERIC	ALPHA	SYMBOL

VALUE	NUM	ALF	SYM	CODE
0	0	C	+	
1	1	S	-	L
2	2	T		E
3	3	X	=	I
4	4	Z	R	H
5	5	R	I	B
6	6			I
7	7	@	@	I
8	8			
9	9			
A	R			
B	I			
C	I			
D	I			
E				
F	@			

where:
E = Error
I = Illegal
L = Low
H = High
R = Controller Reject
B = High and Low
@ = Reject

b. To run using hand print, change the following parameters to:

(ADV) =0
(DPA) = (Refer to Table 11)
(IMC) = (Utilize OCR ruler to determine IMC)
(TMC)= (Utilize OCR ruler to determine TMC)
(FF0) =7 (Refer to Table 4)
(LCT) =0

These entries will allow continuous reading of the same line. The reference line for lines F and H must be modified at the teletype to the correct alpha or symbol as the basic mode of extraction is numeric.

c. On Line Character Correction Option

The OLCC option may be driven by entering the parameter C, OCR (OLC) = Y. *Each Reject Read will then be displayed on the tube. To continue test after each display, depress a rubout character. Actual character correction of rejected character is beyond the scope of RX1.

NOTE

All extractions (Alpha, Numeric, Symbol) must be rejected to cause a display on the OLCC display, unless ASCII mode is utilized (FF0=27).

8. Copying Tapes

a. To use RX1 to copy the 955 controlware tape, utilize the following command (ensure that all other magnetic tape parameters are set to the initial states):

MTx(BCD), MTx(BCD)

b. To copy the 955 auxilary tape used with RX3, utilize the following parameters:

C, MTI(TFM)=1	(Tape Format = 4/6/6)
C, MTO(TFM)=1	
C, MTI(FCT)=0	(Copy to Double File Mark)
MTx(BIN), MTx(BIN)	

II. MESSAGES

A. NORMAL MESSAGES

1. BEGIN RX1A30 V2.0, IA = XXXX VX.X, CP07.

Initial typeout where XXXX = the initial address of the program.

2. NEXT JOB
I
The computer is waiting for an input.

3. THE B/C IS LOADED

The FF104 has been loaded correctly.

*If standard Hand Print mode of 7 is used without ASCII characters, a reject is displayed on OLCC only if all three extractions of the character are rejected.

4. EOF

The end of file has been depressed on the 955. Normal message 5 will be output to the standard output device.

5. LINES = A CHTRS. = B SUB. = C REJ. = D

In response to command E or an EOF from the 955, the above message will output where, A, B, C, and D are 8 digit decimal numbers noting the number of lines read, characters read and compared, substitution errors, and reject errors respectively.

B. COMMAND MESSAGES

1. MANUAL INTERRUPT

The manual interrupt has been depressed. Message II. A. 2. will now be output.

2. READY OR EOF

In response to the 955 going not ready. If the end of file is depressed, see message II. A. 5. If the system is made ready (EOF not depressed) normal operation will continue.

3. CLEAR SKIP SWITCH

The SKIP switch is set while autoloading the buffer controller. Clear the SKIP switch.

C. ERROR MESSAGES

1. ILLEGAL ENTRY

Self-explanatory.

2. B/C CHECKSUM ERROR

A checksum error occurred while loading the FF104.

3. B/C FAILED TO RESPOND

The FF104 generated an external reject to a director function.

4. MT DOES NOT RESPOND

The mag tape externally rejected a function.

5. CHECK FF104 CONV. AND EQUIPMENT NUMBER

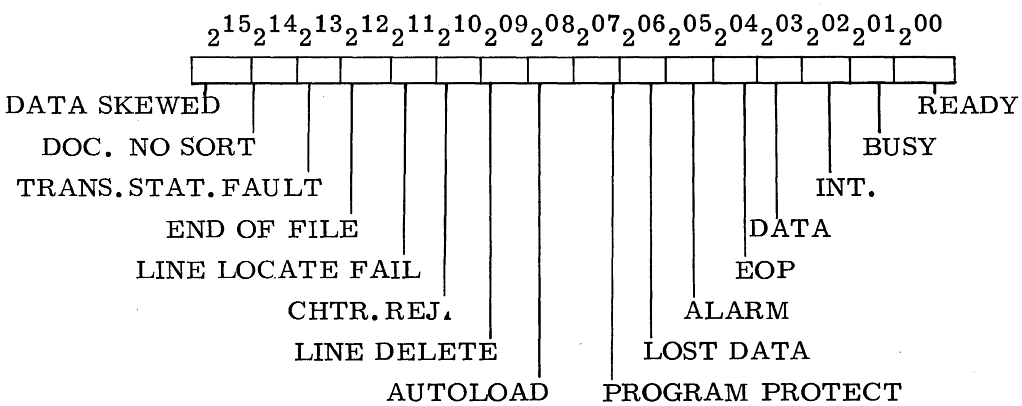
The 1700 internally rejected when trying to function the FF104.

6. Q REG. VALUE = XXXX

The value in the Q register at the time of a reject.

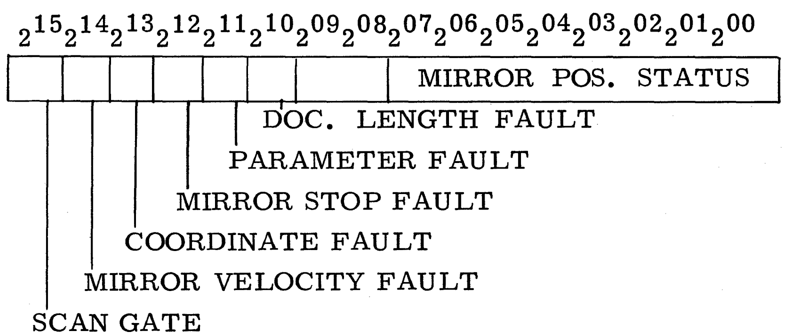
7. SYSTEM STATUS = XXXX

The 955 system status after an error.



8. 955 STATUS = XXXX

The 955 mechanical status after an error.



9. EXTERNAL REJECT
Self-explanatory.

10. FF104 PROGRAM PROTECT SWITCH IS NOT SET
Self-explanatory.

11. PROGRAM PROTECT FAULT AT LOCATION $XXXX
XXXX = the 1700 core location.

12. MEMORY PARITY ERROR AT LOCATION $XXXX
XXXX = the 1700 core location.

13. FF104 BUSY FROM START
FF104 external reject.

14. FF104 NOT READY
Self-explanatory.

15. DELETE LINE
Taken from 955 system status.

16. BLANK LINE
Taken from 955 system status (lost data).

17. DOCUMENT NO SORT
Taken from 955 system status.

18. TRANSPORT FAULT OCCURRED THIS LINE
Taken from 955 system status.

19. LOST DATA
Taken from 955 system status.

20. LINE LOCATE AND DATA SKEW
Taken from 955 system status.

21. BLK.CH.FAIL, RUN BC2
One of 3 possible conditions exists and control is returned to the teletype. The conditions are:
a. A reject when the status says that data is ready.
b. A reject before the data transfer is complete.
c. No reject when extra data is requested.

22. UNDEFINED ALARM STATUS
An alarm status was received from the FF104 but, the remaining status does not indicate the error.

23. PRINTER ALARM
Self-explanatory.

24. AUTOLOAD REQUIRED
Taken from 955 system status.

III. TEST DESCRIPTION

A. INITIALIZATION

1. Load the standard set of test documents.
2. Put the 955 in a ready condition.

B. OPERATION

1. Purpose

   a. Determine the system operability.

   b. Isolate general problem areas for further testing using the more comprehensive diagnostics.

2. Procedure

   a. Execute the test using the A(Z), B(Z) commands.

   EX: Read and print using the standard test documents. (See special considerations for hand-print I. D. 7. b.) simply type:

   OCR, LPR

   b. See attached flow charts for a detailed flow of OCR testing.

TABLE 1

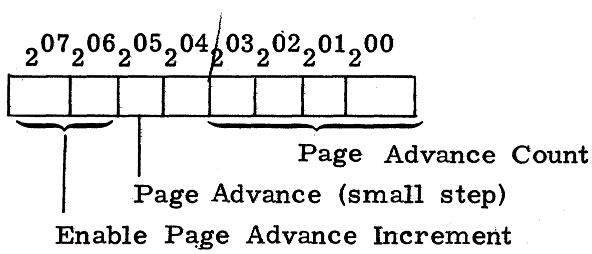
STANDARD I/O EQUIPMENT TABLE

	MT Input	MT Output	Line Printer	OCR
EQUIPMENT	7	7	4	A
INTERRUPT	3	3	-	A
MODE	3	3	3	3
FORMAT	0	0	-	-
CONVERTER	0	0	0	0
FILE	1	1	1	1

NOTE

Mode = 1 = BCD, 2 = BIN, 3 = ASCII
Format = The frame arrangement in each 1700 word.

TABLE 2. PAGE ADVANCE



0x = 6/in.
4x = 5 1/3 /in.
8x = 5/in.
Cx = 4/in.

TABLE 3. 955 TRANSPORT STATUS

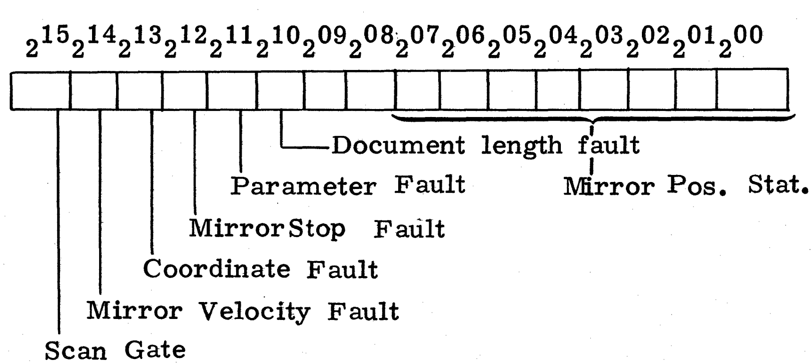
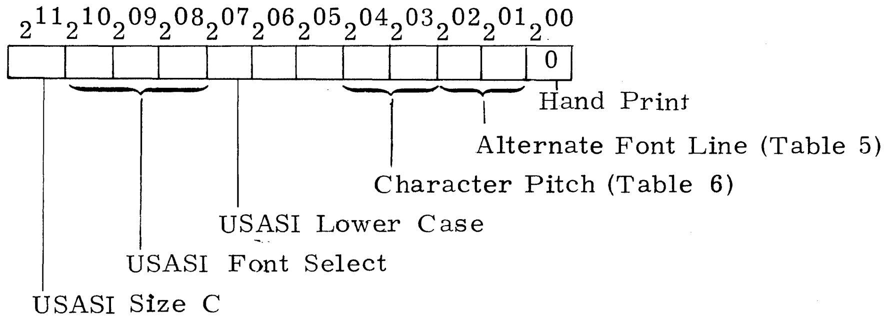


TABLE 4. ALTERNATE FONT (FFw) w = 0 → 7



In Table 4, if $2^0 = 1$, the remaining bits change their meaning as follows:

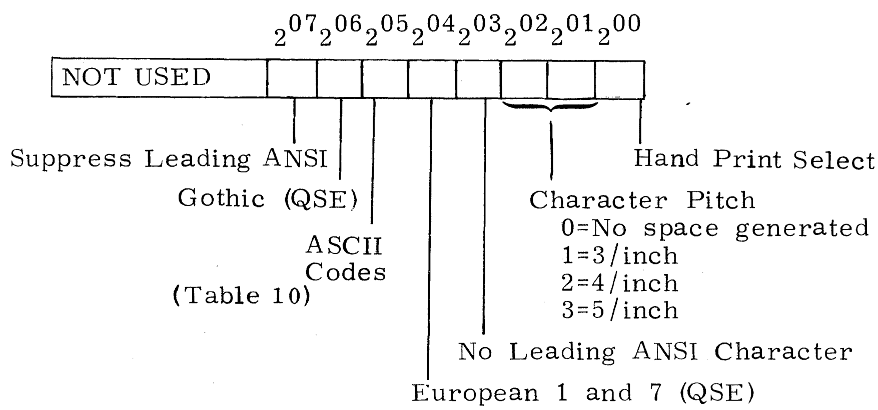


TABLE 5. ALTERNATE FONT LINE NUMBER (A02, A01)

Alternate Font Line	A02	A01
No Selection	0	0
Alternate Font Line 1	0	1
Alternate Font Line 2	1	0
Alternate Font Line 3	1	1

TABLE 6. HORIZONTALCHARACTER PITCH (A04, A03)

Font	Pitch	Size	A04	A03
1403	10/in.	A	0	0
1428	10/in.	A	0	0
12F	10/in.	A	0	1
7B	7/in	C	0	0
N0F	10/in.	C	0	0
E13B	8/in.	A	1	0
OCR-B	10/in.	A	0	0

TABLE 7. USASI FONT SELECT (A10, A09, A08)

USASI FONT	A10	A09	A08
Full USASI Select	0	0	0
Mark Sense	0	0	1
Numeric	0	1	0
Numeric and Control	0	1	1
Numeric and Alpha 5	1	0	0
Numeric Alpha-26 and Punctuation 1	1	0	1
Numeric Alpha-26 and Punctuation 2	1	1	0
Unused	1	1	1

TABLE 8. BUFFER SCAN CONTROL

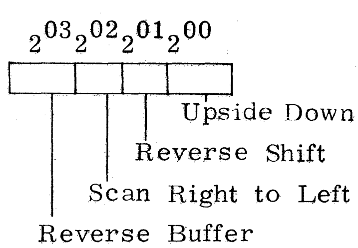


TABLE 9. READER AND CHARACTER CODES

Bit Position			7 6 5 4	# 0 0 0	# 0 0 1	# 0 1 0	# 0 1 1	# 1 0 0	# 1 0 1	# 1 1 0	# 1 1 1
3	2	1	0								
0	0	0	0	FILL*		SP	0	REJ	P		p
0	0	0	1			△	1	A	Q	a	q
0	0	1	0			▽	2	B	R	b	r
0	0	1	1			#	3	C	S	c	s
0	1	0	0			$	4	D	T	d	t
0	1	0	1			%	5	E	U	e	u
0	1	1	0			&	6	F	V	f	v
0	1	1	1			"	7	G	W	g	w
1	0	0	0			(	8	H	X	h	x
1	0	0	1			)	9	I	Y	i	y
1	0	1	0			*	:	J	Z	j	z
1	0	1	1			+	;	K	unused	k	
1	1	0	0			,		L			
1	1	0	1			-	=	M	↓	m	
1	1	1	0			.	↑	N	—	n	
1	1	1	1			/	?	O	‡	o	

*Displayed as 5B, generally on TTY left bracket.

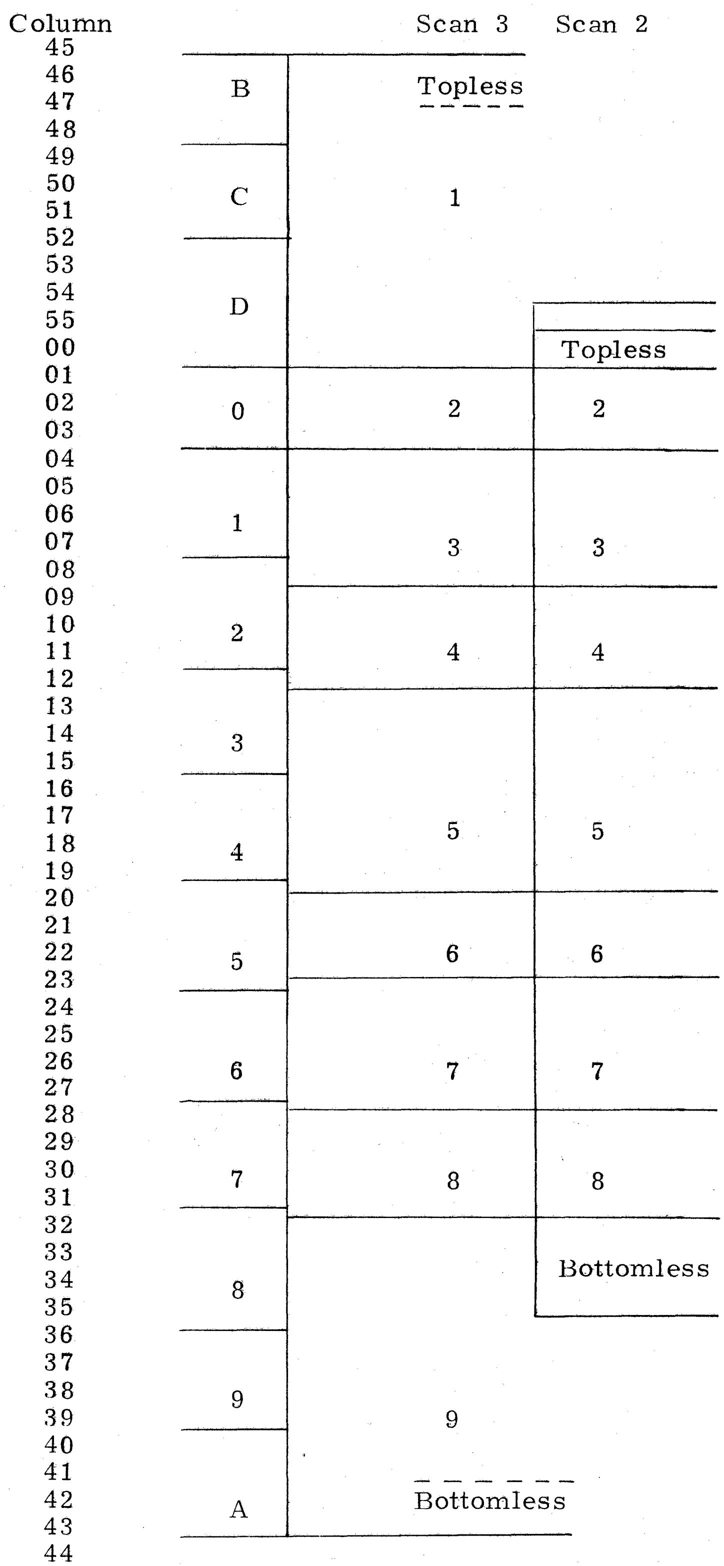


Figure 1. Servo Data (RX1 VRS FF104)

TABLE 10. HDW ENTRY (ID = 7)

2^{11}	2^{10}	2^9	2^8	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Field 1		Field 2		Field 3		Field 4		Field 5		Field 6	

Where:

00	Alpha data
01	Numeric and symbols
10	Numeric with trailing alpha
11	Numeric

Example:

To read the following line of hand print

1234 | 5 = 4 | 543C | 1234 | CSTXZ

the following entries would be made:

C, OCR (FF0) = 27 (five characters/inch, ASCII codes, hand print)

C, OCR (IMC) = XX
C, OCR (TMC) = XX
C, OCR (HD0) = DB0

OCR, TTY

A1234 5=4 543C 1234 CSTXZ

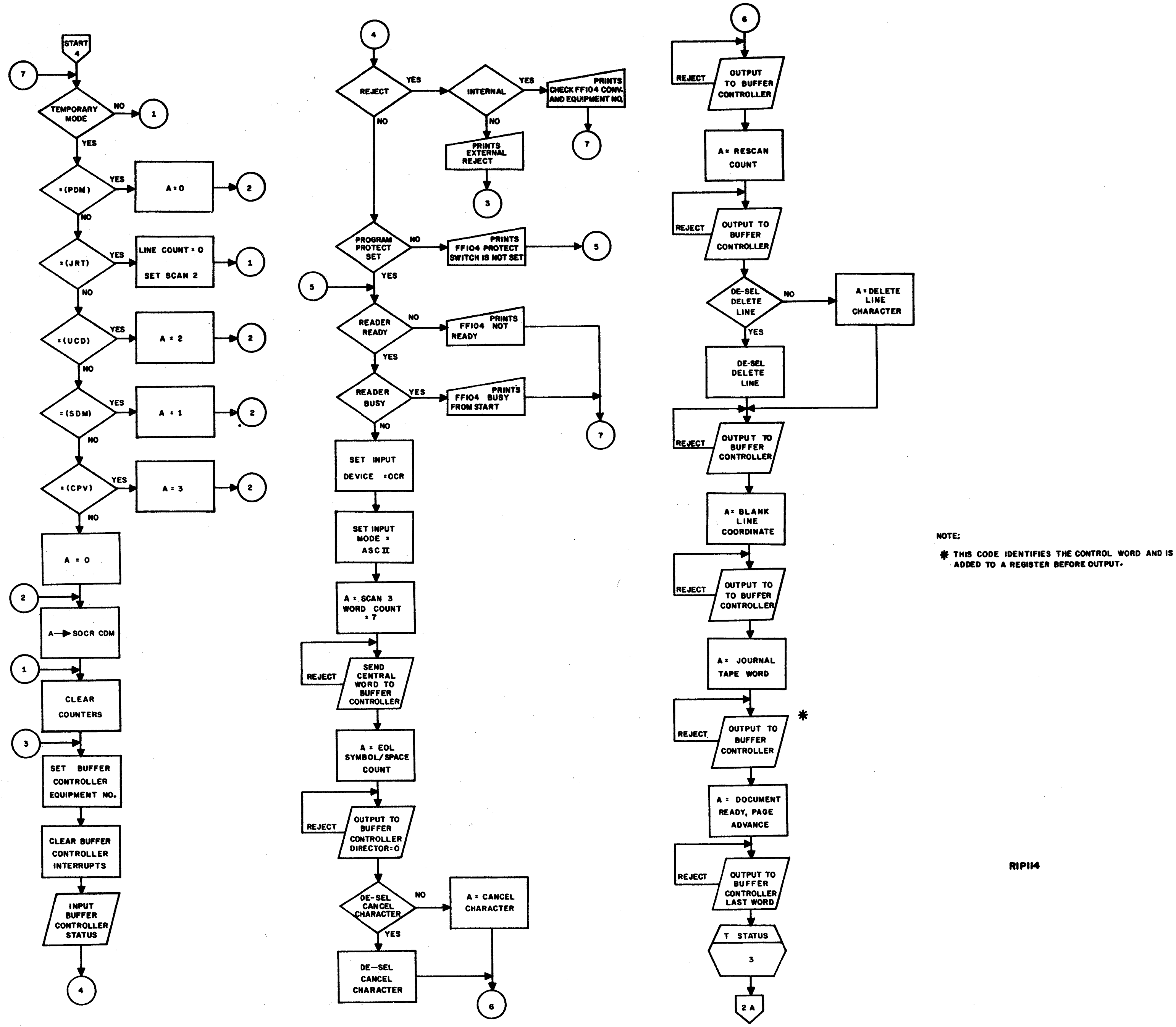
TABLE 11. RX1 DPA TABLE

Instructions:

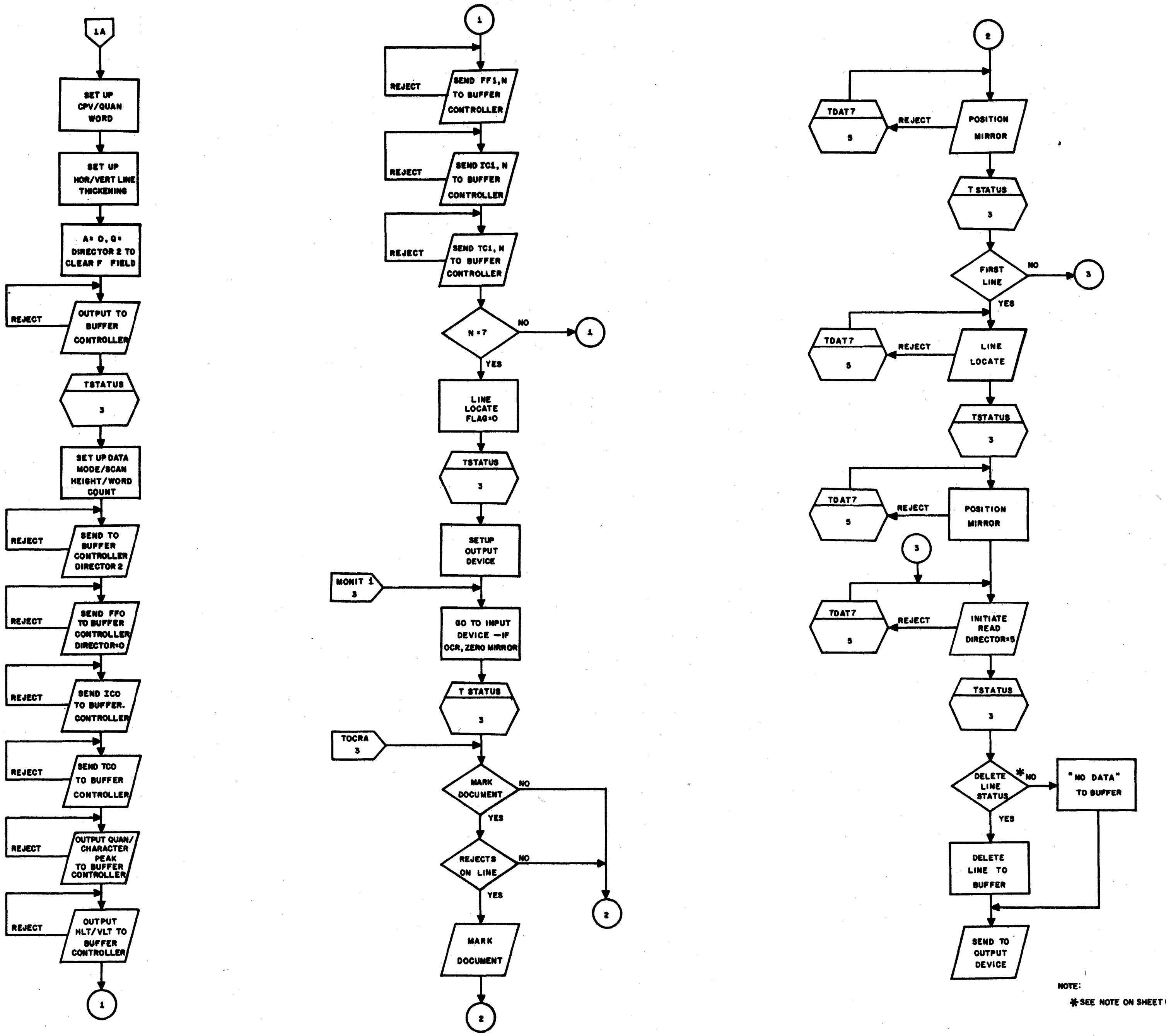
1. Measure distance from top of document to center of line.
2. Locate measurement in table.
3. Read DPA value.

Inch	0	1	2	3	4	5	6	7	8
.00		64	E1	15E	1DB	258	2D5	352	3CF
.05		6A	E7	165	1E1	25E	2DC	358	3D5
.10		71	EE	16B	1E8	265	2E2	35F	3DC
.15		77	F4	171	1EE	26B	2E8	365	3E2
.20	00	7D	FA	178	1F4	271	2EE	36B	3E8
.25	06	83	101	17E	1FA	278	2F5	371	3EE
.30	0D	8A	107	184	201	27E	2FB	378	3F5
.35	13	90	10D	18A	207	284	301	37E	3FB
.40	19	96	113	191	20D	28A	307	384	3FF
.45	1F	9C	11A	197	213	291	30E	38A	
.50	26	A3	120	19D	21A	297	314	391	
.55	2C	A9	126	1A3	220	29D	31A	397	
.60	32	AF	12C	1A9	226	2A3	320	39D	
.65	38	B5	133	1AF	22C	2AA	326	3A3	
.70	3F	BC	139	1B6	233	2B0	32D	3AA	
.75	45	C2	13F	1BC	239	2B6	333	3B0	
.80	4B	C8	145	1C2	23F	2BC	339	3B6	
.85	51	CE	14C	1C8	245	2C3	33F	3BC	
.90	58	D5	152	1CF	24C	2C9	346	3C3	
.95	5E	DB	158	1D5	252	2CF	34C	3C9	

60182000 P

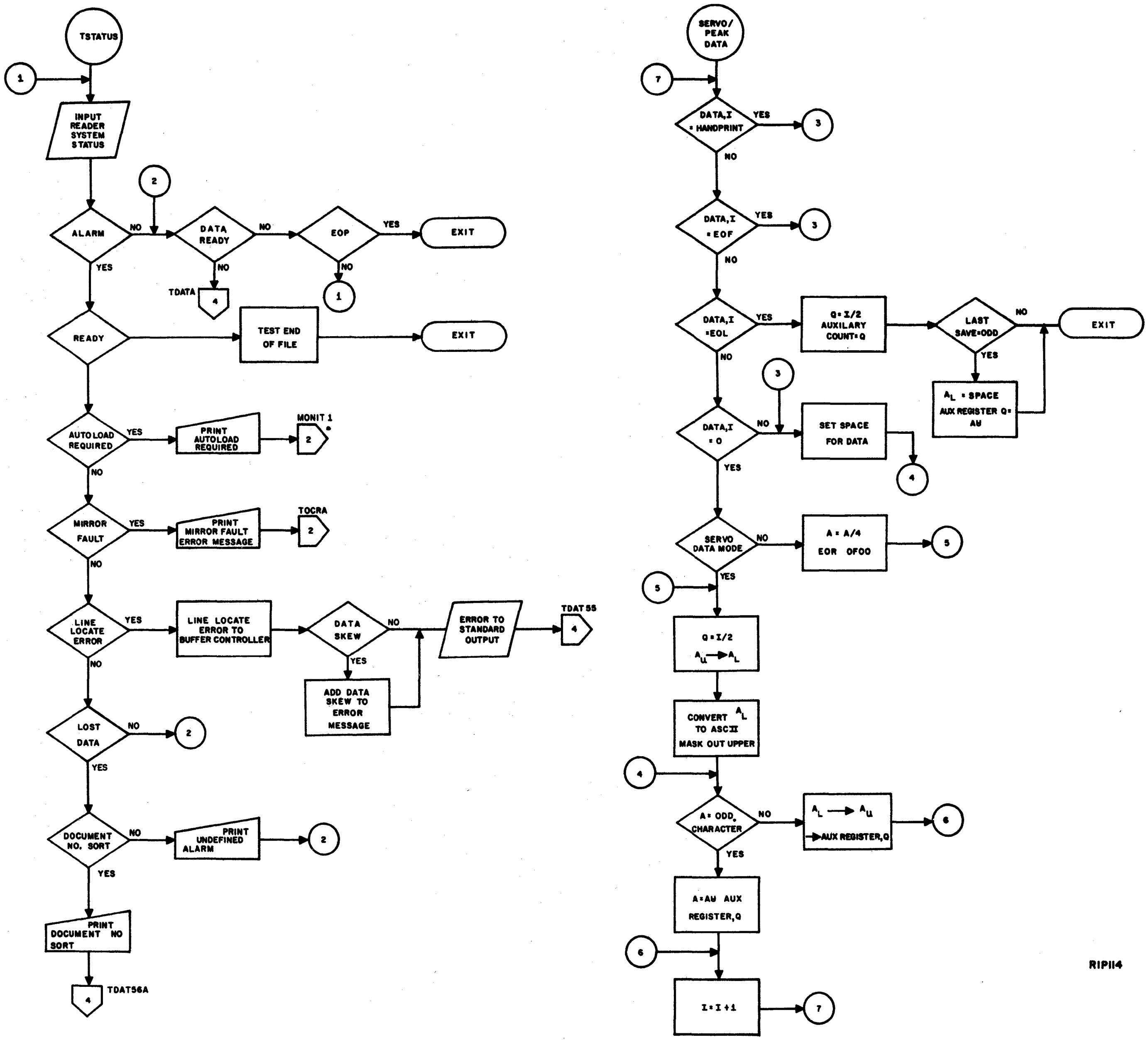


Flow Chart of RX-1 System Test (Sheet 1 of 5)

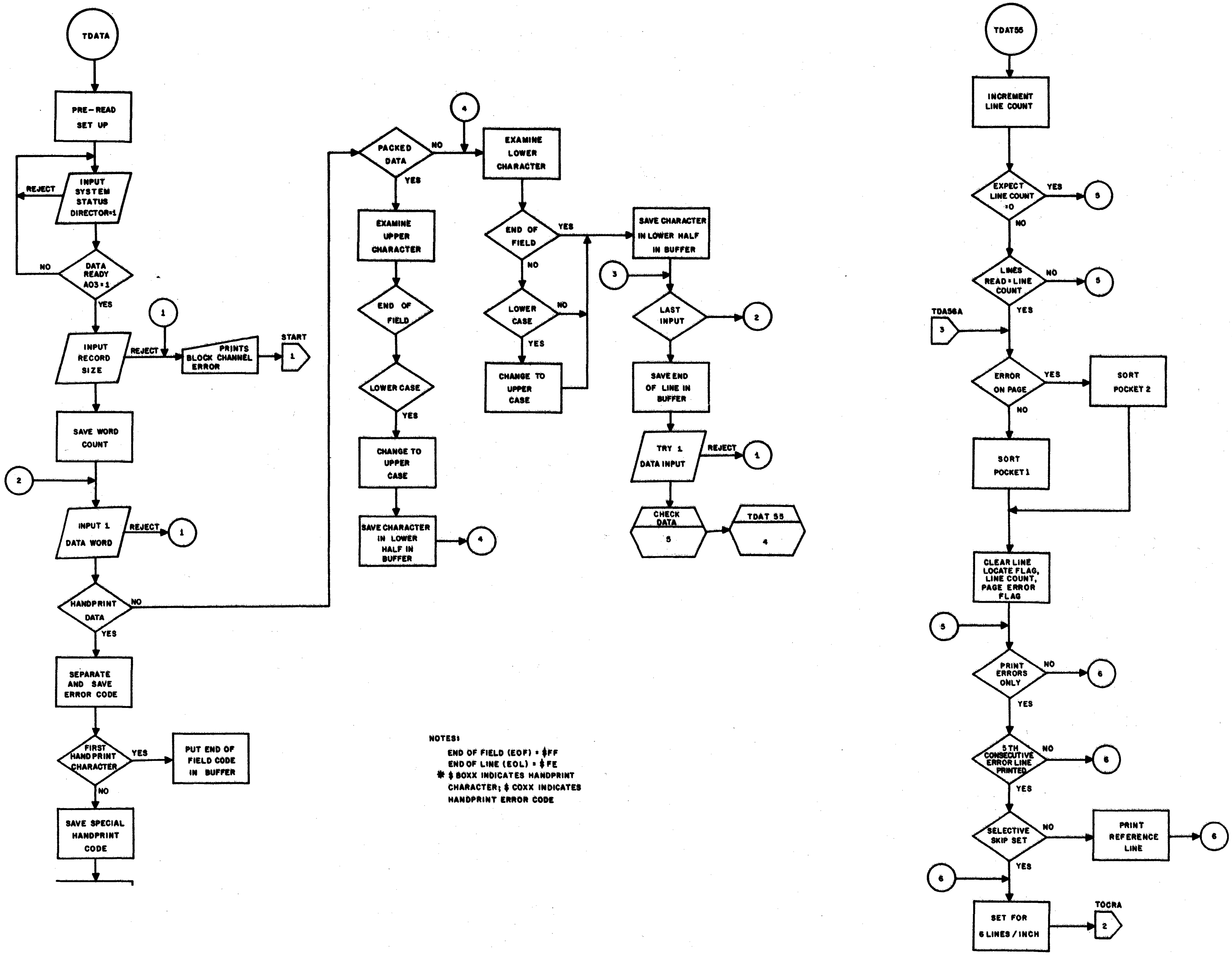


RIPII4

Flow Chart of RX-1 System Test (Sheet 2 of 5)

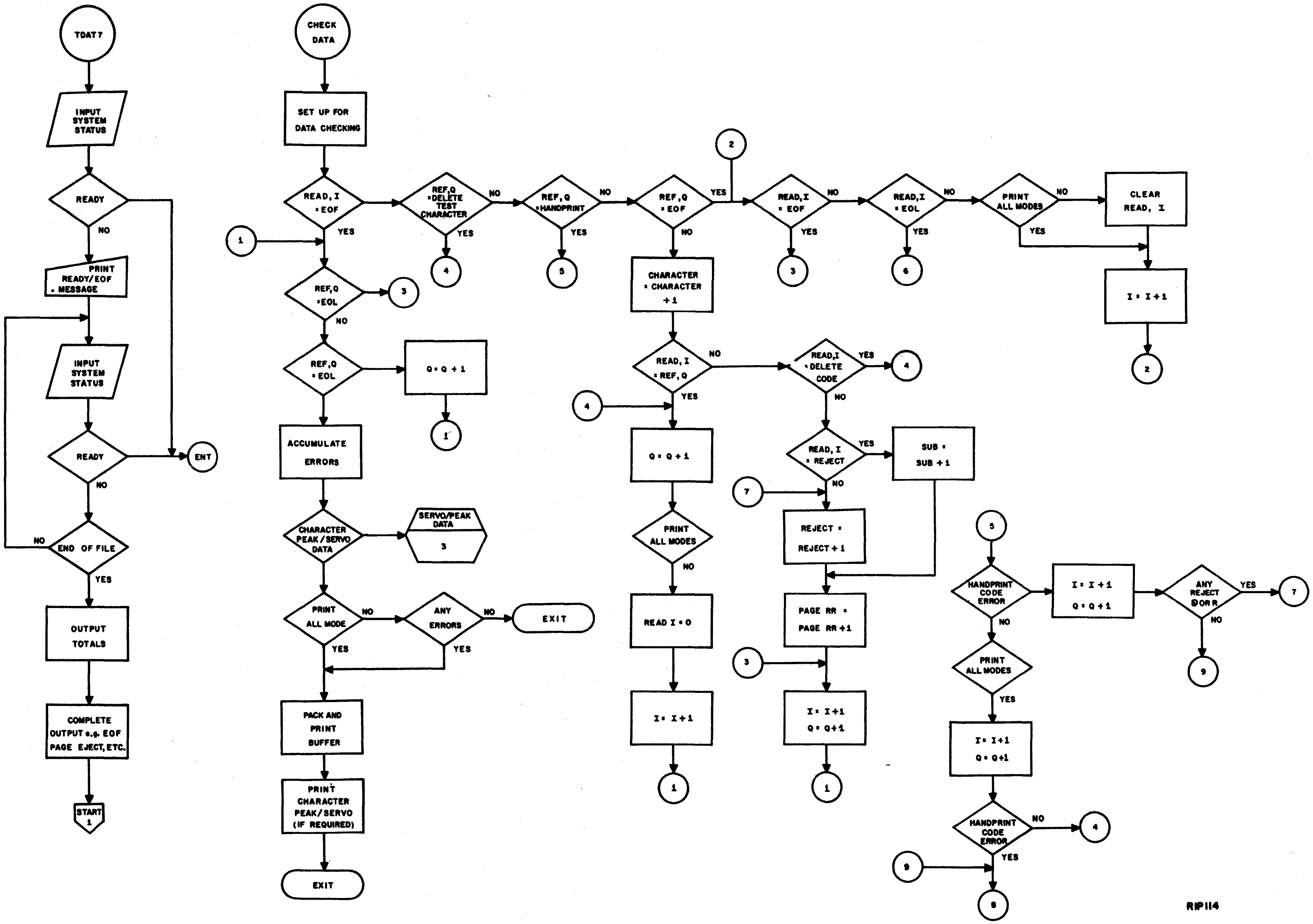


Flow Chart of RX-1 System Test (Sheet 3 of 5)



Flow Chart of RX-1 System Test (Sheet 4 of 5)

RIP114



Flow Chart of RX-1 System Test (Sheet 5 of 5)

955-959/1700-1774-1784 MODULE TEST
(LDRA32 Loader Test No. 32
and
RX3A33 Test No. 33)

I. TEST DESCRIPTION

RX3 is intended for use with the 955/959-1700/1774/1784. RX3 is intended to give the customer engineer the capability of testing the 955/959 in a simulated data mode such that the results are repeatable for troubleshooting.

The following is a brief description of each module contained in RX3. Each module contained in RX3 actually consists of a controlware which is loaded into the 955 Buffer Controller for operation of specific functions. Refer to Operating Procedures for complete operating instructions for each module.

Module 1	Electronic Read and Verify (Standard and Optional Fonts) Servo Data Test (OCRA and OCRB) Load and Shift Register Test On-Line Character Correction Test Six Lines per Inch Tests
Module 2	Page and Document Handling Transport Sensor Tests Transport Speed Tests Transport Slippage Test Feed and Sort Exerciser
Module 3	Operator Panel Test
Module 4	Mirror Test
Module 5	Handprint Electronic Read and Verify

A. RESTRICTIONS

1. Computer (1705/1774/1784) with 8K memory is required.
2. Teletype (1711/1712/1713, or 1711-4) or 713 Display Terminal is required. If the 713 is used, all lower-case characters are accepted by the computer as upper-case characters.

3. For off-line operation a buffer controller console is required.

4. No provision has been made to load Print Train Images to the 1742-120 Line Printer.

5. RX3 interfaces to SMM only for loading. All parameters are entered via the TTY after loading of the test with the exception of Magnetic Tape Equipment Code which is placed in the Q register when loading. (See Section II.)

6. RX3 requires that the Ready Fault be bypassed on the 955 Maintenance Panel, and that the SIMULATED/OPTICAL switch be in the SIMULATED position.

B. The following equipment types may be utilized by RX3:

Computer	1705
	1774
	1784 with A/Q Channel Adapter
Tape Units	1732 - 608/609, 800 BPI
	1732-2 - 615-93/615-73 (ICL), 800 BPI
	3518/60128 - 659, 800 BPI

NOTE

If the 659 Tape Unit is utilized, RX3 will not be loaded via the SMM tape; special instructions will accompnay the system.

Console Entry Devices	1711, (Mod 35 Teletype)
	1711-4 (Mod 33 Teletype)
	1712
	1713
	713, Conversational Display
Line Printers	1742
	1742-30
	1742-60
	1742-120 (If 1742-120 is utilized, the image must be loaded previous to running RX3.)

II. OPERATING PROCEDURES

A. LOADING

RX3 is loaded via SMM-17 (Magnetic Tape Version). When loading RX3, the test is called in by loading test number 32 (Loader). When calling test number 32, use Q register setting equal to magnetic tape equipment code (381, 1381, etc.). When RX3 is loaded, the Magnetic Tape Code and Tape Converter Code in the Q register are used as the Standard Magnetic Equipment Code and Tape Converter Code.

If SMM detects an error during the loading of test number 32, the standard SMM diagnostic will be displayed. If a Mag Tape Status error is encountered during the loading of RX3 by test number 32, an error halt will occur with the A register = 0200, Q register = (Magnetic Equipment Code). If a RUN is executed, the tape will be backspaced and the record will be read again. When RX3 has been completely loaded, test number 32 will transfer control to RX3, which will then display the following message:

BEGIN RX3A33 REV. 4.0 V.3.1 CP07 IA = 0200

NEXT

At this point, RX3 is ready to perform any of the tasks for which it is intended. The following represents a table of standard equipment codes which are assumed by RX3. These values may be altered by the procedure described in Appendix A.

During the execution of RX3 if the MANUAL INTERRUPT button is depressed, control is transferred to this point and the message NEXT is displayed.

TABLE 1. STANDARD EQUIPMENT CODES AND INTERRUPT LINES

955	Equipment Code	A_{16}	(BE)
955	Interrupt Line	$7\ \cancel{A}_{16}$	(BI)
1742	Printer Equipment Code	4	(PE)
1732	Equipment Code	*	(ME)
1732	Interrupt Line	*	(MI)
	Tape Unit Number	1	(TN)

*The standard Magnetic Tape Equipment Code and Interrupt Lines are determined by the loader and the Q register upon calling test number 32. These values are then passed to RX3 to be used as standards.

Proceed from this point in operation to the appropriate section of this write-up as determined by what is to be accomplished with RX3. The following list represents the major portions of RX3.

Module Number	Options	Description
1	EX	Read and verify
	SD	Read with no output or compare
	Servo Data	Used to determine if Servo Data logic is performing properly
	LC	On-Line Correction Test, verify OLCC unit operation
	SR	Shift Register/Load Register Test
	QL	Quick Look Test, allows the user to run all images in an automatic mode

Module Number	Subtest	Description
2	1	Verify that all document sensors see white when no documents are on the transport.
	2	Verify that all sensors between the Read Zone and Sort Station 1 are capable of seeing a document.
	3	Same as above except Sort Station 2 is used.
	4	Transport Speed Test verifies that the transport is running at the specified speed between Read Zone and Sort Station 1.
	5	Same as above except that Sort Station 2 is used instead of Sort Station 1.
	6	Transport Slippage Test verifies that a document does not slip on the belt or that there is not too much backlash in the transport belts.
	7	Feed and Sort Exerciser feeds and sorts documents as specified by parameters detecting large gaps, length faults, etc.

Module Number	Options	Description
3		Operator Panel Test verifies that all lights and switches on the operator consoles are operational.
4		Mirror Test verifies that the mirror stops when told to, that no drift is encountered, that proper speed is achieved, etc.
5		Handprint Electronic Read and Verify
	EX	Read and Verify
	SD	Read No Verify (suppress DATA READY)
	QL	Quick look of specified handprint fonts

B. MODULE 1 OPERATING PROCEDURES

- Select Module 1 (SM=1).*
- Load Module 1 (AL).
- Proceed to the appropriate portion (1 or 2).

1. Electronic Read and Verify, Theory of Operation

RX3, upon receiving the command to begin a test, loads the images defined into the Shift register one column at a time until the complete image has been loaded. While the image is being loaded, character data ready is tested; if ready, the character read is stored. If an error is detected and suppress data is not set, the information is transmitted from the buffer controller to the 1700 computer for display. This is repeated until the number of repetitions selected is completed when the BC informs the 1700 it has completed the test.

The following list of parameters may be selected by performing an Automatic Parameters Entry (AP). If AP is not used, these parameters must be defined.

Image Position (IP=T, 0)*
Read Parameters (RP)
    Character Pitch = (7)
    Font Enable = (Standard, see Appendix B)
    Character Peak = (C)
    Character Voltage = (F)
Repetitions = 0 Infinite (RE)
Output Device = TTY (OT, OP)

*Refer to Appendix A for complete list of all parameters and descriptions.

Define Font to be Run (DF)
Load Images (DD, SS, LF)

Execute Test:	(EX)	Read and Verify or
	(SD)	Suppress Data
	(SO)	Suppress Output or
	(SC)	Suppress Communications (Requires B/C Console)

Upon completion of Repetitions Selected, an end of test message will be displayed. (Refer to Appendix D for all error message descriptions.)

2. Quick Look, Theory of Operation (Module 1)

The use of Quick Look to determine the readability of a 955 is the easiest and fastest method of running all modes. Quick Look varies each image such that it is run reverse, upside down, normal, and all combinations of these. These modes apply only to fonts not termed external. If an external font is run, the only mode used is normal.

- Define repetions (RE).
- Define dump on error only if desired (DE).
- Define files and execute (QL).
- If dump on error has been specified, the next message should be END OF TEST.
- Depress MANUAL INTERRUPT to continue with next entry.

Example: RUN all modes for ANSI Thin, Medium, and Thick fonts.

QL = ANSI THIN-ANSI THICK (CR)

Example: RUN all modes for ANSI Thin and ANSI Thick fonts.

QL = ANSI THIN,
ANSI THICK (CR)

The following list describes the way in which the ANSI Thin font (or any other font) is read when processed by the Quick Look (QL*) parameter.

Name= ANSI	THIN	Pos=TOP	Mode= NORMAL	Pitch=MIN.
Name= ANSI	THIN	Pos=TOP	Mode= NORMAL	Pitch=NOM.
Name= ANSI	THIN	Pos=TOP	Mode= NORMAL	Pitch=MAX.
Name= ANSI	THIN	Pos=TOP	Mode= UPSDOWN	Pitch=MIN.
Name= ANSI	THIN	Pos=TOP	Mode= UPSDOWN	Pitch=NOM.
Name= ANSI	THIN	Pos=TOP	Mode= UPSDOWN	Pitch=MAX.
Name= ANSI	THIN	Pos=TOP	Mode= S/R/NORM	Pitch=MIN.
Name= ANSI	THIN	Pos=TOP	Mode= S/R/NORM	Pitch=NOM.
Name= ANSI	THIN	Pos=TOP	Mode= S/R/NORM	Pitch=MAX.
Name= ANSI	THIN	Pos=TOP	Mode= S/R/UPSD	Pitch=MIN.
Name= ANSI	THIN	Pos=TOP	Mode= S/R/UPSD	Pitch=NOM.
Name= ANSI	THIN	Pos=TOP	Mode= S/R/UPSD	Pitch=MAX.
Name= ANSI	THIN	Pos=CEN	Mode= NORMAL	Pitch=MIN.
Name= ANSI	THIN	Pos=CEN	Mode= NORMAL	Pitch=NOM.
Name= ANSI	THIN	Pos=CEN	Mode= NORMAL	Pitch=MAX.
Name= ANSI	THIN	Pos=CEN	Mode= UPSDOWN	Pitch=MIN.
Name= ANSI	THIN	Pos=CEN	Mode= UPSDOWN	Pitch=NOM.
Name= ANSI	THIN	Pos=CEN	Mode= UPSDOWN	Pitch=MAX.
Name= ANSI	THIN	Pos=CEN	Mode= S/R/NORM	Pitch=MIN.
Name= ANSI	THIN	Pos=CEN	Mode= S/R/NORM	Pitch=NOM.
Name= ANSI	THIN	Pos=CEN	Mode= S/R/NORM	Pitch=MAX.
Name= ANSI	THIN	Pos=CEN	Mode= S/R/UPSD	Pitch=MIN.
Name= ANSI	THIN	Pos=CEN	Mode= S/R/UPSD	Pitch=NOM.
Name= ANSI	THIN	Pos=CEN	Mode= S/R/UPSD	Pitch=MAX.
Name= ANSI	THIN	Pos=BOT	Mode= NORMAL	Pitch=MIN.
Name= ANSI	THIN	Pos=BOT	Mode= NORMAL	Pitch=NOM.
Name= ANSI	THIN	Pos=BOT	Mode= NORMAL	Pitch=MAX.
Name= ANSI	THIN	Pos=BOT	Mode= UPSDOWN	Pitch=MIN.
Name= ANSI	THIN	Pos=BOT	Mode= UPSDOWN	Pitch=NOM.
Name= ANSI	THIN	Pos=BOT	Mode= UPSDOWN	Pitch=MAX.
Name= ANSI	THIN	Pos=BOT	Mode= S/R/NORM	Pitch=MIN.
Name= ANSI	THIN	Pos=BOT	Mode= S/R/NORM	Pitch=NOM.
Name= ANSI	THIN	Pos=BOT	Mode= S/R/NORM	Pitch=MAX.
Name= ANSI	THIN	Pos=BOT	Mode= S/R/UPSD	Pitch=MIN.
Name= ANSI	THIN	Pos=BOT	Mode= S/R/UPSD	Pitch=NOM.
Name= ANSI	THIN	Pos=BOT	Mode= S/R/UPSD	Pitch=MAX.

Pitch: MIN. = 3 clear columns
NOM. = 7 clear columns
MAX. = 12 clear columns

Pos: TOP = Images are read in the upper 28 bits of the Shift register.

CEN = Images are read in the center 28 bits of the Shift register.

BOT = Images are read in the lower 28 bits of the Shift register.

Mode: NORMAL character images are read normal (F).

UPSDOWN character images are read upside-down (Ⅎ).

S/R/NORM character images are read shift-reverse normal (ꟻ).

S/R/UPSD character images are read shift-reverse up-side-down (ⅎ).

NOTE

When running with images in TOP and upside-down, the image is actually in the bottom of the window. When data is seen in the Shift register, the data should always appear as (ꟻ) or (F).

3. Servo Data Test

The purpose of the Servo Data Test is to evaluate that portion of the 955 logic which interprets where the character lies in the window. The Servo Data Test also checks the top scrub logic. The images used for this test consist of the character E, beginning at the top of the window which generates a topless condition. The second-character position is two marks which should be scrubbed out so that a space will be generated. The third-character position begins a series of characters which drop in the window by one light pipe at a time. As the characters drop through to the bottom of the window, a specific count should be generated for each character that count is verified to be correct. This process is continued until the number of repetitions selected has been run; at which time, an end of test printout will occur.

- Define repetitions (RE).
- Define font (DF) (SDTST or SDBTST).
  If OCRA is the basic font in the 955, use SDTST as font name.
  If OCRB is the basic font, use SDBTST as the font name.
- Load font (LF).
- Execute: Execute with printout (EX) or execute no printout for troubleshooting (SD).
- When the requested number of repetitions has been run, an END OF TEST printout will occur.

a. Special Error Messages for Servo Data Test

1) Topless Not Set indicates that the first character of the Servo Data Images did not generate a topless condition.

2) Bottomless Not Set indicates that the last character of the Servo Data Images did not generate a bottomless condition.

3) Top Scrub Logic Failed indicates that the data contained in the second-character position of the images did not get scrubbed as intended and generated some character other than a space.

4) Illegal Topless Status indicates that a character other than the first or second (scrub character) generated a topless condition.

5) Illegal Bottomless Status indicates that a character other than the last character generated a bottomless condition.

6) Servo Data = XX
Expected = XX

Servo Data = XX
Received = XX

This indicates that the Servo Data received did not match the expected Servo Data.

4. On-Line Character Correction

Upon selection, the On-Line Character Correction Module of RX3 loads the specified images to the buffer controller. It then begins to shift the images through the Shift register. When the column output is equal to the column count (CC) specified, the Dino signal (OC-210) will be brought up. The Dino signal will stay up until the Dino Time (DT) has elapsed. If the Dino Time parameter is equal to zero, the Dino signal will be brought up and stay up until new instructions are received from the operator. Once started, the OLC processor runs forever.

- If automatic parameters are to be used, type (LC=A). This will force the following parameters to be used:

  Font (DF) ANSI Medium
  Character Images (SS) A-E
  Image Position (IP) Bottom-Normal (B, O)
  Dino Time (DT) 2 Seconds (2000)
  Column Count (CC) 35

- If automatic parameters are not to be used, specify all items listed previously and type (LC=(CR)).

NOTE

Any of the parameters listed previously may be altered during the test as indicated below. Once the OLCC portion has begun operation, an AL must be performed before running any other portion of Module 1.

Example 1: Alter Dino time to 5 seconds.

Manual Interrupt

Type DT=5000(CR)

Type LC=(CR)

Example 2: Alter Character Image to F through J

Manual Interrupt

Type SS=F-J(CR)

Type LC=(CR)

5. Load Register/Shift Register Test

The Load and Shift Register Test gives the user an indication of where within the Load/Shift register a problem is occurring. Upon indicating which pattern to send through the register, RX3 (Module 1) begins loading that image to the buffer controller. When the READY button is depressed, the image is output to the Shift register through the Load register. With the Dump Register Control SW monitoring the Load register, the data is taken from the Dump register and data verification is done. If any difference is noted, an error message results. The Load Register Test is terminated when the STOP button is depressed and the IMAGE REGISTER DUMP switch is placed in DUMP position. This allows data to be serialized and sent through the entire Shift register before a Data Compare is done.

- Determine which image from the following figure is to be used for the test by typing SR=X(CR).

```
COLUMN    000000000111111111122222222223333333333444444444455555
          123456789012345678901234567890123456789012345678901234
X = 1 -   001000000000000000000000000000000000000000000000000000
    2 -   000000000000000000000000000000000000000000000000000100
    3 -   001010101010101010101010101010101010101010101010101000
    4 -   001111111111111111111111111111111111111111111111111100
    5 -   000000000000000000000000000000000000000000000000000000
```

Load Register/Shift Register Error Messages

```
L/R Failed
Exp Pat = XXXXXXXXXXXXXX*Y
          XXXXXXXXXXXXXX*Y
          XXXXXXXXXXXXXX*Y
          XXXXXXXXXXXXXX*Y
Rec Pat = XXXXXXXXXXXXXX*Y
          XXXXXXXXXXXXXX*Y
          XXXXXXXXXXXXXX*Y
          XXXXXXXXXXXXXX*Y
          XXXXXXXXXXXXXX*Y
```

(Y is an ID code for the 14 bits (0-3). Refer to BC Input Channel 7.)

S/R Failed

Same as above.

- The READY light on the 955 should now be flashing. Set the 955 DUMP switch to INPUT. Depress the READY button to begin operation of the Load Register Test.
- To halt the Load Register Test, depress the STOP switch on the 955 Operator's Console.
- The 955 READY indicator will now begin flashing. Set the 955 DUMP switch to output. Depress the READY indicator to begin the Shift Register Test.
- To halt the Shift Register Test, depress the 955 STOP indicator. An END OF TEST message should now appear on the specified output device.

NOTES

Load Register/Shift Register:

- To enable an oscilloscope presentation of the data as it is, output to the Load/Shift register sync on General Sync 2.
- To eliminate an error typeout before performing the (SR=X), type (SO). To reestablish Error Printout, perform (EO).

Module 1:

- All images are loaded from the auxiliary tape into the Buffer Controller starting at location 500_{16}. In the event it is necessary to alter an image, see Appendix B.
- For sync of an oscilloscope during Electronic Read, sync on READ.

C. MODULE 2 OPERATING PROCEDURES

Module 2 is a transport checkout routine consisting of seven subtests. Each subtest performs a specific function in checking out the 955 Transport.

- Select Module 2 (SM=2).
- Load Module 2 (AL).
- Determine which of the following subtests to run and proceed to that portion of the writeup.

Subtest 1	Tests all sensors for white
Subtest 2	Tests all sensors between Read Zone and Sort Station 1 for black
Subtest 3	Tests all sensors between Read Zone and Sort Station 2 for black
Subtest 4	Transport Speed Test between Read Zone and Sort Station 1
Subtest 5	Transport Speed Test between Read Zone and Sort Station 2
Subtest 6	Document Slippage Test
Subtest 7	Feed and Sort Exerciser

1. Subtest 1 - Light Sensor Test

   This section samples all transport photocells and, if on, will output an error message.

   a. Select subtest (ST=1).

   b. Define repetitions (RE=0-65,000).

   c. Execute test (EX).

   d. When selected number of repetitions have been run, an END OF TEST message will result.

NOTE

This test requires no documents.

   e. Error Messages

      The basic format of the error message is:

      955 SENSOR STATUS XXXX EXP Y REC Z

      XXXX = RZ - Read Zone
      SE - Sort Entry
      DD - Doubles detector
      SST1 - Sort Station 1
      SST2 - Sort Station 2
      SPF1 - Sort Pocket 1 Full
      SPF2 - Sort Pocket 2 Full

      Y-Z = 0 - Sensor not covered
      1 - Sensor covered

2. Subtest 2 - Dark Sensor Test (SST1)

   This section moves a document at 40 ips down the transport and ensures that all sensors between Read Zone and Sort Station 1 do conduct when the document covers them and do not conduct when the document does not cover them.

   a. Select subtest (ST=2).

   b. Define repetitions (RE=0-6500).

   c. Execute test (EX).

   d. Place one document on 955 Feed Up Table.

   e. Depress READY button; document should be run down the transport and placed in Sort Station 1. STOP indicator will light.

f. If selected number of repetitions have been run, END OF TEST message will be output. If not, go back to step d.

g. The error messages used for Subtest 2 are the same format as those used for Subtest 1.

3. Subtest 3 - Dark Sensor Test (SST2)

This test is the same as Subtest 2 except that Sort Station 2 is used in place of Sort Station 1.

a. Select subtest (ST=3).

b. Define repetitions (RE=0-65000).

c. Execute test (EX).

d. Place one document on 955 Feed Up Table.

e. Depress READY. The document should be sorted to Sort Station 2 and STOP indicator should light.

f. If the selected number of repetitions have been run, an END OF TEST message will be output. If not, go back to step d.

g. The error messages for Subtest 3 have the same format as those for Subtest 1.

4. Subtest 4 - Transport Speed Test (SST1)

This subtest verifies that when a document is transported from the Read Zone Sensor through to Sort Station 1 along the way, the document was moving at the proper speed. This is accomplished by timing the actual amount of time a sensor was covered. The sensors used are the Read Zone, Sort Entry, and Sort Station 1. If the speeds are not correct, an error message will result.

a. Select subtest (ST=4).

b. Define repetitions (RE=0-65000).

c. Define feed parameters (FP).

d. Execute test (EX).

e. Place one document on 955 Feed Up Table.

f. Depress 955 READY switch. The document should be transported to Sort Station 1 and the STOP indicator will light. If the selected number of repetitions has been completed, an END OF TEST message will result. If not, go back to step e.

g. Error Message Formats

1) DOC VEL AT RZ EXP XX.XX REC YY.YY INCHES/SEC.

Indicates that the document speed as determined by the length of time the Read Zone photocell was covered was YY.YY inches per second.

2) DOC. VEL AT SST1 EXP70.00 REC YY.YY INCHES/SEC.

Indicates that the document speed as determined by the length of time Sort Station 1 photocell was covered was YY.YY inches per second.

5. Subtest 5 - Transport Speed Test (SST2)

This test is exactly like Subtest 4 except that Sort Station 2 is utilized in place of Sort Station 1.

a. Select subtest (ST=5).

b. Define repetitions (RE=0-65000).

c. Define feed parameters (FP).

d. Execute test (EX).

e. Place one document on 955 Feed Up Table.

f. Depress READY. The document should be moved to Sort Station 2. The 955 STOP indicator will light if the selected number of repetitions have been run and END OF TEST message will be displayed. If not, go to step e.

g. The error messages for Subtest 5 are the same as those for Subtest 4 except that Sort Station 2 is substituted for Sort Station 1.

6. Subtest 6 - Document Slippage

Due to engineering specification changes, this test is replaced by RX4, Stepping Accuracy Test. Do not run Subtest 6.

7. Subtest 7 - Feed and Sort Exerciser

The purpose of this subtest is to determine if feed failures are occurring. Once the subtest is placed in execution, it will run until such time as no more documents are fed. This subtest detects such things as gap less than 1/4 inch, gap greater than 2 inches, doubles, stacker full, and sort checks. During transport movement, the diagnostic also counts the number of documents fed, and upon selection (ET), prints the number of documents fed and the time required to do it.

a. Select subtest (ST=7).

b. Define feed parameters (FP).

c. Define sort parameters (SP).

d. Execute test (EX).

e. Place documents on 955 Feed Up Table.

f. Depress 955 READY indicator to begin test.

g. Documents will begin feeding at the specified rate (FP) and sorting to the specified stacker or stackers.

h. When hopper is empty, depress the END OF FILE switch to terminate the test. If a fault of any type should occur, follow one of the following procedures.

1) To recover from Hopper Empty, press END OF FILE switch to terminate test, or go to step 6 to continue test. The system is now idling, waiting for a new (EX) command. At this time, an error totals may be requested by typing (ET).

2) To recover from Transport Check or Misfeed, remove documents which caused the jam and perform step 6).

3) To recover from Sort Check, remove all documents from Sort and document turn-around area. Perform step 6).

4) To recover from Sort Pocket Full, empty Sort Pockets and perform step 6).

5) To recover from Doubles, depress STOP and perform step 6).

6) To remove documents from Feed-Up Table, press READY. (This will clear the transport of all documents.) Replace documents on Feed Up Table and depress READY to continue test.

i. Error Messages

1) DOUBLES

2) HOPPER EMPTY or MISFEED or TRANSCHK

3) TRANSCHK AT RZ

4) TRANSCHK RZ-SE

5) DOC GAP LESS THAN 1/4 INCH

6) DOC GAP GT 2.0 INCHES

7) STACKER FULL

8) SORT CHECK AT SE

9) SORT CHK SE-SST1

10) SORT CHK SST1

11) SORT CHK SST1-SST2

12) SORT CHK SST3

13) XXXXXX Documents feed in XX min. XX sec.
XX DBLS XX JAMS

D. MODULE 3 OPERATING PROCEDURE

Module 3 is the Operator Panel Test. Once loaded and executed, the test does not relinguish control back to the computer; it will run until another module is loaded.

- Select Module 3 (SM=3).
- Load Module 3 (AL).
- Execute (EX).

Once placed into operation, the indicators will light in sequence top-left to bottom-right. This will continue until the END OF FILE button is depressed. The END OF FILE must be held in until all indicators light. When released, an indicator will begin to flash. When depressed, the light will stay on until released and the next indicator will begin flashing. This will continue until the last switch is depressed, and then the entire procedure will be repeated.

NOTE

No error messages are applicable to Module 3.

E. MODULE 4 OPERATING PROCEDURE

Module 4 is the Mirror Test Section of RX3 and is intended to check the Mirror Electronics. The user must specify the coordinates and dwell time. Dwell time represents time between mirror movements. Mirror speed is tested, and if not within tolerance, an error will be generated.

- Select Module 4 (SM=4).
- Load Module 4 (AL).
- Define Mirror Coordinates (MC).
- Define repetitions (RE=0-65000).
- Execute test (EX).
- Depress 955 READY switch to begin test.

1. Error Messages

   a. MNZV NOT GENERATED WITHIN 10 MSEC FOLLOWING STOP COMMAND

   This error indicates that mirror near zero velocity did not occur following a Mirror Stop command.

   b. MIRROR COUNT or VELOCITY FAULT XXXX.

   XXXX = 1000 Mirror Velocity Fault
   = 0020 Mirror Count Fault

   c. ENCODER COUNT EXP 00 REC XX

   The mirror is positioned out of scan gate and the Encoder Count was not equal to 0.

   d. FORWARD MIRROR COUNT FAULT

   A mirror count fault was detected after the mirror reached the specified forward coordinate.

   e. FWD COORD ACT=XXXX MNZV=YYYY DWELL=ZZZZ

   The mirror moved more than three coordinates after Mirror Forward command was dropped.

f. SCAN FWD MIRROR SPEED * EXP 75.00
REC XX.XX INCHES/SEC.

Indicates that the mirror forward speed is out of tolerance.

g. REV. MIRROR COUNT FAULT

A Mirror Count Fault was detected after the mirror reached reverse coordinate specified.

h. REV. COORD MDPNT=WWWW ACT=XXXX MNZV=YYYY DWELL=ZZZZ

After a Reverse Mirror movement and after the Stop Mirror command was given, the mirror moved more than three coordinates.

i. REV. PULSES REC. IN FWD MOTION X-Y

The encoder generated reverse pulses while the mirror was scanning forward. X is the encoder status before reverse pulse was defected, and Y is the encoder status after reverse pulse was defected.

j. ENCODER COUNT OUT OF SEQUENCE (FWD) X-Y.

Indicates that the Encoder Count incremented by more than one count. X is the coordinate before the error, and Y is the coordinate after the error.

k. FWD. PULSES REC. IN REV. MOTION X-Y

Indicates that while the mirror was in reverse motion, forward pulses were received. X indicates the coordinate before the forward pulse was received, and Y indicates the coordinate after the forward pulse was received.

1. ENCODER COUNT OUT OF SEQUENCE X-Y

Indicates that while the mirror was in reverse motion, a sequence error was detected between coordinates X and Y.

F. MODULE 5 OPERATING PROCEDURES

Module 5 provides the capabilities of reading handprint electronic images stored on magnetic tape. These images may be in the form of an auxiliary tape or a tape generated by RX4. There are two modes for reading as follows:

- Read and Compare
- Read without Compare

  Select Module 5 (SM=5).

  Load Module 5 to BC (AL).

  Proceed to the appropriate section of this writeup.

1. Electronic Read and Verify

The following parameters which are required may be entered by Automatic Parameters Entry (AP).

a. Test to be run on-line (SC, EC)

b. Standard output device of TTY (OT)

c. Output level normal (SO, EO)

d. Character pitch (RP)=3

   Character pitch represents the number of clear columns inserted between images.

e. Repetitions = indefinite (RE=0-65000)

f. Definite font (DF)

g. Definite data or load font (DD, LF)

h. Execute test (EX) Read and Verify or (SD) Suppress Data or (SO) Supress Output or (SC) Suppress Communications (requires Buffer Controller Console)

2. Quick Look Operating Procedures

   a. Define repetitions (RE=1-65000).

   b. Define dump on error, if desired (DE).

   c. Define fonts to be run (QL).

   The Quick Look Processor allows the user to run a series of fonts with the specified automatic parameters. Upon completion of all fonts defined, an END OF TEST printout will occur.

3. Error Messages

   a. NO DATA READY RESPONSE ON X

      Indicates that no data ready was generated for any images. X indicates the first character of the font.

   b. CONTINUOUS DATA READY X

      Indicates that image X generated multiple data readys.

   c. HANDPRINT REV. X.Y

      Indicates the revision number of the handprint images.

   d. CHARS READ=XXXXXXXX ERR=XXXXXXXX SUB=XXXXXXXX REJ=XXXXXXXX

      Reference Line =

      Numeric =

      Alpha =

      Symbol =

      This printout is the normal error printout. It may be eliminated by use of the suppress output parameter (SO) or (SD) the suppress DATA READYS.

   e. COLUMN READY FAILED

      Indicates that the column ready signal in the buffer controller is not changing state.

APPENDIX A - PARAMETER ENTRIES AND DESCRIPTIONS

Parameter	Description	Range	Initial State	Modules Affected
AC	ALTER CORE Allows the user to alter contents of 1700 core via TTY. Example: AC = X(CR) X = YYYY X+1 = (CR) Where: X = Location to be changed Y = Data to be placed in location X (CR) = Terminates entries	N/A	N/A	N/A
AL	AUTOLOAD BUFFER CONTROLLER This parameter allows the user to load the specified (SM) module to the buffer controller. The 955 Auxiliary Tape must be mounted on the specified tape unit (TN). Example: AL BC LOADED REV X.Y	N/A	N/A	All
AP	AUTOMATIC PARAMETERS This parameter allows the user to specify several items at one time for a specific job. The following lists by module describe the parameter which is reset by AP.	See text	See text	All

	Parameter	Value
General		
Output Device	(OT, OP)	TTY
Output Level	(SO, EO)	EO
Repetitions	(RE)	O/INF.
Module 1		
Pitch	(RP)	7
Char. Peak	(RP)	C
Char. Volt	(RP)	F
Image Position	(IP)	Top
Image Shift	(IP)	Normal
Data Ready Level	(SD)	Not Selected

Parameter	Description	Range	Initial State	Modules Affected
AP (Cont'd)	**Module 2** Sort Parameters (SP) PS Document Length (FP) 130 Transport Speed (FP) 20 Subtest Select (ST) 7 **Module 3** Not used **Module 4** Not used **Module 5** Pitch (RP) 3			
BE	BUFFER CONTROLLER EQUIPMENT CODE Allows the user to specify a different buffer controller equipment code.	2-F	A	All
BI	BUFFER CONTROLLER INTERRUPT LINE NUMBER Allows the user to alter the buffer controller interrupt line number allocation.	2-F	A	All
CC	COLUMN COUNT Allows the user to define where the underline is to begin when running On-Line Character Correction portion of Module 1. This parameter defines where the DINO signal is to be set. The Column Count is computed in the following manner: I+P+I+P . . . . . . Where I = Image width in columns P = Pitch Example: If it is desired to set DINO on the first column of the D in a character set of A-E ANSI, the following calculation would hold true.	See text	See text	See text

Module parameters for AP (Cont'd):

	Parameter	Value
Module 2		
Sort Parameters	(SP)	PS
Document Length	(FP)	130
Transport Speed	(FP)	20
Subtest Select	(ST)	7
Module 3		
Not used		
Module 4		
Not used		
Module 5		
Pitch	(RP)	3

Parameter	Description	Range	Initial State	Modules Affected
CC (Cont'd)	A+ P+ B+P+C+ P+ D 15+7+15+7+15+7+1=67 15 = Number of columns/ ANSI character 7 = Pitch			
DC	DUMP CORE Allows the user to dump portions of core to the output device (OT, OP). Example: NEXT OT NEXT DC FWA = 100 LWA = 110 0100 X X X X X X X X 0108 X X X X X X X X 0110 X X X X X X X X NEXT	N/A	N/A	N/A
DD	DEFINE DATA This parameter allows the user to specify which characters of a font are to be loaded to the buffer controller to be read. This parameter is used in two ways: one for Module 1 and one for Module 5. Module 1 If the characters (AEFG1) are to be loaded from a font, proceed as follows: DF = Font name (ANSI Thin, etc) DD = A, E, F, G, 1, (CR) NOTE RX3 will respond with a comma if the character typed is legal. If the font being processed is CW206, CW206LC, OCRB65N, Katakana, or OCRB Spec., the character code is typed (two characters).	See text	See text	1, 5

Parameter	Description	Range	Initial State	Modules Affected
DD (Cont'd)	Example: DF = CW206 THIN DD = 7F, 7D, (CR) Module 5 When Module 5 has been selected, the entries are defined as follows: DF = HP File Name (HP0, etc.) DD = 0;01,@;02,(CR) The character previous to the semicolon represents the character placed in the reference line. The two characters after the semicolon represent the position in the file (HP0, etc.) where the image may be found.			
DE	DUMP ON ERROR This parameter is associated with Quick Look for Module 1 or 5. When running Quick Look, this parameter will allow the user to only list the portions of the test in error. To dump headers only as file is run, DE=H(CR). To dump only those files in error, DE=(CR). NOTE This parameter will be reset upon completion of Quick Look.	See text		1, 5
DF	DEFINE FONT Allows the user to define the font to be run. See Appendix B for complete list of all fonts available on the standard auxiliary tapes. Spell font name exactly as it appears in Appendix B. Example: The font to be run is ANSI Thin DF = ANSI THIN(CR)	See text	N/A	1, 5

Parameter	Description	Range	Initial State	Modules Affected
DF (Cont'd)	If the font to be processed is not part of the standard auxiliary tape, preface the font name with an asterisk (*). Example: The font to be run is FIRSTA (generated by RX4) DF = *FIRSTA(CR)			
DR	DATA RECEIVE This parameter allows the user to dump core of the buffer controller to the specified output device (OT, OP). Example: Dump location 12 through 14 of the buffer controller: NEXT OT NEXT DR FWA=12(CR) LWA=14(CR) 0012=XXX NEXT	N/A	N/A	All
DS	DATA SEND This parameter allows the user to alter locations within the buffer controller after a module (1 through 5) has been loaded. This parameter is most useful to the user to alter images within the buffer controller after loading the image file (DD, LF, SS). The following descriptions apply to the data as it appears in the buffer controller memory. 1. Module 1 - Standard Font Location 500_{16} begins the start of image data. Each column of data occupies two words of core.	N/A	N/A	1-5

Parameter	Description	Range	Initial State	Modules Affected
DS (Cont'd)	Bits 14 and 15 of the word represent control bits (OC-7-14, 15). Each image utilizies 15 columns of data (30_{10} words). 2. Module 5 - Handprint Fonts Location 500_{16} begins the start of image data. Each column of data occupies four words of core. Most handprint images use 19_{10} columns of data (76_{10} words). Example: Alter location 503 to 3013: NEXT DS FWA= 503 0503=3013 0504=(CR)			
DT	DISPLAY TIME This parameter, associated only with the On-Line Correction portion of Module 1, varies the display time on the OLCC display: 0 = Indefinite 1-65000 = Number of m/second for display Example: Set display time = 2 seconds DT = 2000(CR)	0-65000	0	1
EC	ENABLE COMMUNICATIONS This parameter allows the user, once he has selected the Suppress Communications Parameter (SC), to enable communications once again between the computer and the buffer controller, and to restart the test in progress.	N/A	N/A	All

Parameter	Description	Range	Initial State	Modules Affected
ED	ENABLE DATA READY This parameter allows the user, once he has selected Suppression of Data Ready (SD), to enable Data Ready, and to restart the test in progress.	N/A	N/A	All
EO	ENABLE OUTPUT This parameter, when selected, allows the user to reestablish output of error diagnostics and to restart the test in progress.	N/A	N/A	All
ET	ERROR TOTALS This parameter, when selected, dumps the error totals for the images being processed. This parameter must not be selected when (SD) parameter is in effect. For Module 2, this parameter is only legal for Subtest 7.	N/A	N/A	1, 2, 5
EX	EXECUTE TEST This parameter begins execution of a test.	N/A	N/A	All
FP	FEED PARAMETERS This parameter allows the user to define feed parameters, document length, and transport speed. Example: Define feed parameters for document length of 5.5 inches and a transport speed of 40 ips. NEXT FP DL=55(CR) TS=40(CR) NEXT Document length is defined in tenths of inches.	See text	See text	2

Parameter	Description	Range	Initial State	Modules Affected
FP (Cont'd)	Transport speed is one of the following: 5 = 5 ips 10 = 12.5 ips 20 = 20 ips 40 = 40 ips			
IP	IMAGE POSITION This parameter allows the user to define the manner in which a font is to be run by specifying the portion of the Load/Shift register in which characters are loaded and the shift of that character (upside-down, reverse, normal, and up-side-down/reverse). Example: NEXT IP=X,Y(CR) NEXT Where: X=T - Top C - Center B - Bottom Y=0 - Normal shift 1 - Reverse shift 2 - Upside-down 3 - Reverse/upside-down NOTE When defining an image position, the font must be loaded after definition of image position.	See text	Top, normal	1

Parameter	Description	Range	Initial State	Modules Affected
LC	ON-LINE CHARACTER CORRECTION PROCESSOR SELECT This selection is not really a parameter but a start test selection. Example: NEXT LC=(CR) or NEXT LC=A(CR) Where: A = Use automatic parameters. Automatic parameters for OLCC: Font = ANSI Medium (DF) Characters = A through E (SS) Image position = Bottom (IP) Character pitch = 7 (RP) Display time = 2 seconds (DT) Column count = 35 (CC) (CR) = Use parameters as specified. The parameters listed for A must have already been accomplished.	See text	See text	1
LF	LOAD FONT This parameter allows the user to load the defined font (DF) to the buffer controller with the image position (IP) defined. Image position does not alter Handprint images.	N/A	N/A	1, 5

Parameter	Description	Range	Initial State	Modules Affected
MC	MIRROR COORDINATE This parameter allows the user to define the mirror coordinates to be used for Module 4 Mirror Test. Example: NEXT MC FWDMC=X(CR) REV MC=Y(CR) DWELL TIME=Z(CR) Where: X = Forward Mirror coordinate. Y = Reverse Mirror coordinate. If only a (CR) is entered, a zero mirror is used to reverse mirror. Z = Dwell time represents the time after mirror near zero velocity that the diagnostic will wait before giving the next mirror command. NOTE If only a (CR) is typed, the parameter FWDMC or Dwell Time is not altered.	See text	None	4
ME	MAGNETIC TAPE EQUIPMENT CODE The standard Magnetic Tape Equipment Code is determined by the user upon loading. The Q register is used and passed on RX3 as the ME code.	2-F	See text	All
MI	MAGNETIC TAPE INTERRUPT LINE NUMBER The Magnetic Tape Interrupt Line is determined by the loader, and the line number is passed on to RX3.	2-F	See text	All

Param-eter	Description	Range	Initial State	Modules Affected
OP	OUTPUT TO PRINTER When selected, this parameter alters the output device to the printer. NOTE Printer equipment code (PE) must have previously been defined.	N/A		All
OT	OUTPUT TO TELETYPE When selected, this parameter resets the output device to TTY.	N/A		All
PE	PRINTER EQUIPMENT CODE This parameter allows the user to define the printer equipment code.	2-F	4	All
QL	QUICK LOOK SELECTION This parameter allows the user to specify that image files be run in a Quick-Look mode. See Module 1 or 5 Operating Procedures.	N/A	N/A	1,5
RE	REPETITIONS SELECT This parameter allows the user to define the number of repetitions to be run from a particular test. 0 = Run test forever. 1-65000 = Run test this number of times.	0-65000	0	All

Parameter		Description	Range	Initial State	Modules Affected
RP	READ PARAMETERS AND SELECTION This parameter allows the user to specify several different parameters to either Module 1 or 5.				
	Char-Pitch	The number of clear columns to be inserted between images.	$0\text{-}13_{10}$		
	Font Enable	Allows the user to define the font lines and other parameters (see Appendix E) about a specific font. (See Appendix B).	See text		
	Char-Peak	Allows the user to define the portion of the character where character peak should occur.	$0\text{-}15_{10}$	12	
	Char Volt	Allows the user to specify the the minimum voltage code for a character. If the character is less than the specified voltage code, an error printout will occur.	$0\text{-}15_{10}$	15	

Example: Define the following:

Char-Pitch as 2

Font 1428 on alternate font line 2

Char-Peak as 13

Char Volt as 15

```
NEXT RP
CHAR-PITCH=2(CR)
FONT ENABLE=1428=9(CR)
CHAR-PEAK=13(CR)
CHAR-VOLT=(CR)
NEXT
```

NOTE

If the parameter is not to be altered, type (CR). Multiple font enables may be accomplished by typing , instead of (CR).

Parameter	Description	Range	Initial State	Modules Affected
SC	SUPPRESS COMMUNICATIONS Upon selection, RX3 either restarts the test in progress or starts the test defined. When this mode of operation is used, a buffer controller console is required to operate the 955. (See Appendix F for complete details). Therefore, a test may be started on a 955, and the computer is then free to do anything else while the test is being run.	N/A	N/A	All
SD	SUPPRESS DATA READY In the event data ready signals are not working properly, this parameter will allow the module to be started in operation with data ready not checked (no data verify, etc). This parameter is for scoping and troubleshooting only.	N/A		1, 5
SM	SELECT MODULE This parameter allows the user to specify which module (1-5) is to be run.	1-5	1	All
SO	SUPPRESS OUTPUT This parameter enables the user to suppress all output for troubleshooting and restarts the test in progress.	N/A		All
SP	SORT PARAMETERS This parameter, associated only with Module 2, Subtest 7, defines the sort pockets to be used (P=primary and S=secondary). Example 1: Place all documents in the primary stacker: NEXT SP=P(CR) NEXT	P or S	PS	2

Parameter	Description	Range	Initial State	Modules Affected
SP (Cont'd)	Example 2: Place first document in primary and second document in secondary stacker: NEXT SP=PS(CR) NEXT			
SR	SHIFT REGISTER/LOAD REGISTER TEST SELECT Refer to Module 1 operating procedures. Example: Run SR test with Pattern 2: NEXT SR=2(CR)			
SS	SUBSET SELECT Allows the user to define a group of characters to be loaded into the buffer controller for reading. This parameter may not be used with SDTST, SDBTST, KATAKANA, CW206, CW206LC, OCRB65N, OCRBSPEC, or any font which does not have standard ASCII character codes. Example: Define characters S-V to be loaded from the ANSI Thin image file. NEXT DF=ANSI THIN NEXT SS=S-V(CR)	N/A	N/A	1
ST	SUBTEST SELECT This parameter allows the user to select the subtest to be run with Module 2. (See Module 2 Operating Procedures.)	1-7	7	Z

Parameter	Description	Range	Initial State	Modules Affected
TC	TAPE CONVERTER CODE When the tape controller (1732 only) is connected through a 1706, this parameter may be used. Upon loading RX3, the Q register should be set and that parameter will be carried on to RX3 as the standard code. The possible entries would be: 1706 Number 1 TC=2(CR) 1706 Number 2 TC=7(CR) 1706 Number 3 TC=C(CR)	See text	See text	All
TD	TAPE DRIVE SELECTION The only time this parameter is to be used is with the 60128/3518-659 Tape System. This parameter informs RX3 that the tape unit is special. It also informs RX3 of equipment codes, etc. Example: Define 659 with 3518 equipment code of 4: NEXT TD=659(CR) 3518=4(CR) NEXT	N/A	N/A	N/A
TN	TAPE UNIT NUMBER This parameter allows the user to select the tape unit to be used for the auxiliary tape. NOTE If the tape controller is a 1732-2, the maximum tape unit number is 3. Example: NEXT TN=2(CR)	0-7	1	All
XT	EXIT TEXT When executed, this parameter will recall SMM17. The standard SMM loading procedures apply (that is, set SELECTIVE STOP and SKIP switches before typing XT).			

APPENDIX B - REVISION 4.0 AUXILIARY TAPE DESCRIPTION

File Number	File Name	Standard Font Enable	File Description
1			RX3 Module 1 Controlware
2			RX3 Module 2 Controlware
3			RX3 Module 3 Controlware
4			RX3 Module 4 Controlware
5			RX3 Module 5 Controlware
6			RX4 Module 1 Controlware
7			RX4 Module 2 Controlware
******** Begin Standard Font Files ********			
8 9 A	ANSI THIN ANSI MEDIUM ANSI THICK	0123456	CW210 OCRA Alpha-Numeric Files
B C D	OCRB71 THIN OCRB71 MEDIUM OCRB71 THICK	0123456	CW209 OCRB 71 Alpha-Numeric Files
E	SDTST	0123456	Servo-Data Test for OCRA
F	SDBTST	0123456	Servo-Data Test for OCRB
******** Begin Handprint Files ********			
10	HP0	D	Zero's Character Set
11	HP1	D	One's Character Set
12	HP2	D	Two's Character Set
13	HP3	D	First Half of Three's Character Set
14	HP33	D	Last Half of Three's Character Set
15	HP4	D	Four's Character Set
16	HP5	D	Five's Character Set
17	HP6	2D	Six's Character Set
18	HP7	D	Seven's Character Set
19	HP8	D	Eight's Character Set
1A	HP9	D	Nine's Character Set
1B	NREJECTS	D	Numeric Rejects Character Set
1C	SPECIALS	0D	High, Low, Error File
1D	HPMARK	D	Field Mark Character Set
1E	HPX	D	X Character Set
1F	HPC	D	C Character Set
20	HPS	D	S Character Set
21	HPT	D	T Character Set

File Number	File Name	Standard Font Enable	File Description
22	HPZ	D	Z Character Set
23	HPPLUS	D	+ Character Set
24	HPMINUS	D	- Character Set
25	HPEQUAL	D	= Character Set
26	HPENA	0D	Handprint Enable Test File
27	HPCLR	D	Handprint Clear Test File
28	BLACK GOODIES	1D	Black Fill Test File
29	CW207	D	Super Reject Test File
2A	USA@	D	European 1's Reject for USA 1's
2B	HPE1	8D	European 1's Character Set
2C	HPE7	8D	European 7's Character Set
2D	GOTHIC	9D	Gothic Character Set
2E	SUPER GOODIES	9DE	Test Super Fill File
2F	ENCODER	D	Test Character Encoder Logic
30	FEATURES	D	Sample Features for Troubleshooting
31	SPLITS/JOINS	D	Sample Features for Troubleshooting
32	FLATS/SLOPES	D	Sample Features for Troubleshooting
********	Begin Optional and QSE	Fonts ********	
33	RABINOW THIN		
34	RABINOW MEDIUM	0123456	CW149 Font Files
35	RABINOW THICK		
36	1428 THIN		
37	1428 MEDIUM	8	CW139 Font Files
38	1428 THICK		
39	1403 THIN		
3A	1403 MEDIUM	8	CW141 Font Files
3B	1403 THICK		
3C	E13/B THIN		
3D	E13/B MEDIUM	9C	CW134 Font Files
3E	E13/B THICK		
3F	7B THIN		
40	7B MEDIUM	8	CW137 Font Files
41	7B THICK		
42	12F THIN		
43	12F MEDIUM	8	CW138 Font Files
44	12F THICK		
45	NOF THIN		
46	NOF MEDIUM	8C	
47	NOF THICK		
48	CW206 THIN		
49	CW206 MEDIUM	0123456	CW206 Font Files
4A	CW206 THICK		

File Number	File Name	Standard Font Enable	File Description
4B 4C 4D	OCRB65N THIN OCRB65N MEDIUM OCRB65N THICK	8	OCRB 1965 Standard Numeric Only Font
4E 4F 50	OCRAN THIN OCRAN MEDIUM OCRAN THICK	8	OCRA Numeric Only Font File
51 52 53	LOWER CASE THIN LOWER CASE MEDIUM LOWER CASE THICK	01234568	OCRA Lowercase Character Set
54 55 56	OCRBLC THIN OCRBLC MEDIUM OCRBLC THICK	01234568	
57 58 59	CW206LC THIN CW206LC MEDIUM CW206LC THICK	01234568	CW206 Lowercase Font File
5A 5B 5C	OCRB SPEC THIN OCRB SPEC MEDIUM OCRB SPEC THICK	0123456	OCRB Special Characters
5D	UP1	0123456F	6/Inch Track Up Test
5E	DOWN1	0123456F	6/Inch Track Down Test
5F	UP2	0123456F	6/Inch
60	DOWN2	0123456F	6/Inch
61	WAVE	0123456F	6/Inch
62	INDENT	0123456F	6/Inch
63	TOPLESS	0123456F	6/Inch
64	BOTLESS	0123456F	6/Inch
65 66 67	KATAKANA THIN KATAKANA MEDIUM KATAKANA THICK	0123456	Katakana QSE Font Files

NOTE

Files 5D through 64 are for OCRA font only.

A. SUMMARY

Standard Font Enable refers to the font enable setup for that file upon initialization of RX3. When describing Font Enable for hand print, the following special options are available:

1. These functions allow the user to set, clear, or add the specified bit to all Handprint Font Enable Masks.

2. Refer to Appendix E for complete description of Font Enable.

   Example 1: Add the Rescan bit to all Handprint Font Enable Masks:

   ```
   NEXT RP
   CHAR PITCH=(CR)
   FONT ENABLE=ADD=2
   CHAR PEAK=(CR)
   CHAR VOLT=(CR)
   NEXT
   ```

3. When selecting a font (DF,QL), spell font name exactly as it appears in the file name column.

4. When describing a font for Font Enable (RP), do not type the Thin, Medium, or Thick portion of the name.

   Example: Enable ALT. font line 2 for 1428:

   ```
   NEXT RP
   CHAR-PITCH= 7(CR)
   FONT ENABLE=1428=9
   CHAR PEAK=(CR)
   CHAR VOLT=(CR)
   ```

When running Handprint (Module 5), the Select Subset (SS) parameter is illegal.

The HPENA font will verify that the Handprint unit will reject a character if READ is enabled in the middle of a character. It also verifies that if READ is dropped in the middle of a character, that character is also rejected.

The HPCLR file is composed of nine character images. Four of the nine are good images and should generate Handprint Clear signals. The other five are bad and should not generate Handprint Clear signals.

The following font character codes are handled specially, because the character code generated is not standard ASCII.

CW206

CW206LC

OCRB65N

KATAKANA

OCRB SPEC

This paragraph is to inform the user of the format of image data in the buffer controller at the time data is being read.

The user can alter the bit configuration of these images to enable special matrix troubleshooting. The following examples illustrate how this is accomplished.

1. OCR (Module 1)

   In this example, the ANSI Medium character E is modified.

   a. Load Module 1 (AL).

   b. Define font (DF=ANSI MEDIUM).

   c. Define image position (IP=T, 0).

   d. Load font (LF, SS, DD). (In this case, Define Data was used (DD=E, (CR)).

   e. Dump image from core to TTY or printer (DR).

   All fonts are loaded beginning at location 500_{16} of the buffer controller:

   FWA=500
   LWA=520

0500	3FFF	FC02	3FFF	FC02	3FFF	FC02	3033	0C02
0508	3033	0C02	3033	0C02	3033	0C02	3033	0C02
0510	3033	0C02	3003	0C02	3003	0C02	3033	0C02
0518	3003	0C02	3003	0C02	3003	0C02	A32A	0C40
0520	7328	7864	CB0C	4325	7864	A323	010B	6B20

   1) Image width is 15 columns.

   2) Column 1 is locations 500, 501.
      Column 2 is locations 502, 503, etc.

3) Each word is broken down as follows:

Bits 15 through 2	Data
Bits 0 and 1	Image position:
	3 Top
	2 Top Middle
	1 Bottom Middle
	0 Bottom

Refer to Buffer Controller Output Channel 7.

If an image position of Top is used, bits 0 and 1 will be a 3 for the first word and a 2 for the second word.

4) The actual video as seen on an oscilloscope appears as follows:

```
                                    1 1 1 1 1 1
Column  1 2 3 4 5 6 7 8 9 0 1 2 3 4 5  ____
        . . . . . . . . . . . . . . .
        . . . . . . . . . . . . . . .
        * * * * * * * * * * * * * * *
        * * * * * * * * * * * * * * *
        * * * x . . . . . . . . . . .      Bits 15 through 2 of
        * * * x . . . . . . . . . . .      word One
        * * * x . . . . . . . . . . .
        * * * x . . . . . . . . . . .
        * * * x . . . . . . . . . . .
        * * * x . . . . . . . . . . .
        * * * * * * * * * . . . . . .
        * * * * * * * * * . . . . . .
        * * * x . . . . . . . . . . .
        * * * x . . . . . . . . . . .  ____
        * * * x . . . . . . . . . . .
        * * * x . . . . . . . . . . .
        * * * x . . . . . . . . . . .
        * * * x . . . . . . . . . . .
        * * * * * * * * * * * * * * *
        * * * * * * * * * * * * * * *      Bits 15 through 2 of
        . . . . . . . . . . . . . . .      word Two
        . . . . . . . . . . . . . . .
        . . . . . . . . . . . . . . .
        . . . . . . . . . . . . . . .
        . . . . . . . . . . . . . . .
        . . . . . . . . . . . . . . .
        . . . . . . . . . . . . . . .
        . . . . . . . . . . . . . . .  ____
```

f. To alter the zero bits, indicated with an x, to one bits, perform the change as follows:

DS
ADR = 506
506 = 3FFF
507 = FC02
508 = (CR)

g. The image as now modified may be run in any manner by RX3.

NOTE

This procedure only alters an image in core, not on the auxiliary tape.

2. Handprint (Module 5)

In this example, the first zero of the HP0 file is modified.

a. Load Module 5.

b. Define font (DF=HP0).

c. Load image (LF or DD).
(In this case, Define Data was used (DD=0; 01, (CR).)

d. Dump image from the BC to the TTY or printer. All fonts are loaded beginning at location 500_{16} of the buffer controller:

NEXT DR

FWA=500
LWA=548

0500	0003	000E	FC01	0000	0003	000E	FE01	0000
0508	0003	000E	FF01	0000	0003	0012	01C1	0000
0510	0003	01E2	01F1	0000	0003	0E02	001D	0000
0518	0003	0C02	0005	0000	0003	0A02	0005	0000
0520	0003	0902	0005	0000	0003	0882	0005	0000
0528	0003	0842	0005	0000	0003	0802	0005	0000
0530	0003	0802	0005	0000	0003	0E02	001D	0000
0538	0003	01E2	01E1	0000	0003	0012	0201	0000
0540	0003	000E	FC01	0000	0003	000E	FC01	0000
0548	0003	000E	FC01	0000	0001	0A00	A045	2465

1) Image width is normally 19 columns; the HP3 and HP33 files are 25 columns.

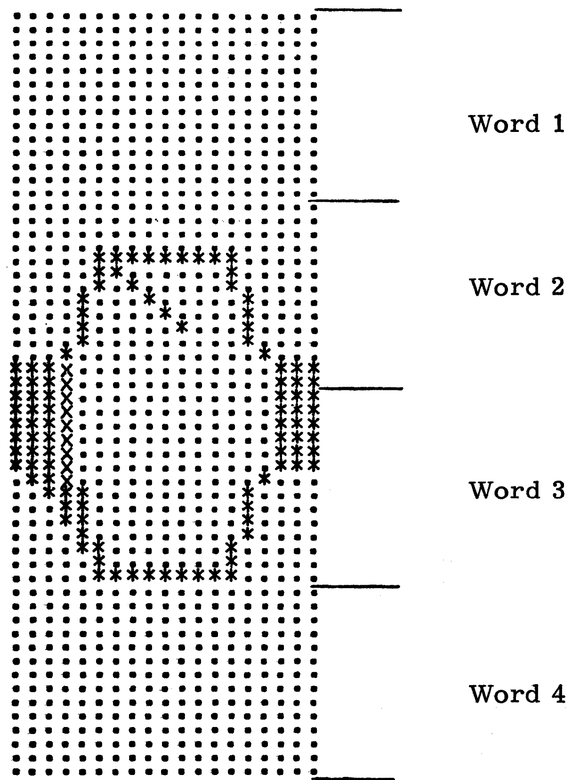
2) Column 1 is contained in locations 500, 501, 502, 503.

3) Each column of handprint data is four words of core.

4) Refer to Buffer Controller Output Channel 7 for description of each word.

5) The actual video data as seen on an oscilloscope appears as follows:

```
                 11111 11111
Column  123 45678 901234 56789
```



e. To alter column 4 as shown above, proceed as follows:

DS
ADR = 50D
50D = 1E(CR)
50E = FFC1(CR)
50F = (CR)

APPENDIX C

RX3 provides the capability of running any of the medium or thick fonts available on the auxiliary tape with six lines to the inch mode enabled. This is accomplished by setting bit F in the Font Enable Mask. (See Appendix E.)

NOTE

The Thin files are single-column images and do not meet the 6/Inch black algorithms, and therefore, cannot be run.

A. OPERATING PROCEDURE

1. Load RX3 as normal.
2. Select Module 1 (SM=1).
3. Load Module 1 from auxiliary tape (AL).
4. TTY will respond with BC LOADED REV X.Y.
5. Define Read Parameters (RP). (See Appendixes B and E.)
6. Define Font (DF). (See A.8.)
7. Execute test Read and Verify (EX) or Suppress Data Ready (SD).
8. The following is a list of special files designed to be used for 6/Inch. These files are formed on the standard auxiliary tape.

   Example: Read the standard ANSI Medium Font file with 6/Inch enabled.

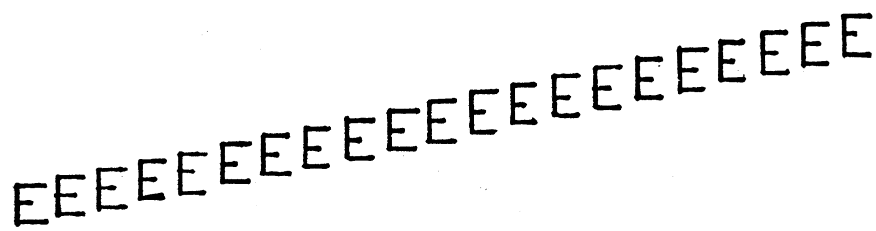
```
NEXT DF=ANSI MEDIUM

NEXT RP
CHAR PITCH = (CR)
FONT ENABLE = ANSI = 0123456F(CR)
CHAR PEAK=(CR)
CHAR VOLT=(CR)

NEXT LF

NEXT RE=X(CR)     (Repetitions)
NEXT EX
```

a. File Name = UP1

The UP1 file consists of 21 character images. The first image is loaded from Light Pipe 26 to Light Pipe 43. Each subsequent image is loaded one light pipe higher with respect to the previous image.

The purpose of this file is to rest the 6/Inch logic to ensure that the Window tracks each image going up by one light pipe.

All images in this file should be read correctly if the Window is tracking properly.

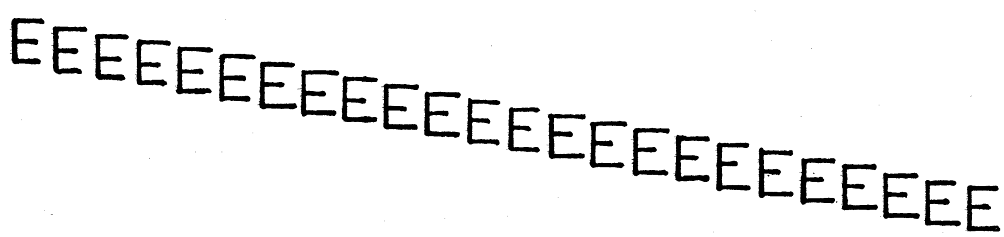


b. File Name = DOWN1

The DOWN1 file consists of 21 character images. The first image is loaded from Light Pipe 4 to Light Pipe 21. Each subsequent image is loaded one light pipe lower with respect to the previous image.

The purpose of this file is to test the 6/Inch logic to ensure that the Window can track each image going down by one light pipe.

All images in this file should be read correctly if the Window is tracking properly.

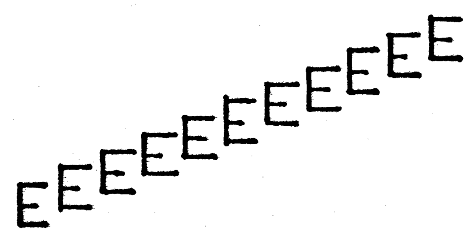


c. File Name = UP2

The UP2 file consists of 11 character images. The first image is loaded from Light Pipe 26 to Light Pipe 43. The remaining 10 images are loaded two light pipes higher with respect to the previous image.

The purpose of this file is to ensure that the Window can track each image as it goes up by two light pipes.

If the Window is tracking properly, all images in this file should be read correctly.

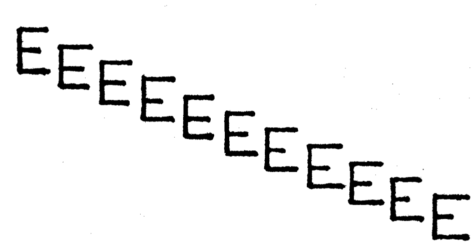


d. File Name = DOWN2

The DOWN2 file consists of 11 character images. The first image is loaded from Light Pipe 4 to Light Pipe 21. Each subsequent image is loaded two light pipes lower with respect to the previous image.

The purpose of this file is to ensure that the Window can track each image going down by two light pipes.

All images in this file should be read properly if the Window is tracking properly.



e. File Name = WAVE

The WAVE file consists of 18 character images. The first two images are loaded from Light Pipe 16 to 33. The remaining images are loaded in the following sequence:

Character Number	Relative Position	Light Pipes
1-2	Base	16-33
3-4	Down 1	17-34
5-6	Down 2	19-36
7-8	Up 1	18-35
9-10	Up 2	16-33
11-12	Up 1	15-32
13-14	Up 2	13-30
15-16	Down 1	14-31
17-18	Down 2	16-33

The purpose of the WAVE file is to ensure that the Window can track up and down within the same line of data.

Provided the window is tracking properly, all characters in this file should read correctly.

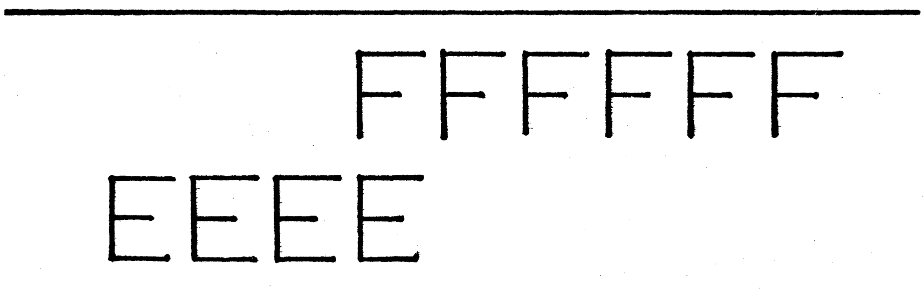
EEEEEEEEEEEEEEEEEE

f. File Name = INDENT

The INDENT file consists of 12 character images. The purpose of this file is to check out the Indent logic.

If the Indent logic is working properly, the first three images should be recognized as E. The fourth image will have no profile due to the higher profile of the F images, and therefore, should generate a space code. The last six images should be read as F.

The expected result from the reader is EEE FFFFFF. The E images are in Light Pipes 34 through 51. The F images are in Light Pipes 06 through 23.



g. Font Name = TOPLESS

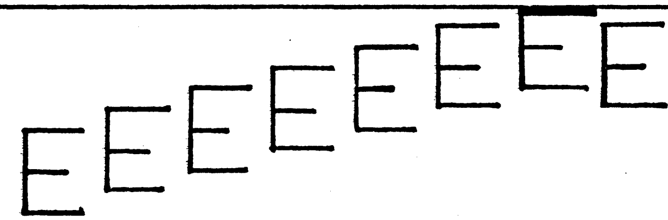
The TOPLESS file consists of eight character images. The first image is loaded from Light Pipe 8 to Light Pipe 25. The seventh image is loaded starting at light pipe 1 and it should generate a Topless condition.

The purpose of this file is to verify that the Topless logic works properly with 6/Inch option installed.

All images, with the exception of the seventh character, should be read correctly.

In the event the reader does not generate a Topless condition, an N will be printed in the error line.

Character	Light Pipe Position
1-3	8-25
4	6-23
5	4-21
6	3-20
7	1-18
8	3-20



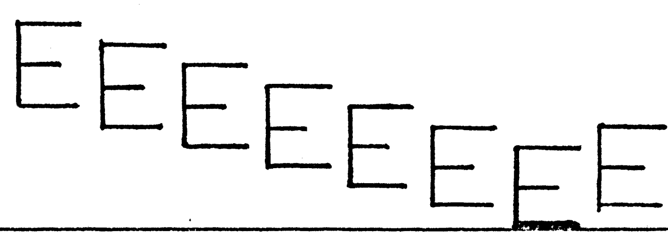
h. File Name = BOTLESS

The BOTLESS file consists of eight character images. The first image is loaded from Light Pipe 30 to Light Pipe 47. The seventh image is loaded so that it will generate a Bottomless condition.

The purpose of this file is to ensure that the Bottomless logic works correctly with the 6/Inch option installed.

In the event the reader does not generate a Bottomless condition on the seventh character, an N will be placed in the error line.

Character	Light Pipe Position
1-3	30-47
4	32-49
5	35-52
6	36-53
7	37-54
8	30-47



APPENDIX D - MESSAGE DESCRIPTIONS

A. MESSAGES COMMON TO ALL MODULES

1. BEGIN RX3A33 REV. X.Y. V.X.Y.Z. CP07 IA=0200

REV. X.Y.	=	The revision of RX3
V.X.Y.Z.	=	The lastest revision of SMM with which RX3 was checked out
CPXX	=	The types of computers on which RX3 has been checked out
IA=0200	=	RX3 is always loaded at initial address of 0200_{16}.

2. NEXT
   Indicates that RX3 is ready to accept a new parameter or command from the teletype. This message will be displayed whenever the MANUAL INTERRUPT is depressed.

3. BC LOADED REV X.Y
   Indicates that the buffer controller has been loaded with the module last requested (SM). X.Y represents the revision number of that module.

4. END OF TEST
   Indicates that the test in progress has been completed. At this point, a MANUAL INTERRUPT will return control to the NEXT processor.

5. ILLEGAL AUX TAPE
   Indicates that the tape mounted does not contain the proper information.

6. CHECKSUM ERROR
   Indicates that after the module was loaded to the buffer controller, the data did not verify properly. Reload the buffer controller.

7. BC DOES NOT RESP
   Indicates that while trying to load the buffer controller, it did not reply to a (Director 1 - Clear Controller, Clear Interrupt) function.

NOTE

Check Buffer Controller Equipment Code (BE).

8. MT STATUS ERROR

   Indicates a parity error has been detected on the magnetic tape.

9. ONA

   Option is not available. Generally indicates that the parameter just typed is not legal.

10. PRINTER ALARM

    Indicates an internal or external reject or status function was received from the line printer.

NOTE

Check Printer Equipment Code (PE).

11. ER/IR A=XXXX Q=ZZZZ I=ZZZZ R=XXXX

    Indicates that an external or internal reject was detected from the buffer controller.

    A = A register at time of failure

    Q = Q register at time of failure

    I = Index register at time of failure

    R = Return address or address of the output instruction within RX3

12. SELECTED FONT NOT AVAILABLE

    This error could occur while defining a file name (DF, QL), and indicates that RX3 does not know of a font by the name specified.

13. ALLOWABLE ENTRIES EXCEEDED

    This message, encountered only while defining data (DD), indicates that too many characters have been defined; only 60 entries are allowed.

14. COLUMN READY FAILED

    Indicates that the column ready signal (IC-600) is not changing state.

15. CONTINUOUS DATA RDY X

    The set of images presently being run creates multiple data readys for a character. For troubleshooting, use SD parameter.

16. NO DATA RDY RESP. ON X

    Indicates that character X (the first character of the font) did not generate a data ready. For troubleshooting, use SD parameter.

NOTE

Ensure SIMULATED/OPTICAL switch on the 955 is set to SIMULATED.

17. BC/X FAILED TO REPLY ON FUNCTION RELOAD BC/X
Indicates that after functioning buffer controller X, it did not reply with an interrupt within a time limit. The buffer controller must be reloaded at this time (AL).

18. INCORRECT REPLY FROM BC/X RELOAD BC/X
Indicates the buffer controller X has missinterpreted an instruction from the computer. The buffer controller must be reloaded at this time (AL).

B. MODULE 1 RELATED MESSAGES

1. READ AND VERIFY
CHARS-READ = XXXXXXXX ERR = YYYYYYYY REJ = ZZZZZZZZ
REF. LINE =
ERR. LINE =
VOLT. LINE =

This printout will occur when a read error has been detected.

X	Total number of characters read
Y	Total number of characters either substituted or with a low voltage code
Z	Total number of rejected characters
REF. LINE	The characters in this line are the characters used for reference. This line may be printed as two lines, giving the character codes of the characters in the event they are not printable ASCII codes. (See sample below.)
ERR LINE	Represents the characters which were not interpreted properly by the 955. The character is replaced by a space if it was read properly. If the codes are not standard ASCII codes, this line will be printed on two lines.
VOLT LINE	The code (0-F) in this line represents the voltage at which the character was recognized. If this voltage is less than the CHAR-VOLT (RP) parameter specified, an error will occur.

```
Example 1:  Font=ANSI THIN (DF)
            CHAR VOLT=F (RP)
            SELECT SUBSET = A-H (SS)
            EXECUTE (EX)
CHARS READ = 00000080 ERR=00000002 REJ=00000001
REF  LINE   = ABCDEFGH
ERR  LINE   =   @ E O
VOLT LINE   = FF0FEF5F
```

Indicates that the character C was rejected. The character E had a low voltage code. The character G was substituted by the character O.

```
Example 2:  FONT = CW206 THIN (DF)
            CHAR VOLT= F (RP)
            LOAD FONT (LF)
            EXECUTE  (EX)
CHAR READ=00000040 ERR=00000002 REJ=00000001
REF  LINE = 7777
            EFDC
ERR  LINE =  4  7
             1@C
VOLT LINE = F30D
```

This message indicates that the character whose character code is 7F was recognized as an A character code 41. The character represented by code 7D was rejected. The character whose code is 7C received a low voltage code.

2. Load Register Shift Register Test

   a. L/R FAILED
      Refer to Module 1 Operating Procedures.

   b. S/R FAILED
      Refer to Module 1 Operating Procedures.

   c. SCRUB DATA TEST FAILED
      Refer to Module 1 Operating Procedures for error messages.

   d. SERVO DATA TEST FAILED
      Refer to Module 1 Operating Procedures for error messages.

C. MODULE 2 - RELATED MESSAGES

Refer to Module 2 Operating Procedures for error messages.

D. MODULE 3 - RELATED MESSAGES

Module 3 contains no error messages.

E. MODULE 4 - RELATED MESSAGES

Refer to Module 4 Operating Procedures for error messages.

F. MODULE 5 - RELATED MESSAGES

Same as Module 1 Read and Verify plus the following additional messages.

1. HANDPRINT REV. X.Y.

   This message indicates the revision of the images used for handprint.

2. CHARS READ=XXXXXXXX ERR=XXXXXXXX SUB=XXXXXXXX REJ=XXXXXXXX

   REF LINE =

   NUMERIC =

   ALPHA =

   SYMBOL =

   This message indicates that an error has occurred.

CHARS READ	Total number of characters read
ERR	Total number of characters on which the error bit was set (IC-504)
SUB	Total number of characters on which a substitution was detected
REJ	Total number of characters on which a reject was detected

The following special codes may be seen in the REF, NUMERIC, ALPHA, and SYMBOL lines:

E	Indicates that the error bit (IC-504) was set on this character.
N	No data ready was generated for this character.
H	A high bit (IC-503) was detected for this character.
L	A low bit (IC-505) was detected for this character.
D	Both high and low were detected for this character.
#	Indicates that a super reject was detected for this character. (This error is available only with the CW207 file.)

APPENDIX E - FONT ENABLE PARAMETER DESCRIPTION

The Font Enable Mask is a word which the 1700 passes to the buffer controller for output on channel 5 when running Module 1. When running Module 5, there are special bits associated with the word. Contained witin RX3 is a Font Enable Mask associated with each file on the auxiliary tape plus one to be used for external fonts. Each of these masks is accessible to the user through the Read Parameter (RP). The following examples show how to alter a Font Enable Mask. Refer to individual font options to determine the exact meaning of each bit in the font mask. The following tables represent the generalized meaning of each bit. The first is for OCR (Module 1) and the second for Handprint (Module 5). Appendix B describes the Font Enable Mask setup as standard for each font on the auxiliary tape.

A. OCR FONT ENABLE MASK

Bit	Signal	Description
0	MARK SENSE	ENABLE ZERO AND CANCEL
1	NUMERIC	Enables characters 1-9
2	CONTROL	Chair, Fork, Hook
3	ALPHA 5	CSTXZ
4	ALPHA 21	A, B, D-R, U-W, Y
5	PUNCT 1	.$-&%:=+()?/
6	PUNCT 2	*,;"'
7	Optical Scaling	Size 4 is not used in RX3
8	Alt. Font Line 1	
9	Alt. Font Line 2	
A	Alt. Font Line 3	
B	Pitch 7/Inch	
C	Pitch 8/Inch	
D		
E		
F	6/Inch	

B. HANDPRINT FONT ENABLE MASK

Bit	Description
0	Set Character Pitch to 0*
1	Enable Black Fill (OC-601)
2	Enable Rescan (OC-202)
3	Enable 0-9, X (OC-203)
4	
5	
6	
7	
8	European 1 and 7 Select
9	Gothic Select
A	
B	
C	
D	Handprint Select
E	Super Fill Select
F	

Example 1: Enable Alternate Font Line 1 and all of the standard control lines for ANSI font:

```
NEXT RP
CHAR-PTICH=(CR)
FONT ENABLE=ANSI=01234568(CR)
CHAR PEAK=(CR)
CHAR VOLT=(CR)
NEXT
```

Example 2: Enable European 1 and 7 Select for the Encoder Handprint File:

```
NEXT RP
CHAR-PITCH=(CR)
FONT ENABLE=ENCODER=8D(CR)
CHAR-PEAK=(CR)
CHAR-VOLT=(CR)
```

*This bit allows the buffer controller to ignore the standard Pitch Parameter (RP) and not place any clear columns between characters.

The following special parameters are available for Handprint Font Enable. These parameters are to be used as a file name in the Font Enable Parameter. This allows the user to alter the entire set of Handprint Font Enables as indicated.

ADD	Add to all Handprint Font Enable Masks the indicated bits.
CLR	Clear from all Handprint Font Enable Masks the indicated bits.
SET	Set all Handprint Font Enable Masks to the indicated setting.

Example: Enable 0-9, X on all Handprint Font Masks:

```
NEXT RP
CHAR PITCH=(CR)
FONT ENABLE=ADD=3(CR)
CHAR PEAK=(CR)
CHAR VOLT=(CR)
NEXT
```

APPENDIX F - OFF-LINE MODE OPERATING PROCEDURE

A. MODULE 1

If the SELECTIVE STOP switch on the Maintenance Console is set, the module will come to a halt under six conditions. This is determined by examining the contents of the A register on the Maintenance Console.

1. End of Test A Register = 0000

   The module has read the selected set of images the requested number of times. To repeat the test, the operator should now enter in A register the number of repetitions (zero for indefinite) and press the GO button.

2. Continuous Data Ready A Register = XX40

   The 955 generated more than one Character Data Ready for every image being read. XX is the number of Character Data Ready generated. To continue, enter 0001 in the A register to suppress Character Data Ready and 0000 to enable Character Data Ready. Press the GO button.

3. No Data Ready Response A Register = 00XX

   The 955 has failed to give out the ASCII code on the image indicated by XX ASCII code. To restart the module, press GO.

4. Character Image Rejected A Register = XX40

   The image indicated by XX ASCII code was rejected by the 955. To continue, press GO.

5. Character Image Misread A Register = XXYY

   The 955 misread the image indicated by ASCII code. YY is the ASCII code given out by the 955.

6. Load Register Test Failed A Register = 00C0

   The Load register failed A register = 00C0.

   The Load register failed to give out the same pattern. To verify the expected pattern, press the GO button four times. Press the GO button four more times to verify the pattern received. To repeat the test, press GO.

7. Shift Register Test Failed A Register = 01C0

   The pattern changed while going through the Shift register. Press the GO button four times to verify the expected pattern. Press the GO button four more times to verify the pattern received.

B. PAGE AND DOCUMENT HANDLING TEST ERROR HALTS (MODULE 2)

Not defined.

C. OPERATOR PANEL TEST ERROR HALTS (MODULE 3)

None

D. MIRROR TEST ERROR HALTS (MODULE 4)

If the SELECTIVE STOP switch on the Maintenance Console is not set, the program will bypass all mirror failures which might occur. If the switch is set, the program, upon detecting a mirror fault, will come to a halt displaying in the A register the error halt number. Additional information on the error halts is obtained by pressing the GO button and observing the contents of A.

1. ERROR HALT NUMBER 0 = SCAN FORWARD SPEED FAULT
   The mirror speed was not 75 inches per second as expected. Press the GO button, A=expected msec. count. Press the GO button again, A=actual msec. count in which the Scan Forward command was up.

2. ERROR HALT NUMBER 1 = MNZV FAILED
   Mirror near zero velocity was not generated within 1 msec. following Stop Mirror command.

3. ERROR HALT NUMBER 2 = MIRROR COUNT OR VELOCITY FAULT
   Mirror status error. Press GO, A=mirror status, 1000=mirror velocity fault, and 0020=mirror count fault.

4. ERROR HALT NUMBER 3=MIRROR ENCODER FAILED
   Press GO, A will contain the ENCODER status. If A=000X, the ENCODER count was not zero as expected when mirror was out of Scan Gate, X= encoder count. If A=01XV, reverse pulses were received in forward motion. (X=encoder count status before reverse pulses occurred and Y=encoder count status after reverse pulses occurred.) If A=02XY, encoder count is out of sequence (FWD). (The encoder incremented by more than 1. X= encoder count status before it went out of sequence and Y=encoder count status after it went out of sequence.) If A=03XY, forward pulses were received in reverse motion. (X=encoder count before forward pulses were detected, and Y=encoder count after forward pulses were detected.) If A=04XY, encoder decremented by more than 1. (X=encoder status before it went out of sequence and Y=encoder current after it went out of sequence.)

5. ERROR HALT NUMBER 4 = FWD MIRROR COUNT FAULT
Mirror count fault was detected after the mirror reached the forward coordinate.

6. ERROR HALT NUMBER 5 = FWD COORDINATE FAULT
The mirror moved more than three coordinates from the Time Scan Forward command was dropped until after the dwell time.

   GO A = Forward coordinate
   GO A = MNZV coordinate
   GO A = Dwell coordinate

7. ERROR HALT NUMBER 6 = REV MIRROR COUNT FAULT
Mirror count fault was detected after the mirror reached the reverse coordinate.

8. ERROR HALT NUMBER 7 = REVERSE COORDINATE FAULT
The mirror went behind the reverse coordinate by more than three coordinates following a Stop command.

   GO A = Midpoint coordinate
   GO A = Reverse coordinate
   GO A = MNZV coordinate
   GO A = Dwell coordinate

E. HANDPRINT ELECTRONIC READ AND VERIFY ERROR HALTS (MODULE 5)

All error halts will be bypassed if the SELECTIVE STOP switch on the Maintenance Console is not set.

1. NO DATA READY RESPONSE A = 00XX
XX is the ASCII code corresponding to the image which failed to generate Data Ready. To suppress Data Ready, clear A register; press GO button.

2. CONTINUOUS DATA READY A = 0140
To suppress Data Ready, clear A register; press GO button.

3. ERROR, SUBSTITUTION OR REJECT DETECTED
A Register = 00XX (Expected ASCII code); press GO
   = 00XX (Numeric code); press GO
   = 00XX (Alpha code); press GO
   = 00XX (Symbol code); press GO

I. OPERATIONAL PROCEDURE

A. RESTRICTIONS

1. Requires an 8K 1700.
2. Requires a (TF201-A01) FR101 Maintenance Console.
3. The 1700 does not give error messages detected by the command and memory tests.
4. SMM17 is used for overlay loading.

B. LOADING PROCEDURE

1. Standard SMM call.
2. Test number 56.

C. PARAMETERS

1. Automatic (none)
2. Manual

a. On receiving a "MANUAL INTERRUPT (MI)", control is transferred to the "ENTER PARAMETERS" routine (see flow chart fco). If initialization is complete (see I. C. 3.), parameters can now be entered. An "ONA" response to an entry indicates that the option is not available. The following is a list of options.

Code	Task	Reference
AL = n	Autoload test n	II. B. 11
BD	Buffer controller dump	II. B. 12
BE	Select buffer equipment no.	II. B. 2
BI	Select buffer interrupt line	II. B. 3
DL	Delete autoloading	II. B. 7
EL	Enable autoloading	II. B. 8
EX = n	Execute test n with program loading	II. B. 9
PL	Punch program boot loader	II. B. 10
PP	Punch program	II. B. 13
TB	Select upper and lower transfers	II. B. 6
TL	Select lower transfers	II. B. 6
TU	Select upper transfers	II. B. 6
XT	Exit from test to SMM17	II. A. 2

3. Forced (Automatic) Requests

   a. Should anything happen to prevent the normal flow of the program before a series of required entries are made, the program will re-start its list of automatic calls. The following is a list of those calls.

      ENTER PARAMETERS

      BE = Requesting buffer equipment no.
      BI = Requesting buffer int. line.

4. Stop/Jump Parameter

   a. The parameter can be displayed in A for a change, just after an entry in the enter parameters routine if the SKIP and STOP switches are set. The used bits are:

      Bit 8 = 1 = Suppress Error Message Output

D. OPERATING INSTRUCTIONS

1. Load BC2 via SMM17 operating instructions.
2. Respond with the correct entry on the teletype to the request (see I.C.3.).
3. After I.D.2 is complete, manual entries can now be made. If no other entries (other than to execute test) are made, the following is assumed in the program:

   a. EL and TB.

II. MESSAGES

A. NORMAL MESSAGES

1. BEGIN BC2 FR101 TEST IA = XXXX

   Initial typeout where XXXX = the initial address of the program. Rerun from P = IA.

2. END BC2 TEST

   In response to code (XT), the test is terminated and control is returned to SMM17.

B. COMMAND MESSAGES

1. BE = X*

   Requesting buffer controller equipment number where X = 0 → F.

2. BI = X*

   Requesting buffer controller interrupt line where X = 2 → F.

3. ENTER PARAMETERS

   In response to a manual interrupt or on an entry completion, entries may now be made via teletype (see I. C. 2).

4. PROGRAM X WAITING FOR PARAMETERS

   In response to codes (EX or AL), this message denotes that text X has been loaded and is waiting for manual intervention at the Maintenance Console. Master clear the BC and run the test according to the procedures for that test. The tests are as follows:

Test	Remarks	BC2 Listing Page
1 = BCQ	Quick Look Program	50
2 = BCCOM	Buffer Controller COM Test	70
3 = MEM	2 1/2D Memory Test (750 nanoseconds)	178
4 = MM1	Memory Test (1.1 microseconds)	236
5 = MM2	Memory Test (1.1 microseconds)	265
6 = MY1	Memory Test	288
7 = MY2	Memory Test (200 nanoseconds)	316
8 = BCM (Y4)	Memory Test	341

5. TX

   Where X = U for upper, = L for lower, and = B for both upper and lower. This command modifies the program boot loader, henceforth referred to as PBL, accept data on only that specified portion(s) of the block transfer channel as valid data. TU and TL will disable autoloading the PBL. If DL (see II. B. 10) has not been entered, a jump to the PBL will be autoloaded. If EL (see II. B. 11) is entered, the modified boot will be autoloaded. TB will re-enable PBL loading. See Figure 2 for combinations.

---

* These entries are force requested at initialization.

6. DL

This option will delete the autoloading of the PBL and a jump to it. It is assumed that a boot is in at $F6F. The BC must be set to that address and run before execution takes place. (See EX at II. B. 12 and Figure 2.)

7. EL

This option enables autoloading of the PBL in its existing configuration. (Cancel DL option and TU/TL boot loading restrictions.) (See Figure 2.)

8. EX = x

This option begins the program controlled loading of text x and does an interface coupler check (Figures 1 and 2). It begins by autoloading the PBL if not restricted by TU, TL, or DL options. It next runs an interface check and finally loads the program (see fc1, 2, 3, and 4).

9. PL

If the 1700 has a paper tape punch, this option will generate a paper tape of the PBL in its current configuration. It should be loaded and run at P = 0000 on the Maintenance Console.

10. AL = x

Autoloads program x (Figure 2).

11. BD
FWA = XX0 LWA = YYF

This option will cause the 1700 to autoload a small boot into the first 15 locations and dump XX0 YYF to the selected error output device. If locations 000 00F are important, they should be written down before execution of this option begins. F is not actually printed but should be understood.

12. PP

Punches the last program executed onto paper tape in console loading format.

C. ERROR MESSAGES

1. ONA

Notes that the requested option is not available.

2. AUTOLOADING LOADER FAILED

Five attempts to load the FR101 Loader (or a jump to it) were made but an initial interrupt response from the loader was not received.

3. CH X FAILED SET = XXXX CLR = YYYY

   Some of the channel bits have failed to be as expected, either solidly or intermittently. Those that failed to set are in (CLR = YYYY) and those that failed to clear are marked in (SET = XXXX). Possible channels are 0, 1, and B (for block transfer channel). The 1's in either word mark the bit in error.

4. FR101 PROGRAM LOADING FAILED

   After a required amount of time without a data interrupt or five consecutive errors on the same transfer, program loading is aborted and the above message is output.

5. NO BC INT. X

   In the required amount of time, an interrupt was not received during program loading.

   X = 1 = No controlware alarm and end of operation.
   = 2 = No data interrupt during interface check.
   = 3 = No data interrupt during actual program load.

6. INTERNAL REJ. ON INPUT DIRECTOR = X

   The computer internally rejected on an attempt to input using director X.

7. EXTERNAL REJ. ON INPUT DIRECTOR = X

   The buffer controller rejected the 1700 on an attempt to input using director X.

8. INTERNAL REJ. ON OUTPUT DIRECTOR = X

   The computer internally rejected on an attempt to output using director X.

9. EXTERNAL REJ. ON OUTPUT DIRECTOR = X

   The buffer controller rejected the 1700 on an attempt to output director X.

10. COUPLER STATUS E= XXXX A= YYYY S= NN

    While all directors were being exercised, the coupler status was collected by the buffer controller and later sent to the 1700 for analysis. The ones output were found to be in error. E = expected and A = actual (see Figure 1) NN = the status position in the table.

11. SMM OVERLAY LOADING FAILED

    Self explanatory

III. DESCRIPTION

A. INITIALIZATION

1. Clear the buffer controller via the Maintenance Console.
2. Set the Maintenance Console STOP switch.

B. OPERATION

1. Purpose
   a. Check all directors.
   b. Check all data lines.
   c. Check all interrupts.
   d. Check coupler status.
   e. Check system status.
   f. Check the BC memory.
   g. Check the BC instructions.
2. Procedure
   a. See flow charts for execution flow.
   b. Load one of the tests via AL or EX options.
   c. When the test is loaded, examine all errors in the priority order given:
      1) Coupler status errors (Figure 1)
      2) System status (channel 0 errors)
      3) Interrupt errors
   d. From the Maintenance Console, run the test just loaded, according to the following procedures.

FR101 BC QUICK LOOK COMMAND AND MEMORY TEST

Operating Procedure

Restrictions

The SLS instruction must be operational to flag a UJR error and when the CE assembly option is selected.

The Jump instructions must be operational to flag most other instruction failures and when the HANG assembly option is selected.

The SCB instruction must be operational to flag errors when the BUZZ assembly option is in use.

At least one of the assembly options must be selected.

1. CE - Stop on an SLS instruction at the failing routine.
2. HANG - Hang on a Jump instruction at the failing address.
3. BUZZ - Alert buzzer upon errors and hang.

One direct cell must be available for testing purposes. (COMQL) is preset to a 2 for this. The original contents are reset at the end of a pass.

Channel instructions are not tested.

The loading address through the loading address +100 is not tested in the memory test.

Loading Procedure

Set the SELECTIVE STOP switch on the Maintenance Console.

Type "AL = 1" for autoloading or,
"EX = 1" for controlled loading.

Using the Maintenance Console, clear and start the test at P = 0000.

Parameters

None - except for the assembly options: CE, HANG, BUZZ, COMQL, (LWATEST) = the last memory test address.

Messages

The failing address (observe P by use of the Maintenance Console) must be compared with a listing of BCQ to determine the failure.

(B1) = Failing memory address in memory test.

Significant Locations

Direct cell COMQL is preset to a 2 for direct testing.
(LWATEST) = FFF to test 4K.

Description

Command Test

Execute at least one of each format one instructions and check the results. Stop if any errors.

Execute at least one of each format two instructions and check the results. Stop if any errors.

Memory Test

Set the address into the first available location after BCQ.

Continue setting and checking each location with its address until the (LWATEST) is reached. (Preset to test 4K.)

On errors

a. (B1) = Failing address.

b. (B1) = Expected data.

End of Pass

Reset address COMQL to original data.

Exit to loading address +3 to restart test.

The test will keep looping if no error is encountered.

Comments

The UJR instruction is tested first and if a failure occurs, BCQ will stop on an SLS instruction and alert buzzer if selected.

All other Jump instructions are tested next and if a failure occurs, BCQ will stop on an SLS instruction (if CE enabled) or hang on a UJR 0 instruction (if HANG is enabled).

All other instructions follow in logical order.

(BCQRST) approximately = 70 may be set to 0 for an end of pass SLS.

Timing

The test takes less than 1 second to run the command test.

The memory test takes less than 1 second to test 4K of memory.

One complete pass is equal to the command test time plus the memory test time.

BUFFER CONTROLLER COMMAND TEST (BCC)
(Formerly BCCOM)

Operating Procedure

Restrictions

The Input/Output tests will require a strap to shunt output channels to a corresponding input channel for test purposes.

Loading Procedure

Set the SELECTIVE STOP switch on the Maintenance Console.

Type "AL = 2" or,
"EX = 2"

Master Clear and Channel Clear the Maintenance Console.

Run from location 0000.

Parameters

Five programmed stops occur in the I/O instructions test of Section 4. The action required for each of the stops is as follows:

Stop 1 - Set a not equal to zero to bypass the block transfer test.

Stop 2 - Set a not equal to zero to bypass the normal channel test.

Stop 3 - Set A to designate the initial hexadecimal numbers of the output channel-bit and the corresponding input channel-bit to be tested.

	Output		Input	
	CH	BIT	CH	BIT
A =	XXXX	XXXX	XXXX	XXXX

Each channel and bit number is to be designated by one hexadecimal digit 0 through F.

Stop 4 - Set A to designate the number of successive channels (M) and bits (N) to be tested starting with the I/O channel-bit numbers specified in stop 3.

	Channels (M)		Bits (N)	
A =	XXXX	XXXX	XXXX	XXXX

The normal channel test will loop through the instruction test sequence N- times, one loop for each consecutive increment of both input and output bit numbers designated in stop 3. The input-output channel numbers do not change. Upon completion of the bit incrementing loop both input and output channel numbers are incremented and the bit sequence test repeated. Upon completion of M times N loops through the normal channel test the program will exit to stop 5. If A is not changed during stop 4, the normal channel test makes one pass to test the I/O channel-bit combination specified in stop 3 and exits to stop 5.

At stop 4 the test operator can insert the hexadecimal digits 01, 02, ..., 0E, 0F, through 10 to represent from 1 to 16 channels and from 1 to 16 associated bits to be tested.

Stop 5 - (A) is initially set at 1 by parameter flag RPTFLAG. Clear (A) to zero in order to exit from the normal channel test. Else, the program will return to stop 3 for repeating the normal channel test.

Error Stops and General Information

The SELECTIVE STOP switch must be set before running the test. The Selective Stop instruction (SLS) is used for error stops and is assumed to be working. No programmed stop will occur in test sections 1, 2, or 3 unless a failure is encountered.

The encounter of an error stop requires the test operator to review the series of assembled instructions (see listing) leading up to the SLS Stop instruction (error). In most cases the operator would only have to look at the instructions contained within one or two SLS instructions just prior to the error stop. The instruction under test would be similar to an elementary test sequence out of the overall command test and separated from other instructions under test by SLS stops. Error stops are designated by EEEEE in the rightmost portion of the assembly listing.

Instructions being tested are noted by ***** in the rightmost portion of the assembly listing comment field.

BC Core Locations of Interest (with Maintenance Console)

Specific Locations

Start of Program	Address - 0000
Restart	Address - 0F48
Stop 1 - Bypass Block Transfer Test	Address - 0E4D
Stop 2 - Bypass Normal Channel Test	Address - 0E52
Stop 3 - Normal Channel I/O Setup	Address - 0E56
Stop 4 - Normal Channel Counter	Address - 0E5B
Stop 5 - Repeat Normal Channel Test	Address - 0EFA

Section Description

Basic Command Test Sequence

This test is divided into four different sections based upon the number of storage reference cycles of the instruction. The sections are arranged in the following order:

Section 1 - One Storage Cycle

Direct Jumps
No Address
Condition Jumps
Relative Address Test
Condition Bit Test
Shift Test (see Table 1)
Scale Test (see Table 1)
Adder Test (see Table 2)
Select Bits in A
Enter Instructions

The following instructions are tested in this order:

Direct Jumps

UJD - Unconditional Jump
ZJD - Zero Jump
NJD - Non-Zero Jump
PJD - Positive Jump
MJD - Minus Jump

No Address

LDN - Load
ADN - Add
SBN - Subtract
LMN - Logical Minus
LPN - Logical Product
LCN - Load Complement

Condition Jumps

FJD - False Jump Direct

TJD - True Jump Direct
FJR - False Jump Relative
TJR - True Jump Relative

Relative Address Test

ADR - Add Relative
SBR - Subtract Relative
LCR - Load Complement Relative

Condition Bit Tests

TOV - True on Overflow
TOP - True on Odd Parity
TAB - True on Bit of A
INT - True on "OR" of Internal tests

Shift Test (Table 1)

SRC - Shift Right Circular
SLC - Shift Left Circular
SRO - Shift Right Open

Scale Test (Table 1)

SCA - Scale A to A

Adder Test (Table 2)

Select Bits in A

SAB - Set Bit in A
CAB - Clear Bit in A
MAB - Complement Bit in A

Enter Instructions

EN1 - Enter Index 1 Direct
ENA - Enter A Direct
EN2 - Enter Index 2 Direct
IN1 - Increase Index 1
EI1 - Enter and Increment Index 1
EI2 - Enter and Increment Index 2

IN2 - Increase Index 2
TA1 - Transfer A to Index 1
TA2 - Transfer A to Index 2

Section 2 - Two Storage Cycles

Memory References Direct
Load Bytes
Clear
Loads and Enters
Indirect Addressing Test
Indirect Jump Test
Index 1 Tests
Index 2 Tests

Section 3 - Three and Four Storage Cycles

Destructive Load
Replaces Test
Four Storage Cycle

Section 4 - I/O Instructions

Normal Channel Tests

SCB - Set Channel Bit
IAN - Input From Channel to A
CCB - Clear Channel Bit
TCB - Test Channel Bit
OAN - Output From A to Channel
OSN - Set Channel for Ones in A
OCN - Clear Channel for Zeros in A

Block Transfers

OTD - Output
IND - Input

General Notes on Section 4

Program Stops (with Maintenance Console)

Two program stops (SLS) (stop 1 and stop 2) are found at the start of the I/O instructions test. These stops allow the test operator to bypass either the normal channel test and/or the block transfer test. The bypass parameter flags "CHKBLOK" and "CHKNORM" are initialized during their respective stops and remain in effect for all subsequent passes through the command test. The bypass parameters can be reset by setting (P) to location "CBSTOP" and processing the stop 1 and stop 2 test operator options.

Three program stops (SLS) (stop 3, stop 4, and stop 5) are contained within the normal channel test. Stop 3 allows the test operator to select an input/output channel and bit combination for use as operands in the instruction test sequence. Stop 4 is used as a counter to designate the number of channels and number of bits that are to be tested. The initial value of the counter contains a channel count of 1 and a bit count of 1. Stop 5 occurs at the end of the normal channel instruction test sequence. This stop allows the test operator the option to either continue the normal channel test or to exit from the test.

Following an initial pass through the program stops in Section 4, the command test executes a series of parameter initializing instructions. These instructions allow the test to restart and provide a jump to the start of the command test. Assuming no error stop will occur, the command test will continuously loop through the entire program (including the I/O tests if previously selected).

Restart - Restart of Test

Assembler instructions for command test restart.

TABLE 1. SHIFT/SCALE TESTS

The following are the Shift/Scale network operands used in the BC Command Test.

A-Register	Correct Result	Bit 8	Shift Count	Input Number
0000	0000	0	0	0
0000	0000	1	1	1
0000	0000	1	2	2
0000	0000	1	4	3
0000	0000	1	8	4
0000	0000	1	F	5
FFFF	FFFF	1	0	6
FFFF	FFFF	1	1	7
FFFF	FFFF	1	2	8
FFFF	FFFF	1	4	9
FFFF	FFFF	1	8	10
FFFF	FFFF	1	F	11
4020	4020	1	0	12
0001	0002	1	F	15
FFFE	FFFE	1	0	16
AAAA	5555	1	1	17
AAAA	AAAA	1	0	18
5555	5555	1	0	19
5555	AAAA	1	1	20
CCCC	3333	1	2	21
CCCC	CCCC	1	0	22
3333	3333	1	0	23
3339	4CCE	1	2	24
F0F0	0F0F	1	4	25
0F4F	F0F4	1	4	26
FF00	00FF	1	8	27
00FF	FF00	1	8	28
FF00	7F80	0	1	29
FF00	FF00	0	0	30
F0F0	F0F0	1	0	31
00FF	00FF	1	0	32
000F	0000	0	4	33
0003	0000	0	2	34
0001	0000	0	1	35
00FF	0000	0	8	36
FF00	3FC0	0	2	37

TABLE 1. SHIFT/SCALE TESTS (Cont'd)

A-Register	Correct Result	SCALE	Input Number
FFFF	0000	SCALE	38
0000	0010	SCALE	39
8000	0000	SCALE	40
4000	0001	SCALE	41
2000	0002	SCALE	42
1000	0003	SCALE	43
0800	0004	SCALE	44
0400	0005	SCALE	45
0200	0006	SCALE	46
0100	0007	SCALE	47
0080	0008	SCALE	48
0040	0009	SCALE	49
0020	000A	SCALE	50
0010	000B	SCALE	51
0008	000C	SCALE	52
0004	000D	SCALE	53
0002	000E	SCALE	54
0001	000F	SCALE	55
F7FF	0000	SCALE	56
1FFF	0003	SCALE	57
00FF	0008	SCALE	58
00F7	0008	SCALE	59
00F3	0008	SCALE	60
40F3	0001	SCALE	61
42F3	0001	SCALE	62
02F3	0006	SCALE	63
0273	0006	SCALE	64
4273	0001	SCALE	65
4233	0001	SCALE	66
80C0	0000	SCALE	67
800C	0000	SCALE	68
0030	000A	SCALE	69
8010	0000	SCALE	70
8001	0000	SCALE	71
C001	0000	SCALE	72
E001	0000	SCALE	73

TABLE 1. SHIFT/SCALE TESTS (Cont'd)

A-Register	Correct Result	SCALE	Input Number
F001	0000	SCALE	74
F801	0000	SCALE	76
7FFF	0001	SCALE	
07FF	0005	SCALE	
007F	0009	SCALE	
0007	000D	SCALE	

TABLE 2. ADDER TESTS

The following are the adder operands used in the BC Command Test.

A-Register	Memory	Correct Result	G349	Adder General Bit	Input No.
	Logical Product				
0000	0000	0000	0	X	0
FFFF	0000	0000	0	X	1
0000	FFFF	0000	0	X	2
FFFF	FFFF	FFFF	1	X	3
	Exclusive OR				
0000	0000	0000	0	X	4
FFFF	FFFF	0000	0	X	5
FFFF	0000	FFFF	0	X	6
0000	FFFF	FFFF	0	X	7
	Add				
0000	0000	0000	0	0	8
FFFF	0000	FFFF	0	0	9
0000	FFFF	FFFF	0	0	10
0001	FFFF	0000	1	1	11
FFFF	FFFF	FFFE	1	1	12
1111	1111	2222	0	0	13
2222	2222	4444	0	0	14
4444	4444	8888	0	0	15
8888	8888	1110	1	1	16
	Subtract				
0000	0000	0000	1	1	17
FFFF	0000	FFFF	1	1	18
8888	8888	0000	1	1	19
CCCC	5555	7777	1	1	20
	Add				
3333	AAAA	DDDD	0	0	21
	Subtract				
0000	0001	FFFF	0	0	22
	Add				
FFFF	0001	0000	1	1	23

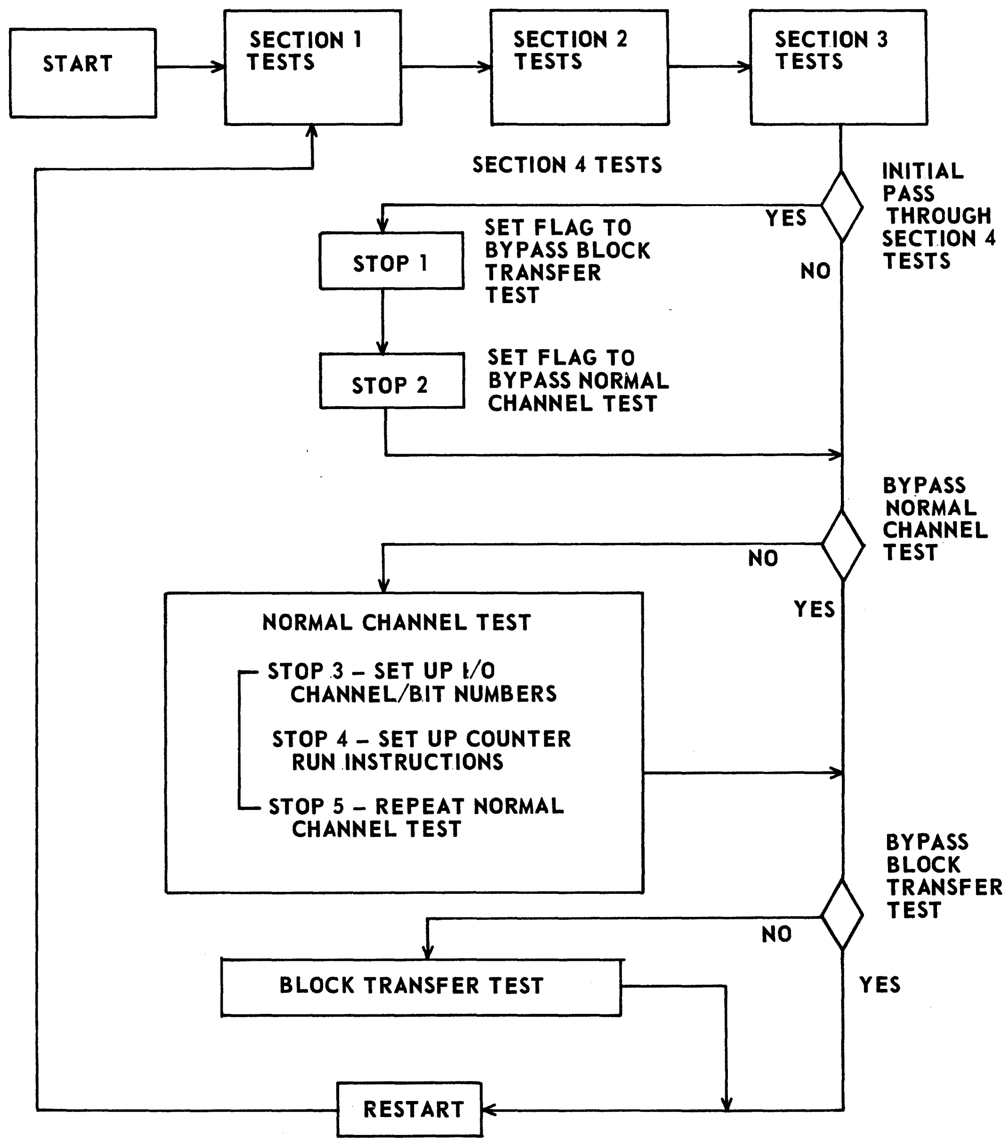
TABLE 2. ADDER TESTS (Cont'd)

A-Register	Memory	Correct Result	G349	Adder General Bit	Input No.
	Subtract				
FEFE	EFEF	0F0F	1	1	24
	Add				
6666	5555	BBBB	0	0	25
9999	5555	EEEE	0	0	26
	Subtract				
FDFD	DFDF	1E1E	1	1	27
F7F7	7F7F	7878	1	1	28
	Add				
DFDF	0202	E1E1	0	0	29
EFEF	0101	F0F0	0	0	30
	Subtract				
9999	5555	4444	1	1	31
FBFB	BFBF	3C3C	1	1	32
	Add				
7F7F	0808	8787	0	0	33
1111	3333	4444	0	0	34
	Subtract				
CCCC	AAAA	2222	1	1	35
	Add				
BFBF	0404	C3C3	0	0	36
1111	7777	8888	0	0	37
	Subtract				
815F	5555	2C0A	1	1	38
D52A	5555	7FD5	1	1	39
	Add				
1111	BBBB	CCCC	0	0	40
3333	7777	AAAA	0	0	41
0707	0A0A	1111	0	0	42

TABLE 2. ADDER TESTS (Cont'd)

A-Register	Memory	Correct Result	G349	Adder General Bit	Input No.
	Subtract				
7070	5F5F	1111	1	1	43
0000	0100	FF00	0	0	44
0000	0010	FFF0	0	0	45
0C0C	AAAA	6162	0	0	46
F59F	5555	A04A	1	1	47
5555	AAAA	AAAB	0	0	48
8888	5555	3333	1	1	49
C0C0	AAAA	1616	1	1	50
	Add				
0C0C	5555	6161	0	0	51

BLOCK DIAGRAM



BUFFER CONTROLLER MEMORY TEST (MEM)
(Formerly MEMORY)
(2 1/2D, 750 Nanoseconds Memory)

Operating Procedure

Restrictions

None

General Information

The memory test starts at location 0 upon completion of test loading and master clear.

Loading Procedure

Set the SELECTIVE STOP switch on the Maintenance Console.

Type "AL=3" or "EX=3".

Master Clear and Channel Clear the Maintenance Console.

Run from location P = 0000.

Parameters

The operator may view/change the test parameters by enabling breakpoint on instruction at location X0080. There are two consecutive stops:

First Stop

B2 = 0000
B1 = Test number + section
A = Pseudo switches (preset to 0200)

Bit 0	- Not used	8000
1	- Stop at end of test/bank	4000
2	- Stop at end of pass	2000
3	- Stop at end of section	1000
4	- Stop at end of condition	0800
5	- Not used	0400
6	- Stop on error	0200
7	- Repeat test in same stack	0100
8	- Repeat test in same test area	0080
9	- Not used	0040
10	- Repeat pass	0020

Bit 11	- Repeat section	0010
12	- Repeat condition	0008
13	- Not used	0004
14	- Not used	0002
15	- Not used	0001

Second Stop

B2 = 0000

B1 = Test number + section

A = Sections (preset to FFC0)

Bit 0 = Section 0 - Addressing test
1 = Section 1 - Zeros test
2 = Section 2 - Ones test
3 = Section 3 - Checkerboard test
4 = Section 4 - Worst pattern test
5 = Section 5 - Sliding 1 then 0 - bit
6 = Section 6 - Sliding 1 then 0 - word
7 = Section 7 - Disturb test
8 = Section 8 - Worst pattern disturb
9 = Section 9 - Random

Normal Stops

B2 = 0000 - Parameter Stop

First Stop - B1 = Test number + section
B2 = 0000
A = Pseudo switches

Second Stop - B1 = Test number + section
B2 = 0000
A = Sections

B2 = 0800 - Condition Stop

First Stop - B1 = Test number + section
B2 = 0800
A = 0000

Second Stop - B1 = 1111
B2 = 2222
A = 0000

B2 = 1000 - End of Section Stop

First Stop - B1 = Test number + section
B2 = 1000
A = 0000

Second Stop - B1 = 1111
B2 = 2222

B2 = 2000 - End of Pass Stop

First Stop - B1 = Test number + section
B2 = 2000
A = 0000

Second Stop - B1 = 1111
B2 = 2222
A = 0000

B2 = 4000 - End of Test Stop

First Stop - B1 = Test number + section
B2 = 4000
A = 0000

Second Stop - B1 = 1111
B2 = 2222
A = 0000

Error Stops

The SELECTIVE STOP switch must be set before running the test. The Selective Stop instruction (SLS) is used for error stops and is assumed to be working.

On error stops, the following is displayed:

B2 = 0200 - Error

First Stop - B1 = Test number + section
B2 = 0200
A = Error code

Second Stop - B1 = Actual data
B2 = Expected data
A = Failing address

Third Stop - B1 = 1111
B2 = 2222
A = 0000

Section Description

Section 0 (Bit 0) - Addressing Test

Each address contains its own address.

1. Write up, read up, and check.
2. Write down, read down, and check.
3. Write up, read down, and check.
4. Write down, read up, and check.

Section 1 (Bit 1) - Zeros Test

1. Fill test areas with zeros, read, and check.
2. Repeated ten times.

Section 2 (Bit 2) - Ones Test

1. Fill test areas with ones, read, and check.
2. Repeated ten times.

Section 3 (Bit 3) - Checkerboard Test

1. Fill test areas with alternating 1 + 0, read, and check.
2. Repeated ten times.
3. Fill test areas with alternating 0 + 1, read, and check.
4. Repeated ten times.

Section 4 (Bit 4) - Worst Pattern Test

1. Fill test areas with worst pattern.
2. Read, and store all words on this word line.
3. Read, complement, and store all words on this word line.
4. Test all words on this word line.
5. Repeat from 2 on all word lines in test areas.
6. Check all word lines in test areas.

Section 5 (Bit 5) - Sliding 1 Then 0 on Bit Line

1. Fill test areas with zeros.
2. Slide a 1 down the bit line, test, and restore to zero.
3. Repeat from 2 for all bit lines.
4. Fill test areas with all ones.
5. Slide a 0 down the bit line, test, and restore to zero.
6. Repeat from 2 for all bit lines.

Section 6 (Bit 6) - Sliding 1 Then 0 On Word Line

1. Fill test areas with zeros.
2. Slide a 1 across the word line, test, and restore to zero.
3. Repeat from 2 for all word lines.
4. Fill test areas with all ones.
5. Slide a 0 across the word line, test, and restore to one.
6. Repeat from 2 for all word lines.

Section 7 (Bit 7) - Disturb Test

1. Fill test areas with all ones.
2. Store zeros in word to be tested.
3. Store a word of all ones 100 times above, below, and on either side of test cell.
4. Check test cell.
5. Repeat from 3 for all words in test area.
6. Perform 100 loads above, below, and on either side of test cell.
7. Check test cell.
8. Repeat from 6 for all words in test area.

Section 8 (Bit 8) - Worst Pattern Disturb

1. Fill test areas with worst pattern alternately reversing the current direction on the X line.
2. Read and verify the test areas.

Section 9 (Bit 9) - Random Test

1. Randomly write addresses in their address in test areas.
2. Repeat random sequence in 1 above verifying addresses.
3. Randomly generate code to execute a load, store, or no operation (TOV) sequence on a randomly generated address using random data.
4. Execute the generated code.
5. Verify the data.
6. Repeat 4096 times.

MEMORY MAP 4K

0000 – 03FF	RESIDENT PART 1
0400 – 07FF	TEST AREA
0800 – 0BFF	RESIDENT PART 2
0C00 – 0FFF	TEST AREA

MEMORY MAP 8K (LOADED AT 0)

0000 – 03FF	RESIDENT PART 1
0400 – 07FF	
0800 – 0BFF	RESIDENT PART 2
0C00 – 0FFF	
1000 – 13FF	
1400 – 17FF	TEST AREA
1800 – 1BFF	
1C00 – 1FFF	TEST AREA

The test resident and test areas move end around within their respective stacks until all sections have run on all quarters. The resident then moves to the next stack if 8K or to address 0000 if 4K.

BUFFER CONTROLLER MEMORY TEST (MM1)
(Formerly MEMT1)
(FR101/BB104, 1.1 Microsecond)

Operating Procedure

Restrictions

Do not master clear unless the test is in low core and a restart is desired.

General Information

The memory test starts at location 0 upon completion of test loading and master clear.

Loading Procedure

Set the SELECTIVE STOP switch to ON.

Type "AL = 4" or, "EX = 4".

Master Clear and Channel Clear at the Maintenance Console.

Run from location 0000.

Parameters

Test selections and control parameters can be inserted by starting at location 0000 with the A register not equal to zero.

Parameters are preset to run all tests and repeat the section. Halts will occur only on detection of errors.

Procedure

After loading Master Clear, set the HALT on PARITY ERROR switch. If no parameter changes are to be made, run. If parameters are to be entered, set any bit in the A register.

Run. The program will halt at location 0004E. Setting the indicated bits in the A register will select the following:

Bit 15	Test 6 selected
Bit 14	Test 7 selected
Bit 7	Halt at end of section
Bit 6	Halt at end of test
Bit 5	Repeat selected test
Bit 4	8K memory option

After setting bits, run.

NOTE: When selecting the repeat test option, select only one test.

Error Stops

The SELECTIVE STOP switch must be set before running the test. The Selective Stop instruction (SLS) is used for error stops and is assumed to be working.

Two error routines are incorporated in MEMT1: Disturb Error Analysis and Error Analysis.

Disturb Error Analysis

When an error is encountered during a Disturb cycle, this routine is used to display the pertinent data. Two halts take place in this routine. Depending on where the program is resident, X will equal 0 for lower core and 8 for upper core. Z will equal the bank number.

First error halt at locatipn P - ZX96

Register contents:

B1 - Correct word
B2 - Error data
A - Address of error cell

Second error halt at location P - ZX98

A - Current test number

Error Analysis

When an error occurs while reading data, this routine is used to display pertinent data.

First error halt at location P - ZX76

Register contents:

B1 - Correct data
B2 - Error data
A - Address of error cell

Second error halt at location P - ZX84

Register contents:

B1 - Test resident area*
B2 - Testing area*
A - Current test number

NOTE: The error data located in B2 is the logical difference between the correct data word and the incorrect data word. This represents bits picked up or dropped. Therefore, it is possible to determine the incorrect word as follows:

Example:	FFFF	CORRECT DATA	(B1)
	0100	ERROR DATA	(B2)
EXC. OR	----		
	FEFF	ERROR WORD	(IN CORE)

* Lower core - 1; upper core - 2.

Memory parity errors cannot be detected by the software. If the PARITY ERROR switch is in the HALT position, a halt will occur and the operator can manually inspect the following registers.

S - Contains the address of the error cell

X - Contains the error data

To resume testing after a parity error halt, clear the parity error indication and run.

Section Description

This memory test consists of two segments labeled MEMT2 and MEMT1.

MEMT1 contains two comprehensive worst pattern tests.

Test 6 - Parity Plane Test

> Tests the ability of each core in the parity plane to hold zero and one while the rest of the plane holds worst pattern and complement worst pattern.

Test 7 - Worst Pattern Test

> Tests the ability of each location in the test area to hold worst pattern and complement worst pattern while the remainder of the test area holds worst pattern. Each location is tested to hold complement worst pattern and worst pattern while the remainder of the test area holds complement worst pattern.

Both tests use the following disturb method.

> Disturbs are accomplished by reading a combination of locations (Y1) and (Y2). (Y1) is a location that contains all zeros and is in the same inhibit group as location (X) but not on a common drive line with (X). (Y2) has the same specification as (Y1) except that it is on a common drive line with location (X).

Philosophy

The tests in MEMT1 are designed to reside in and test a 4K memory stack. An option is provided to test two 4K stacks or 8K of memory. This option can be expanded to test any number of 4K stacks of the same memory. However, testing will remain the same as if each stack were an individual memory. All tests use a common relocation and error routine. Additional tests can be added provided they conform to the existing concepts, parameters, etc.

Method

The 4K stack is divided into two sections referred to as lower core (0000-07FF) and upper core (0800-0FFF). When the test resides in lower core, upper core will contain the pattern and be tested. The test is then relocated to upper core and then lower core will contain the pattern and be tested.

0000	LOWER CORE	07FF
0800	UPPER CORE	0FFF

BUFFER CONTROLLER MEMORY TEST (MM2)
(Formerly MEMT2)
(FR101/BB104, 1.1 Microsecond)

Operating Procedure

Restrictions

After an error stop, do not Master Clear unless test is resident in quadrant zero, and a restart is desired.

General Information

The memory test starts at location 0 upon completion of test loading and master clear.

Loading Procedure

Set the SELECTIVE STOP switch to ON on the Maintenance Console.

Type "AL = 5" or "EX = 5".

Master Clear and Channel Clear on the Maintenance Console.

Run from location 0000.

Parameters

Test selection and control parameters can be inserted by starting at location 0000 with the A register not equal to zero. Parameters are preset to run all tests and repeat the section. Halts will occur only upon detection of errors.

Procedure

After loading Master Clear, set HALT on PARITY ERROR switch. If no parameter changes are to be made, run. If parameters are to be entered, set any bit in the A register.

Run. The program will halt at location 002C. Setting the indicated bits in the A register will select the following.

NOTE: The 8K memory option must be selected when 8K is available.

Bit 15 Test 1 selected
Bit 14 Test 2
Bit 13 Test 3

Bit 12	Test 4
Bit 11	Test 5
Bit 7	Halt at end of section
Bit 6	Halt at end of test
Bit 5	Repeat selected test
Bit 4	8K memory option

After the A register is set up as desired, run.

NOTE: When selecting the repeat test option, select only one test to run, otherwise the first test selected will be repeated.

Error Stops

The SELECTIVE STOP switch must be set before running the test. The Selective Stop instruction (SLS) is used for error stops and is assumed to be working.

Error Analysis

Upon detection of an error the first of two error halts will occur at location ZX57 (x - 0, 4, 8 or C depending on the quadrant the test resides in at the time and Z - bank number). Pertinent data is displayed in the following registers.

First error halt at location P - ZX57

B2 - Error data
B1 - Correct data
A - Location of error cell

Second error halt at location P - ZX6E

B2 - Number of test quadrant
B1 - Number of quadrant test resides in
A - Number of test running

NOTE: The error data located in B2 after the first halt is the logical difference between the correct data word and the incorrect data word. This represents bits picked up or dropped, therefore, it is possible to determine the incorrect word as follows:

Example 1		012F	Correct data
	EXC. or	1001	Error data (B2)

		112E	Error word (in core)
Example 2		FFFF	Correct data
	EXC. or	0100	Error data

		FEFF	Error word (in core)

After the first halt, returning the switch to RUN will result in the second halt. After the second halt, returning the switch to RUN will resume the testing where it left off.

CAUTION: Do not Master Clear unless test is resident in quadrant 0 and you desire to start over.

NOTE: Error data displayed in B2 represents bits dropped or picked up (failing bits).

A memory parity error indication cannot be sensed by the program. If the PARITY ERROR switch is in the HALT position, a halt will occur on a parity error and the operator can manually inspect the following registers:

S register	Contains the error cell address
X register	Contains the error data

After a parity error halt, clear the parity error and run.

Section Description

This memory test will consist of two segments labeled MEMT2 and MEMT1.

MEMT2 contains five memory quick check tests.

Test 1 - Zeros Test

Tests the ability of locations to hold all zeros.

Test 2 - Ones Test

Tests the ability of all locations to hold all ones.

Test 3 - Address Test

Tests the S register and the ability of each cell, in the test stack, to hold its own address.

Test 4 - Shifting Zeros

Tests the ability of each plane to hold all zeros while the rest of the planes hold all ones.

Test 5 - Shifting Ones

Tests the ability of each plane to hold all ones while the rest of the planes hold all zeros.

Test Philosophy

The tests in MEMT2 are designed to reside in and test a 4K memory stack. An option to test two 4K stacks or 8K of memory is provided. However, testing will remain the same as if each stack were an individual memory. All tests use a common relocation and error routine and all testing is done on a quadrant basis.

Method

The 4K stack is divided into four sections referred to as quadrants. When the test is resident in quadrant 1 a pattern will be written into quadrants 2, 3, and 4. Quadrant 4 will be tested. The test will then be moved to quadrant 2, a pattern will be written into quadrants 1, 3, and 4 and quadrant 3 will be tested; and so on in this manner until all quadrants are tested.

0000			4K Stack
	1	2	
	3	4	0FFF

BUFFER CONTROLLER MEMORY TEST (MY1)
(Formerly BCMY1)
(FV156, 200 Nanosecond Memory)

Operating Procedure

Restrictions

None

General Information

The memory test starts at location 0 upon completion of test loading and master clear. Restart of the test following any stop is accomplished by setting the (P) to location 0.

NOTE: Location 0 may be at 0, 200 hex, 800 hex or at A00 hex depending on where the test is residing at the time it is stopped.

Loading Procedure

Set the SELECTIVE STOP switch on the Maintenance Console

Type "AL = 6" or "EX = 6".

Master Clear and Channel Clear the Maintenance Console.

Run from location 0000.

Parameters

The operator may select certain parameters by enabling SELECTIVE STOP. There are two consecutive parameter stops at which point the operator can select parameters.

The First Stop

(A) = 00XX - 0001 initially
= 00X1 - Stop on error
= 00X2 - Stop at end of section
= 00X4 - Stop at end of test
= 00X8 - Repeat section

The Second Stop

(A) = XXXX - F860 initially
= 8XXX - Addressing test

(A) = 4XXX - Zeros test

= 2XXX - Ones test

= 1XXX - Checkerboard test

= X8XX - Odd parity pattern test

= XX4X - Random data test

= XX2X - Random addressing test

Parameters can also be changed at end of test stop same as in 1 and 2 above.

Error Stops

The SELECTIVE STOP switch must be set before running the test. The Selective Stop instruction (SLS) is used for error stops and is assumed to be working. No programmed stop will occur in test sections 1, 2, 3, or 4 unless a failure is encountered.

On error stops, the following is displayed:

First Stop

A = Address of tested location

B1 = Correct data

B2 = Actual data

Second Stop

A = (PARM001)

B1 = FWA of parameters

B2 = Section number

Section Description

NOTE: All referrals to complemented data are one's complement.

Addressing Test (each location holds its own address)

1. Write up, read up, and check.
2. Write down, read down, and check.

Zeros Test

1. Write zeros in all locations.
2. Read each location three times checking data on the third read.

Ones Test

1. Write ones in all locations.
2. Read each location three times checking data on the third read.

Checkerboard Test

1. Write alternate word lines of AAAA, AAAA, AAAA, AAAA and 5555, 5555, 5555, 5555.
2. Read each location three times checking data on the third read.
3. Complement the pattern and repeat 1 and 2.

Odd Parity Pattern Test (special parity pattern)

1. Write pattern in memory.
2. Read each word three times and check data on the third read.

Random Data (a pass number is available to change the random data generated)

1. Generate and store random data.
2. Read and check data.

Random Addressing

1. Each location has its own address written into it.
2. A group of 32 addresses are formed, read, and checked.
3. Repeat 1 and 2 1000 times.

Sample of Sliding One On Bit Line

```
00100000000000000010
00100000000000000010
00100000000000000010    Across is word line
00100000000000000010
00100000000000000010
00100000000000000010
00100000000000000010
00100000000000000010
```

Up is bit line

Sample of Sliding One On Word Line

```
00000000000000000000
00000000000000000000
00000000000000000000    Across is word line
00000000000000000000
11111111111111111111
00000000000000000000
00000000000000000000
00000000000000000000
```

Up is bit line

Test Layout

Test resides respectively in:

1. Area marked "RES1", testing area marked "TEST1"
2. Area marked "RES2", testing area marked "TEST2"
3. Area marked "RES3", testing area marked "TEST3"
4. Area marked "RES4", testing area marked "TEST4"

SEG1	SEG2	SEG3	SEG4	
03FF RES3 TEST2 0200	07FF RES3 TEST2 0600	0BFF RES4 TEST1 0A00	0FFF RES4 TEST1 0E00	Memory Plane 1
01FF RES1 TEST4 0000	05FF RES1 TEST4 0400	09FF RES2 TEST3 0800	0DFF RES2 TEST3 0C00	Memory Plane 0

BUFFER CONTROLLER MEMORY TEST (MY2)
(Formerly BCMY2)
(FV156, 200 Nanosecond Memory)

Operating Procedure

Restrictions

None

General Information

The memory test starts at location 0 upon completion of test loading and master clear. Restart of the test following any stop is accomplished by setting the (P) to location 0.

NOTE: Location 0 may be at 0, 200 hex, 800 hex or at A00 hex depending on where the test is residing at the time it is stopped.

Loading Procedure

Set the SELECTIVE STOP switch on the Maintenance Console.

Type "AL = 7" or "EX = 7".

Master Clear and Channel Clear the Maintenance Console.

Run from location 0000.

Parameters

There are two consecutive parameter stops at which point the operator can select parameters.

On the First Stop -

(A) = 00XX - 0001 initially
= 00X1 - Stop on error
= 00X2 - Stop at end of section
= 00X4 - Stop at end of test
= 00X8 - Repeat section

On the Second Stop -

(A) = XXXX - 0780 initially
= X4XX - Sliding one, then zero on bit line
= X2XX - Sliding one, then zero on word line
= X1XX - Disturb test
= XX8X - Disturb complement test

Parameters can also be changed at end of test stop same as in 1 and 2 above.

Error Stops

The SELECTIVE STOP switch must be set before running the test. The Selective Stop instruction (SLS) is used for error stops and is assumed to be working. No programmed stop will occur in test sections 1, 2, 3, or 4 unless a failure is encountered.

On error stops, the following is displayed:

First Stop

A = Address of tested location
B1 = Correct data
B2 = Actual data

Second Stop

A = (PARM001)
B1 = FWA of parameters
B2 = Section number

Section Description

NOTE: All referrals to complemented data are one's complement.

BCMY2 Test Sections

Sliding One, Then Zero on Bit Line Test

Sliding One

1. One of the 16 bit lines of a word on a word line is set to one, the other bits in that word are set to zero.
2. The same pattern is repeated for the other three words on the word line and throughout the portion of memory being tested.

3. Read data and check it.
4. Shift pattern to other 15 bit positions and repeat 1, 2, and 3

Sliding One, Then Zero on Word Line

Sliding One

1. The portion of memory being tested is set to all zeros.
2. Set one entire word line to all ones.
3. Read word line of all ones and check data.
4. Repeat 1, 2, and 3 with next word line set to all ones.

Sliding Zero (same as sliding one with complement data)

Disturb Test (each location X is tested as follows)

1. Write X with all ones, 1000 times.
2. Write (X-1) and (X+1) locations with zeros 1000 times each alternating between the two.
3. Write X with zeros.
4. Write (X-1) and (X+1) with ones, 1000 times alternating between the two.
5. Location X is quickly read out and checked.

Disturb Test Complement

Same as Disturb Test with complemented data.

BUFFER CONTROLLER MEMORY TEST (BCM)
(Formerly BCMY4)

Operating Procedure

Restrictions

None

General Information

The memory test starts at location 0 upon completion of test loading and master clear. Restart of the test following any stop is accomplished by setting the (P) to location 0.

NOTE: Location 0 may be at 0, 200 hex, 800 hex or A00 hex depending on where the test is residing at the time it is stopped.

BCM is the same as BCMY4 the Word Organized Memory Test.

Loading Procedure

Set the SELECTIVE STOP switch on the Maintenance Console.

Type "AL = 8" or "EX = 8".

Master Clear and Channel Clear the Maintenance Console.

Run from location 0000.

Parameters

Parameters start at address 2:

PARM001 Preset to 4600 Hex

- Bit 1 = Stop at end of test (4XXX)
- Bit 3 = Stop at end of section (1XXX)
- Bit 5 = Stop on error (X4XX)
- Bit 6 = Run 8K on second pass (X2XX)
- Bit 11 = Repeat section (XX1X)

PARM002 Preset to 7800 Hex

- Bit 0 = Not used
- Bit 1 = Section 1 (digit noise)
- Bit 2 = Section 2 (sliding one, then zero)
- Bit 3 = Section 3 (add one, FFFF times)
- Bit 4 = Section 4 (word line disturb)

Error Stops

The SELECTIVE STOP switch must be set before running the test. The Selective Stop instruction (SLS) is used for error stops and is assumed to be working. No programmed stop will occur in test sections 1, 2, 3, or 4 unless a failure is encountered.

When running from SMM 6000 or 7000, the section counter will stop incrementing when an error occurs.

On error stops, the following is displayed:

First Stop

A = Address of tested location
B1 = Correct data
B2 = Actual data

Second Stop

A = (PARM001)
B1 = FWA of parameters
B2 = Section number

Section Description

NOTE: All referrals to complemented data are one's complement.

BCM Test Sections

Digit Noise Test (Attempt to generate noise on digit current turnoff, thereby causing a failure on the next Read operation.)

1. Store all ones in memory portion to be tested.
2. Store all zeros in same memory segments but in the other memory plane.
3. Store all zeros in memory word (X).

4. Store Load A (X) instruction on the same word line as (X).
5. Jump to Load instruction stored in 4 above, read and check data.
6. When each location has been tested, repeat 1 through 5 using complemented data.

Sliding One, Then Zero in One Word Test -

1. Store all zeros in memory.
2. Store all in location (X).
3. Read and write location (X) three times (check data on last read).
4. Shift data left one place in location (X).
5. When each location has been tested, repeat 1 through 4 using complemented data.

Add One, FFFF times, to each location. No data check is done. Parity error stop is expected if a memory problem exists.

Word Line Disturb Test

1. Write all ones in the first test segment.
2. Write all ones in the corresponding non-test segment.
3. Write the first test location 100 times using the same pattern of step 1.
4. Store the complement of step 3 at the test location.
5. Disturb memory by performing a 2-instruction loop 100 times.
6. Read and check the test location.
7. Restore the test location with the original pattern.
8. Repeat steps 3 through 7 for each of 200 hex test locations.
9. Repeat steps 3 through 8 with the complement patterns.
10. Calculate the word line address. Use the address of the store instruction of step 4 to define a corresponding location within the non-test segment.
11. Store the complement of the contents of the word line address at the word line address.
12. Repeat steps 3 through 9.
13. Repeat steps 1 through 12 using the following patterns for steps 1 and 2.

Step	Test Segment Pattern	Non-Test Segment Pattern
A	All Ones	All Zeros
B		

Step	Test Segment Pattern	Non-Test Segment Pattern
A	All Zeros	
B		All Ones
A	All Zeros	
B		All Zeros

14. Repeat steps 1 through 13 for the second segments.

15. Relocate test.

Sample of Sliding One On Bit Line

```
00100000000000000010
00100000000000000010
00100000000000000010      Across is word line
00100000000000000010
00100000000000000010
00100000000000000010
00100000000000000010
00100000000000000010
```

Up is bit line

Sample of Sliding One On Word Line

```
00000000000000000000
00000000000000000000
00000000000000000000      Across is word line
00000000000000000000
11111111111111111111
00000000000000000000
00000000000000000000
00000000000000000000
```

Up is bit line

Test Layout

Test resides respectively in:

1. Area marked "RES1", testing area marked "TEST1"

2. Area marked "RES2", testing area marked "TEST2"

3. Area marked "RES3", testing area marked "TEST3"

4. Area marked "RES4", testing area marked "TEST4"

SEG1	SEG2	SEG3	SEG4	
03FF RES3 TEST2 0200	07FF RES3 TEST2 0600	0BFF RES4 TEST1 0A00	0FFF RES4 TEST1 0E00	Memory Plane 1
01FF RES1 TEST4 0000	05FF RES1 TEST4 0400	09FF RES2 TEST3 0800	0DFF RES2 TEST3 0C00	Memory Plane 0

S No.	Stored In BC At*	1700 Expects	Comments
	000		Number of captured status words in the BC
01	001	FF80	First capture depicting coupler not ready
02	002	FF89	Coupler ready/data time out
03	003	FF81	Coupler ready, data time out cleared
04	004	FF80	Coupler ready cleared
05	005	FF84	Director 1 A = 1 causing clear coupler status
06	006	FF80	Clear above
07	007	FFA3	Director 2 A = 1 clear coupler
08	008	FF80	Clear above
09	009	FFB3	Director 3 A = 1/clear coupler
10	00A	FF80	Clear above
11	00B	FFC3	Director 4 A = 1/clear coupler
12	00C	FF80	Clear above
13	00D	FFD3	Director 5 A = 1/clear coupler
14	00E	FF80	Clear above
15	00F	FFE3	Director 6 A = 1/clear coupler
16	010	FF80	Clear above
17	011	FFF3	Director 7 A = 7/clear coupler
18	012	0000	Status extension area
19	013	0000	Status extension area
20	014	0000	Status extension area

* The actual status may be examined in the buffer controller should it not be transferred to the 1700. Three conditions can cause the data not to be shipped back to the 1700:

1. The EOP/Alarm interrupts did not issue to the 1700 (step the 1700 and status the coupler via Director 1) or coupler busy did not set on Director 2 in the 1700. Both of these conditions will not give any coupler status (junk at 02 - 14).
2. A Director 7 with A = 7 was never received (coupler status list incomplete).
3. The status was taken and an attempt to ship was made but the Data interrupt failed.

** A Director 7 or A = 7 is sufficient to terminate the coupler status collection and force the return of the status to be 1700.

Figure 1. Coupler Status

		BD	EX=X	TB	AL=X	EX=X	DL	EX=X	TL	EX=X	EL	EX=X	TU	EX=X	AL=X	
			/			/		X		/		X				A/L JUMP TO LOADER
			X			/		/		X		/		\		A/L LOADER
					X										X	A/L PROGRAM
		\														A/L DUMP
				X					X				X			MOD. LOADER
									X				X			DISABLE LOADER LOAD.
							X									DISABLE A/L
				X							X					ENABLE A/L
						X		X				X				ASSUMES LOADER IN
			\			\		\		\		\		\		EOP INT. CHECK
			\			\		\		\		\		\		ALARM INT. CHECK
		\	\		\	\		\		\		\		\	X	DIRECTOR 8 & 9 CHECK
			\		/	\		\		\		\		\	/	DIRECTOR 0→7 CHECK
			\			\		\		\		\		\		COUPLER STAT. CHECK
			\			\		\		\		\		\		INTERRUPT STAT. CHECK
			\			\		\		\		\		\		CHECK BLK. CH. $2^0 \rightarrow 2^{15}$ IN
			X			X		X		/		/		X		CHECK BLK. CH. OUT $2^0 \rightarrow 2^7$
			X			/		/		X		X		X		CHECK BLK. CH. OUT $2^8 \rightarrow 2^{15}$
			\			\		\		\		\		\		LOADS PROGRAM
			\			\		\		\		\		\		VERIFIES DATA TRANS.
			\			\		\		\		\		\		CHECK B. C. CH. 1
			\			\		\		\		\		\		DATA INTERRUPT CHECK
						X		X				X				SEE NOTE 1

LEGEND

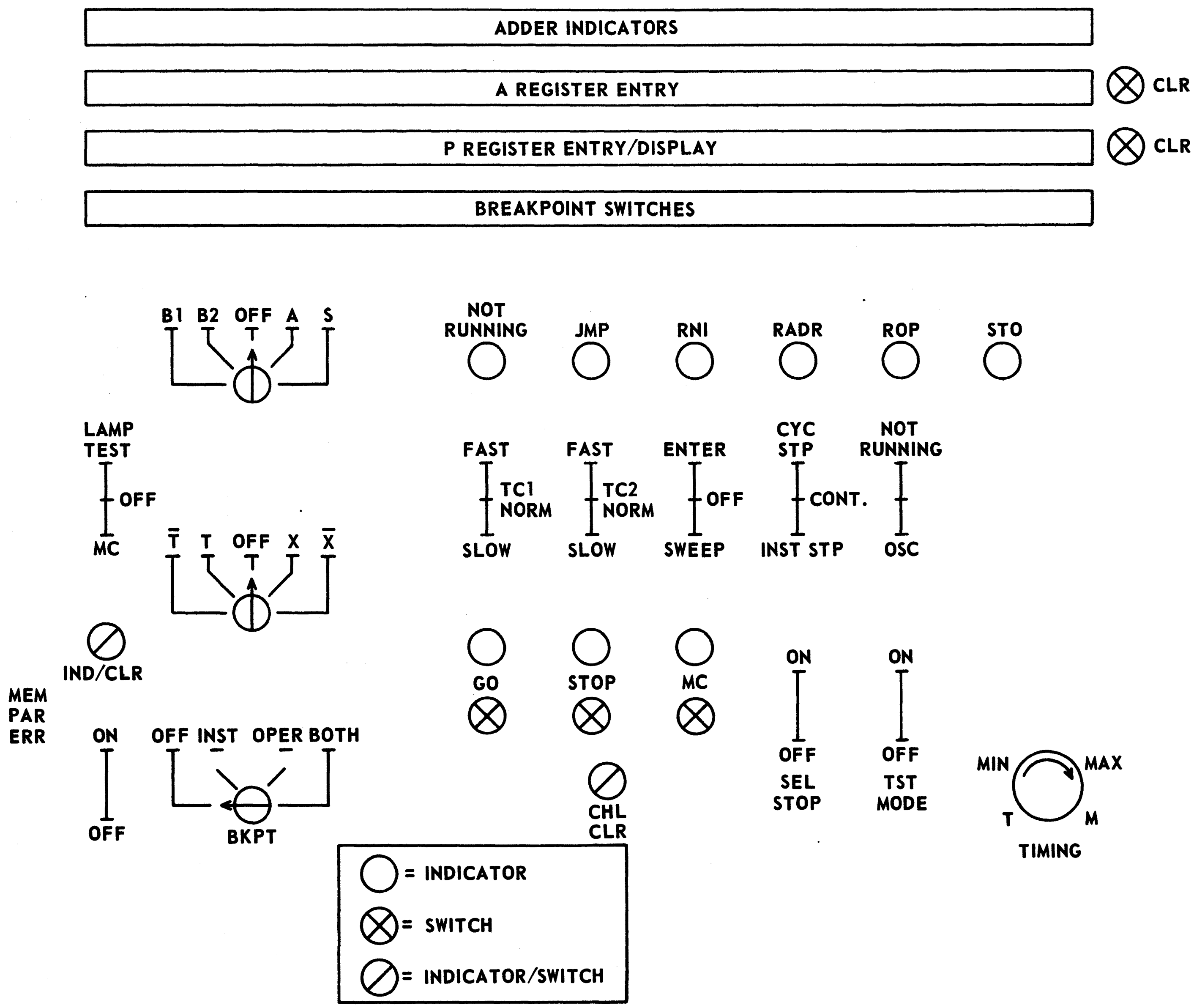
☐ = NOT USED

\ = USED

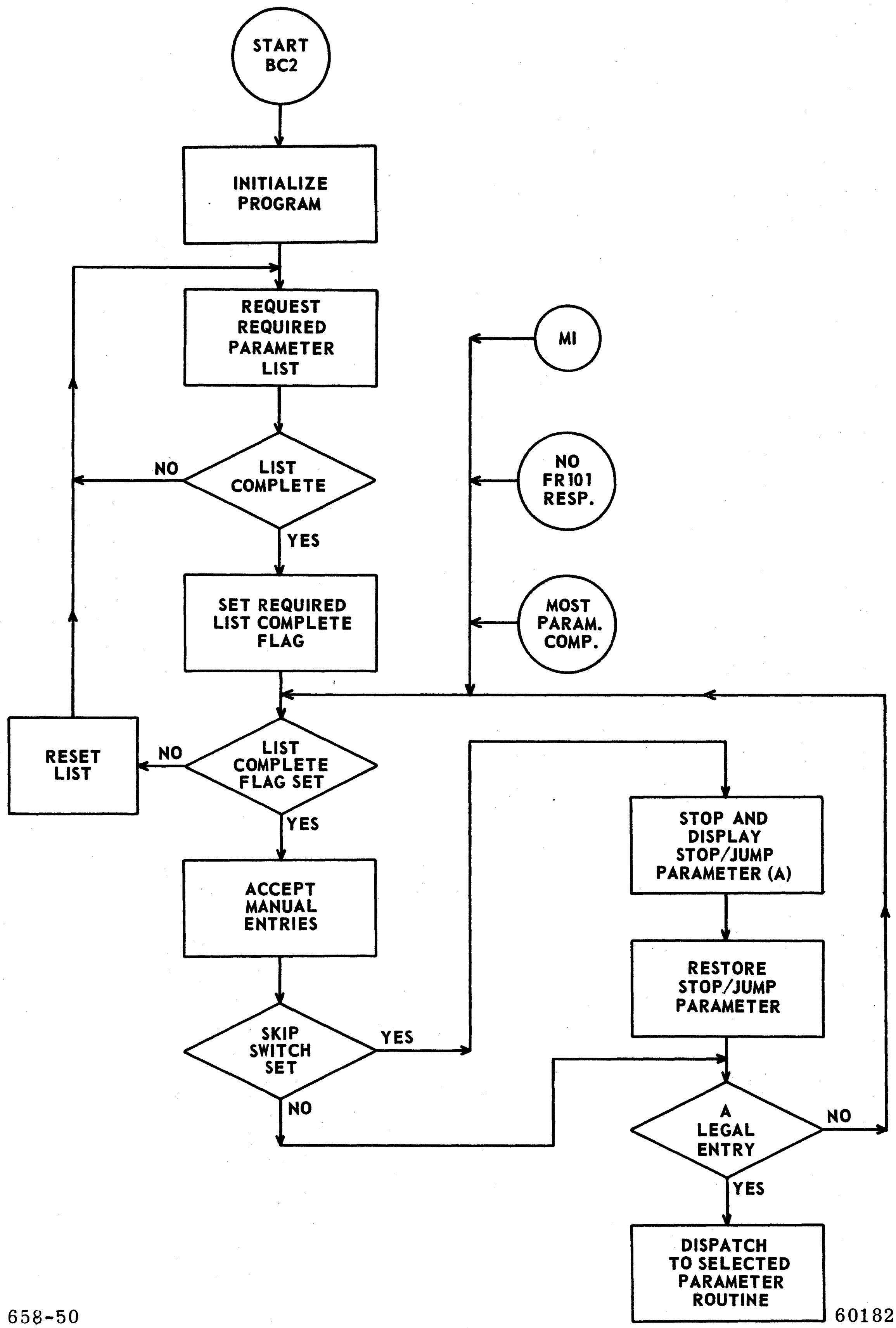
/ = NOTICE

NOTE 1: THIS PATTERN ASSUMES THAT THE PROPER LOADER WAS LOADED VIA THE MAINTENANCE CONSOLE.

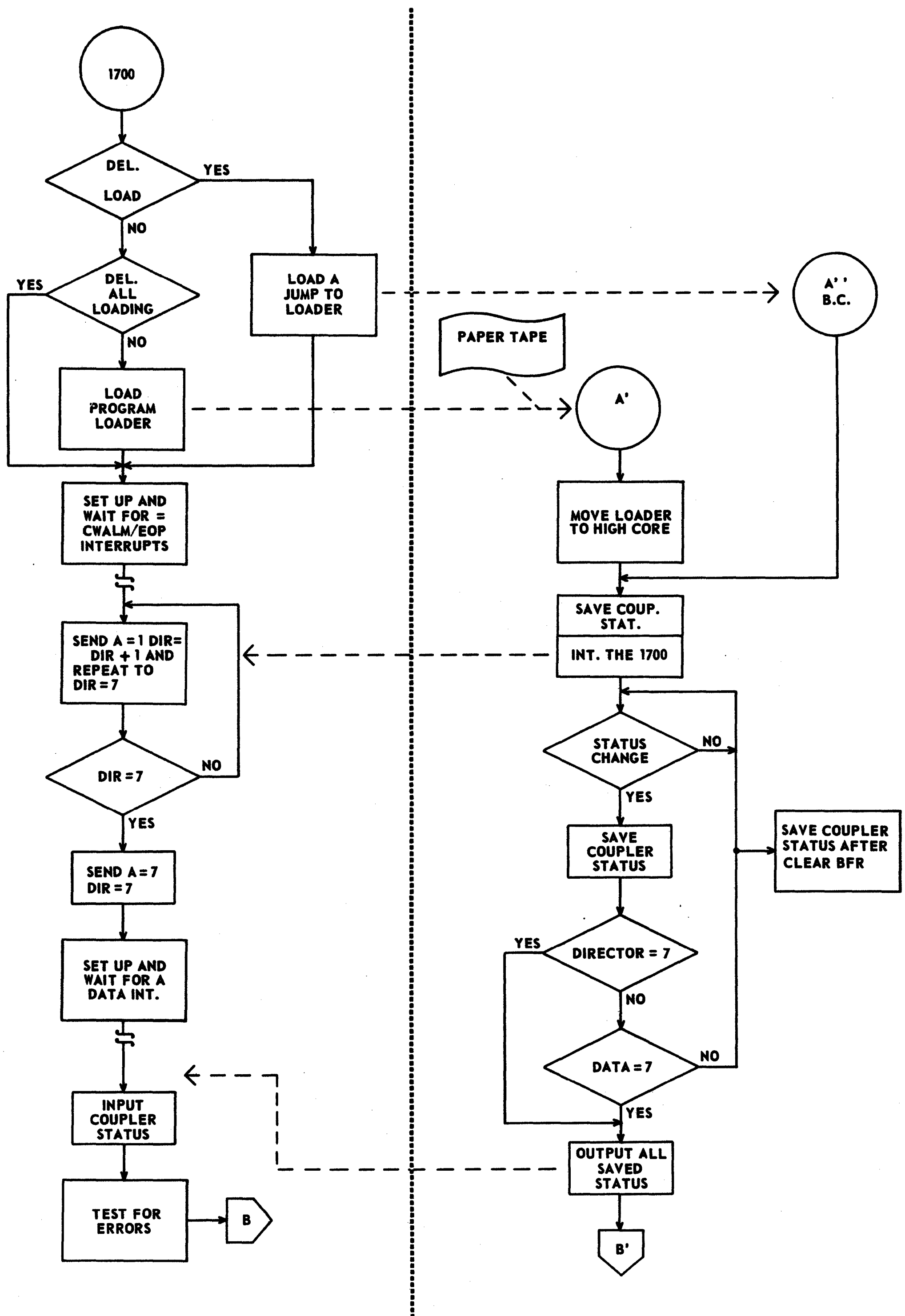
FIGURE 2

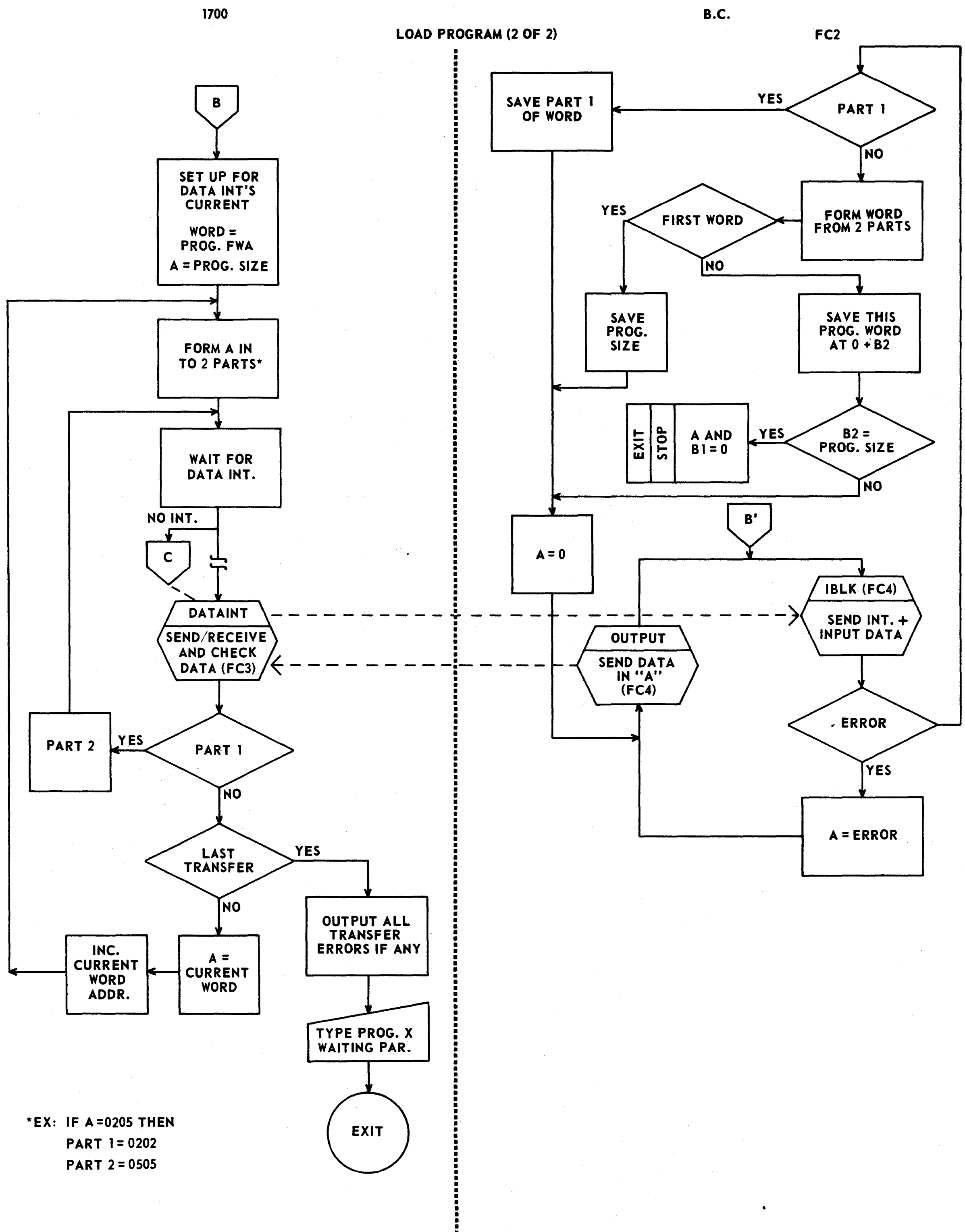

ADDER INDICATORS
A REGISTER ENTRY
CLR
P REGISTER ENTRY/DISPLAY
CLR
BREAKPOINT SWITCHES
B1 B2 OFF A S
NOT RUNNING
JMP
RNI
RADR
ROP
STO
LAMP TEST
OFF
MC
FAST
TC1 NORM
SLOW
FAST
TC2 NORM
SLOW
ENTER
OFF
SWEEP
CYC STP
CONT.
INST STP
NOT RUNNING
OSC
$\overline{T}$ T OFF X $\overline{X}$
IND/CLR
GO
STOP
MC
MEM PAR ERR
ON
OFF
OFF INST OPER BOTH
BKPT
CHL CLR
ON
OFF
SEL STOP
ON
OFF
TST MODE
MIN
MAX
T
M
TIMING
= INDICATOR
= SWITCH
= INDICATOR/SWITCH

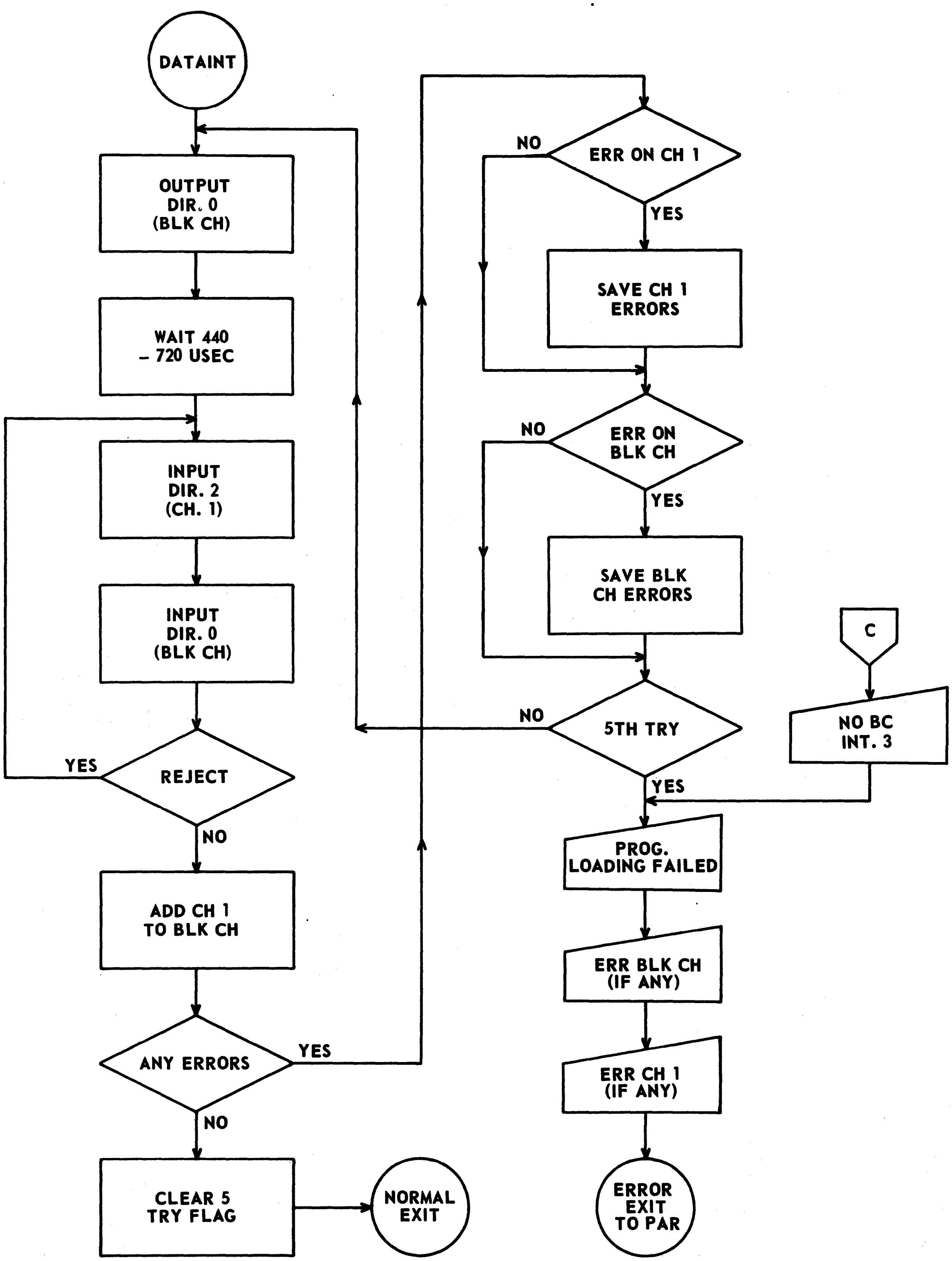
658-19

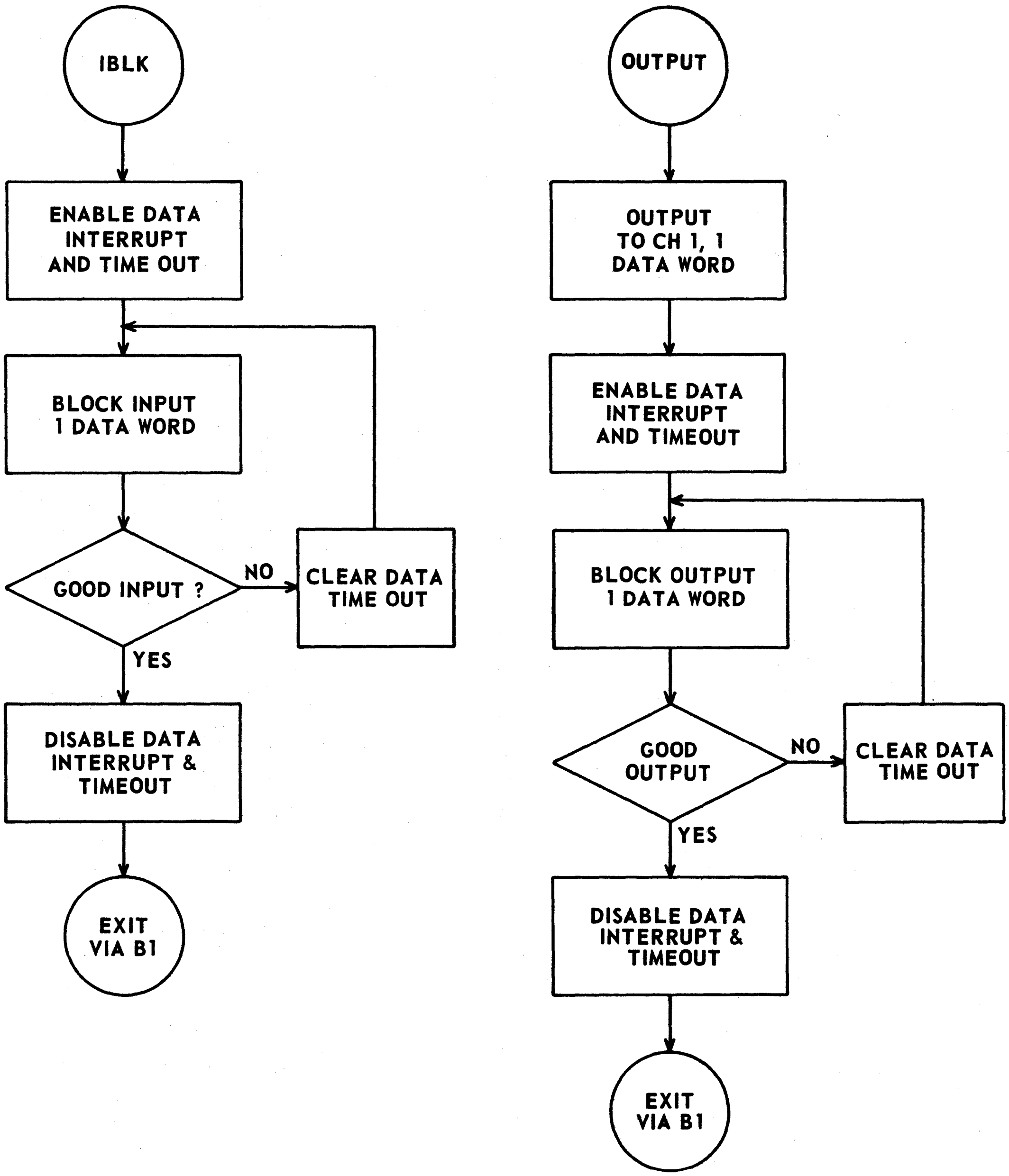


START BC2
INITIALIZE PROGRAM
REQUEST REQUIRED PARAMETER LIST
LIST COMPLETE
NO
YES
SET REQUIRED LIST COMPLETE FLAG
MI
NO FR101 RESP.
MOST PARAM. COMP.
LIST COMPLETE FLAG SET
NO
RESET LIST
YES
ACCEPT MANUAL ENTRIES
SKIP SWITCH SET
YES
NO
STOP AND DISPLAY STOP/JUMP PARAMETER (A)
RESTORE STOP/JUMP PARAMETER
A LEGAL ENTRY
NO
YES
DISPATCH TO SELECTED PARAMETER ROUTINE


1700
DEL. LOAD
YES
NO
LOAD A JUMP TO LOADER
A'' B.C.
DEL. ALL LOADING
YES
NO
PAPER TAPE
LOAD PROGRAM LOADER
A'
MOVE LOADER TO HIGH CORE
SET UP AND WAIT FOR = CWALM/EOP INTERRUPTS
SAVE COUP. STAT.
INT. THE 1700
SEND A = 1 DIR= DIR + 1 AND REPEAT TO DIR = 7
STATUS CHANGE
NO
YES
DIR = 7
NO
YES
SAVE COUPLER STATUS
SAVE COUPLER STATUS AFTER CLEAR BFR
SEND A = 7 DIR = 7
DIRECTOR = 7
YES
NO
SET UP AND WAIT FOR A DATA INT.
DATA = 7
NO
YES
INPUT COUPLER STATUS
OUTPUT ALL SAVED STATUS
TEST FOR ERRORS
B
B'


1700
LOAD PROGRAM (2 OF 2)
B.C.
FC2
B
SET UP FOR DATA INT'S CURRENT
WORD = PROG. FWA
A = PROG. SIZE
FORM A IN TO 2 PARTS*
WAIT FOR DATA INT.
NO INT.
C
DATAINT
SEND/RECEIVE AND CHECK DATA (FC3)
PART 2
YES
PART 1
NO
LAST TRANSFER
YES
NO
INC. CURRENT WORD ADDR.
A = CURRENT WORD
OUTPUT ALL TRANSFER ERRORS IF ANY
TYPE PROG. X WAITING PAR.
EXIT
*EX: IF A=0205 THEN
PART 1 = 0202
PART 2 = 0505
SAVE PART 1 OF WORD
YES
PART 1
NO
YES
FIRST WORD
FORM WORD FROM 2 PARTS
NO
SAVE PROG. SIZE
SAVE THIS PROG. WORD AT 0 + B2
EXIT
STOP
A AND B1 = 0
YES
B2 = PROG. SIZE
NO
B'
A = 0
IBLK (FC4)
SEND INT. + INPUT DATA
OUTPUT
SEND DATA IN "A" (FC4)
ERROR
YES
A = ERROR


DATAINT
OUTPUT DIR. 0 (BLK CH)
WAIT 440 - 720 USEC
INPUT DIR. 2 (CH. 1)
INPUT DIR. 0 (BLK CH)
REJECT
YES
NO
ADD CH 1 TO BLK CH
ANY ERRORS
YES
NO
CLEAR 5 TRY FLAG
NORMAL EXIT
ERR ON CH 1
NO
YES
SAVE CH 1 ERRORS
ERR ON BLK CH
NO
YES
SAVE BLK CH ERRORS
5TH TRY
NO
YES
C
NO BC INT. 3
PROG. LOADING FAILED
ERR BLK CH (IF ANY)
ERR CH 1 (IF ANY)
ERROR EXIT TO PAR


IBLK
ENABLE DATA INTERRUPT AND TIME OUT
BLOCK INPUT 1 DATA WORD
GOOD INPUT ?
NO
CLEAR DATA TIME OUT
YES
DISABLE DATA INTERRUPT & TIMEOUT
EXIT VIA B1
OUTPUT
OUTPUT TO CH 1, 1 DATA WORD
ENABLE DATA INTERRUPT AND TIMEOUT
BLOCK OUTPUT 1 DATA WORD
GOOD OUTPUT
NO
CLEAR DATA TIME OUT
YES
DISABLE DATA INTERRUPT & TIMEOUT
EXIT VIA B1

1700 SOURCE/6000 LISTING UPDATE

BC2 UPD Test No. 5E

CAUTION

This test is not modified to run under SMM17 Version 3.0, and must be run under Version 2.3 until further notice.

I. OPERATIONAL PROCEDURE

A. RESTRICTIONS

1. Does not run with SMM17. Uses are for loading only.
2. Requires 2 tape units and 1 teletype.
3. Requires that the 1700 source be at load point and end with an EOF mark.
4. Requires that the 6000 listing tape be at load point on its tape.
5. Requires special control cards in the 1700 source prior to a run with this program (Figure 1 types 5 and 6).
6. Updates only 1 program at a time.
7. Set P=2 and run to reload SMM17.

B. LOADING PROCEDURES

1. Standard SMM17 call.
2. Test number 5E.

C. PARAMETERS

1. Entry via teletype (see II B).

D. OPERATING INSTRUCTIONS

1. Load UPD via SMM17 operation instructions.
2. Mount a scratch tape on TU1.
3. Mount 1700 source tape on TU0.
4. Respond to teletype requests (see II B).
5. When TU0 rewinds, unload (if using a 2 tape system) and mount the 6000 listing tape on TU0. Change TU0 - TU2. Depress and release the SKIP switch.

6. When the teletype goes back to request entries again, the job is complete and TU1 is holding the new source tape.

II. MESSAGES

A. NORMAL MESSAGES

1. None

B. COMMAND MESSAGES

1. MT0=ICE, MT1=ICE, MT2=ICE
XXX YYY ZZZ

   This message is requesting the interrupt line, converter number, and equipment number respectively for tape units (TU)0, 1, and 2 respectively.

2. BC NAME = AAAAAAAA

   This message is requesting a name of up to 8 characters (less with a carriage return) which exactly matches the name in the 1700 source special control cards (Figure 1 types 5 and 6).

C. ERROR MESSAGES

1. None

	01	03	07	11	17	18	26	30	35	41 … 72
1	*	REMARKS CARDS								
2		NUM	$HHHHH	AAA	SSSSSSSS		OOO	RRRRRRRRR		COMMENTS
				NLST						
3		NUM	$00000							
		NUM	$10000							
		NUM	$00000							
				LST						
4				EJT						
	*			NN NNNNNNN				PAGE	NNNN	
5*	*			STRT		NNNNNNNN				
6*	*			END		NNNNNNNN				

*These types are not made by the Edit program (in 1700 source).

The above shows the types of cards generated by the BC2 Edit program (SE).

The program is extracted from a 6000 External Listing tape of the TVC assembly and inserted between type 5 and 6 cards bearing the same name as on those cards and specified by teletype. Up to an 8-character name is permitted. Types 5 and 6 are 1700 rem cards and inserted in the 1700 source some time prior to the use of BC2 Edit. The following is a list of the types generated for the respective TVC code:

TVC	GENERATES TYPE
Page eject	4
Rem card	1
BSS card/ORG card	1 for the statement, 3 with as many NUM $0000 as necessary to fill the block requirement.
INST. card	2
END card	1
TIME and all other non instruction types	
CON/code types	2

Figure 1.

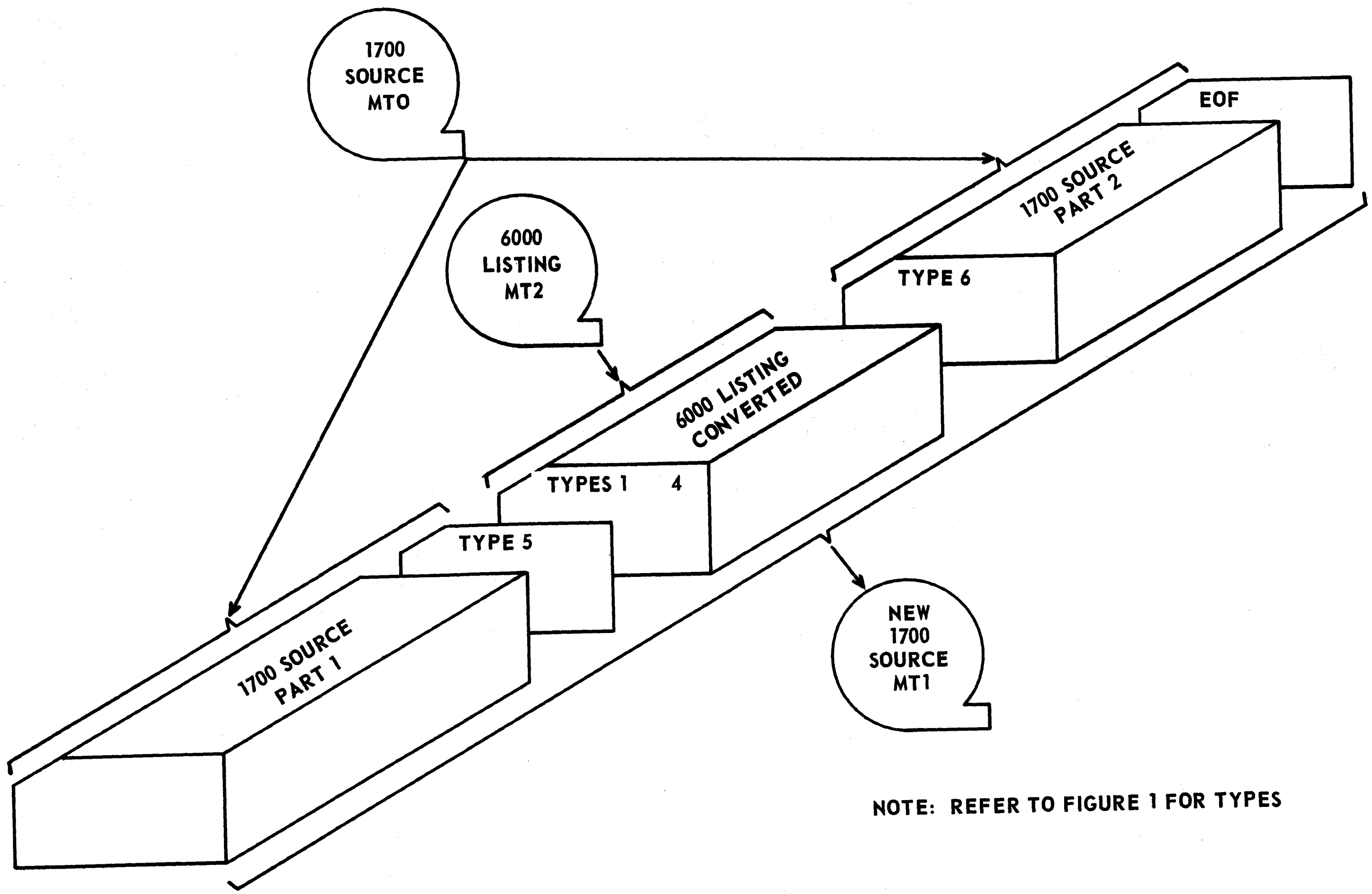

1700
SOURCE
MTO
6000
LISTING
MT2
EOF
1700 SOURCE
PART 2
TYPE 6
6000 LISTING
CONVERTED
TYPES 1 4
TYPE 5
1700 SOURCE
PART 1
NEW
1700
SOURCE
MT1
NOTE: REFER TO FIGURE 1 FOR TYPES

Figure 2

1700/FR101/955 TRANSPORT TEST

(RX4A34 Test No. 34)

I. OPERATING PROCEDURE

A. RESTRICTIONS

1. Requires an 8K 1700 with a 608 or 609 MT and a TTY.
2. The diagnostic interfaces to SMM17 only for loading.
3. Test parameters are accepted only from TTY.
4. Manual parameters must be terminated with the BC equipment code.
5. Entries performed after a parameter request must be terminated with a CR.
6. The test may not be run in an off-line mode unless the system includes a maintenance console.

B. RX4 LOADING PROCEDURE

The standard SMM17 calls as test number 34. See Table 1 for loading pro- edure. Following the initial test typeout (BEGIN RX4A34 REV X.X V.X.X IA = XXXX), the program will request module selection by typing:

SMX=Y

The operator should now define the BC equipment code (X) before selecting the desired module (Y).

Module 1 = Optical Dump and Stepping Accuracy Test

Module 2 = Hand Print Space/Input Channel 7 Exerciser

After module selection the program will request the BC interrupt line by typing:
BIX = Y

The operator should now define the interrupt line (Y) for the BC X.

TABLE 1. RX-4 STANDARD LOADING PROCEDURE

Step	Procedure
	NOTE Manual parameter entries following the "=" sign at the TTY must be terminated by a carriage return. The asterisk (*) equals buffer controller equipment code selected.
1	Ensure that system is energized.
2	Set EQUIPMENT SELECT switches at rear of buffer controller to selected equipment code (1 to F).
3	Open rear door of tape controller and set EQUIPMENT switch to 7.
4	At tape transport, set UNIT SELECT switch to 0. Mount SMM17 controlware maintenance tape and position to load point.
	NOTE Perform step 5 only if two tape transports are available. If only one tape transport is available, proceed to step 6.
5	At second tape transport, set UNIT SELECT switch to 1. Mount SMM17 auxiliary test tape and position to load point.
6	Set CLEAR. Press P REGISTER SELECT pushbutton. Set 1FC0 (0001 1111 1100 0000) into Display register.

TABLE 1. RX-4 STANDARD LOADING PROCEDURE (Cont'd)

Step	Procedure
7	Press X REGISTER SELECT pushbutton. Set ENTER. Set SELECTIVE STOP. Enter SMM17 bootstrap program instructions (see SMM17 Reference Manual) as follows: a. Set instruction into Display register b. Set STEP c. Press CLEAR pushbutton d. Repeat until all instructions are entered.

TABLE 1. RX-4 STANDARD LOADING PROCEDURE (Cont'd)

Step	Procedure
	Set ENTER SWEEP switch to center position. Set CLEAR.
8	Press P REGISTER SELECT pushbutton. Set 1FCO (001 1111 1100 0000) into Display register. Set SELECTIVE STOP and SELECTIVE SKIP switches. Set RUN.
9	Press Q REGISTER SELECT pushbutton. Set 0205 (0000 0010 0000 0101) into Display register. Set RUN.
10.	Press AQ REGISTER SELECT pushbutton. Set 30B0 0011 0000 1011 0000) into Display register. Set SELECTIVE SKIP switch to center position. Set RUN.
11.	TTY prints SMM17 VER X.X
12.	Press A REGISTER SELECT pushbutton. Set 3401 (0011 0100 0000 0001) into Display register. Set RUN.
13.	Press A REGISTER SELECT pushbutton. Set 0000 (0000 0000 0000 0000) into Display register. Set RUN.

TABLE 1. RX-4 STANDARD LOADING PROCEDURE (Cont'd)

Step	Procedure
14.	TTY prints BEGIN RX-4 1700/FR101/955 TRANSPORT TEST IA-XXX. Prints SM*. Type selected buffer controller equipment code (1 to F).
15.	TTY prints =. Type number of module test to be performed (1 to 2).
16.	TTY prints BI*=. Type interrupt line for selected buffer controller (1 to F).
17.	TTY prints NEXT. Type AP*.
18.	TTY prints NEXT. NOTE Perform step 19 only if SMM17 auxiliary test tape is not loaded. If two tape transports are available and SMM17 auxiliary test tape is already loaded (step 5), proceed to step 20.
19.	At tape transport, set UNIT SELECT switch to 1. Mount RX4 auxiliary test tape and position to load point.
20.	If the tape transport is a 659: Type TD* TTY prints = Type 659 TTY prints 3518 #= Type 3518 equipment number (1-7).
21.	Type AL*.
22.	TTY prints =. Type H (hardware) or S (controlware). Program autoloads selected module to buffer controller.

TABLE 1. RX-4 STANDARD LOADING PROCEDURE (Cont'd)

Step	Procedure
23.	TTY prints THE BC IS LOADED if autoload was successful. If autoload failed, TTY prints CHECKSUM ERROR, or BC does not respond.

NOTE

RX-4 standard loading procedure complete. Proceed to appropriate module test operating procedure as follows:

Module 1 - Section I. D.
Module 2 - Hand Print Space/Input Channel 7 Exerciser

C. MODULE AUTOLOAD PROCEDURE

1. Select Automatic Parameter (AP*)
   Upon selection the program will set up the standard I/O equipment table (see Table 2) and the automatic parameter table for the selected module. See Table 3 for module 1.

   The standard I/O equipment table and the automatic parameter table assigned to the selected module may be changed at any time by using the MI (Manual Interrupt) button on the TTY. The program upon sensing the MI button depressed will respond with:
   NEXT

   The operator should now define a parameter.
   See Table 4 for common manual parameters.
   See Table 5 for module 1 manual parameters.

2. Select autoload parameter (AL*). See Table 5. The program will now autoload the selected module to the BC and will respond with an appropriate message to informing the autoload status.

TABLE 2. STANDARD I/O EQUIPMENT TABLE

MTI	E= 7, I = 7, M= B, F = 466, C= 0, U = 1.
MTO	E= 7, I = 7, M= B, F = 466, C= 0, U = 1.
LP	E = 4

Common Automatic Parameters

Output Device = TTY

Output Level = Normal

Repetitions = Zero (Run test indefinite)

E = Equipment

I = Interrupt

M = Mode

F = Format

C = Converter

U = Unit

TABLE 3. AUTOMATIC PARAMETERS

MODULE 1

a.	Black fill-disabled	(BF*=0)
b.	Character peak = A	(CP*=A)
c.	Document position = 544 mils	(DP*=544)
d.	Dwell time = 32 milliseconds	(DT*=32)
e.	Final coordinate = 50_{16}	(FC*=50)
f.	Font enable = ANSI	(FE*=FE00)
g.	Forward step = 1/3 inch or 336 mils	(FS*=336)
h.	Horizontal line thicken = disabled	(HT*=0)
i.	Initial read coordinate = 2A	(IC*=2A)
j.	Character image width = 22 columns	(IW*=22)
k.	Optical dump mode = reject	(OD*=R)
l.	Quantize level = 78	(QL*=78)
m.	Steps per page = 32	(SP*=32)
n.	Subtest number 5 optical dump	(ST*=5)
o.	Transport speed = 20 IPS	(TS*=20)
p.	Vertical line thicken = 30	(VT*=30)

MODULE 2

a.	Black fill=disabled	(BF*=0)
b.	Character peak = A	(CP*=A)
c.	Document position = 544	(DP*=544)
d.	Final coordinate = A0	(FC*=A0)
e.	Font enable = FE00	(FE*=FE00)
f.	Forward step = 0	(FS*=0)
g.	Horizontal line thicken = disabled	(HT*=0)
h.	Initial read coordinate = 2A	(IC*=2A)
i.	Quantize level = 78	(QC*=78)
j.	Steps per page = 32	(SP*=32)
k.	Subtest number = 1	(ST*=1)
l.	Transport speed = 0	(TS*=0)
m.	Vertical line thicken = 30	(VT*=30)
n.	Dump mode	(DM*=0)

*Buffer controller equipment code.

TABLE 4. COMMON MANUAL PARAMETERS

1. AL*= Autoload module to FR101
2. AP* = Automatic parameters
3. BD* = Buffer controller dump
4. BE* = Buffer controller equipment
5. BI* = Buffer controller interrupt
6. DR* = Data receive from controller
7. DS* = Data send to controller
8. EC* = Enable controller communication (On-line mode)
9. EO* = Enable output
10. EX* = Execute test
11. ME* = Mag. tape equipment
12. MI* = Mag. tape interrupt
13. OM* = Output to mag. tape
14. OP* = Output to printer
15. OT* = Output to TTY
16. PE* = Printer equipment
17. RE* = Repetitions
18. SC* = Suppress communication (Off-line mode)
19. SM* = Select module
20. SO* = Suppress controller output
21. TC* = Mag. tape converter
22. TN* = Mag. tape unit number
23. LI* = List captured video data images from mag. tape
24. ID* = Dump captured video data images from mag. tape

---

* Buffer controller equipment code. For more detailed information see Table 6.

TABLE 5. MANUAL PARAMETERS LOOK UP TABLE

MODULE 1

1.	BF*	Black fill
2.	CP*	Character peak
3.	DP*	Document position
4.	DT*	Dwell time
5.	FC*	Final read coordinate
6.	FE*	Font enable
7.	FS*	Forward step
8.	HT*	Horizontal line thicken
9.	IC*	Initial read coordinate
10.	IW*	Image width
11.	OD*	Optical dump
12.	QL*	Quantize level
13.	RS*	Reverse step
14.	SP*	Steps per page
15.	ST*	Subtest select
16.	TS*	Transport speed
17.	VT*	Vertical line thicken
18.	ER*	Electronically read captured video data

MODULE 2

1.	BF*	Black fill
2.	CP*	Character peak
3.	DM*	Dump mode
4.	DP*	Document ready position
5.	FC*	Final read coordinate
6.	FE*	Font enable
7.	FS*	Forward step distance
8.	HT*	Horizontal line thicken
9.	IC*	Initial read coordinate
10.	QC*	Quantize level
11.	SP*	Steps per page
12.	ST*	Subtest select
13.	TS*	Transport speed
14.	VT*	Vertical line thicken

NOTE

Refer to Table 7 for more detailed information.

*Buffer controller equipment code.

TABLE 6. COMMON MANUAL PARAMETERS SPECIFICATIONS

Step	Procedure
1.	AL* = Select Autoload mode (H=hardware, S=controlware).
2.	AP* = Upon selection, the program will set up the automatic parameters and returns to the monitor.
3.	BD* = Buffer controller core dump.
4.	BE* = Change BC equipment code (code range 1-F).
5.	BI* = Define BC interrupt line (range 1-F).
6.	DR* = Any section of the FR101 memory is to be dumped on the output device by defining FWA (first word address) and LWA (last word address).
7.	DS* = Modify, insert, or delete any section of the FR101 memory. Upon selection, the program will type: ADR = Define BC core location address. Terminate with a (CR) define operand. Terminate operand with a comma (,) for sequential store and with a period (.) for single store. To terminate update enter "STOP (CR)" in response to ADR =
8.	EC* = Upon selection, the program changes the mode of operation from off-line to on-line and the test is restarted.
9.	EØ*= The program sets the output level to normal and the test is restarted.
10.	EX* = Send to the FR101 module the parameter table and execute the test.
11.	ME* = Select mag. tape equipment code (range 1-F).
12.	MI* = Select mag. tape interrupt line (range 1-F).
13.	OM* = Enter (CR) to output on mag. tape, the video data in a listing format. Enter font name or file name to dump on mag. tape the video data in auxiliary format.
14.	OP* = The program selects the line printer for the output device.
15.	OT* = The program selects the TTY for the output device NOTE (PE*) must have been previously selected.
16.	PE* = Select printer equipment code (range 1-F).

TABLE 6. COMMON MANUAL PARAMETERS SPECIFICATIONS (Cont'd)

Step	Procedure
17.	RE* = Define repetitions (number range $0\text{-}65500_{10}$). This parameter corresponds to the number of pages to be processed.
18.	SC* = Change output mode from on-line to off-line and restart the test.
19.	SM* = Select module.
20.	SO* = Change the output level so that all error messages will be suppressed and restart the test.
21.	TC* = Select mag. tape converter (range 0-F).
22.	TN* = Select mag. tape unit number (range 0-7).
23.	LI* = Define file number in decimal. To dump all the files, enter 0 (zero). Dump on the selected output device the summary and the video data captured on mag. tape in a listing format. NOTE Select output device (OT or OP) before selecting LI* parameter.
24.	ID* = This parameter allows character images captured on mag. tape to be dumped in auxiliary tape format. Dump any one of the fonts captured. Dump only those characters which there is concern with. Here are some examples on how to dump these fonts. Example 1: (SINGLE FILE DUMP) ID* = File name (CR) Dump all the images contained in the request file. NOTE 1. Refer to the typeout or printout for file name selection. The typeout or printout was given at the time the data was captured on mag. tape. 2. Select the output device prior to the selection of ID* parameter.

TABLE 6. COMMON MANUAL PARAMETERS SPECIFICATIONS (Cont'd)

Step	Procedure
	Example 2: (MULTI FILES DUMP * SEQUENTIAL) ID* = File Name A, File Names (CR) Dump file name A, file name B, file name C, and file name D. Example 3: (MULTI FILE DUMP * RANDOM) ID* = File name B, file name D (CR) Skip file name A, dump file name B, skip file name C, dump file name D. Example 4: (SINGLE FILE DUMP * PARTIAL RANDOM) ID* = File name A (1, 5, 14, 16) Looking at the Error Line below, character position 1, 5, 14, and 16 correspond to A, E, N, and P, respectively. The images A, E, N, and P will be displayed on selected output device. Example 5: (SINGLE FILE DUMP * PARTIAL SEQUENTIAL) ID* = File name B (5-7) Looking at the Error Line below, character position 5, 6, and 7, correspond to E, F, and G, respectively. The images E, F, and G, will be displayed on output device. ERR. LINE = ABCDEFGHIJKLMNOP CHARACTER = 0000000001111111 POSITION = 1234567890123456

TABLE 7. MANUAL PARAMETERS SPECIFICATIONS

MODULE 1

1. BF* = Black fill 0 = Disable 1 = Enable.

2. CP* = Character peak reference (range 1-F).

3. DP* = Document position or document ready. Enter in mils the distance from the leading edge of the document to the center line of the first line to begin reading.

4. DT* = Dwell Time (millisecond range $1\text{-}65000_{10}$).
This is a time delay performed after every step and upon sensing page near zero velocity.

5. FC* = Final read coordinate (range 1-FC).

6. FE* = Font enable for selection, refer to BC channel 5 output. For ANSI enter FE00.

7. FS* = Forward step (distance in mils from centerline to centerline).

8. HT* = Horizontal line thicken 0 = disable 1 = enable.

9. IC* = Initial read coordinate (range 6-FA).

10. IW* = Character image width (column count).

11. OD* = Optical dump mode respond with A, R, or S where:
A = Absolute dump
R = Dump on reject only
S = Dump on substitutions or rejects
If S is selected, the program will type REF LINE =

Define the reference line.

NOTE

The reference line should be shorter in length than the data to be read.

12. QL* = Quantize level (range 1-FF).

13. RS* = Reverse step (distance in mils).

14. SP* = Steps per page (steps to be performed on one page).

15. ST* = Subtest Select 1, 3, or 5 where:
1 = Forward Stepping Accuracy Test
3 = Troubleshooting Stepping Test
5 = Optical Dump Test

16. TS* = Transport speed; 5, 10, 20, 40, (IPS).

17. VT* = Vertical line thicken (range 1-3F).

---

* Buffer controller equipment code.

18. NR* = Number of rescans (range 1=65000).
This parameter specifies the number of times each line must be read.

19. ER* = Electronically read captured video data from the optics. After selection of this parameter perform the following steps:

a. Set the 955 SIM/OPT switch to SIM.

b. Press 955 READY switch.

The RX4/Module 1 Firmware is now circulating the character images captured from the optics during live read.

An EX* command will terminate Electronic Read and initiates live read.

NOTE: 1. Character Data Ready are not verified during Electronic Read.

2. Character images captured from the optics and residing in the buffer controller, can be modified for study purposes while they are being read electronically. The procedure is as follows:

PROCEDURE TO MODIFY CHARACTER IMAGES.

SAMPLE OF VIDEO DATA DUMP

```
                                                            Column
................******************......................     1
................******************......................     2
................*****.*.................................     3
.................***....................................     4
..................****..................................     5
...................*****................................     6
....................****................................     7
....................****................................     8
...................*****................................     9
..................****..................................    10
.................****...................................    11
................****....................................    12
................******************......................    13
................******************......................    14
.................*****************......................    15   CW=15   IA=BFD
```

BINARY DATA EQUIVALENT FOR THE IMAGE LISTED ABOVE

ADR	Data	Column
BFD	= 0003 1FFE FC01 0000	15
C01	= 0003 3FFE FC01 0000	14
C05	= 0003 3FFE FC01 0000	13
C09	= 0003 3C02 0001 0000	12
C0D	= 0003 1E02 0001 0000	11
C11	= 0003 0F02 0001 0000	10
C15	= 0003 07C2 0001 0000	9
C19	= 0003 03C2 0001 0000	8
C1D	= 0003 03C2 0001 0000	7
C21	= 0003 0702 0001 0000	6
C25	= 0003 0E02 0001 0000	5
C29	= 0003 1C02 0001 0000	4
C2D	= 0003 3E82 0001 0000	3
C31	= 0003 3FFE FC01 0000	2
C35	= 0003 3FFE FC01 0000	1

If we wish to delete the bit circled in column 3 and add the two bits in column 6, perform the following steps:

1. MANUAL INTERRUPT RX4
   TTY PRINTS : NEXT
2. TYPE DS*
   TTY prints
3. ADR = C2E (CR)
   TTY prints
   C2E = 3E02.
   TTY prints
4. ADR = C22 (CR)
   TTY prints
   C22 = 07C2
   TTY prints
5. ADR = STOP (CR)
   TTY prints
   NEXT

   NOTE: 1. Four computer words are required for every column of data.

   2. Only the most significant 14 bits of a computer word represent data, the least significant two bits (bit 2/0 and bit 2/1) is a code which specifies the position in the L/R (Load/Register) where the 14 bits of data must be loaded.

      CONTROL CODE 3 = Upper 14 positions of L/R
      2 = Upper middle 14 positions of L/R
      1 = Lower middle 14 positions of L/R
      0 = Lower 14 positions of L/R

   3. Referring to step 3, the period (.) after 3E02 implies that the next change is not sequential. For sequential store use comma (,) instead of period (.).

   4. Step 5 return control to RX-4 monitor.

MODULE 2

1. BF* = Black fill 0=Disable 1=Enable.

2. CP* = Character peak reference (range 1-F), applies only to first character of the line for subtest 1.

3. DP* = Document reader position. Enter in decimal the distance in mils from the leading edge of the document to the center of the line being read.
   Example: For a document-ready position of 1.5 inches, perform the following entry:
   DP* = 1500 (CR)

*Buffer controller equipment code.

4. FC* = Final read coordinate. Center in hex the final or stop read coordinate to be used (the program will not allow more than 65 iterations of character data ready per line).

5. FE* = Font enable (see BC on font channel 5). For ANSI, use FE=FE00 and for hand print, use FE=4.

6. FS* = Forward step distance. Enter in decimal the distance from the center of one line to the center of the next line.

7. HT* = Horizontal line thicken 0=Disable 1=Enable.

8. IC* = Initial read coordinate. Enter in hex the initial read coordinate for the data to be read (range 6-FA).

9. QL* = Quantize level. Enter in hex the quantize level to be used (range 1-FF). This level will be used for the first character of the line; hardware will increase this by 30_{16} for the rest of the line.

10. SP* = Steps per page.

11. ST* = Subtest select (1).

12. TS* = Transport speed (5, 10, 20, 40 IPS).

13. VT* = Vertical line thicken (range 1-3F).

14. DM* = Dump mode
    0 = Dump data for all characters
    1 = Dump only error data

*Buffer controller equipment code.

D. OPERATING PROCEDURE (MODULE 1)

1. Forward Stepping Accuracy Test *

a. Select subtest number 1 (ST*=1).
Upon selection, the program will set up the following parameters for subtest number 1, section 1.

Section 1 Automatic Parameters

Initial read coordinate	= 2A
Terminal read coordinate	= 50
Transport speed	= 20 IPS
Step length	= 1/3 inch
Steps per page	= 25
Document position	= 544 mils
Quantize level	= 78
Font enable	= ANSI
Pages to be processed	= 40
Dwell time	= 50 milliseconds
Tolerance	= 30 mils

b. Place at least 40 documents in the hopper.

c. Verify that on maintenance panel OPTICAL/SYM switch is set to OPTICAL.

d. On the Operator's Control Panel press READY switch. Section 1 is now running. Section 1 will perform 1000 1/3-inch steps at 20 IPS. Upon completion, the RX4/1700 program will inform the operator whether or not the test is accepted, and sets up the following parameters to run Section 2.

Section 2 Automatic Parameters

Initial read coordinate	= 2A
Terminal read coordinate	= 50
Transport speed	= 40 IPS
Step length	= 1 inch
Steps per page	= 10
Document position	= 544 mils
Quantize level	= 78
Font enable	= ANSI
Pages to be processed	= 40
Dwell time	= 50
Tolerance	= 42 mils

* Use document number 60217511A, 60217512A, or 60217513A.

The operator should now do the following:

1) Place at least 40 documents in the hopper.
2) On Operator's Control Panel press READY switch.

Section 2 is now running. Section 2 will perform 400/1-inch steps at 40 IPS. Upon completion, the RX4/1700 will inform the operator whether or not the test is accepted.

Theory of Operation for Section 1

The RX4 controlware performs a document ready and positions the first line on the document at servo data 16 ± 3. A 1/3-inch step (336 mils) is now performed at a speed of 20 IPS. The controlware scans between coordinate 2A and 50 capturing the first four characters and compares it to the average servo data obtained on the first line. If the difference is greater than 30 mils, the controlware will inform the RX4/1700 monitor that a stepping error has been detected and transfer the following information to the RX4/1700 monitor:

1) Page count
2) Line count
3) Servo data average of the first line
4) Servo data average after stepping
5) Transport coordinates

The RX4/1700 monitor processes the page count and line count by transferring their respective values to a print picture, analyzes the transport coordinates and determines transport drift. A forward (+) drift of a 3-conveyor count is accepted and a reverse (-) drift of 1-conveyor count is also accepted. If there is any drift the program transfers the conveyor count to the print picture. By analyzing the servo data, the program determines if the amount of error is greater than 48 mils ($X | X > 48$ mils). This is considered a fatal error and the test will be rejected. The program will display the following message:

SECTION 1 FAILED

If the error is greater than 30 mils but less than or equal to 48 mils, the program will register the error incrementing a counter. Upon completion of Section 1 the program will monitor this counter. If the total number of errors is greater than 5 percent, the program will display the following message:

SECTION 1 FAILED

If the total number of errors is less than or equal to 5 percent, the program displays the following message:
SECTION 1 PASSED

Section 2 Theory of Operation

The theory of operation described in Section 1 applies also to Section 2. The only difference is that the tolerance is greater and the number of steps is 400 instead of 1000.

Upon completion of Section 2, the program will display one of the following messages:
SECTION 2 PASSED
SECTION 2 FAILED

2. Troubleshooting Stepping Test (Subtest #3)

The following parameters are required:

a.	Transport speed	(TS*)
b.	Forward step length	(FS*)

NOTE

A forward step parameter of zero indicates that the transport will be run at the specified speed nonstop.

c.	Dwell time	(DT*)
d.	Number of steps	(RE*)

The above parameters are already set to automatic (see Table 5), however change any of them as desired.

Perform the following steps:

a. Execute test (EX*)
b. On Operators Control Panel press READY switch to begin test.
c. The STOP button on the operator control panel will stop transport motion, and upon depressing the READY button, the test will be restarted provided the number of repetitions has not been surpassed.

3. Optical Dump Test (Subtest #5)

The following parameters are required:

a.	Initial read coordinate	(IC*)
b.	Final read coordinate	(FC*)
c.	Forward step length	(FS*)
d.	Document position	(DP*)
e.	Quantize level	(QL*)
f.	Font enable	(FE*)

g. Steps per page (SP*)

h. Dwell time (DT*)

i. Number of pages (RE*)

j. Transport speed (TS*)

k. Optical dump mode (OD*)

l. Character width (CW*)

The preceding parameters are already set to automatic (see Table 5); change any of them as desired.

Perform the following steps:

a. Execute test (EX*)

b. Place documents in the hopper

c. On Operators Control Panel press READY switch

E. OPERATING PROCEDURE (MODULE 2)

1. Subtest 1 (Hand Print Space/Input Channel 7 Exerciser)

a. Select subtest number 1 (ST*=1).

b. Select repetitions, pages to be processed (RE*=X). 0=Run test indefinitely

NOTE

If a document runout occurs, the Repetitions Counter is reset to 1.

c. Select any other parameters desired as described in Table 7.

d. Execute test (EXA).

e. Place test document(s) in input hopper.

f. Press reader READY to begin test.

g. After the specified number of documents have been ready, an end of test message will result.

Theory of Operation

Upon selection of the Execute command (EX*), the 1700 passes to the controlware the parameters required (Tables 6 and 7) and indicates that controlware should begin operation. The controlware then performs the following procedures:

1. Moves a document to Document Ready position (DP*). In the event that no document ready occurs, STOP indicator will light. Place more documents in the hopper and depress reader READY.

2. Locates the first line of the document by either:

   a. ANSI OCRA02 OCRB document (FE=FEOO) - After DPA, the first line is located at the servo data count of 16 $\pm$1.

   b. Hand Print (FE=4) - The line is positioned such that no topless or bottomless data is present.

NOTE

In the event a line locate cannot be performed within eight tries, the document will be ejected and the next document will be used.

3. Zeros mirror.

4. Reads the line.

   a. The first character is read using the FE* parameter. When the data ready occurs for the first character, hand print read is enabled. As each character is read when the hand print data ready occurs, mirror coordinates from input channel 4 and the start and stop coordinates from input channel 7 are stored in an internal software buffer. When 65 characters have been read or the final read coordinate has been reached, reading stops.

5. Edits the data:

   a. Input channel 4 mirror coordinate at hand print data ready time must be equal to input channel 7 stop coordinate (- 1 to + 7, 6-mils coordinate).

   b. IC7 start coordnate must be equal to or less than IC7 stop coordinate.

   c. IC7 start coordinate must be equal to or less than IC4 mirror coordinate at hand print data ready time by no more than three 48-mil coordinates.

   If an error is detected, the print line will show an asterisk the last position of the print line.

6. If all data is to be printed (DM*=0) out, insert that data with the line count and page count to the 1700. Otherwise, (DM*=1) output any error data to the 1700.

7. The 1700 will now display the error data.

8. Advances the page (FS*=X) the specified amount.

9. If end of page (SP*=X), sorts and goes to 1; otherwise, goes to 4.

Diagnostic Printout

The following diagnostic printout is organized into four columns.

The first column is a series of sequential numbers representing the character position on the test document. For example, 1 is the first character (A), 2 is the second character (B), and so on.

The second column represents the end coordinate of the character, in 48-mil pulses as received at controller input channel 4 at hand print data ready time; the number in this column is in hexadecimal.

The third column represents the starting coordinate of the character in a combination of 48-mil and 6-mil pulses as received at controller input channel 7. The first digit in the following example is the tag bit of the start coordinate register and should always be a 1. The second two digits are the start coordinate of the character in 48-mil pulses (this number is hexadecimal). The fourth digit is the number of 6-mil counts to be added to the 48-mil counts to give the true start coordinate. Thus, the four numbers in the following example represent a starting coordinate of 2328 mils.

1304

tag bit

48-mil count

6-mil count

$$30_{16} = 48_{10}, \qquad \begin{array}{rr} 48 \times 48 = & 2304 \\ 4 \times 6 = & +24 \\ \hline & 2328 \text{ mils} \end{array}$$

The fourth column represents the end coordinate of the character in 48- and 6-mil pulses as received at controller input channel 7. The first two digits are the hexadecimal count of 48-mil pulses, and the last digit is the count of 6-mil pulses. (The first digit of this column is actually a tag bit which is always zero; since leading zeros are suppressed, this digit does not appear.) An asterisk (*) after the last digit in this column indicates that the end coordinate received on channel 7 (column 4) does not correlate with the mirror count on channel 4 at hand print data ready time (column 2).

To check the accuracy of the 6-mil coordinate counter, compare the quantities in the second and fourth columns. The count in the fourth column for any character should be within - 1 to + 7, 6-mil pulses of the count in the second column. For example, for character 7, the 48-mil end coordinate count is 3D, and the 48-mil/6-mil count is 3D4. This is within acceptable limits and demonstrates the finer accuracy of the 6-mil coordinate count. For character 8, however, the difference in the two counts is +9, which is in error; an asterisk is printed at the end of column 4.

NOTE

Do not attempt comparisons beyond character 36. The characters on the test document beyond 36 are symbols and punctuation marks, which may be rejected by the Dirt algorithm.

RX4,	MOD/2/A/1		PC=1 LC=31
1	30	0	307
2	33	1314	330
3	35	1335	351
4	37	1356	372
5	39	1377	392
6	3B	13A0	3B4
7	3D	13C0	3D4
8	3F	13E0	401*
9	41	1402	417
10	43	1424	436
11	46	1443	460
12	48	1464	481
13	4A	1485	4A2
14	4C	14A5	4C2
15	4E	14C6	4E2
16	50	14F0	504
17	52	1510	524
18	58	1530	586
19	5B	1592	5B0
20	5D	15B3	5D0
21	5F	15D4	5F0
22	61	15F5	612
23	63	1615	632
24	65	1637	654
25	67	1657	674
26	69	1677	694
27	6B	16A0	6B6
28	6D	16C2	6D4
29	6F	16E2	6F6
30	72	1704	720
31	74	1722	740
32	76	1744	761
33	78	1764	781
34	7A	1786	7A2
35	7C	17B0	7C0
36	80	17F0	804
37	82	1813	823
38	84	1834	844
39	86	1852	866
40	88	1872	887
41	8B	1894	8B0
42	8D	18B4	8D1
43	8F	18D5	8F1
44	93	1917	933
45	95	1937	954
46	97	1957	974
47	99	1977	994
48	9B	19A0	9B4
49	9D	19C0	9D5
50	9F	19E1	9F5

II. MESSAGES

A. NORMAL MESSAGES

1. BEGIN RX4A34 REV X.X V.X.X IA = XXXX

2. NEXT

The RX4 monitor has control and is awaiting on an input from TTY.

3. THE BC IS LOADED

The selected module has been loaded to the FR101 and the checksums are correct.

4. END OF TEST

B. COMMON ERROR MESSAGES

1. ONA (option not available)

2. MT DOES NOT RESPOND

The program received an external reject while trying to connect the MT. Verify MT equipment code and unit number.

3. MT STATUS ERROR

The program has detected a parity error.

4. ILLEGAL AUX. TAPE

5. BC/X FAILED TO REPLY ON FUNCTION RELOAD BC/X

The 1700 program is unable to communicate to BC/X. The program requests that BC/X be reloaded.

6. CHECKSUM ERROR

The checksum computed on the module while being loaded to the FR101 is not equal to the checksum computed during the transfer of the module from the FR101 to the 1700 program.

7. INCORRECT REPLY FROM BC/X RELOAD BC/X

The module residing in BC/X has lost control. It is not sending the correct reply to the 1700 program.

8. LOAD 1742-120 IMAGE

This diagnostic does not provide means to load the 1742-120 Image Memory.

C. MODULE 1 ERROR MESSAGES

1. Subtest Number 1 Normal and Error Messages

SECTION 1 PASSED

The RX4 controlware has performed the 1000 1/3-inch steps and the number of steps in error does not exceed 5 percent.

SECTION 1 FAILED

Either a fatal error just occurred or the number of steps in error at the completion of the test is not within 5 percent. Fatal error (X|X > 48 mils).

SECTION 2 PASSED

The RX4 controlware has performed the 400/1-inch steps and the total number of steps in error is within 5 percent.

SECTION 2 FAILED

Either a fatal error just occurred or the number of steps in error at the completion of Section 2 is not within 5 percent. Fatal error = (X|X > 60 mils).

```
EXPSD---ACTSD---MILS OFF--DRIFT-LC--PC--EID
  XX      X X     ±   XX    ±X   XX  XX  XXX
```

The preceding message is displayed whenever a stepping error is detected.

EXPSD:
Average servo data obtained from the first line of the document.

ACTSD:
Average servo data obtained after the step was performed.

MILS OFF
Difference between the EXPSD and ACTSD multiplied by 6.
1 light pipe = 6 mils.
+ XXX indicates overstepping - XXX indicates understepping.

DRIFT:

Number of conveyor counts which the transport moved from the time the Stop Motion command was executed until after the 50-millisecond dwell time.

Drift of +3 and -1 is accepted.

+X indicates a forward drift greater than 3.

-X indicates a reverse drift greater than $|-1|$.

LC: Line count

PC: Page count

EID: Error identification

FSE = Forward stepping error

TLD = Topless data

BLD = Bottomless data

2. Subtest Number 5 Error Messages

   a. VIDEO DATA OUT OF SEQUENCE EXP. 3.2.1.0 Rec W.X.Y.Z

   As each column of video data comes out of the Dump register (1 column = 4 words) the first word should have a control code of 3 (bit 14 and 15 set), the second word should have a 2 (bit 14 set), the third word should have a 1 (bit 15 set), and the fourth word should have a 0 (bit 14 + 15 clear).

   The 1700 program prior to dumping a column of data will monitor these codes and if it detects that they are out of sequence, it will display the above message.

   b. MAXIMUM CHARACTER Width Exceeded (37 columns)

   The program has detected that the width of an image (black data only) is greater than 37 columns. This exceeds the size of the buffer which holds the black video data. Change the optical dump mode to Absolute (OD*A) in order to obtain a video data dump. In Absolute mode the program dumps one column at a time without looking for transition.

c. Delete Line Detected, DUMP is in Absolute Mode

Delete line detected on the line just read. The RX4 will now change the optical Dump mode to absolute in order to perform the video data dump on a character width greater than 37 columns of black. At the completion of the dump, the RX4 will reset the optical dump to its original mode.

d. Dump Register Failed

During one Column Ready pulse time the BC program did not detect a word coming out of the Dump register with a control code of 3 (bits 14 and 15 set).

e. Sample of Video Data Dump in Absolute Mode

```
PC=XXXX  LC=XXXX
LINE READ=ABCD....
VOLT LINE=FFFF....
SERVO     =2222.....
      DATA=2122.....

20 CLEAR COLUMNS

.......................................*
....................................****
..................................******
................................********
..............................**********
............................******.***
.......................*********...***
.......................********....***
.......................*********...***
.........................*************
.............................***********
...............................*********
..................................******
.....................................***

6 CLEAR COLUMNS

.....................*******************
.....................*******************
.....................*******************
.....................***.....***.....***
.....................***.....***.....***
.....................***.....***.....***
.....................***.....***.....***
.....................***.....***.....***
.....................***.....***.....***
.....................***.....***.....***
.....................***.....***.....***
.....................***.....***.....***
.....................***.....***.....***
.....................***.....***.....***
......................***...*****...****
......................*****************
.......................***************
........................******..*****
AND SO FORTH .....
```

NOTE

1. PC = Page count, LC = Line count.
2. Servo data consists of two lines. Read servo data vertically.
3. The video data is rotated 90 degrees. This is because in Absolute mode the video data is listed in the exact same way it comes out of the Dump register.

f. Video Data Dump (Reference Mode)

EXAMPLE:

```
PC=1  LC=1
REF. LINE= ABCDEFGH I JKLMNOPQR
ERR. LINE=       @
VOLT LINE=FFFFOFFFF FFFF FFFFF
SERVO     =111111111 1111 11111
     DATA=777777778 8777 77777
    8 CLEAR COLUMNS
..........................*
........................******
.......................********
.....................*****..*****
....................****......****
...................****........****
..................***............***
..................**..............**
..................**..............**
..................**..............**
..................******************
..................******************
..................**...**..**....***
..................**..............**
..................**..............** .. CW=15  IA=8C6
00000000011111111112222222222333333333344444444445555555
12345678901234567890123456789012345678901234567890123456
    7 CLEAR COLUMNS
..................**
.................******............*
.................********.........**
.................*********........**
..................**********......**
..................***********.....**
..................**..********....**
..................**...*******....**
..................**....********..**
..................**......**********
..................**......**********
..................**......**********
..................**......**..*******
..................****...************
..................********************
..................******************* .. CW=16  IA=91E
```

```
6 CLEAR COLUMNS
..................**
..................**
..................**
..................**....**
..................**....**
..................**....**
..................**....**
..................**....**
..................**....**
..................**....**
..................**....**
..................**....**
..................****.************
..................*****************
..................***************** .. CW=15  IA= 976
```

NOTE

1. PC (page count) refers to the document count in the secondary pocket.
2. The ERR. LINE shows only the characters rejected or substituted.
3. The symbol @ indicates character reject.
4. SERVO DATA consists of two lines. Read servo data vertically. Example: The servo data for the character C is 17, the servo data for the I is 18.
5. CLEAR COLUMNS is the number of clear columns between characters.
6. CW (character width) is the number of black columns the image is composed of.
7. For every bad character a set of three characters images are displayed. The bad character is preceded by the numbers 1 through 56 which represent the light pipes.
8. The program considers dirt anything less than four columns of black.
9. The character images have been inverted for easier reading.

g. Sample of Video Data Dump in Reject Mode

```
PC=1  LC=27
ERR. LINE=ABCD@FGH...
VOLT LINE=FFFF3 FFF...
SERVO     =1 1 1 1 1 1 1 1
      DATA=5 5 6 5 6 6 5 6
    4 CLEAR COLUMNS
.......................****
.....................********
....................**********
..................*****....*****
.................****........****
................***...........***
................**.............***
................**..............**
................**..............**
................******************
................******************
................******************
................**..............**
................**..............**
.................................*  CW=15  IA=8C6
00000000011111111112222222222333333333344444444445555555
12345678901234567890123456789012345678901234567890123456
    6 CLEAR COLUMNS
................****............**
................*********.......**
................***********.....**
................************....**
................***********.**..**
................***....********.**
................***.....**********
................**......******.***
................******************
................**......**.********
................**......**..********
................**......**...********
................*********************
................*********************
................*********************
.................................***   CW=16  IA=91E
    7 CLEAR COLUMNS
................**
................**
................**
................**....**
................**....**
................**....**
................**....**
................**....**
................**....**
................**....**
................**....**
................******************
................******************
.................****************   CW=15  IA=976
```

h. Sample of Hand Print Video Data Dump in Reference Mode

```
PC=1  LC=1
REF. LINE=12345678
NUMERIC  =      @
ALPHA    =      @
SYMBOL   =      @
    16 CLEAR COLUMNS
.........................................***
.......................................*******
......................................********
.....................................***....***
....................................***.....***
....................................***......**
....................................***......**
....................................***......**
.....................................**......**
.....................................**......**
.....................................***.....**
.....................................***.....**
......................................***...***
........................**............****.****
........................**.............*******
........................***.............*****
.........................***...........******
..........................****......*******
...........................**************
............................***********
...............................****  CW=21  IA=A5E
00000000011111111112222222222333333333344444444445555555
12345678901234567890123456789012345678901234567890123456
    10 CLEAR COLUMNS
...........................**
.........................***********************
.........................***********************
........................***......**************
........................***
........................***
........................***
........................***
........................***
.........................**
.........................***
.........................***
..........................**
..........................***
...........................**
...........................**
...........................**  CW=17  IA=ADA
    15 CLEAR COLUMNS
.........................***............*******
........................*****..........*********
.......................********......******..****
.......................***.*****...****.......****
.......................***...****..***.........***
.......................**.....********.........***
......................***......******..........***
......................***.......*****........****
.......................**.......****************
.......................**......***.************
........................**********************  CW=11  IA=B68
```

NOTE

1. PC = Page count, LC = Line count. PC refers to the document count in the secondary pocket.
2. In the NUMERIC, ALPHA, AND SYMBOL line the symbol @ indicates character reject.
3. The numbers 1 through 56 always precede a bad image. These numbers correspond to the light pipes.
4. CW (character width) is the number of black columns that forms the image.
5. IA (initial address) is the initial address in the BC of the video data corresponding to the character image.

i. Sample of Hand Print Video Data Dump in Absolute Mode

```
PC=1  LC=1
NUMERIC=012345678
ALPHA   =@@Z@XS@@@
SYMBOL  =@@@@+@@@@

    39 CLEAR COLUMNS
.............................*********
...........................**************
.........................******************
........................********************
.......................******.........*******
......................*****..............*****
......................****................****
......................***..................****
.....................****..................****
.....................***....................***
.....................****...................***
.....................****...................***
......................***..................****
......................****................****
.......................*****.............*****
.......................******..........******
........................**********.**********
.........................*******************
...........................***************
.............................***********
```

20 CLEAR COLUMNS

```
......................************************
.....................*************************
.....................*************************
...........................******************
```

21 CLEAR COLUMNS

```
........................**
.......................***.................***
......................****................*****
......................****...............******
......................***...............*******
.....................****..............********
.....................****.............*********
.....................***.............**********
.....................***.............*****.****
.....................***............*****..****
.....................***...........*****...****
.....................***..........*****....****
.....................****........*****.....****
.....................****.......*****......***
......................****.....*****.......****
......................*****...*****........***
......................************.........***
.......................***********.........***
........................********...........***
..........................*****............***
```

NOTE

1. PC (page count) refers to the document count in the secondary packet.
2. The symbol @ indicates character reject.
3. Character substitutions are not detected in this mode.
4. CW (character width) is the number of black columns the character image is made up of.
5. IA (initial address) refers to the buffer controller initial address of the image displayed.
6. The rejected character is always preceded by the numbers 1 through 56, which correspond to the light pipes.
7. Anything less than four columns of black data will be considered as dirt by the RX4.
8. Character images have been inverted for easier reading.

j. Magnetic Tape Video Data Dump (Listing Format)

The purpose of this option is to save time. On most systems video data dumps are performed on TTY which takes a very long time. If a line printer should be available elsewhere in the plant, video data could then be captured on magnetic tape and listed on the line printer available.

NOTE:

1. Data is written on MT in the format described in the previous figures.
2. Data is written on MT in BCD.
3. Use manual parameter LI* to dump video data from magnetic tape.
4. A tape mark is written at the end of each dump.

k. Magnetic Tape Video Data Dump (Auxiliary Tape Format)

The following summary will be displayed on the line printer if one is available; otherwise the summary will be displayed on the TTY.

Example:

```
PC = XXXX       LC = XXXX    FN = FONT NAMED
REF.    LINE = ABCD . . . (If in Reference mode)
ERR.    LINE =
VOLT    LINE = FXFF
SERVO        = 1X11
        DATA = 7X67
```

NOTE:

1. Data is written on magnetic tape in 466 binary.
2. Density = 800 BPI.

3. "Font Name" is the name which is defined.
   The program assigns the letters A-Z in order to make the name unique for every dump performed.

4. Character images recorded on magnetic tape in auxiliary tape format can be listed by using manual parameter ID*.

5. The first record of every dump on magnetic tape consists of Name Mask (sum of the ASCII codes describing the name) reference line ASCII codes if in Reference mode. If in Reject or Absolute mode, the reference line consists of the ASCII codes generated by the 955 Reader.

6. All the video data corresponding to the character read will be recorded on magnetic tape. The program does not attempt to separate the bad images from the good ones, since this could affect the end result when the images are read electronically with the RX3 module 1.

7. A tape mark will be written at the end of each dump.

l. Handprint Optical Dump Specifications

1) Restrictions

- Optical dump in Reject mode is illegal.
- The program will not handle leading ANSI characters.
- A rescan parameter is available. However, this parameter allows the same line to be read any number of times. It does not allow the errors occurred in the first scan to be corrected.

The above restrictions are necessary if the program is to be effective. The more sophisticated the program, the less useful it becomes. In other words, if the amount of core storage available for capturing video data is too small, the diagnostic would become obsolete.

2) Theory of Operation

a) Absolute Mode

In Absolute mode the program upon sensing the READY switch depressed will bring a document to the read zone and position it 1 inch past read zone plus the amount of mils specified with the document position parameter. It scans between the specified read coordinates and reports to the operator the information obtained from the scan. (Refer to the preceding figures.)

If a forward step has been specified (FS*), the program performs the step ignoring high and low characters and once again reports the information to the operator.

b) Reference Mode

In Reference mode the program upon sensing the READY switch depressed, brings a document to the read zone and positions it 1 inch past read zone sensor plus the amount of mils. Specified with the document position parameter. It scans only the character data. At this point the program monitors the first 3-character data ready words for high and low signals. If both high and low are detected, the program will reject this document and bring up a new one. If more than one high signal is detected, the program performs a 64 mils reverse step. If more than one low signal is detected, the program performs a 64 mils forward step. Once again, the program scans between the read coordinates and checks for high and low signals. If within six attempts the program does not succeed to get rid of high or low signals, the document will be rejected.

Upon succeeding in positioning the line, the program scans the line one more time capturing character data and video data.

Character data is now analyzed and compared to the reference line. If rejects or substitutions are detected, the program will report the information to the operator. (Refer to the preceding figures.)

If more lines must be read from the same document, the program will perform the forward step specified with the FS* parameter, check for high or low signals, and adjust the line if more than one signal is up, and return one again to capture character data and video data.

Hand Print Operating Procedure to Simulate Controlware

1. Parameters for Initial Scan

OD*=S	(Optical dump = Reference mode)
FE*=4	(Enable hand print font line)
HT*=0	(Disable horizontal line thicken)
VT*=30	(Vertical line thicken = 30)
QL*=78	(Quantize level = 78)
BF*=0	(Disable black fill)
DP*=	(Total mils (in decimal) from leading edge of document to the center of the line you wish to read)
FS*=	(Forward step length (total mils in decimal)) NOTE: FS*=0 for stationary read.
SP*=	(Steps per page or number of lines that you wish to read)
EX*	Execute test

Press 955 READY switch

If no substitutions or rejects are detected, change the following parameters to perform the first rescan.

2. First Rescan

VT*=21	(Vertical line thicken = 21)
BF*=1	(Enable black fill)
EX*	(Execute test)

Press 955 READY switch

If no substitutions or rejects are detected after the first rescan, change the following parameters to perform the second rescan.

3. Second Rescan

QL*=80	(Quantize level = 80)
BF*=0	(Disable black fill)
EX*	(Execute test)

Press 955 READY switch

If no substitutions or rejects are detected after the second rescan, change the following parameters to perform the third and final rescan.

4. Third Rescan

VT*=12	(Vertical line thicken = 12)
BF*=1	(Enable black fill)
EX*	(Execute test)

Press 955 READY switch

NOTE: If no errors (substitutions or rejects) are detected during the three rescans, hand print errors were possibly caused by skew in the document.

To test this theory perform the following steps:

FS*=0 (Stationary read)
EX* (Execute test)
Press 955 READY switch

Manually move the document as the program is performing stationary read.

NOTE: Skew of ±1.5 degree is normal.

Sample of Error Printout on the Forward Stepping Accuracy Test

EXPSD---ACTSD---MILS OFF---DRIFT-LC-PC--EID

EXPSD	ACTSD	MILS OFF	DRIFT	LC	PC	EID
15	2	+ 78		1	1	FSE
15	4	+ 66		2	1	FSE
15	5	+ 60		3	1	FSE
15	6	+ 54		4	1	FSE
15	5	+ 60		5	1	FSE
15	5	+ 60		6	1	FSE
15	6	+ 54		7	1	FSE
15	5	+ 60		8	1	FSE
15	7	+ 48		9	1	FSE
15	4	+ 66		10	1	FSE
15	4	+ 66		11	1	FSE
15	4	+ 66		12	1	FSE
15	3	+ 72		13	1	FSE
15	4	+ 66		14	1	FSE
15	5	+ 60		15	1	FSE
15	4	+ 66		16	1	FSE
15	6	+ 54		17	1	FSE
15	3	+ 72		18	1	FSE
15	5	+ 60		19	1	FSE
15	6	+ 54		20	1	FSE
15	6	+ 54		21	1	FSE
15	5	+ 60		22	1	FSE
15	7	+ 48		23	1	FSE
15	5	+ 60		24	1	FSE
15	6	+ 54		25	1	FSE
18	3	+ 90		1	2	FSE
18	8	+ 60		2	2	FSE
18	9	+ 54		3	2	FSE
18	9	+ 54		4	2	FSE
18	8	+ 60		5	2	FSE

NOTE

1. The above error printout was forced by defining a forward step of 400 mils instead of 336 mils (1/3 inch) which is the actual spacing between lines on the document.
2. No values are listed under drift, because it was within tolerance.

2. Subtest Number 5 Optical Dump

a. Absolute Mode

RX4 module 1, upon sensing the READY switch depressed, will initiate 40 IPS speed and wait for a document to be sensed at read zone. If a document is already covering read zone sensor at the time the READY switch is depressed, the program will bypass it and wait for a new one. As soon as a document is sensed at read zone, the program will allow the document to move 1 inch (distance from read zone sensor to read area) plus the number of mils specified with the document position parameter (DP*).

Since this is an absolute dump, the program will not attempt to line locate. The program will now perform a zero mirror and position the mirror to the initial read coordinate (IC*). Character peak reference, font lines, and read will now be enabled.

Due to the high frequency in which the video data comes out of the Dump register, the program will not terminate the scan when the mirror reaches the final read coordinate (FC*). This is due to the fact that having to capture video data, character data, servo data, and character voltage, the program cannot monitor the mirror encoder without losing video data. Therefore, the scan will be terminated, based on a video data word count.

The formula to compute the video data word count is:

((FC - IC)/2) (IW X 4)

FC = Final read coordinate

IC = Initial read coordinate

IW = Image width (column count)

EXAMPLE:

IC = 2A, FC = 50, IW = 22

Converting IC and FC from hexadecimal to decimal;

IC = 42 FC = 80

Using the formula

((80-42)/2) (22X4)

= 38/2X88

= 19 X 88

= 1672

After 1672 video data words have been taken, the program will drop Scan Mirror Forward command and execute a Stop Mirror command. The firmware will now inform the 1700 program that the video data is ready for output. The 1700 program will request page count, line count, line read, servo data, and character voltage and displays them on the output device.

The 1700 program will now request the BC to transfer one column of video data (four words), checks the four words for proper control codes sequence and if they are in sequence, display the column of data. This process will continue until 1672 words or 418 columns of video data have been listed. The 1700 program will now instruct the BC program to continue with the test.

The BC program will now monitor the forward step (FS*) parameter. If it is set to zero, it will perform another scan on the same line. This is known as stationary read. If the step is not set to zero, the program will perform the step specified (FS*) before executing the next scan. This process continues until the specified number of steps have been executed on a single document. After the requested number of steps have been executed, a new document will be brought into the read area and the test starts over again.

NOTE

Stepping in Absolute mode may cause either bottomless or topless. This is because the program in Absolute mode does not adjust the step using servo data, it actually performs an absolute step without any adjustments whatsoever. This mode will allow you to test how accurate the transport can step without using servo data.

b. Reject of Reference Mode

The BC program, upon sensing the READY switch depressed, will initiate a 40 IPS speed and wait for a document to be sensed at read zone. If a document is already covering read zone sensor at the time the READY switch is depressed, the program will ignore it. As soon as a document is sensed at read zone sensor, the program will allow the document to move 1 inch (distance from read zone sensor to read area) plus the number of mils specified with the document position parameter. The program will now line locate and position the line at servo data 16$\pm$ 3 (16 = center). The mirror will now be positioned at the initial read coordinate. Character peak reference, font lines, and read are now enabled. The program will now begin to capture video data, character data, servo data, and character voltage. When the computed number of video data words have been captured, the program will drop the Scan Forward Mirror command and bring up Stop Mirror command. If this is a dump on reject only, the program will analyze the character data, and if any rejects are detected, the program informs the 1700 program. If this is a dump on Reference mode, the characters generated by the reader are compared against the reference line and if any substitutions are detected, the program informs the 1700. The 1700 program, upon notification that either rejects or substitutions have been detected, will request the BC program to transfer page count, line count, character data, character voltage, and servo data and displays all the information on the selected output device. The 1700 program will now begin to request 1 column of video data (four words) at a time. Checks the four words for proper control code sequence (EXP. = 3. 2. 1. 0) and if they are found to be out of sequence, the operator will be informed, the program checks to see if this is a clear column (all 56 bits clear). If it is a clear column, a clear column count will be incremented by 1 and a test is performed to determine if a black to white transition just occurred. If no transition occurred, more video data will be requested. If the column of data contains black data, the program transfers the four words to the video data buffer and tests for an overflow (37 columns of black). If an overflow is detected, the program informs the operator and no other action is taken.

Upon a transition from white to black, the program determines if the image residing in the video data buffer must be listed. The program will list the image if so determined and checks to see if there are any more to be listed.

If there are no more images to be listed, the program instructs the BC program to continue with the test. The BC program will now monitor the forward step parameter and if set to zero will rescan the same line (stationary read); otherwise the program will test to see if the specified number of steps have been performed on this page. If not, the program performs the specified step making the necessary adjustments (by using servo data) so that the next line will be as close as possible in the center of the optic. When the specified number of steps have been executed on a page, a new page is brought in the read area and the test is repeated all over again.

SC/1700/FR101/FR113 INTERFACE TEST

(BC3A59 Test No. 59)

(Non-Supported Class III Test)

I. OPERATING PROCEDURE

A. RESTRICTIONS

1. Requires an 8K 1700 system with a 608 or 609 MT and a TTY.
2. The diagnostic interfaces to SMM17 only for loading.

B. LOADING PROCEDURE

1. BC3 loads via SMM as test number 59, utilizing standard SMM loading procedures.
2. Upon loading BC3 will print the following message.

   BEGIN BC3A59 REV. X.X V.3.1 IA=XXXX
3. This message is followed by:

   BCE=

   This message indicates that the program is waiting for the user to define the Buffer Controller Equipment Code ($0\text{-}F_{16}$), followed by a carriage return.
4. The Teletype will now display:

   BCI=

   This message indicates that the program is waiting for the user to define the interrupt line to be used for the Buffer Controller ($0\text{-}F_{16}$), followed by a carriage return.

C. BC3 TEST FUNCTIONS

1. Section 1 Functions 'Control Lines Test'

   a. Director 1 write, expect reply.

   b. Director 2 read, expect reply.

   c. Director 2 write, expect reply.

   d. Director 1 write, expect internal reject.

2. Section 2 Functions 'Autoload Test'

   a. Verify Autoload status bit.

   b. Verify that it is possible to autoload 4K words to the BC with no hang-ups.

   c. Verify data autoloaded to the BC.

   d. Verify data received from the BC.

3. Section 3 Functions 'Status + Interrupts Test'

   a. Program Protect Switch Status test.

   b. Director 1 Status test.

   c. Director 2 Status test.

   d. Data Interrupt + Status test.

   e. EOP Interrupt + Status test.

   f. Alarm Interrupt + Status test.

   g. Lost Data Interrupt + Status test.

4. Section 4 Functions 'Directors + Functions Test'

   a. Starting with Director 2 through 7, verify that the coupler decodes the correct director.

   b. Verify that the BC receives the correct function with each director.

5. Section 5 Functions 'Block Transfer ECO Test'

   a. Starting with one word and continuing up to 4K, verify that the BC always accepts and transmits the correct number of words.

SECTION 1. BC CONTROL LINES TEST

NOTE: To bypass this section set the SELECTIVE SKIP switch on the 1700 Console.

TTY types: Section 1 Running.

TTY types: Set BC Equipment to X.

Enter CR after setting the BC equipment switch to X.

Functions performed in Section 1:

1. Director 1 Write, Expect Reply
2. Director 2 Read, Expect Reply
3. Director 2 Write, Expect Reply
4. Director 1 Write E $\neq$ X Expect Internal Reject
5. Director 1 Write W $\neq$ 0 Expect Internal Reject

If the responses to the functions listed above are correct, the program will request that the BC equipment number be changed to a different combination and the test repeated.

Combinations 2, 4, 8, F, and A are tested:

At the completion of the section the program types: END OF SECTION 1.

Section 1 Error Message

EXP = AA REC=BB F=X D=Y E=Z W=XX WHERE

EXP = AA

AA is the expected response on the function performed. AA takes the form of RE (Reply), IR (Internal Reject), or ER (External Reject).

REC = BB

BB is the actual response received. BB takes the form of RE (Reply), IR (Internal Reject), or ER (External Reject).

F = X

X is the function performed. X takes the value of R (Read) or W (Write).

D = Y

Y is the director used in the function.

E = Z

Z is the equipment number used in the function. Z = 2, 4, 8, F, or A.

W = XX

XX is the converter number used in the function. XX = 0-10

After typing the above error message, the program types ACTION (C, R) =.

The operator should now select C to continue or R to repeat the same function.

NOTE: If an R is entered in response to ACTION(C, R)= the program will re-execute the same function for as long as the function fails. In other words, it will repeat on error only. To repeat the same function unconditionally, set the SELECTIVE SKIP switch on the computer before entering R. To exit from this unconditional loop, clear the SELECTIVE SKIP switch. The program will now start processing the next function.

SECTION 2 AUTOLOAD TEST

TTY types: Section 2 Running.

Clear SKIP switch if it was set to skip Section 1.

Section 2 Error Messages

AUT BIT NOT SET
ACTION (C, R)=

Following a DIR 9 write, the autoload status bit was not a "1".

Enter R in response to ACTION (C, R)=. The program will perform a DIR 9 continually until the problem is solved. The program will inform the operator by ringing the TTY bell when it receives the proper status response.

AUT HANG UP. WC=XXXX (XXXX Range = 1 - 1000_{16})
EXP=RE REC=IR F=W D=8 E=A W=0

During the 4K Autoload Test, the program received an Internal Reject on a Director 8 at WC (word count) XXXX.

Since no other section can be processed unless the autoload works properly, enter R in response to ACTION (C, R)=.

The program will perform the autoload continually until it succeeds to perform a 4K autoload.

AUT. BIT NOT CLR
ACTION (C, R)=

Following a Director 1 Write (Master Clear BC), the autoload status bit was not a "0".
Enter R in response to ACTION (C, R)=.

AUTOLOAD TO BC FAILED
ACTION (C, R)=

The data autoloaded to the BC is incorrect.

Enter C in response to ACTION (C, R)=

TTY types: Data=.

Define the data to be autoloaded to the BC as four hexadecimal digits or less, terminate DATA selection with a (CR).

The program will now continually autoload the data defined until the operator presses the TTY manual interrupt button. The program upon sensing the TTY interrupt will request a new data word.

To terminate, enter STOP in response to DATA=.

BLOCK TRANSFER FAILED
ACTION (C, R)=

The word count received from the BC is incorrect.

Section 5 will check Data Block Transfer Logic. We cannot jump to Section 5 at this time because D1 and D2 status and interrupts have not been checked yet. Enter C in response to:

ACTION (C, R)=, after the status is checked the cause of Data Block Transfer Failure will be determined.

INCORRECT DATA FROM BC EXP=XXXX REC=YYYY

The data coming from the BC is incorrect.

If no errors are detected during the autoload test, the TTY types END OF SECTION 2.

SECTION 3 DIRECTOR 1 AND DIRECTOR 2 STATUS CHECK
DATA, EOP, ALARM AND LOST DATA INTERRUPTS CHECK

NOTE: BC interrupt line must be on interrupt line 4 or 7.

TTY types: Section 3 Running.

Section 3 Error Messages for D1 and D2 Status

EXP BIT 2/X SET DY

REC BIT 2/X CLR DY

ACTION (C, R)=

OR

EXP BIT 2/X CLR DY

REC BIT 2/X SET DY

ACTION (C, R)=

NOTE: If all bits of the Director are expected to be clear, EXP ALL DY STATUS BITS CLEAR will be displayed.

Where X is the bit being tested and Y the director.

See tables below for D1 and D2 status bits specifications.

If an R is entered in response to ACTION (C, R)=, the program will set and clear continually the status bit in error. Should the CE correct the status bit in error, the program will ring the TTY bell, and proceed to test next status bit.

Interrupt Failure Error Messages

1. NO DATA INTERRUPT
2. NO EOP INTERRUPT
3. NO ALARM INTERRUPT
4. NO LOST DATA INTERRUPT

NOTE: Additional information will be displayed if the status is incorrect.

Expected status before BC generates Data interrupt.

READY (Bit 2/0 set)
BUSY (Bit 2/1 set)

Expect status after BC generates Data interrupt:

READY (Bit 2/0 set)
BUSY (Bit 2/1 set)
INT. (Bit 2/2 set)
DATA (Bit 2/3 set)

Expected status before BC generates EOP interrupt:

READY (Bit 2/0 set)
BUSY (Bit 2/1 set)

Expected status after BC generates EOP interrupt:

READY (Bit 2/0 set)
INT. (Bit 2/2 set)
EOP (Bit 2/4 set)

Expected status before BC generates Alarm interrupt:

READY (Bit 2/0 set)
BUSY (Bit 2/1 set)

Expected status after BC generates Alarm interrupt:

READY (Bit 2/0 set)
BUSY (Bit 2/1 set)
INT. (Bit 2/2 set)
ALARM (Bit 2/5 set)

Expected status before BC generates Lost Data interrupt:

READY (Bit 2/0 set)
BUSY (Bit 2/1 set)

Expected status after BC generates Lost Data interrupt:

READY (Bit 2/0 set)
BUSY (Bit 2/1 set)
INT. (Bit 2/2 set)
ALARM (Bit 2/5 set)
LOST DATA (Bit 2/6 set)

DIRECTOR 1 STATUS CHANNEL 0

Bit Position	Status Function
2/0	READY
2/1	BUSY
2/2	INTERRUPT
2/3	DATA
2/4	EOP (END OF OPERATION)
2/5	ALARM
2/6	LOST DATA
2/7	PP (PROGRAM PROTECT)
2/8	AUTOLOAD
2/9	LINE DELETE
2/10	CHARACTER REJECT
2/11	LLF (LINE LOCATE FAILURE)
2/12	EOF (END OF FILE)
2/13	TRANSPORT STATUS FAULT
2/14	DOCUMENT NO SORT
2/15	DATA SKEWED

DIRECTOR 2 STATUS CHANNEL 1

Bit Position	Status Function
2/0 - 2/7	MIRROR POSITION STATUS
2/8	UNUSED
2/9	UNUSED
2/10	DOCUMENT LENGTH FAULT
2/11	PARAMETER FAULT
2/12	MIRROR STOP FAULT
2/13	COORDINATE FAULT
2/14	MIRROR VELOCITY FAULT
2/15	SCAN GATE

SECTION 4

Starting with Director 2 through 7 the BC3 program will perform two functions for every director.

Example:

Function number 1 = Director 2, A = 0000
Function number 2 = Director 2, A = FFF8

Theory of Operation

The BC upon receiving the Director function, transfers back to the BC3 monitor the actual director decoded by the coupler and the function. BC3 monitor will verify that the coupler decoded the correct director and that the correct function was received by the BC.

Error Messages

BC DECODE WRONG DIRECTOR EXP=DX REC=DY

Where DX is the expected director and DY is the director actually decoded by the coupler.

BC RECEIVED INCORRECT FUNCTION ON DX EXP=XXXX REC=YYYY

BC3 monitor after it displays one of the above error messages requests operator's action by typing:

ACTION(C, R)= Where

C = Continue
R = Repeat on error only

NOTE: To repeat the same Director function unconditionally, set the SELECTIVE SKIP switch before entering R in response to ACTION(C, R).

After Directors 2 through 7 have been verified, the BC3 monitor types END OF SECTION 4.

SECTION 5 ECO TEST

Data Block transfer to and from the BC, starting with a data block of one word up to 4000. Each time the program verifies that the BC accepts only as many words as instructed to, and transfers back the same number.

Error Messages

BC HANG UP ON DATA INPUT

During a Data Block transfer of X words $(x \mid 1 \leq x \leq 4000_{10})$ to the BC, the BC failed to generate EOP interrupt.

BLOCK TRANSFER FAILED
FROM 1700 TO BC
EXP=XXXX ACT=YYYY

The BC accepted more or less than XXXX data words than instructed. XXXX is the number of words the BC should have accepted before generating an EOP interrupt. YYYY is the number of words the BC actually accepted.

LOST DATA STATUS
FROM 1700 TO BC
EXP=XXXX ACT=YYYY

During a Data Block transfer of x words from the 1700 to the BC, the BC generated Lost Data status.

This is a fatal error. Once the 1700 initiates a data transfer to the BC it does not terminate data output to the BC unless the BC generates an EOP interrupt or the 1700 detects timeout on data transfer.

ILLEGAL LOST DATA STATUS
FROM 1700 TO BC
EXP=XXXX ACT=YYYY

The BC accepted as many words as instructed to, yet the BC generated a Lost Data Status condition.

NOTE: Under normal conditions, that is: following a successful Data Block transfer, the condition bit in the BC should be true, if it is false the BC program will generate a Lost Data status.

BC HANG UP ON DATA OUTPUT

During a Data Block transfer of x words from the BC to the 1700, the BC has failed to terminate the data transfer with an EOP interrupt. Data transfer has been terminated by the 1700 upon detecting timeout on data transfer.

BLOCK TRANSFER FAILED
FROM BC TO 1700
EXP=XXXX ACT=YYYY

The BC has failed to transfer the correct number of words.

NOTE: On any one of the above messages, the BC3 types:

ACTION (C, R) = Where
C = Continue
R = Repeat on error only

NOTE: To repeat the same function unconditionally, set the SELECTIVE SKIP switch before entering R in response to ACTION(C, R). To exit from this unconditional loop clear the SELECTIVE SKIP switch.

If no errors are detected in the Block Transfer ECO Test, the BC3 will type:

END OF SECTION 5
END OF TEST
ACTION(C, R)=

Enter R if the entire test is to be re-run.

Enter C if BC3 is to be terminated (a SELECTIVE STOP will occur). If a run is executed from the SELECTIVE STOP, BC3 will be restarted.

NOTE: SMM17 must be reloaded before loading another test. A restart of BC3 can be executed by a Master Clear, and run from location 0.

929/1784 DIAGNOSTIC
(LR1A31 Test No. 31)

I. GENERAL TEST DESCRIPTION

A. EQUIPMENT CONFIGURATION

The following list of equipment represents equipment which this diagnostic either requires or is capable of using.

1. Compuater
   1784 900- or 600-Nanosecond Cycle Time
   Minimum of 8K is required

2. Tape Units (Optional)
   1732-2 Controller with 615-93 or 615-73 Nonphase Encoded only or
   1732 Tape Controller with 608/609 Tape Unit connected through an A/Q Channel Adapter

3. Teletype
   Model 33 or
   Model 35 or
   713 Display when the 713 Display is used as a console.
   Teletype data may be entered as upper- or lowercase.

4. Printer (Optional)
   1742 with A/Q Channel Adapter or
   1742-30 or
   1742-120

B. LR1 DESCRIPTION

LR1A31 is intended to be a run-alone diagnostic and as such does not follow standard operating procedures for an SMM diagnostic.

The following list is a brief description of the test sections contained in LR1.

Section 1 Function Codes Test
Operator Panel Test
Not Ready to Ready Interrupt Test

Section 2	Alarm Interrupt Test Direct Storage Addressing Test End of Operation Interrupt Test Director 3 Status Test Director 2 Status Test
Section 3	Dynamic and Static Document Slippage Test Drum Speed Test, Coordinates Verification Test
Section 4	General Read and Compare Test
Section 5	Document Handling and Sorting Test

This diagnostic interfaces with SMM only for loading and determination of computer memory speed and size.

II. LOADING

This test is loaded as test number 31 using the standard SMM17 loading techniques; however, no other test may be called to run with or after LR1. Upon completion of LR1, SMM must be reloaded.

Upon initiation of test 31, the teletype will respond:

```
BEGIN LR1A31 REV. 1.0, V. 3.1.0 CP04 IA=XXXX
CLR SLS SET PP
```

Where XXXX indicates the address where LR1 was loaded.

NOTE

LR1 upon loading destroys the SMM Monitor. Because of this fact, SMM must be reloaded before another test may be run.

After the initiation message has been printed, perform the following steps.

- Clear the SELECTIVE STOP switch.
- Set the PROGRAM PROTECT switch.

Upon setting the PROGRAM PROTECT switch, the following message will be displayed:

NEXT

LR1 is now ready for operation. Proceed to the appropriate section of this manual for a continuation of the operating procedures.

III. RESTART

If at any time a complete restart of LR1 is desired, perform the following steps.

A. Master clear the computer.

B. Clear PROGRAM PROTECT switch.

C. Set P register = initial address (IA).

D. Run (GO).

E. Set PROGRAM PROTECT switch.

In the event that the above procedure does not result in the message NEXT being displayed, a DSA addressing error has occurred, which for unknown reasons was not detected at the time of the failure. The diagnostic has been destroyed by this error and must be reloaded.

IV. OPERATING PROCEDURES

A. GENERAL

After initial loading (Section II) or Restart (Section III), depressing the MANUAL INTERRUPT button will result in the message NEXT being displayed on the teletype. This message indicates that the diagnostic is ready to accept any of the parameters or commands listed in Appendix F.

All sections of this diagnostic make use of a standard set of parameters such as OCR Equipment Code, OCR Interrupt Line Number, etc. Refer to Appendix F for a complete list of all the parameters which may be altered.

The alteration of these codes and parameters is accomplished via the teletype after the printout NEXT. Select the proper two-character alpha code for the desired parameter (AP, OE, OI, etc.), type these two characters, and follow the procedure detailed in Appendix F for that parameter.

Example:

Alter the 929 Interrupt Line Number to 5

```
NEXT OI =5(CR)
NEXT  |  |Type
   |  |  Computer
   |  |___Type
   |______Computer
```

1. Section Selection and Execution

After the typeout NEXT:

Type EX =Z(CR) to execute a single section or EX =Y-Z(CR) to execute multiple sections.

Where: Y - Starting section number 1-5

Z - Ending section number 1-5

NOTE

In all examples, the underlined characters indicate that the user should type, while all other characters are typed by the program LR1. (CR) indicates a carriage return.

B. SECTION 1

Section 1 verifies that all director functions and status responses are accepted by the 929 properly; however, Section 1 cannot verify that the 929 performs properly for each director 0 - 9 and ensures that the 929 replies properly. Section 1 also verifies that interrupt selection and interrupt responses and status are proper for all but the Alarm and End of Operation interrupts. Refer to Section V for a detailed program flow.

1. Applicable Parameters

Refer to Appendix F for a detailed description of each parameter.

AP	Automatic Parameters
OE	OCR Equipment Code
OI	OCR Interrupt Line Number
RE	Repetitions
SE	Suppress Error Printout

2. Operation

a. Ensure teletype is at message NEXT.

b. Alter appropriate parameters (see Appendix F).

c. Ready 929; no documents are required for Section 1.

d. Type EX =1(CR)

e. The teletype will respond with SECTION 1 RUNNING.

f. Follow instructions given on TTY (see IV.B.3).

g. In the event of an error printout, go to 4.

h. Upon completion of Section 1, the following message will be displayed:

SECTION 1 COMPLETED
END OF TEST
NEXT

3. Control Messages (in order of occurence)

a. SECTION 1 RUNNING

Indicates that Section 1 has begun operation.

b. SET QL TO X

Indicates that the user is to set the Quantize Level switch on the 929 Operator Panel to position X and type a carriage return.

Where: X = L - Light
M - Medium
D - Dark

c. MAKE 929 NOT READY

Depress the READY indicator/switch on the 929 Operator Panel, wait for the 929 Drum to stop, and type a carriage return.

d. PRESS EOF SWITCH

Depress END OF FILE indicator/switch on 929 Operator Panel. Ensure indicator lights. Type a carriage return.

e. CLR EOF SWITCH

Depress END OF FILE indicator/switch on 929 Operator Panel. Ensure indicator light goes out. Type a carriage return.

f. READY 929

Depress READY indicator/switch on 929 Operator Panel. Ensure indicator lights. Wait for drum to come up to full speed. Type a carriage return.

g. SECTION 1 COMPLETED

Indicates that Section 1 has completed all operation.

4. Applicable Error Messages

a. 929 Status Error (see Appendix B)

b. 929 Function Error (see Appendix A)

c. 929 Status Function Error (see Appendix C)

d. OCR NOT READY (see Appendix H)
Indicates that the 929 was not ready at the start of Section 1. The action message which follows the OCR NOT READY message requires a REPEAT (R) entry to continue with Section 1. If a CONTINUE (C) is entered, control is transferred to the NEXT processor.

C. SECTION 2

This section is intended to test the Alarm and End of Operation interrupts, and verify OCR and Mark Read Direct Storage addressing. The alarm interrupt is tested by setting the input buffer length to zero and performing a read. The read is a two-field read, asking for a field separator at the terminal coordinates. This should force an Alarm interrupt.

The OCR Direct Storage Addressing Test is performed by the same basic procedures as above, except the buffer length is set to two. When the first read is performed, the input buffer address is zero (0000). The second read address is 1EFF and the third read address is XF00, where X is the highest bank in the computer. Upon completion of the read, the entire core of the computer is checked for the data which should have been read (FF5B, FF5B). If the address where data is found differs from the expected address, an error will occur.

The Mark Read DSA addressing is performed in the same manner as the OCR test, except the expected data is (FF5B, E05B).

For a complete program flow of Section 2, refer to Section V.

1. Applicable Parameters

Refer to Appendix F for a detailed description of each parameter.

AP	Automatic Parameters
OE	OCR Equipment Code
OI	OCR Interrupt Line Number
RE	Repetitions
SE	Suppress Error Printout

2. Operation

a. Ensure TTY is at message NEXT.

b. Ensure the 929 is capable of handling the document to be used for this section. (Section 5 may be used for this purpose.) The leading 3/4 inch of the document must be blank.

NOTE

The same document may be used for Sections 2 and 3 if the leading 3/4 inch of the document is blank. Only two documents are required for each repetition of Section 2.

c. Ready 929.

d. Type <u>EX</u> =<u>2(CR)</u>.

e. The teletype responds with SECTION 2 RUNNING.

f. Section 2 contains no manual intervention unless an error occurs; therefore, the next typeout which should occur is SECTION 2 COMPLETED.

g. In the event an error occurs, go to 4.

3. Applicable Control Messages

a. SECTION 2 RUNNING
Indicates that Section 2 processing is now starting.

b. SECTION 2 COMPLETED
Indicates that all of Section 2 processing has been completed.

4. Applicable Error Messages

a. 929 Status Function Error (see Appendix A)

b. 929 Status Error (see Appendix B)

c. 929 Function Error (see Appendix C)

d. OCR NOT READY
ACTION (C, R)=
Indicates that the 929 was not ready at the start of Section 2. Ready 929 and type R(CR).

e. DSA PROTECT FAULT XXXX
or
OMR DSA PROTECT FAULT XXXX
This message indicates that the DSA channel has attempted to store data at location XXXX or XXXX+1, and in trying to perform the storage operation, a Protect fault was generated.

At this time, the following table represents the locations of core which are protected.

LOC 0000 1	Unprotected
IA LR1 Prog End	Protected
	Unprotected

f. DSA WCNT ERROR E=0002 A=XXXX

or

OMR DSA WCNT ERROR E=0002 A=XXXX

This message indicates that although status 2 or 3 from the 929 indicated that two words were transferred to the computer, XXXX words were found in core.

NOTE

Indeterminable results will occur unless the user replies to the Action message with R Repeat.

g. DSA ADR ERR (1) E=XXXX A=YYYY (2) E=XXXX A=YYYY

or

OMR DSA ADR ERR (1) E=XXXX A=YYYY (2) E=XXXX A=YYYY

This error printout indicates that after having read two words of data consisting of FF5B for OCR or FF5B and E05B for Mark Read, the data was not located in core where it should have been.

XXXX = Expected address

YYYY = Actual address

NOTE

The data input for OCR is FF5B which should have been stored in two successive locations of core. The (1) section of the printout refers to the first word and the (2) section of the printout refers to the second word.

When the Mark Read portion of the DSA test is run, the expected data is FF5B E05B.

D. SECTION 3

Section 3 tests document slippage and drum speed. Document slippage is tested in two stages: dynamic and static. Dynamic slippage is tested by feeding and sorting 12 documents and saving the coordinates of the first and last characters on the last 10 of these documents. The coordinates which were saved are then compared against the coordinates specified in the Document Parameter (DP). If the difference is greater than two coordinates, an error printout will occur. Before the data input is used for Document Slippage Test, the coordinates received are tested to ensure that they are incremental, (that is, the latter is greater than the preceeding coordinate). If there is a discrepancy, an error message will be displayed. The Static Test is performed in much the same manner as the Dynamic Test; however, the document is not sorted.

The Drum Speed Test is accomplished by determining the length of time the drum requires to rotate one complete revolution and converting this time into inches per second for the error printout. The Drum Speed Test is run 10 times for each repitition of Section 3.

Refer to Section V for a complete program flow of Section 3.

1. Applicable Parameters

   Refer to Appendix F for detailed descriptions of each parameter.

AP	Automatic Parameters
DP	Document Parameters
OE	OCR Equipment Code
OI	OCR Interrupt Line Number
RE	Repetitions
SE	Suppress Error Printout

2. Operation

   a. Ensure TTY is at message NEXT.

   b. Ensure 929 properly handles the document to be used for this section.

   c. Set 929 Read Height to proper line.

   d. Provide Document Parameter (DP) as described in Appendix F.

   e. Ready 929 (14 documents are required for each repetition of Section 3).

   f. Execute Section 3. Type EX =3(CR).

   g. Teletype responds with SECTION 3 RUNNING.

   h. Section 3 requires no manual interventions unless an error is detected; therefore, the next message should be SECTION 3 COMPLETED.

      In the event of errors, go to 4.

3. Applicable Control Messages

   a. SECTION 3 RUNNING
      Indicates that Section 3 has begun its operations.

   b. SECTION 3 COMPLETED
      Indicates that Section 3 has terminated all testing.

4. Applicable Error Messages

   a. Status Function Error (see Appendix C)

   b. Function Error (see Appendix A)

   c. Status Error (see Appendix B)

   d. DOC SLIPPAGE (DYNAMIC) EXP=XXXX/YYYY ACT=XXXX/YYYY
      This error indicates that while running the dynamic portion of the Slippage Test a difference of more than two coordinates between expected and actual was detected. Up to 10 of these errors may be output for each repetition of Section 3.

   e. DOC SLIPPAGE (STATIC) EXP=XXXX/YYYY ACT=XXXX/YYYY
      Same as above, except that the error was detected during the static portion of the test.

   f. DRUM SPEED (STATIC) EXP=0221IPS ACT=XXXXIPS
      This error indicates that the drum speed has varied outside the range of 210 to 223 inches per second.

   g. COORDINATE SEQUENCE ERROR
      XXXX
      YYYY
      ZZZZ
      Indicates that the coordinates received from the 929 were not in sequence. X indicates the data read and Y, Z indicates the coordinate for that character.

E. SECTION 4 - GENERAL READ AND COMPARE TEST

1. Applicable Parameters
   Value in () indicates the automatic selection. Refer to Appendix F for complete description (N) of each parameter.

AP	Automatic Parameters
BB	Buffer Build (N)
CC	Character Coordinate Mode Select (N)
CM	Compare Mode Select (B)
CP	Character Position (NA)

CS	Character Sort Parameter (Substitution to Pocket 3, Reject to Pocket 2)	
EO	Enable Overflow (N)	
FN	Field Number Parameter (0)	
OE	OCR Equipment Code	
OI	OCR Interrupt Line Number	
OM	Output to Magnetic Tape (OT)	
	ME	Magnetic Tape Equipment Number (7)
	MU	Magnetic Tape Unit Number (0)
	MI	Magnetic Tape Interrupt Line Number (7)
OP	Output to Printer (OT)	
	PE	Printer Equipment Code (4)
	PM	Printer Model Select
OT	Output to Teletype (Normal Selection)	
QL	Quantize Level Select (2)	
RE	Repetitions (Section 4 Resets RE to 1)	
RP	Read Parameters Selection (3017/15/AO)	
	FF	Alter Mode Word
	IC	Alter Initial Coordinate
	FC	Alter Final Coordinate
RS	Rescan Selection (No Rescans)	
SE	Suppress Error Printout (No)	
SO	Select Output (E)	
SP	Sort Parameters (See CS Parameter)	
TD	Trap Document Selection (No)	

2. Operation

   a. Ensure TTY is at message NEXT.

   b. Alter appropriate parameters from the preceding table. This list is further described in Appendix F.

   c. Type EX =4(CR).

   d. The TTY will respond with SECTION 4 RUNNING.

   e. The computer is waiting for the 929 to become ready at this point. If compare mode = B and this is the first time Section 4 has been run since it was set to B, LR1 will type the reference line. If the reference line is good, type G(CR). If another document should be read for the reference line, type B(CR). If corrections are to be made, type C(CR). If G was typed, LR1 accepts the data, places it into the reference line, and continues with Section 4 reading and compareing the data. A reference line printout will occur every 10 errors. If C was typed, a CR is executed and the user may alter the makeup of the reference line by typing the character. To eliminate the compare mode on a character, type *. To terminate the entry, type a CR.

If the program hangs anytime during the execution of Section 4, the 929 has halted because of a no feed, early feed, or late feed causing a reader pause condition. All other conditions are causes for an error diagnostic on the TTY. Refer to Appendixes A, B, C, and H for descriptions of error messages.

f. When the desired number of documents have been run, allow the 929 to run out of documents and then depress the END OF FILE switch on the 929 console. This will result in error totals to the TTY and an exit from Section 4. This is the only way to exit Section 4 except by Manual Interrupt. Document totals are only cleared by the End of File.

The printout is as follows:

```
D=XXXXXXXX  C=YYYYYYYY  R=ZZZZ  S=AAAA
SECTION 4 COMPLETED
END OF TEST
```

Where: X = Documents run

Y = Characters read

Z = Number of rejects

A = Number of substitutions

3. Control Messages

   a. SECTION 4 RUNNING

   b. SECTION 4 COMPLETED

   c. ERROR TOTALS MESSAGE

4. Error Messages

   a. Status Function Error Message (see Appendix C)

   b. Status Error Message (see Appendix B)

   c. Function Error Message (see Appendix A)

5. Summary

   a. After loading, Section 4 is set up to read the standard OCRA test documents in a Compare mode. This may be altered before execution of Section 4 (see CM parameter).

b. Buffer build is a method of data manipulation which most customers with the 929 utilize to cut down the number of errors encountered with the 929. This routine depends upon rescan selection for the second and third reads of the OCR data. When buffer build is enabled, the first read of the OCR data is taken as a base and any rejects are replaced with the data of the second and third reads if the character was not rejected. This is done on a character by character analysis so that all the good characters are retained and only the rejected ones are altered. If more or less characters are input on a rescan, the data is thrown away.

c. Read parameters are entered by an (RP) parameter and are never altered by the diagnostic. The RP parameter will set the E bit for the last OCR and Mark Read entries. Caution must be exercised to enter the table in the sequence the 929 will read it. Read parameters apply only to Section 4.

d. To obtain a new reference line after execution of Section 4, set compare mode to B (NEXT CM=B(CR).

e. When running Section 4 with suppression of error selected to ensure an End of File is detected, allow the 929 to come to a normal late feed condition and depress the END OF FILE switch.

f. Character code FF_{16} is converted to $5E_{16}$ for display purposes.

F. SECTION 5 - DOCUMENT HANDLING AND SORTING TEST

1. Applicable Parameters

AP	Automatic Parameters
OE	OCR Equipment Code
EO	Pocket Overflow Selection
SE	Suppress Error Printout
RE	Repetitions (Section 5 resets this parameter to 1)

2. Operation

a. Ensure TTY is at message :NEXT.

b. Alter desired parameters.

c. Ready 929.

d. Execute Section 5.
Type EX =5(CR). TTY responds with SECTION 5 RUNNING SS=.

e. The computer at this time is waiting for the user to specify the sort sequence to be used by Section 5. The sort sequence specified will be run over and over until an End of File is detected. This may be accomplished in one of the following three ways.

1) SS = * Use standard sort table:

11111021111103

Where: 0 - Recirculate document
1 - Sort to accept pocket
2 - Sort to reject pocket 1
3 - Sort to reject pocket 2

2) SS = XXX. . . . (CR)

Where: X = Indicates where a document is to be sorted. Up to 25 documents may be indicated. Use the same values as indicated above.

3) SS = (CR) Use parameters previously selected.

f. The sort and handling test is now running. This section contains no error conditions and operates only on status. This section is dependent upon the operator for detection of error conditions.

The only exit from Section 5 is to depress the END OF FILE switch when the 929 is in a Not Ready condition. This will result in a document total message to the TTY. These document totals are reset only by the END OF FILE switch.

After the document totals have been displayed, the message SECTION 5 COMPLETED will also be displayed.

3. Applicable Control Messages

a. SECTION 5 RUNNING
Indicates that control has been transferred to Section 5 and that Section 5 is in control.

b. SECTION 5 COMPLETED
Indicates that Section 5 has now completed all of its operation. This message will only be output after detection of an End of File by Section 5.

c. Document Total Message
TOT XXXXXXXX P2 YYYYYYYY P3 ZZZZZZZZ

Where:

XXXXXXXX	Represents the total number of documents stacked
YYYYYYYY	Represents the total number of documents sorted to reject pocket 1
ZZZZZZZZ	Represents the total number of documents sorted to reject pocket 2

NOTE

The totals indicated may not agree with the totals shown on the 929 document counters because of lost documents, etc.

If Enable Pocket Overflow is selected, the totals for pockets 2 and 3 combined will indicate the number of documents counted on the 929.

4. Applicable Error Messages

   929 Status Function Error (see Appendix C).

V. SECTION DESCRIPTION

A. SECTION 1 - FUNCTION CODES, OPERATOR PANEL, END OF FILE, AND NOT READY TO READY INTERRUPT TESTS

1. Set message ID to 1, and test Director 1.

   a. Test OCR Ready.

      1) If reply to status is received, go to V.A.1.a.2).

         a) Report Status Function Error.
         b) Repeat and go to V.A.1.

      2) Test OCR status for Ready. If status is correct, go to V.A.1.b.

         a) Report Status Error.
         b) Repeat and go to V.A.1.
         c) Continue is illegal and will result in an exit from Section 1 to message NEXT.

   b. Output Director 1, clear controller, clear interrupt, and reset read table.

      1) If function is accepted, go to V.A.1.c.

         a) Report Function Error.
         b) Repeat and go to V.A.1.b.

   c. Test OCR status for Ready.

      1) If status function is accepted, go to V.A.1.c.2).

         a) Report Status Function Error.
         b) Repeat and go to V.A.1.c.

      2) If status is correct, go to V.A.2.

         a) Report Status Error.
         b) Repeat and go to V.A.1.b.

2. Set message ID to 2, test Director 0, and set word number to 1.

   a. Output one word Director 0 (A register is word number).

      1) If function is accepted, go to V.A.2.b.

         a) Report Function Error.
         b) Repeat and go to V.A.1.

   b. Test status for Ready.

      1) If status function is accepted, go to V.A.2.b.2).

         a) Report Status Function Error.
         b) Repeat and go to V.A.2.b.

      2) If status is correct, go to V.A.2.c.

         a) Report Status Error.
         b) Repeat and go to V.A.1.

   c. Increment word number.

      1) If word number = 17, go to V.A.3.

      2) Go to V.A.2.a.

3. Set message ID to 4 and test Director 2.

   a. Output Director 2 (A=OCR buffer address).

      1) If function is accepted, go to V.A.3.b.

         a) Report Function Error.
         b) Repeat and go to V.A.3.

   b. Test OCR for Ready.

      1) If status function is accepted, go to V.A.3.b.2).

         a) Report Status Function Error.
         b) Repeat and go to V.A.3.b.

      2) If status is correct, go to V.A.4.

         a) Report Status Error.
         b) Repeat and go to V.A.3.

4. Set message ID to 5 and test Director 3.

   a. Output Director 3 (OCR rescan buffer address).

      1) If function is accepted, go to V.A.4.b.

         a) Report Function Error.
         b) Repeat and go to V.A.4.

b. Test status for Ready.

1) If status function is accepted, go to V.A.4.b.2).

a) Report Status Function Error.
b) Repeat and go to V.A.4.b.

2) If status is correct, go to V.A.5.

a) Report Status Error.
b) Repeat and go to V.A.4.

5. Set message ID to 6 and test Director 6.

a. Output Director 6 (OCR and mark read buffer length).

1) If function is accepted, go to V.A.5.b.

a) Report Function Error.
b) Repeat and go to V.A.5.

b. Test OCR Status for Ready.

1) If status function is accepted, go to V.A.5.b.2).

a) Report Status Function Error.
b) Repeat and go to V.A.5.b.

2) If status is correct, go to V.A.6.

a) Report Status Error.
b) Repeat and go to V.A.5.

6. Set message ID to 7 and test Director 1.

a. Output Director 1 (reset read table).

1) If function is accepted, go to V.A.6.b.

a) Report Function Error.
b) Repeat and go to V.A.6.a.

7. Set message ID to 8, test Director 5, and set field number to 1.

a. Output Director 5 (A = field number).

1) If function is accepted, go to V.A.7.b.

a) Report Function Error.
b) Repeat and go to V.A.6.

b. Test OCR status for Ready.

1) If status function is accepted, go to V.A.7.a.2)b).

a) Report Status Function Error.
b) Repeat and go to V.A.7.b.

2) If status is correct, go to V.A.7.c.

a) Report Status Error.
b) Repeat and go to V.A.7.a.1).

c. Increment field number by 1.

1) If field number is equal to 17, go to V.A.8.

2) Go to V.A.7.a.

8. Set message ID to 10 and test Director 6.

a. Output Director 6 function.

1) If function is accepted, go to V.A.8.b.

a) Report Function Error.
b) Repeat and go to V.A.8.

b. Test OCR status.

1) If status function is accepted, go to V.A.8.b.2).

a) Report Status Function Error.
b) Repeat and go to V.A.8.b.1).

2) If status is correct, go to V.A.9.

a) Report Status Error.
b) Repeat and go to V.A.8.

9. Set message ID to 11 and test Director 7.

a. Output Director 7.

1) If function is accepted, go to V.A.9.b.

a) Report Function Error.
b) Repeat and go to V.A.9.

b. Test OCR status for Ready.

1) If status function is accepted, go to V.A.9.b.2).

a) Report Status Function Error.
b) Repeat and go to V.A.9.b.1).

2) If status is correct, go to V.A.10.

a) Report Status Error.
b) Repeat and go to V.A.9.

10. Set message ID to 12 and test Director 8.

a. Output Director 8 function.

1) If function is accepted, go to V.A.10.b.

a) Report Function Error.
b) Repeat and go to V.A.10.

b. Test OCR status for Ready.

1) If status function is accepted, go to V.A.10.b.2).

a) Report Status Function Error.
b) Repeat and go to V.A.10.b.1).

2) If status is correct, go to V.A.11.

a) Report Status Error.
b) Repeat and go to V.A.10.

11. Set Message ID to 13 and test Director 9.

a. Output Director 9 function.

1) If function is accepted, go to V.A.11.b.

a) Report Function Error.
b) Repeat and go to V.A.11.

b. Test OCR status for Ready.

1) If status function is accepted, go to V.A.11.b.2).

a) Report Status Function Error.
b) Repeat and go to V.A.11.

2) If status is correct, go to V.A.12.

a) Report Status Error.
b) Repeat and go to V.A.11.b.

12. Set message ID to 14 and test Quantize Level Status.

a. Clear index.

b. Type message SET QL TO X.

c. Wait for carriage return.

d. Test OCR status 2.

   1) If status function is accepted, go to V.A.12.d.2).

      a) Report Status Function Error.
      b) Repeat and go to V.A.12.d.

   2) If OCR status 2 is correct, go to V.A.12.e.

      a) Report Status Error.
      b) Repeat and go to V.A.12.d.

e. Increment index by 1.

   1) If index equals 3, go to V.A.13.

f. Go to V.A.12.b.

13. Set message ID to 15 and test End of File Status and Interrupt.

a. Type message MAKE 929 NOT READY.

b. Output Director 1, clear controller, clear interrupt, and enable not ready to ready interrupt.

   1) If function is accepted, go to V.A.13.c.

      a) Report Function Error.
      b) Repeat and go to V.A.13.b.

c. Wait for carriage return.

d. Type message PRESS END OF FILE.

e. Wait for carriage return.

f. Test for interrupt.

   1) If interrupt is received, go to V.A.13.g.

      a) Set message ID to 16.

g. Test OCR status.

   1) If status function is accepted, go to V.A.13.g.2).

      a) Report Status Function Error.
      b) Repeat and go to V.A.13.g.

   2) If status is correct and interrupt is received, go to V.A.14.

      a) Report Status or Interrupt Error.

         ID = 15 Status Error
              16 Interrupt Error

      b) Repeat and go to V.A.13.

14. Set message ID to 17.

    a. Type message CLEAR EOF SWITCH.

    b. Wait for carriage return.

    c. Test OCR status.

        1) If status function is accepted, go to V.A.14.c.2).

            a) Report Status Function Error.
            b) Repeat and go to V.A.14.c.

        2) If status is correct, go to V.A.14.d.

            a) Report Status Error.
            b) Repeat and go to V.A.14.c.

    d. Output Director 1, clear interrupt, and clear controller.

        1) If function is accepted, go to V.A.15.

            a) Report Function Error.
            b) Repeat and go to V.A.14.d.

15. Set message ID to 18.

    a. Test OCR status; expect NOT READY.

        1) If status function is accepted, go to V.A.15.a.2).

            a) Report Status Function Error
            b) Repeat and go to V.A.15.

        2) If status is correct, go to V.A.15.b.

            a) Report Status Error.
            b) Repeat and go to V.A.15.

    b. Output Director 1, clear interrupt, enable not ready to ready, and reset read table.

        1) If function is accepted, go to V.A.16.

            a) Report Function Error.
            b) Repeat and go to V.A.15.b.

16. Set message ID to 10 and test Not Ready to Ready Interrupt.

    a. Type message READY 929.

    b. Wait for user to type a carriage return.

    c. Test for interrupt.

        1) Set message ID to 20 if no interrupt was received.

d. Test OCR status and expect ready, interrupt, not ready to ready interrupt.

1) If status function is accepted, go to V.A.16.d.2).

a) Report Status Function Error.
b) Repeat and go to V.A.16.d.

2) If status is correct and interrupt was received, go to V.A.17.

a) Report Status Error.
ID - 19 incorrect status
ID - 20 interrupt not received
b) Repeat and go to V.A.20.

17. Set message ID to 21.

a. Output Director 1 and clear interrupt.

1) If function is accepted, go to V.A.18.

a) Report Function Error.
b) Repeat and go to V.A.17.a.

18. Set message ID to 22.

a. Output Director A and expect external reject.

1) If external reject, go to V.A.19.

a) Report Function Error.
b) Repeat and go to V.A.18.

19. Exit Section 1 and return control to message NEXT.

20. Type message MAKE 929 NOT READY.

a. Go to V.A.15.a.

B. SECTION 2 - ALARM INTERRUPT, DSA ADDRESSING, END OF OPERATION INTERRUPT, AND DIRECTOR STATUS TESTS

1. Set message ID to 1 and test OCR Ready.

a. Take Director 1 status.

1) If status function is accepted, go to V.B.1.a.1).

a) Report Status Function Error.
b) Repeat and go to V.B.1.a.

2) If status is correct, go to V.B.2.

a) Display OCR NOT READY message.
b) Repeat and go to V.B.1.
c) Continue is illegal and will result in an exit from Section 2 to to the TTY message NEXT.

2. Set message ID to 1, set Section 2 switch to 0, and wait for OCR Ready.

a. Take Director 1 status.

1) If status function is accepted, go to V.B.2.b.

a) Report Status Function Error.
b) Repeat and go to V.B.2, a.

b. If status is ready, go to V.B.3.

1) Go to V.B.2.

3. Set message ID to 5 and set up for Alarm Interrupt Test.

a. Reset Read Table and clear interrupts, Directior 1.

1) If function is accepted, go to V.B.3.b.

a) Report Function Error.
b) Repeat and go to V.B.2.

b. Output Mode Word, Director 0, and Word 1.

1) If function is accepted, go to V.B.3.c.

a) Report Function Error.
b) Repeat and go to V.B.2.

c. Output Coordinates Field 1, Director 0, and Word 2.

1) If function is accepted, go to V.B.d.

a) Report Function Error.
b) Repeat and go to V.B.2.

d. Output Mode Word Field 2, Director 0, and Word 1.

1) If function is accepted, go to V.B.3.e.

a) Report Function Error.
b) Repeat and go to V.B.2.

e. Output Coordinates Field 2, Director 0, and Word 2.

1) If function is accepted, go to V.B.3.f.

a) Report Function Error.
b) Repeat and go to V.B.2.

f. Output OCR buffer first-word address and Director 2.

    1) If function is accepted, go to V.B.3.g.

        a) Report Function Error.
        b) Repeat and go to V.B.2.

g. Set buffer length to zero, Director 4.

    1) If function is accepted, go to V.B.3.h.

        a) Report Function Error.
        b) Repeat and go to V.B.2.

h. Read line 1, Director 8.

    1) If function is accepted, go to V.B.3.i.

        a) Report Function Error.
        b) Repeat and go to V.B.2.

i. Clear interrupts, feed, and enable alarm interrupt, Director 1.

    1) If function is accepted, go to V.B.3.j.

        a) Report Function Error.
        b) Repeat and go to V.B.2.

j. Test OCR status and expect Ready.

    1) If status function is accepted, go to V.B.3.j.2).

        a) Report Status Function Error.
        b) Repeat and go to V.B.3.j.

    2) If status is correct, go to V.B.4.

        a) Report Status Error.
        b) Repeat and go to V.B.2.

4. Set message ID to 6, Alarm Interrupt Test.

    a. Read OCR, Director 6.

        1) If function is accepted, go to V.B.4.b.

            a) Report Function Error.
            b) Repeat and go to V.B.2.

    b. Wait for Alarm interrupt; if not received within specific time period, set switch.

    c. Test OCR status 1 and expect $125 as status.

        1) If status function is accepted, go to V.B.4.c.2).

            a) Report Status Function Error.
            b) Repeat and go to V.B.4.c.

2) If interrupt was received, go to V.B.4.c.3).

a) Set message ID to 7.

3) If status is correct and interrupt was received, go to V.B.5.

a) Report Status Error.
b) Repeat and go to V.B.2.

5. Set message ID to 7.

a. Clear interrupt, Director 1.

1) If function is accepted, go to V.B.6.

a) Report Function Error.
b) Repeat and go to V.B.2.

6. Set message ID to 8.

a. Set OCR and mark read buffer lengths to 2, Director 8.

1) If function is accepted, go to V.B.6.b.

a) Report Function Error.

b) Repeat and go to V.B.2.

b. If Section 2 switch = 0, go to V.B.6.d. (Switch is used to determine if running Mark Read or OCR; OCR is run first.)

c. Set message ID to 13.

1) Clear interrupt and reset Read Table, Director 1.

a) If function is accepted, go to V.B.6.c.2), report Function Error, repeat, and go to V.B.2.

2) Output Mode Word Field 1 and Director 5.

a) If function is accepted, go to V.B.6.c.3), report Function Error, repeat, and go to V.B.2.

3) Output Coordinates Field 1 and Director 5.

a) If function is accepted, go to V.B.d., report Function Error, repeat, and go to V.B.2.

d. Clear address index.

e. Output first-word address, Director 2 for OCR and Director 9 for Mark Read.

If index = 0, address = 0000
1, address = 1EFF
2, address = 7F00

1) If function is accepted, go to V.B.6.f.

a) Report Function Error.
b) Repeat and go to V.B.2.

f. Clear all input buffers. Clear all locations in core containing FF5B or E05B; save addresses for later.

g. Enable Alarm and End of Operation interrupts.

1) If function is accepted, go to V.B.6.h.

a) Report Function Error.
b) Repeat and go to V.B.2.

h. Read OCR or Mark Read, Director 6.

1) If function is accepted, go to V.B.6.i.

a) Report Function Error.
b) Repeat and go to V.B.2.

i. Wait for interrupt; this is an indefinite wait. While waiting for the interrupt, the overflow light will be flashing. When interrupt occurs, go to V.B.6.j.

j. If Computer Protect Fault is not UP at this time, go to V.B.6.k.

1) Report DSA Protect Fault or OMR DSA Protect Fault.

a) Repeat and go to V.B.6.e.
b) Continue and go to V.B.6.p.

k. Clear interrupt, Director 1.

1) If function is accepted, go to V.B.6.l.

a) Report Function Error.
b) Repeat or continue and go to V.B.6.l.

l. Search core for FF5B and E05B, save the address, and set the contents of that address to zero.

m. Test Director 2 or 3 status. The status should reflect two words transferred to the computer.

1) If status function is accepted, go to V.B.6.m.2).

a) Report Status Error.
b) Repeat and go to V.B.6.e.

n. If the number of words of data found in the computer was two, go to V.B.6.O.

   1) Report DSA or OMR DSA Word Count Error.

      a) Repeat and go to V.B.6.e.

o. If the address of the data found in core and the calculated address of the data match, go to V.B.6.p.

   1) Report DSA or OMR DSA Addressing Error.

      a) Repeat and go to V.B.6.e.

p. Increment index for address.

   1) If index = 3, go to V.B.6.q.

   2) Go to V.B.6.e.

q. If Section 2 switch = 0, set it to 1 and go to V.B.6.

r. Restore all FF5B and E05B to their proper places.

7. Set message ID = 9, End of Operation Interrupt Test.

   a. Set OCR buffer input address to 400_{16}, Director 2.

      1) If function is accepted, go to V.B.7.b.

         a) Report Function Error.
         b) Repeat and go to V.B.7.

   b. Set OCR rescan buffer input address to 464_{16}, Director 3.

      1) If function is accepted, go to V.B.7.c.

         a) Report Function Error.
         b) Repeat and go to V.B.7.

   c. Set OCR buffer length to 64_{16}, Director 4.

      1) If function is accepted, go to V.B.7.d.

         a) Report Function Error.
         b) Repeat and go to V.B.7.c.

   d. Reset Read Table, clear interrupts, and feed Director 1.

      1) If function is accepted, go to V.B.7.e.

         a) Report Function Error.
         b) Repeat and go to V.B.7.

e. Output Mode Word, Director 0 and Word 1.

   1) If function is accepted, go to V.B.7.f.

      a) Report Function Error.
      b) Repeat and go to V.B.7.

f. Output coordinates, Director 0 and Word 1.

   1) If function is accepted, go to V.B.7.g.

      a) Report Function Error.
      b) Repeat and go to V.B.7.

g. Clear interrupts and enable End of Operation Interrupt, Director 1.

   1) If function is accepted, go to V.B.7.h.

      a) Report Function Error.
      b) Repeat and go to V.B.7.

h. Test OCR Status 1 and expect Ready.

   1) If status function is accepted, go to V.B.7.h.2).

      a) Report Status Function Error.
      b) Repeat and go to V.B.7.h.

   2) If status is correct, go to V.B.7.i.

      a) Report Status Error.
      b) Repeat and go to V.B.10.

i. Read OCR, Director 6.

   1) If function is accepted, go to V.B.7.j.

      a) Report Function Error.
      b) Repeat and go to V.B.7.

j. Wait for interrupt. If interrupt occurs within a specific time period, set switch.

k. Test OCR Status 1 and expect Ready, Interrupt, and End of Operation.

   1) If status function is accepted, go to V.B.7.k.2).

      a) Report Status Function Error.
      b) Repeat and go to V.B.7.k.

   2) If status is correct and interrupt was received, go to V.B.8.

      a) If interrupt was not received, set message ID to 11.
      b) Report Status Error.
      c) Repeat and go to V.B.7.

8. Set message ID to 12 and strip the documents at the end of Section 2.

   a. Clear controller and reset Read Table, Director 1.

      1) If function is accepted, go to V.B.8.b.

         a) Report Function Error.

   b. Sort document to accept pocket, Director 7.

      1) If function is accepted, go to V.B.8.c.

         a) Report Function Error.

   c. Test status and wait for Ready Busy.

      1) If status function is accepted, go to V.B.8.c.2).

         a) Report Status Function Error.

      2) If status is Not Ready, Busy, go to V.B.8.c.

   d. Clear controller and reset Read Table.

      1) If function is accepted, go to V.B.9.

         a) Report Function Error.

9. Exit Section 2.

10. Feed, Director 1.

    a. If function is accepted, go to V.B.7.i.

       1) Report Function Error.

       2) Repeat and go to V.B.7.

C. SECTION 3 - DOCUMENT SLIPPAGE AND DRUM SPEED TESTS

1. Set message ID to 1, set up for Document Slippage Test, and set switch to DYNAMIC.

   a. Test OCR for Ready status.

      1) If status function is accepted, go to V.C.1.a.2).

         a) Report Status Function Error.
         b) Repeat and go to V.C.1.a.

      2) If status is correct, go to V.C.1.b.

         a) Type message OCR NOT READY.
         b) Repeat and go to V.C.1.a.
         c) Continue is illegal and will result in an exit from Section 3 to the message NEXT.

b. Output Director 1, clear controller, clear interrupts, and reset Read Table.

   1) If function is accepted, go to V.B.1.c.

      a) Report Function Error.
      b) Repeat and go to V.C.1.b.

c. Output Director 0, Word 1, and Mode Word from parameter (DP).

   1) If function is accepted, go to V.C.1.d.

      a) Report Function Error.
      b) Repeat and go to V.C.1.b.

d. Get document coordinates; increment terminal coordinate by five and decrement initial coordinate by five.

e. Output Director 0, Word 2, and coordinates.

   1) If function is accepted, go to V.C.1.f.

      a) Report Function Error.
      b) Repeat and go to V.C.1.b.

f. Output Director 2 and OCR buffer first-word address.

   1) If function is accepted, go to V.C.1.g.

      a) Report Function Error.
      b) Repeat and go to V.C.1.f.

g. Output Director 4 and OCR buffer length.

   1) If function is accepted, go to V.C.1.h.

      a) Report Function Error.
      b) Repeat and go to V.C.1.g.

h. Output Director 8 and read line 1.

   1) If function is accepted, go to V.C.1.i.

      a) Report Function Error.
      b) Repeat and go to V.C.1.h.

i. Set message ID to 1.
   Output Director 1, clear interrupts, enable Alarm interrupt and End of Operation interrupt and feed.

   1) If function is accepted, go to V.C.1.j.

      a) Report Function Error.
      b) Repeat and go to V.C.1.i.

j. Clear index.

1) Output Director 6 and read unpacked coordinate mode, medium quantize level. If function is accepted, go to V.C.1.k.

a) Report Function Error.

b) Repeat and go to V.C.1.

k. Wait for interrupt timeout in 10 seconds.

1) If interrupt is received in time limit, go to V.C.1.a.

a) Report no interrupt, NO INT * RUN SECTION 2.

b) Exit Section 3 NEXT.

l. If performing the Static Document Slippage Test, go to V.C.2.

m. Output Director 7 and sort to accept pocket.

1) If function is accepted, go to V.C.2.

a) Report Function Error.

b) Repeat and go to V.C.1.

2. Set message ID to 2.

a. Test OCR status and expect Ready, Interrupt, and End of Operation.

1) If status function is accepted, go to V.C.2.a.2).

a) Report Status Function Error.

b) Repeat and go to V.C.2.a.

2) If status is correct, go to V.C.2.b.

a) Report Status Error.

b) Repeat and go to V.C.1.

c) Continue and go to V.C.1.

b. Verify that coordinate for the first character is less than the coordinate for the second character, etc. If an error is detected, output character coordinate error message and set ERROR switch.

c. Save coordinates of first and last characters on the line of data read.

1) Take 929 Status 3.

a) If status function is accepted, go to V.C.2.d., report Status Function Error, repeat, and go to V.C.2.c.

d. If 12 documents have been processed, go to V.C.2.g.

e. Output Director 1, clear interrupts, and enable End of Operation and Alarm.

   1) If function is accepted, go to V.C.2.f.

      a) Report Function Error.

f. Go to V.C.1.j.1).

g. Set index to 2; do not use coordinates on first two documents.

h. If index equals 13, go to V.C.2.j.

   1) If coordinates are within tolerance, go to V.C.2.i.

      a) Report Document Slippage Error and set ERROR switch.

j. If no slippage errors were detected, go to V.C.2.k.

   1) Type action message.

   2) Repeat and go to V.C.1.i.

k. If both Dynamic and Static Tests have been run, go to V.C.3.

   1) Set Static Mode and go to V.C.2.e.

3. Set message ID to 3 and test drum speed.

   a. Clear index.

   b. Output Director 4 and set OCR buffer length to 0.

      1) If function is accepted, go to V.C.3.c.

         a) Report Function Error.
         b) Repeat and go to V.C.3.b.

   c. Output Director 1, clear interrupts, and enable End of Operation and Alarm.

      1) If function is accepted, go to V.C.3.d.

         a) Report Function Error.
         b) Repeat and go to V.C.1.

   d. Output Director 6 and read.

      1) If function is accepted, go to V.C.3.e.

         a) Report Function Error.
         b) Repeat and go to V.C.1.

   e. If this is not the first read, go to V.C.3.h.

      1) Wait for the interrupt.

f. Output Director 1 and clear interrupt.

   1) If function is accepted, go to V.C.3.g.

      a) Report Function Error.
      b) Repeat and go to V.C.3.f.

g. If this is the second or subsequent interrupt, go to V.C.3.i.

   1) Go to V.C.3.c.

h. Count the number of computer cycles till the interrupt occurs. When the interrupt occurs, go to V.C.3.f.

i. Save count of cycles.

j. If drum has revolved 10 times, go to V.C.3.k.

   1) Go to V.C.3.c.

k. Clear index.

l. Check counts if count is within ± 1%. Go to V.C.3.m.

   1) Report Drum Speed Error.

m. If index equals 10, go to V.C.3.n.

   1) Increment index and go to V.C.3.1.

n. If no drum speed errors were detected, go to V.C.4.

   1) Type action message.

   2) Repeat and go to V.C.3.

4. Set message ID to 4.

   a. Strip documents off drum.

   b. Exit Section 3.

D. SECTION 4 - VERBAL FLOWCHART

   1. Display SECTION 4 RUNNING message.

   2. If Error Suppression is selected, display CAUTION message.

   3. Clear switches and initialize Section 4.

   4. Set message ID code to 1.

   5. Test OCR Status 1.

      a. If Status 1 function is accepted, go to V.D.5.b.

         1) Report Status Function Error.

         2) Repeat and go to V.D.5.a.

b. If status is Ready, go to V.D.6.

c. If status is End of File, go to V.D.42.

d. If Not Ready, go to V.D.5.

6. Clear sort index.

7. Set message ID code to 1.

8. Clear interrupt (Director 1).

   a. If function is accepted, go to V.D.9.

      1) Report Function Error.

      2) Repeat and go to V.D.7.

9. Set up OCR interrupt trap. When an OCR interrupt occurs, control is transferred to V.D.23.

10. Set message ID code to 2.

11. Initialize OCR read parameters (Directors 0, 1, 2, 3, 4, 5, 8, and 9).

12. Set message ID code to 3.

13. Test OCR Status 1.

    a. If status function is accepted, go to V.D.13.b.

       1) Report Status Function Error.

       2) Repeat and go to V.D.13.a

    b. If alarm status is not set, go to V.D.14.

       1) Report Status Error.

       2) Repeat and go to V.D.4.

       3) Continue and go to V.D.4.

14. Set message ID code to 4.

15. Feed, enable End of Operation interrupt, enable Not Ready to Ready interrupt, enable Alarm interrupt, clear interrupt, and reset or enable Pocket Overflow (Director 1).

    a. If function is accepted, go to V.D.16.

       1) Report Function Error.

       2) Repeat and go to V.D.14.

16. Set message ID code to 5.

17. If this is a rescan document, go to V.D.18 and clear all input buffers to binary zero.

18. Read document: OCR Input Buffer = 0400_{16}
    OCR Rescan Buffer = 0464_{16}
    Mark Read Buffer = $04C8_{16}$

    a. If function (6) is accepted, go to V.D.19.

        1) Report Function Error.

        2) Repeat and go to V.D.4.

19. Enable End of Operation interrupt, Alarm interrupt, and Not Ready to Ready interrupt (Director 1).

    a. If function is accepted, go to V.D.20.

        1) Report Function Error.

        2) Repeat and go to V.D.4.

20. Test WRITE RECORD switch. If a record should be written, do it now. This record would be the last one through the end of operation editing.

21. Wait here for a maximum of .5 second for the 929 to finish reading the document and furnish an interrupt.

    a. If the interrupt occurs, go to V.D.23.

    b. If the interrupt does not occur, go to V.D.22.

22. Test OCR Status 1.

    a. If function is accepted, go to V.D.22.b.

        1) Report Status Function Error.

        2) Repeat and go to V.D.22.a.

    b. If status response is reader pause, go to V.D.4.

        1) Report Status Error.

        2) Repeat or continue and go to V.D.4.

23. Entry is via a 929 interrupt.

24. Set message ID code to 2.

25. Test OCR Status 1.

    a. If status function is accepted, go to V.D.25.d.

        1) Report Status Function Error.

        2) Repeat and go to V.D.25.a.

b. If OCR status is Ready, End of Operation, and Interrupt, go to V.D.26.

c. If last document was not written, write it now.

d. If status is Not Ready to Ready interrupt, go to V.D.11.

e. Set message ID code to 6.

f. If status is reader pause, go to V.D.4. (Wait for Ready.)

g. If status is alarm, report status error.

   1) Repeat and go to V.D.4.

   2) Continue and go to V.D.4.

h. If status is End of Operation, go to V.D.26.

   1) Report Status Error.

      a) Repeat and go to V.D.4.
      b) Continue and go to V.D.4.

26. Set Message ID code to 7.

   a. If Mark Read Reject Status is not set, go to V.D.27.

      1) Report Status Error.

         a) Repeat is not allowed; go to V.D.27.

         b) Continue and go to V.D.27.

27. Clear interrupt.

   a. If function is accepted, go to V.D.28.

      1) Repeat and go to V.D.27.

      2) Continue and go to V.D.28.

28. Determine how many characters were input to the input buffers and save this information. (This is accomplished by searching the buffers until the first word set to binary zero is found.)

29. Increment document and character counters.

30. Set message ID code to 8.

31. If data was received, go to V.D.32.

   a. If Suppress Error (SE) parameter is set, go to V.D.31.a.2).

      1) Report BLANK DOCUMENT message.

      2) Set reject on document flag for sort.

      3) Go to V.D.39.c.5).

32. If not in Character Coordinate Mode (CC) parameter, go to V. D. 33.

    a. Verify that the coordinates which were recieved are incremental. If not, report Character Coordinate Error.

    b. Format and convert actual data.

    c. Output data to specified device.

    d. Sort document and go to V. D. 39. c. 5).

33. Set message ID code to 8.

34. Count rejects on the document.

35. Verify character and reject counts with Directors 2 and 3 status responses.

    a. Test OCR Status 2.

        1) If function is accepted, go to V. D. 35. b.

            a) Report Status Function Error.
            b) Repeat and go to V. D. 35. a.

    b. If Status 2 and Mark Read Word Count agree, go to V. D. 35. c.

        1) Report Status Error.

            a) Repeat is not allowed; go to V. D. 35. c.

    c. If status 3, OCR buffer length, and OCR reject counts agree, go to V. D. 36.

        1) Report Status Error.

            a) Repeat is not allowed; go to V. D. 36.

36. If no rejects are detected on document, go to V. D. 37.

    a. If Rescan or Reject (RS) parameter is not selected, go to V. D. 37.

    b. If the number of rescans selected is zero, go to V. D. 37.

    c. If the number of rescans is equal to the number of rescans selected, go to V. D. 36. h.

    d. If quantize level is not fixed, go to V. D. 36. e.

        1) Set RESCAN READ switch and go to V. D. 16.

    e. If using OPERATOR PANEL switch for quantize level, go to V. D. 36. d. 1).

    f. If this is the first rescan, go to V. D. 36. d. 1).

g. Save number of rejects detected at this quantize level.

   1) If QLV is Light, set QLV - Med, and go to V.D.36.d.1).

   2) If QLV is Med, set QLV - Dark, and go to V.D.36.d.1).

   3) If QLV is Dark, set QLV - Light, and go to V.D.36.d.1).

h. If QLV is fixed, go to V.D.36.k.

i. If operator panel mode, go to V.D.36.k.

j. If three or more rescans were selected, go to V.D.36.l.

k. Set normal read mode to all done with rescans; go to V.D.37.

l. Set QLV to setting at which the least number of rejects occurred; go to V.D.37.

37. If this is not a rescan document, go to V.D.38.

   a. Perform Buffer Build operation.

38. Build temporary reference line. Convert FF code from 929 to 5E code for display purposes. Convert Mark Read data.

39. If compare mode is compare on rejects or compare on substitutions, go to V.D.40.

   a. If not checking field size, go to V.D.39.c.

   b. If OCR and Mark Read buffer equal GO FS parameter, go to V.D.39.c.

      1) Set REJECT DOCUMENT ERROR switch.

   c. Test SELECT OUTPUT MODE switch.

      1) If mode = A, go to V.D.39.d.

      2) If mode = N, go to V.D.39.c.5).

      3) If mode = G and error on DOCUMENT switch is not set, go to V.D.39.d.
      If ERROR switch is set, go to V.D.39.c.5).

      4) If mode = E and error on DOCUMENT switch is set, go to V.D.39.d.
      If ERROR switch is not set, go to V.D.39.c.5).

      5) Sort document and get Sort parameter. If Trap Document mode, go to V.D.39.c.6). Output Director 7 and sort. If function is accepted, go to V.D.39.d.

         a) Report Function Error.

         b) Repeat or continue and go to V.D.16.

6) Go to V.D.16.

d. If it is time to output reference line, do it now. A reference line will be displayed every 10 lines.

e. Set switch to write received data line.

f. Go to V.D.39.c.5).

40. If compare mode = B, go to V.D.41.

a. Edit for rejects, increment reject counters, and go to V.D.39.a.

41. If this is the first read display reference line for evaluation, go to V.D.43.

a. If reply is G, move data to reference line and go to V.D.39.c.5). Clear REFERENCE LINE REQUIRED switch.

b. If reply is B, go to V.D.39.c.5).

c. If reply is C, move reference line and accept correction. Go to V.D.39.c.5).

42. End of file processing.

a. Display CAUTION message if SE=Y.

b. Convert total counters.

c. Display counters.

d. Exit Section 4.

43. Compare received data and reference data increment counters. If error is on document, set ERROR switch and go to V.D.39.c.5).

E. SECTION 5

1. Display SECTION 5 RUNNING message.

2. Display message SS requesting sort sequence.

3. Accept answer.

a. If answer is (CR), go to V.E.4.

b. If answer is *, go to V.E.4.

c. If answer is 0-3, go to V.E.3.e.

d. Display ONA message and go to V.E.2.

e. If this is the 26th entry, go to V.E.3.d.

f. Store entry in table for sorting and go to V.E.3.

4. Clear interrupt.

5. If the 929 is ready, go to V.E.6.

   a. If the 929 is end of file, go to V.E.12.

      1) Go to V.E.5.

6. Feed.

7. If the 929 is ready and busy, go to V.E.8.

   a. If the 929 is ready and not busy, go to V.E.7.

   b. If the 929 is not ready, go to V.E.4.

8. Get sort code.

9. Issue sort function.

10. Increment counters and sort index.

11. Issue reset read table to drop busy and go to V.E.7.

12. Display TOTALS message.

13. Exit Section 5.

APPENDIX A - FUNCTION ERROR DISPLAY

A. DESCRIPTION

The function error display is intended to give the user all indications necessary to evaluate the cause of an illegal I/O response on the 929.

This error will be displayed anytime it is determined that there was an external or internal reject from the 929.

B. FORMAT

E=XX A=YY LF(A)=ZZZZ (Q)=QQQQ (ID)

Where:
- XX = Expected I/O reply
  - RE - reply
  - ER - external reject
  - IR - internal reject
- YY = Actual I/O reply (Same as XX codes above.)
- ZZZZ = Contents of A register when I/O error occurred
- QQQQ = Contents of Q register when I/O error occurred
- ID = Identification code

  The ID code gives the user an exact place in the writeup where the received error is explained. This is accomplished by the use of the Identification Code Breakdown Table contained in this appendix.

In the following example, the message indicates that the 929 did not reply to a Director 1 function of clear controller, etc. This information may be gained through the use of the tables and figures of Appendix D.

The ID code is 01, indicating the portion of the table which applies to this error.

```
Example:  E=RE    LF(A)=0103    (Q)=0101    (01)
          ACTION(C, R)=
```

C. IDENTIFICATION CODE BREAKDOWN TABLE

The first column of this table is the ID code which relates to the message received on the TTY. The second column is a description of the fault.

1. Section 1

ID	Description of Fault
00	Not used
01	Director 1; clearing controller, clearing interrupt, and resetting read table failed
02	Director 0, sending OCR font field table 16_{10} words failed. The A protion of the printout indicates which of the 16 words failed.
03	Not used
04	Director 2, sending OCR first-word address failed
05	Director 3, sending OCR rescan buffer first-word address failed
06	Director 4, sending OCR and mark read buffer lengths failed
07	Director 1, resetting font field table failed
08	Director 5, sending mark read font field table failed. A portion of the printout indicates which word of the 16 words failed.
09	Not used
10	Director 6, reading function failed
11	Director 7, Sorting failed
12	Director 8, reading line failed
13	Director 9, sending mark read first-word address failed
14	Not used
15	Director 1, clearing controller, clearing interrupt, enabling Not Ready to Ready interrupt failed
16	Not used
17	Director 1, clear controller and interrupts
18	Director 1, enabling Not Ready to Ready interrupt, clearing controller, and clearing interrupt failed
19	Not used
20	Not used
21	Director 1, clear interrupt
22	Director A, False Director Test expected external reject

2. Section 2 - ID Basic Test

ID	Q Register	A Register	Description
05	Alarm Interrupt Test		
	XXX0	----	Send OCR read table
	XXX1	0092	Clear interrupts, enable Alarm interrupt, and feed
	XXX1	0102	Reset read table and clear interrupts
	XXX2	0400	Send OCR buffer first-word address
	XXX4	0000	Send OCR buffer length
	XXX8	0002	Select read line 1, size 1
06	Alarm Interrupt Test (Cont'd)		
	XXX6	0001	Read OCR
07	Alarm Interrupt Test (Cont'd)		
	XXX1	0002	Clear interrupt
08	Verify OCR DSA addressing		
	XXX1	0002	Clear interrupt
	XXX1	001A	Clear interrupt and enable End of Operation and Alarm interrupts
	XXX3	----	Send OCR buffer FWA
	XXX4	0002	Set OCR buffer length of two words
	XXX6	0001	Read
09	End of Operation Interrupt Test		
	XXX0	----	Output mode and coordinate
	XXX1	000A	Clear interrupts and enable End of Operation
	XXX1	0080	Feed
	XXX1	0182	Feed, clear interrupts, and reset read table
	XXX2	0400	Set OCR buffer FWA
	XXX3	0464	Set OCR rescan buffer FWA
	XXX4	0064	Set OCR buffer length
	XXX6	0005	Read medium quantize level
10	Not used		
11	Not used		
12	Strip documents from drum at end of Section 2		
13	Verify OMR DSA addressing		
	XXX1	0102	Clear interrupt and reset read table
	XXX5	----	Mode word and coordinates

3. Section 3 - ID Basic Test

ID	Q Register	A Register	Description
01	Dynamic and Static Slippage Test		
	XXX0	----	Send OCR font field table
	XXX1	009A	Feed, clear interrupts, and enable End of Operation and Alarm interrupts
	XXX1	0103	Reset read table, clear controller, and clear interrupts
	XXX2	0400	Send OCR buffer first-word address
	XXX4	0064	Send OCR buffer length
	XXX8	0002	Read line 1, size 1
	XXX6	0025	Read medium quantize level, character coordinate mode
	XXX7	0001	Sort primary
02	Not used		
03	Static Drum Speed Test		
	XXX1	0002	Clear interrupts
	XXX1	001A	Clear interrupts and enable End of Operation and Alarm interrupts
	XXX4	0000	Set OCR buffer length to 0000
	XXX6	0005	Read medium quantize level
04	Strip documents at end of Section 3		

4. Section 4

Identification code breakdown in this section becomes difficult because of the varied parameters which may be used. Therefore, the writeup on the specific error becomes vague.

ID	Description
00	Not used
01	Clear interrupts failed
02	OCR initialization, OCR Directors 0, 1, 2, 3, 4, 5, 7, 8, and 9
03	Not used
04	Rejected Director 1 function after sending OCR read tables and buffer address, etc.

ID	Description
05	Read or Enable interrupt failed
06	Not used
07	Not used
08	Sort command failed

5. Section 5

Section 5 contains no function error printout capability.

APPENDIX B - STATUS ERROR DISPLAY

A. DESCRIPTION

The status error display is an indication that the 929 system status is not what the diagnostic expected at a specific time in the operation of the specific section being utilized at the time.

B. FORMAT

```
SX      E=XXXX     A=XXXX     M=XXXX     LF(A)=XXXX     (Q)=XXXX     (ID)
```

- SX — Director number 1-3 (See Appendix E for complete description of status codes.)
- E=XXXX — Expected status
- A=XXXX — Actual status
- M=XXXX — Mask (Indicates which bits in the status could have caused the failure.)
- LF(A)=XXXX — Contents of the A register for the last 929 function
- (Q)=XXXX — Contents of the Q register for the last 929 function
- (ID) — Identification number (see below)

Example: S1 E=0001 A=0000 M=0005 LF(A)=0001 (Q)=0587 (08)

System status 1 failure

Expected ready (see Appendix D)

Actual status not ready

Mask was for ready and interrupt

Last function was a sort to primary stacker Director 7

Identification code = 08

C. STATUS ERROR - IDENTIFICATION CODE BREAKDOWN TABLE

1. Section 1

ID	Description
00	Not used
01	Expected only ready status after clear controller, clear interrupt, and reset read table
02	Expected only ready status after Director 0 output
03	Not used
04	Expected only ready status after sending OCR buffer first-word address
05	Expected only ready status after sending OCR rescan buffer address
06	Expected only ready status after sending OCR and mark read buffer lengths
07	Not used
08	Expected only ready status after sending reset font field table and one of 16 words to 929 mark read font field table
09	Not used
10	Expected only ready status after sending Director 6
11	Expected only ready status after sending Director 7
12	Expected only ready status after sending Read Line 1, Director 8
13	Expected only ready status after sending mark read buffer first-word address
14	Quantize level switch status is not correct at indicated setting
15	End of file status is not set properly after request to set END OF FILE switch.
16	End of File interrupt is not received
17	Status error after request to drop End of File
18	Status error after clear controller Director 1
19	Incorrect status after request to ready 929
20	Not Ready to Ready interrupt failed after request to ready 929
21	Not used
22	Not used

2. Section 2

ID	Description
01	Not used for Status Error
03	Not used
04	Not used
05	After sending read tables and feed, a Not Ready condition was detected
06	Incorrect status after an interrupt on read (The expected status is alarm, interrupt, buffer length exceeded.)
07	Alarm interrupt did not occur for the same conditions as in ID 06
08	Status 3 Error indicates that the number of words transferred into the OCR buffer was not the required number
09	Ready status was expected after Feed and Read commands were given
10	End of Operation Test failed (Expected Ready, End of Operation, and Interrupt; the actual hardware interrupt was received.)
11	End of Operation and Interrupt failed (Status may or may not be correct as indicated in ID 10.)
12	Not used
13	Status 2 Error indicates that the number of words transferred into the OMR buffer was not two as required

3. Section 3

ID	Description
01	Not used for Status Error
02	Expected Ready, Interrupt, and End of Operation after having performed a read and receiving an interrupt or Tried to take Director 3 status after Read failed

4. Section 4

ID	Description
01	Not used for Status Error Display
02	Not used for Status Error
03	Alarm after sending Director 0 and 5 tables, etc.
04	Not used
05	Some condition caused a timeout without generation of an interrupt after a Feed and Read command
06	Alarm interrupt and/or status caused this error (Conditions could be lost document, missort, etc., or interrupt after Read was not caused by End of Operation, or Alarm.)
07	Mark read reject is set upon receiving End of Operation interrupt.
08	Mark read and/or OCR buffer length does not agree with Director 3 status

5. Section 5

This error is not used in Section 5.

APPENDIX C - STATUS FUNCTION ERROR MESSAGE

A. DESCRIPTION

This error indicates that a status function was either internally or externally rejected.

B. FORMAT

```
SF   EXP=XX     ACT=YY     Q=ZZZZ     (ID)

     Expected response:    Q register at     Identification code
       RE-Reply            time of error

                Actual response:
                  RE-Reply
                  ER-External re-
                      ject
                  IR -Internal re-
                      ject
```

The status function error identification code is the same as the ID code for the status error. Therefore, the Status Error Table may be used. In some cases, the table for Status Error indicates that the ID code is not used. This may indicate that either there is no status for that ID code or that the status error is not displayed; however, a status function may occur.

APPENDIX D - 929 DIRECTOR CODES

A. DIRECTOR 0 - WRITE Q REGISTER = XXX0

Word 1

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

Bits 3-0: Subset Select
Bits 7-4: Font Select
Bits 10-8: Not Used
R - 0 = Inverted
1 = Character not inverted
S - 0 = Do not suppress imbedded blanks
1 = Suppress imbedded blanks
E - 0 = No field with latest stop read coordinate
1 = Field with latest stop read coordinate
F - 0 = Do not emit field separator at terminal coordinate
1 = Emit field separator at terminal coordinate
I - 0 = Recognize reject
1 = Disable reject counter

Word 2

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

Bits 15-8: Start Read Coordinate
Bits 7-0: Stop Read Coordinate

B. DIRECTOR 1 - WRITE Q REGISTER = XXX1

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

Bits 15-10: Not Used
0: Clear Controller
1: Clear Interrupt
2: Not Used
3: Enable End of Operation Interrupt
4: Enable Alarm Interrupt
5: Enable Not Ready to Ready Interrupt
6: Enable Pocket Overflow
7: Feed
8: Reset Read Table
9: Reset Pocket Overflow

C. DIRECTOR 2 - WRITE Q REGISTER = XXX2

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

First-Word Address of OCR Buffer

D. DIRECTOR 3 - WRITE Q REGISTER = XXX3

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

First-Word Address of OCR Rescan Buffer

E. DIRECTOR 4 - WRITE Q REGISTER = XXX4

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Reserved Mark Read Buffer Length								Reserved OCR Buffer Length							

F. DIRECTOR 5 - WRITE Q REGISTER = XXX5

Word 1

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

Bits 12–2: Not Used

Bit 0: MM10
0=12 row
1=10 row

Bit 13: E - 0=No field with latest coordinate
1=Field with latest coordinate

Bit 14: F - 0=Do not emit field separator
1=Emit field separator

Bit 1: MM 0=1 mark/column
1=Multiple marks/column

Bit 15: I - 0=Recognize reject
1=Ignore reject

Word 2

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Start Read Coordinate								Stop Read Coordinate							

G. DIRECTOR 6 - WRITE Q REGISTER = XXX6

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

- Bits 15–6: Not Used
- Bit 5: Unpacked Coordinate Mode
- Bit 4: Rescan Read
- Bits 3–1: Quantize Level:
  - 000 = Use operator panel setting
  - 001 = Light
  - 010 = Medium
  - 100 = Dark
- Bit 0: Read

H. DIRECTOR 7 - WRITE Q REGISTER = XXX7

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

- Bits 15–3: Not Used
- Bit 2: Sort to Reject Pocket 2
- Bit 1: Sort to Reject Pocket 1
- Bit 0: Sort To Accept Hopper

I. DIRECTOR 8 - WRITE Q REGISTER = XXX8

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

- Bits 15–3: Not Used
- Bit 2: Read Line 2
- Bit 1: Read Line 1
- Bit 0: Read Size 4

J. DIRECTOR 9 - WRITE Q REGISTER = XXX9

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

- Bits 15–0: First-Word Address of Mark Read Buffer

APPENDIX E - 929 STATUS CODES

A. DIRECTOR 1 - READ SYSTEM STATUS 1 Q REGISTER = XXX1

15	Transport Error*
14	Missort
13	Ready Interrupt
12	End of File
11	Mark Read Reject
10	Reader Pause
9	Lost Document
8	Buffer Length Exceeded
7	Protected
6	Lost Data
5	Alarm
4	End of Operation
3	Not Used
2	Interrupt
1	Busy
0	Ready

B. DIRECTOR 2 - READ SYSTEM STATUS 2 Q REGISTER = XXX2

15 - 11	Not Used
10 - 8	Quantize Level Switch Setting: 001 - Light 010 - Medium 100 - Dark
7 - 0	Mark Read Word Count

C. DIRECTOR 3 - READ SYSTEM STATUS 3 Q REGISTER = XXX3

15 - 8	OCR Reject Count (if requested)
7 - 0	Number of Words Transferred to the OCR Buffer

*Jam, double feed, interlock.

APPENDIX F - MANUAL PARAMETERS

NOTE

Underlined characters represent those entered by the operator.

Parameter	Description	Section	Static	Reset by AP
AC=XXXX(CR)	Alter Core Allows the user ability to alter memory contents via the TTY. Example: Place in location 125 a 00FF NEXT AC =125(CR) 0125 =00FF (CR) 0126 =(CR) NEXT	N/A	N/A	N/A
AP	Automatic Parameters This entry resets all parameters listed below to the values listed in the static column of this appendix. BB Buffer Build (NO) CM Compare Mode (B) EO Enable Pocket Overflow (N) FN Field Number (All) ME Mag Tape Equipment Code (7) MI Mag Tape Interrupt Line (7) MU Mag Tape Unit Number (0) OE OCR Equipment Code (2) OI OCR Interrupt Line Number (2) OM, OP, OT: OT Output to TTY is selected PE Printer Equipment Code (4) PM Printer Model (1742-30) QL Quantize Level (Medium) RE Repetitions (1) RS Rescans Selection (N, 0, F) SE Suppress Error (NO) SO Select Output	All		

Parameter	Description	Section	Static	Reset by AP
BB =X(CR)	Buffer Build This parameter allows the program to perform a Buffer Build operation on all data when rescans are selected. X = Y Enable buffer build N Disable buffer build When buffer build is selected, the data from the rescan is edited, and those characters which were not rejected on the second or subsequent scan but were rejected on the first scan are replaced. The edited line is then used as a final output record.	4	N	Yes
CC = X(CR)	Character Coordinates Mode Select This parameter allows the user to determine where each character on a document appears. When running with CC = Y, compare mode is ignored. X = Y Enable CC mode N Disable CC mode The following is an illustration of the data output when running with CC = Y. 0123456789 - OCR data 1111122245 8ACEF57946 - Coordinates 222225 2427A4 - Mark read coordinate data The first three lines represent OCR data and the coordinate, and the last two lines represent mark read coordinates. When running in CC = Y with mark read data, the mark read data is not available to the computer.	4	N	Yes

Parameter	Description	Section	Static	Reset by AP
CM =X(CR) or CM =F, =YY(CR)	Compare Mode X = R - Reject mode B - Reject and substitutions mode N - No compare X = F - Field length edit YY = Number of words YY is calculated in the following manner: $YY = \frac{\text{Number of OCR characters}}{2}$ + (OMR columns X 3) NOTE OCR characters consist of characters, spaces, field separators, and fill characters. If the number of OCR characters is even, use Director 0 (mode word bit 14) to enable field separator so that 929 will always generate a fill character. If this is not done, the test will not detect one character dropped.	4	B	Yes
CPX=YY	Character Position This parameter defines the character position to be checked for sort when sorting by characters (see SP parameter). X = Pocket number 1 - Accept pocket 2 - Reject pocket 1 3 - Reject pocket 2 YY = Character position.	4	N/A	No
CSX=ABCD, YY	Character Sort Parameter This parameter defines the characters which will cause a document to be sorted to the indicated pocket. X = Same as above ABCD = Character or characters which will be used for comparison for sort to pocket X, maximum of four characters. YY = Position of the character on the document	4	N/A	No

Parameter	Description	Section	Static	Reset by AP
DC =XX,=YY(CR)	Dump Core This parameter allows the user to dump the contents of memory to the output device. XX = First-word address YY = Last-word address	N/A	N/A	N/A
DH	Dump History Table This parameter allows the user to dump a table containing the last 25 functions issued to the 929 by LR1. Example: NEXT DH 0100 1517 0100 F011 0101 0102 NEXT The leftmost numbers indicate the Q register and the rightmost numbers indicate the A register. The functions are in a reverse sequence (that is, the last function issued is the first printed).	1-4	N/A	N/A
DM	Dump Magnetic Tape This function allows the user to dump the contents of a tape (normally unit 0) to the specified output device (OP or OT). NOTE This operation rewinds the tape before reading the first record. If dumping the output from Section 4, ensure that a file mark was written by going through the end of file process before selecting this operation. Tape format for 9-track is 8-8 ASCII. Tape format for 7-track is BCD even parity.	N/A	N/A	N/A

Parameter	Description	Section	Static	Reset by AP
DP =XXXX/IC/FC	Document Parameters This parameter defines the type of document which is to be used for the tests connected with Section 3. XXXX = Mode word (see Director 0 Word 1) Space generation should not be used. Emit field separator bit must not be used. IC = Initial coordinate This value indicates the codinate at which the first character is to be read. FC = Final coordinate Indicates the coordinate at which the last character on the document is to be read.	3	3011/ 17/ A7	No
DR	Dump Read Table This function allows the user to evaluate the read parameters (RP) currently in use. Example: NEXT DR FIELD MODE ICFC A B MMMM XXYY A B MMMM XXYY NEXT Where: A = Field number (0-F) B = Read mode 1 = Line 1 size 1 2 = Line 2 size 1 (N/A) 3 = Line 1 size 4 (N/A) 4 = Line 2 size 4 (N/A) 5 = Mark read MMMM = Mode word (see Appendix D, Director 0 or 5, Word 1) XX = Initial coordinate YY = Final coordinate	4	N/A	N/A

Parameter	Description	Section	Static	Reset by AP
EF	End of File This entry is the same as depressing the END OF FILE switch during Section 4 operation. This parameter causes the following events to take place. 1. Writes a file mark on tape if OM is specified. 2. Prints job totals. 3. Completes Section 4 operation.	4	N/A	N/A
EO =X(CR)	Enable Pocket Overflow Allows the user to enable or disable the Pocket Overflow condition within the 929 controller. X = Y Enable pocket overflow N Disable pocket overflow	4-5	N/A	Yes
EX =X(CR) or EX =X-Y(CR)	Execute Section or Sections	All	N/A	N/A
FCX= YY(CR)	Alter Final Coordinate This parameter allows the user to alter the final coordinate for a read field within the read parameter (see DR). X = Field number (from RP or DR typeout) YY = Coordinate	4	N/A	N/A
FFX=YYYY(CR)	Alter Mode (Font Field) Word This parameter allows the user to modify the mode word associated with field X. See the DR or RP parameters. X = Field number YYYY = Mode word	4	N/A	N/A

Parameter	Description	Section	Static	Reset by AP
FN =X(CR)	Field Number Parameter This parameter allows the user to select only one of the fields defined with the RP parameter for use in Section 4. This capability enables the user to selectively read portions of a document without reentering all the parameters each time. X = 0-F Read only the indicated field. = Carriage return, read all fields as defined by read parameters entry.	4	All	Yes
FM	File Mark Output Tape			
ICX=YY(CR)	Alter Initial Coordinate This parameter allows the user to alter the initial read coordinates for field X without redefining all read parameters. X = Field number YY = Coordinate	4	N/A	N/A
ME =X(CR)	Magnetic Tape Equipment Code This parameter allows the user to alter the magnetic tape equipment code to match his equipment configuration.	4	7	Yes
MI =X(CR)	Magnetic Tape Interrupt Line Number This parameter allows the user to alter the magnetic tape interrupt line to match his configuration.	4	7	Yes

Parameter	Description	Section	Static	Reset by AP
MU =X(CR)	Magnetic Tape Unit Selection This parameter allows the user to designate the tape unit number to be used when running Section 4 or anytime the OM parameter has been selected. X = 0-3 for 1732-2 Magnetic Tape Controller 0-7 for 1732 Magnetic Tape Controller	4	0	Yes
OE =X(CR)	OCR Equipment Code Selection This parameter allows the user to alter the 929 equipment code used by LR1 to the value specified. X = 2 - F	All	2	Yes
OI =X(CR)	OCR Interrupt Line Number Selection This parameter allows the user to designate the interrupt line for the 929 which will be used by LR1. X = 2 - F	All	2	Yes
OM	Output to Magnetic Tape This parameter is used to designate the magnetic tape described by MU, MI, ME, and TC parameters as the standard output device.	4	No	Yes
OP	Output to Printer This parameter is used to designate the line printer described by the PE, PI, and PM parameters as the standard output device.	4	No	Yes

Parameter	Description	Section	Static	Reset by AP
OT	Output to Teletype This parameter is used to designate the teletype as the standard output device.	4	Yes	Yes
PE =X(CR)	Printer Equipment Code Select This parameter allows the user to alter the printer equipment code used by LR1 to meet system configuration requirements.	All	4	Yes
PM =1742-=X(CR)	Printer Model Select This parameter allows the user to define the printer being used. X = cr-1742 30 - 1742-30 120 - 1742-120	4	30	Yes
QL =X(CR)	Quantize Level Select This parameter allows the user to designate which quantize level Section 4 will use for reading OCR. X = 0 - Use operator panel setting 1 - Light 2 - Medium 3 - Dark	4	2	Yes
RPX, Y=MMMM/ IC/TC	Read Parameters Selection This parameter allows the user to designate the read parameters to be used by Section 4. X = Field number (supplied by LR1) Y = Read mode 1 - Line 1 size 1 2 - Line 2 size 1 (not available) 3 - Line 1 size 4 (not available) 4 - Line 2 size 4 (not available) 5 - Mark read * Skip entry	4	See text	No

Parameter	Description	Section	Static	Reset by AP
	(CR) = End of entries MMMM = Mode word (font field) selection (see appendix D, Director 0 for OCR and Director 5 for mark read) IC = Initial coordinate (see Appendix D, Director 0 or 5) FC = Final coordinate (see Appendix D, Director 0 or 5)			

NOTE

Upon loading LR1, the read parameter selection is specified as follows:

RP0, 1=3011/12/A8

Example:

```
NEXT RP0,1=3011/54/84
         1,5=6002/03/80
         2,(CR)
NEXT
```

Bit 15 in the mode word should not be set; this will cause status 2 or 3 errors in Section 4 if rejects are detected.

Parameter	Description	Section	Static	Reset by AP
RE =X(CR)	Repetitions Selection This parameter allows the user to designate how many times the section selected will be repeated.	All	1	Yes

Parameter	Description	Section	Static	Reset by AP
RS =XYZ(CR)	Rescan Parameter Selection This parameter allows the user to designate how the document is to be rescanned and on what basis. X = Rescan mode R - No rescan on rejects N - No rescan Y = Number of rescans per document 0 - No rescans 1-9- Number of rescans Z = Quantize level to be used for rescan F - Fixed quantize level A - Alternate quantize level and retain best quantize level for next document NOTE When alternate quantize level is used, the quantize level is altered in the following manner: 1st Rescan - No change 2-9th Rescan - If QL = Medium, change to Dark; if Light, change to Medium; if Dark change to Light.	4	N, 0, F	Yes
RW	Rewind Tape This function allows the user to rewind the magnetic tape described by the MI, ME, MU, and TC parameters to load point.	N/A	N/A	N/A

Parameter	Description	Section	Static	Reset by AP
SE =X(CR)	Suppress Error Printout This parameter allows the user to eliminate the error printouts for troubleshooting. This parameter should be used sparingly because what the program will do in some instances cannot be guaranteed. X = R - Suppress errors and repeat C - Suppress errors and continue CR - Normal mode	All	CR	Yes
SO =X(CR)	Select Output Mode This parameter allows the user to select the following modes of data output used for data in Section 4. X = A - Output all data E - Output only error data G - Output only good data N - Output no data	4	E	Yes
SPX=Y(CR) or SPA=B, =ZZ(CR)	Sort Parameters This parameter allows the user to select the sorting to be performed by Section 4. First mode (Sequence sort): X = Space Y = Sort pocket up to nine digits each, indicating a document may be specified	4	See text	No

Parameter	Description	Section	Static	Reset by AP
	Second mode (Sort by character): A = 1-3 pocket to which document will be sorted 1 = Accept Pocket 2 = Reject Pocket 1 3 = Reject Pocket 2 B = Characters which will cause document to be sorted to the indicated pocket; up to four characters may be designated Z = Character position on the document Upon initial loading of LR1, the sort sequence is set up as follows: 1. All documents which have no errors are Accept Pocket 2. All documents which have rejects to Reject Pocket 1 3. All documents which have substitutions to Reject Pocket 2 The parameter which will create the above condition is: SP2=@,=00(CR) 3=S,=00(CR)			
TC =X(CR)	Tape Controller (Buffer Channel) Select This parameter applies to those systems which have the 1732 Tape Controller connected to the system 17 through a 1706 and A/Q Channel Adapter. X = 2 (1706 number 1) 7 (1706 number 2) C (1706 number 3)	4	0	Yes

Parameter	Description	Section	Static	Reset by AP
TD =X(CR)	Trap Document Select This parameter allows the user to use the same document for all testing in Section 4 by not sorting the document. X = Y - Trap the first document N - Run in the normal mode E - Trap the first document with an error	4	N	Yes
TFX= Y(CR)	Troubleshoot Function Routine This command allows the user to execute a function to the 929 Controller via the diagnostic. X = Director number 0-9 (see appendix D) Y = A register to be output (see Appendix D) Upon completion of the parameter entry, the following sequence is executed until a Manual Interrupt is detected. 1. Set A register = Y 2. Set Q register = X + OCR equipment code (OE) 3. Output: If reply is received, go to 4. If external reject is received, go to 5. If internal reject is received, go to 6. 4. If SELECTIVE STOP switch is set, HALT. Otherwise, go to 1. 5. If SKIP switch is set, go to 4. Otherwise, type ER and go to 4. 6. If SKIP switch is set, go to 4. Otherwise, type IR and go to 4.	N/A	N/A	N/A

Parameter	Description	Section	Static	Reset by AP
TSX	Troubleshoot Status Routine This command allows the user to repeatedly get a status from the 929 and display that status. X = Director number (see Appendix E) Upon entry of the 4's parameter, the following sequence of events will take place until MANUAL INTERRUPT is depressed. 1. Set Q register = X + OCR equipment code (OE) 2. Input: If 929 replies, go to 3. If external reject, go to 4. If internal reject, go to 5. 3. If SKIP switch is set, go to 1. Otherwise, type status response and go to 1. 4. If SKIP switch is set, go to 1. Otherwise, type ER and go to 1. 5. If SKIP switch is set, go to 1. Otherwise, type IR and go to 1.			

APPENDIX G - COMMAND MESSAGES

A. NEXT

Indicates that the TTY is ready to accept an entry and that all processing has been suspended. The NEXT typeout will be given anytime the MANUAL INTERRUPT is depressed, system restart is accomplished, or a section/job is completed.

B. ACTION (C, R)=

This message, which follows any error, asks the user to reply with a C (continue) or R (repeat). If C is typed, the computer will continue as though the error did not exist. Use extreme caution when requesting continue because following operations may be jeopardized. If the R is given, the computer will attempt to perform the task again.

C. ONA

This typeout indicates that the last teletype entry was not legal.

D. SET QL TO X

This message is associated with Section 1. It requests the user to set the QUANTIZE LEVEL switch on the 929 Operator Panel to position X. When selection has been made, type CR.

Where: X = L - Light
M - Medium
D - Dark

E. PRESS EOF SWITCH

This message is associated with Section 1. It asks the user to set the END OF FILE switch. When completed, type CR.

F. CLR EOF SWITCH

This message is associated with Section 1. It requests the user to clear the END OF FILE switch. When completed, type CR.

G. SECTION X RUNNING

This message indicates that Section X has begun operation.

H. SECTION X COMPLETED

This message indicates that Section X has completed all operations.

I. END OF TEST

This message indicates that all sections selected by the user have been completed.

J. NO INT * RUN SECTION 2

This message is output by Section 3. It is a fatal error and indicates that the expected End of Operation interrupt did not occur.

K. D=XXXXXXXX C=XXXXXXXX R=XXXX S=XXXX

This message is document and character totals at the end of Section 4.

D = Documents
C = Characters
R = Reject characters
S = Substituted characters

L. MAKE 929 NOT READY

This message is associated with Section 1. It indicates that the user is to depress the 929 READY indicator, wait for the drum to stop, and then type a carriage return.

M. READY 929

This message is associated with Section 1. It indicates that the user is to depress the READY indicator and type a carriage return.

N. CLEAR SLS SET PP

This message is typed out after the loading procedure. It indicates that the user is to clear the SELECTIVE STOP switch and set the PROGRAM PROTECT switch on the computer console.

O. TOT XXXXXXXX P2 XXXXXXXX P3 XXXXXXXX

This message is associated with Section 5. It is output upon receipt of the End of File status from the 929. This message will be followed by the end of section message SECTION 5 COMPLETED.

APPENDIX H - ERROR MESSAGES

A. PROGRAM PROTECT FAULT XXXX

This message indicates that an addressing error has occurred, and that the program LR1 has tried to illegally store data in a protected area of core. XXXX indicates the location which attempted the store.

B. CORE PARITY ERROR XXXX

This message indicates that the data contained in location XXXX or a location referenced by that location was in parity.

C. UNDEFINED INT. ZERO

This message indicates that an interrupt zero was received and that it was not caused by one of the two previous causes.

D. MT NOT READY

This message indicates that the magnetic tape unit is not ready. Check MU and ME specifications.

E. NO WRITE RING

This message indicates that the output tape specified by MU and ME parameters is either not ready or does not have a write ring.

F. FM

This message indicates that while reading magnetic tape, an end of file was detected.

This message will be followed by an action message. If the user wishes to dump the next file, type R(CR) if that is the last file, and if he wishes to exit Dump Tape routine, type C(CR).

G. PARITY ERROR

This message indicates that a tape parity error exists on a tape read. Parity is not tested on write.

R - Drop this record and read next record.
C - Use this record as is.

H. LP NOT READY

This message indicates that the line printer is not ready.

R - Repeat the printer request.
C - Exit to system ready NEXT.

I. OCR NOT READY

This message is at the start of a section and indicates that the 929 is not ready.

R - Take status again.
C - Exit to system ready NEXT.

J. E=XX A=YY LF(A)=AAAA (Q) = QQQQ (ID)

This message is the function error message (see Appendix A).

K. SX E=XXXX A= YYYY M=AAAA LF(A)=AAAA (Q)=QQQQ (ID)

This is the status error message (see Appendix B).

L. DSA PROTECT FAULT XXXX
or
OMR DSA PROTECT FAULT XXXX

This error is encountered in Section 2. It indicates that a protect fault occurred while trying to store data in an unprotected area of core.

M. DSA ADR ERROR (1) E=XXXX A=YYYY (2) E=XXXX A=YYYY
or
OMRDSA ADR ERROR (1) E=XXXX A=YYYY (2) E=XXXX A=YYYY

This message indicates that data was intended to be stored in location XXXX and was actually stored in location YYYY. (1) indicates word 1 and (2) indicates word 2.

N. DSA WCNT ERR E=0002 A=XXXX
or
OMR DSA WCNT ERROR=0002 A=XXXX

When DSA addressing is tested, the OCR buffer length is set to two words. This error indicates that the proper count was not received.

O. DOC SLIPPAGE (STATIC) EXP = XXXX/YYYY ACT = XXXX/YYYY

This message indicates that the document slipped on the drum or that first and last character coordinates were wrong. The test is made with the same document locked on the drum. Check DP parameter.

P. DOC SLIPPAGE (DYNAMIC) EXP = XXXX/YYYY ACT = XXXX/YYYY

This message indicates the same as the previous message, except that the test is made with the documents being sorted each time.

Q. DRUM SPEED (STATIC) EXP=0221 IPS ACT = XXXX IPS

This message indicates that the 929 drum speed is not within tolerance. This error could be caused by computer speed error.

R. SF EXP=RE ACT=XX Q=XXXX

This is the status function error message (see Appendix C).

S. BLANK DOCUMENT

This message indicates that nothing was read from the document being processed. This error is for Section 4.

The document is treated as though it were a reject document.

T. ONA (Option Not Available)

This message indicates an error in the typing of a parameter or specification.

Control is transferred to system ready NEXT.

U. ER

This message indicates that external reject occurred on the command. This typeout is encountered during TS or TF operation. The printout may be eliminated by setting the SKIP switch.

V. IR

This message indicates an internal reject for the same conditions as the previous message.

W. COORDINATE SEQUENCE ERROR
XXXX
YYYY
ZZZZ

This error is associated with Sections 3 and 4. It indicates that while reading the document a coordinate sequence error was detected.

FF111/FF112 (234-14) READER/SORTER CONTROLLER TEST
(RST061 Test No. 61)

I. OPERATIONAL PROCEDURE

A. RESTRICTIONS

1. Multiplexing

a. Timing considerations are critical. A typeout of any kind in non-interrupt mode (bit 5 of Stop/Jump parameter set) by any other test when the Reader/Sorter is feeding documents will cause errors. Stacked typeouts that require more than one message line will cause errors when typeout in interrupt mode (bit 5 of SMM Stop/Jump parameter not set) is selected. Use caution when multiplexing.

b. When running RST061 in compare mode (see Parameter Description), any type of test document may be used; however, they must be in blocks or groups. Any quantity of test documents of the same type may be used. Blocks or groups may be stacked in the input hopper, but they must be separated by a bank (Pocket Separator). Failure to do this will result in compare errors. A Pocket Separator is not required ahead of the first block or group of documents read at the beginning of a section or in Section 2 (see Testing Procedure).

2. Manual Intervention

a. Section 0 requires manual intervention throughout.

b. Sections 2 through 5 require manual depression of the END OF FILE switch to exit (see Testing Procedure).

B. LOADING PROCEDURE

This test operates under control of SMM17. The calling sequence is that specified by SMM17. This test may be restarted at Initial Address (IA).

C. TESTING PROCEDURE

The Reader/Sorter is a DSA only device. The test is interrupt driven and status verified.

1. Test Documents

All of the following documents are available from CEM and will be accepted by RST061 in any order and any quantity (see Restrictions).

*Format A	22231200	*OFF LINE SORT PART 1	22231100
Format B	22231201	*OFF LINE SORT PART 2	22231101
Format C	22231202	*OFF LINE SORT PART 3	22231102
Format D	22231203	*OFF LINE SORT PART 4	22231103
Format E	22231204	*OFF LINE SORT PART 5	22231104
Format F	22231205	*OFF LINE SORT PART 6	22231105
Format G	22231206	*OFF LINE SORT PART 7	22231106
Format H	22231207	*OFF LINE SORT PART 8	22231107
Format J	22231208	*OFF LINE SORT PART 9	22231108
*Format K	22231209	*OFF LINE SORT PART 10	22231109
Format L	22231210		
Format M	22231211		
*Format X	22231212		

2. Pocket Separators

A Pocket Separator is used by this diagnostic to identify the beginning of a new block of data. Data on the document following the Pocket Separator will become the new compare word providing it has no character rejects or other detectable errors. A Pocket Separator is not required if no compare mode (bit 15 of Stop/Jump parameter) is set. The Pocket Separator format must be as follows:

a. Zero amount field (0000000000)

b. Same-character ONUS field (55555555)

c. Same-character routing and transit field (9999-9999)

The specific value of the characters in the ONUS or R/T field is unimportant as long as they are the same and a minimum of seven exists.

Examples:

Acceptable - ⑆7777-7777⑆ ⑇0000000000⑇
Acceptable - ⑆0910-0051⑆ 22222222⑈ ⑇0000000000⑇
Acceptable - ⑆6666-6666⑆ 333333333⑈ ⑇0000000000⑇
Not acceptable - ⑆7734-1200 0125 ⑇0000000000⑇
Not acceptable - ⑆1111-1111⑆ 88888888⑈ ⑇0000002200⑇

Fields 2 and 5 may be blank or may have any data. A Pocket Separator is not required ahead of the first block of documents at the beginning of a section; they may be inserted to change the compare word on the fly.

*Minimum site requirements with minimum recommended quantities of 200 each.

3. Compare Word (Bit 15 of Stop/Jump parameter not set)

   Once a document has been accepted by the program as the compare word, all documents following it until a Pocket Separator is detected will be compared bit by bit to the compare document. Each ASCII data word and MICR symbol that does not compare exactly, with the exception of character reject symbols, will be counted.

   The compare error documents will be routed to the reject pocket and will be displayed when the error buffers are full, when a new compare word is requested, or when end of file is recognized by the controller.

4. Exiting a Section

   Sections 0 and 1 exit upon completion automatically. Sections 2 through 5 exit by manual depression of the END OF FILE switch on the Reader/Sorter. (END OF FILE will not be recognized by the controller unless the document hopper is empty.)

   Manual restart is required after a CP halt or any other condition that causes the Reader/Sorter to go not ready. This is accomplished by pressing the START button or the START/STOP bar on the Reader/Sorter (response to READY READER message).

D. PARAMETERS

If bit 0 of the SMM Stop/Jump parameter is set at the start of the test or before the Initial Address restarts, a parameter stop will occur. The selected parameters will be typed out before any sections are selected.

1. First Stop

   A=6141 Q=Stop/Jump parameter

   Set bit 15 of Stop/Jump parameter if no data compare is desired.

2. Second Stop

   A=Sections to test Q=Interrupt line
   (A) prestored as $3F

   Section 0 (Bit 0) - Static Status Test

   Intervention required.

   Section 1 (Bit 1) - Static DSA Test

   Uses diagnostic mode.

Section 2 (Bit 2) - Dynamic Status Test

Requires documents.

*Section 3 (Bit 3) - Fill Pocket

Fills selected pocket with documents.

*Section 4 (Bit 4) - Ripple Sort

Sorts sequentially from 0 to 13, to 0, etc.

*Section 5 (Bit 5) - Factual Sort

Sorts on selected character/field.

Section 6 (Bit 6) - Unassigned

(Q) prestored as interrupt line 13 ($2000)

3. Third Stop

A=SORT ID Q=Fill pocket

(A) prestored as $301, where 3 equals field sort request and 01 equals character sort request. (Prestored selection will sort on the first character in field 3 in Section 5. If there is no field or character in the requested position, the document will be sorted to S1.)

NOTE

All fields and characters are counted from right to left; special symbols (-, etc.) are not counted.

(Q) prestored as 1. This is the pocket number that will be filled in Section 3. This may be any value from 0 to $C and $F ($D and $E are illegal).

4. Fourth Stop

A=Equipment code Q=Clear end of test counters

(A) The equipment code displayed is the same as prestored or inserted at build test list (contents of IA+6). If an equipment code error occurs, the code may be changed.

*Dynamic data testing is in progress; press END OF FILE to exit section.

(Q) If (Q) equals zero, the end of test counters will be cleared each time a parameter entry is made. If (Q) is not zero, the end of test counters will not be cleared. This allows volume runs to be made and recorded with parameter changes within the run.

NOTE

Any section that actually feeds documents must be completed with an end of file if the documents run in that section are to be counted.

E. MESSAGES

Various messages will appear reporting the condition of the reader, instructions for Section 0, contents of the compare buffer, and contents to the data error buffer. An error code number in hex will follow the contents of the data error buffer that corresponds with the Error Codes List; this is an aid for determining what is wrong with the data.

1. Reader Conditions

   Ready reader
   Hopper empty

2. Instructions for Section 0

   Clear PROGRAM PROTECT

   Set PROGRAM PROTECT

3. Compare Buffer

   < 5432-1098<075#6$0000022222$(COMPARE WORD

4. Data Error

   < 5432-10@8<076#6$0000022@22$(18   19

   18 = CANT read (@ symbol)
   19 = Compare error   (5 read as 6 in ONUS field)

NOTE

There is a stop feed issued after a successful attempt to load the compare buffer. Any data errors occurring during the attempt will be displayed first.

There is a 10-document data error buffer area. The program will issue a CP Halt after the seventh document error and continue checking data until the Reader/Sorter halts. Any additional documents in error will be included in the document error display. The reject pocket light will be on when the reader halts. If there was less than seven documents in error, the documents in the buffer, if any, will be displayed at the end of section or when a new compare word is requested.

F. ERRORS

If Omit Typeouts and Stop on Error is set in the Stop/Jump parameter, all coded errors will be displayed in the standard SMM17 format as follows:

A	Q	A	Q	A	Q	A	Q
6148	STJP	SSEE	RTN	WWWW	XXXX	YYYY	ZZZZ

If Omit Typeouts is not set, all data buffer errors will be in the format as described in Messages, example 4 (see individual error codes for specific A, Q displays).

Error Code	Comments
1	Parameter entry error: A3 A2 parameter Q3 Q2 parameter A4 A3 parameter Q4 Q3 parameter
2	Equipment code error (internal reject on input): A3 Equipment code less director Q3 Equipment code with director
3	External reject on input: A3 N/A Q3 Rejected director code
4	Internal reject on output: A3 Contents of A on reject Q3 Contents of Q on reject
5	External reject on output; report same as error 4
6	Interrupt with no interrupt status: A3 Interrupt request Q3 Status 1
7	Interrupt status with no interrupt; report same as error 6

Error Code	Comments
8	Alarm set with no apparent cause: A3 Status 1 Q3 Status 2 A4 Status 3 Q4 N/A
9	No alarm interrupt;rreport same as error 6.
A	Interrupt and interrupt status with no apparent cause; report same as error 6
B	Two interrupts occurred simultaneously, excluding alarm; report same as error 6
C	Document jam; report same as error 8
D	Document missort; report same as error 8
E	Document multifeed; report same as error 8
F	Document too long; report same as error 8
10	Data parity error; report same as error 8
11	Document gap too small; report same as error 8
12	Feed error; report same as error 8
13	Too late to pocket; report same as error 8
14	Load error; report same as error 8
15	Character reject status with good data: A3 Status 1 Q3 Status 2
16	No character reject status with bad data; report same as error 15
17	No wait pocket decision status when expected; report same as error 15
18	Character rejects (CANT reads) in data; reported as error code following data buffer typeout or: A3 FWA data buffer Q3 Length of data buffer A4 Buffer number (1 to 10) Q4 N/A

Error Code	Comments
19	Compare errors in data [character(s) did not agree with compare buffer]; report same as error 18
1A	More data than expected (document data longer than compare buffer); report same as error 18
1B	Lost data (document data shorter than compare buffer or longer than transfer count); report same as error 18
1C	Non-ASCII data word (hex value of data less than $20, converted to * by program); report same as error 18
1D	Unconverted CANT read symbol (symbol was ? instead of @); report same as error 18
1E	Non-MICR, OMR, or OCR data word; report same as error 18
1F	Non-MICR data word; report same as error 18
20	Unexpected OMR/OCR I.D. present (converted to ! by program); report same as error 18
21-28	Unassigned
29	Expected data interrupt not received: A3 Status 1 Q3 Status 2
2A	Expected EOP interrupt not received; report same as error 29
2B	No DSA transfer: A3 Starting address of failing block Q3 Ending address of failing block
2C	DSA failure (Section 1): A3 Expected data/address Q3 Actual data/address
2D	Reader 1 status will not clear
2E	Reader 1 status will not set
2F	Interrupt timeout: A3 Status 1 Q3 Expected interrupt bit

Error Code	Comments
30	Document committed will not set after a feed command
31	Motor on status will not set
32	Feed on status will not set
33	Busy status will not set when expected
34	Busy status will not clear when expected
35	Stop feed interrupt expected, but not received; report same as error 29
36	Unexpected stop feed interrupt; report same as error 29
37	Document committed not clear
38	Alarm and no pocket interrupt expected but not received; report same as error 29
39	Alarm and lost data interrupt expected but not received; report same as error 29
3A	Remote halt expected but not received
3B	Alarm condition with no alarm status bit

G. END OF SECTION

With the exception of Sections 0 and 1, sections are exited by depression of the END OF FILE switch. This allows the operator to clear the pockets before beginning the next section. The display will be:

Error buffer data and explanation codes
End of section report (if Stop at the end of section is selected in the Stop/Jump parameter)

The end of section report will be as follows:

A	Q	A	Q	A	Q	A	Q	A	Q
6152	STJP	OOSS	RTN	MSDC	LSDC	CARJT	CMPER	SLIPCNT	N/A

MSDC	Most significant document count	(decimal)
LSDC	Least significant document count	(decimal)
CARJT	Character reject count	(decimal)
CMPER	Compare errors	(decimal)
SLIPCNT	Document slip count	(decimal)

The document count may or may not agree with the Reader/Sorter counter. They will not agree if errors occurred that caused the Reader/Sorter to stop feed on its own, without program direction. The percentage of documents read to compare, character reject, and slip counts will agree.

Section counts are cleared after each stop.

H. END OF TEST

The display at the end of test is received in the same manner as the end of section display with the following exceptions:

1. End of test report is always displayed if omit typeouts is not selected.
2. The document count, character reject count, compare error count, and document slip count are accumulative; the count will be added to form a new total on each pass if repeat test is selected.

II. SECTION DESCRIPTION

A. SECTION 0 - STATIC STATUS TEST (Operator intervention required)

1. Loop 1
   a. Request operator empty input hopper.
   b. Determine if device is protected. If it is not protected, request SET PROGRAM PROTECT. If it is protected, request CLEAR PROGRAM PROTECT.
   c. Wait for response or timeout and multiplex.
   d. Repeat message if timeout.
2. Loop 2
   a. Request opposite message from 1b.
   b. Repeat 1c and 1d.
3. Loop 3
   a. Request that device be left protected (CYBER capture requirement).
   b. Repeat 1c and 1d.
4. Loop 4
   a. Determine if device is on-line. If it is not on-line, request SET ON LINE. If it is on-line, request CLEAR ON LINE.
   b. Repeat 1c and 1d.

5. Loop 5

   a. Request opposite message displayed in 4a.

   b. Repeat 1c and 1d.

6. Loop 6

   a. Determine if device has end of file set. If it is not set, request SET END OF FILE. If it is set, request CLEAR END OF FILE.

   b. Repeat 1c and 1d.

7. Loop 7

   a. Determine if feed verify is set. If it is not set, request SET FEED VERIFY. If it is set, request CLEAR FEED VERIFY.

   b. Repeat 1c, 1d, and 5.

8. Loop 8

   a. Issue a clear controller function, expect MICR RDR on to be clear. Error if not.

   b. Request Reader 1 pushbutton is depressed. Error if RDR 1 status is not set.

   c. Select MICR RDR via software approximately 10 microseconds after a clear controller and expect status to be set. Error if it is not set.

   d. Repeat from 8a if selected. Exit if it is not selected.

B. SECTION 1 - DSA TEST

This section uses the controller's diagnostic mode to check DSA transfers of data. The data buffer (400 decimal locations) used throughout RST061 receives the data. The data is the address of the storage location.

Example (after DSA transfer):

P	Contents
0BCD	0BCD
0BCE	0BCE
0BCF	0BCF
0BD0	0BD0

The section will store and compare these locations while multiplexing with other tests. Various addresses and data may be loaded and checked by loading RST061 at different initial addresses using FF00 at build test list.

No documents are required for this section. This section exits after 10 passes through core block.

C. SECTION 2 - DYNAMIC STATUS TEST (Documents required)

1. Initialize routines and counters.

2. Let Start routine initialize reader.

3. Reader ready:

   a. If reader is ready and document counter is less than 2, go to 10.

   b. If reader is not ready, expect ready interrupt and go to 3d.

   c. If reader is ready and document counter is 2 or over, go to 3d.

   d. Activate interrupt timeout and enable all interrupts.

4. Data interrupt (if not expected, error):

   a. If document counter is 2, expect lost data and alarm interrupt. Go to 3d.

   b. If document counter is not 2, expect EOP interrupt. Go to 3d.

5. EOP interrupt (if not expected, error):

   a. If document counter is 19, go to 5d.
   If counter is 2 through 18, go to 5c.

   b. If counter is 1, do not issue a sort command to force late pocket decisions and alarm. Set DSA word count to (A) to prepare for lost data on second document. Go to 3d.

   c. Documents 2 through 18 are processed normally with data interrupt expected next; go to 3d.

   d. Issue a Stop Feed command, sort document, and go to 3d.

   e. If document counter is over 24, report Stop Feed was not detected.

6. Stop feed interrupt (active for all documents after 3):

   a. If document counter is less than 20, report premature stop feed interrupt; otherwise, repeat section from B2.

7. Alarm interrupt (if not expected, go to alarm processor):

   a. Check to ensure proper status was received (no pocket or lost data).

   b. If proper response was received, go to 8.

   c. If status is not correct, go to alarm processor.

8. Status checker:

   a. Check status 1, 2, and 3 for any additional error conditions.

   b. If additional errors are found, go to alarm processor. If no errors are found, go to 8c.

   c. Expect stop feed interrupt next; go to 3d.

9. Transport clear routine (entered by stop feed interrupt first two documents):

   a. Clear reader and controller.

   b. Check document committed; error if it is set.

   c. Check busy; error if it is set.

   d. Go to B2.

10. Initial status check:

   a. Check status for data or alarm. Go to 10c if it is set.

   b. Check status for document committed. Go to 10a if it is not set.

   c. Check motor on, feed on, document committed, busy. Error if any are clear.

   d. Issue stop feed command and go to 3d.

D. SECTION 3 - FILL POCKET (Full data checking)

1. Request reader condition (SEC 3, START, IWAIT):

   a. Wait for ready interrupt if not ready and initialize.

   b. Start feed and/or wait data interrupt if ready.

2. Initiate data transfer (SEC 3, PROINT, IWAIT):

   a. Receive data interrupt and wait for EOP interrupt.

   b. Timeout if not data interrupt and try again; go to 1.

3. Examine data (DTST00):

   a. Determine if Pocket Separator detected preparation data transfer on next document.

   b. Determine if transfer to compare buffer was requested by program:

      1) Check for errors in data.
      2) Transfer word if there are no errors.
      3) Abort transfer if errors and prepare to transfer next document.
      4) Initiate stop feed if transfer was complete.

c. Determine if compare data was requested by program/operator:

1) Check for no compare request (bit 15 of ST/JP).

2) Check for Pocket Separator (no compare).

3) Check for transferring data to compare buffer (no compare).

4) Do a word by word compare (flag errors if any).

d. Determine possible pocket for data based on field and character count.

e. Look for illegal characters, bad data, etc.

f. Select next data buffer if there are errors.

g. Issue CP halt if seven buffers have bad data.

4. Pocket document (SEC 3, POCKT):

a. Section 3 ignores DTST00 pocket request and pockets to FLPKCT (parameter A4). POCKT will reject the document if there were any errors.

b. Return to step 1.

5. Stop feed interrupt (SEC 3, IWAIT, PROINT):

a. Output data buffer if required via DMPDAT and clear.

b. Output compare buffer if required via DMPCMP.

c. Start feed (step 1).

6. CP halt (SEC 3, PROINT, ALRMOO):

a. Dump data buffer (seven items or more).

b. Wait for read (step 1).

7. End of file (SEC 3, PROINT, ALRMOO):

a. Dump data buffer and clear if there is any bad data.

b. Clear compare buffer and prepare to transfer next document.

c. Report end of section message if stopped at end of section.

d. Check repeat section, switch sections, and end test.

E. SECTION 4 - RIPPLE SORT (Full data checking)

Section 4 operates the same as Section 3 except for the pocketing of documents. This section starts pocketing in pocket 0, increments to pocket 13, and decrements to pocket 0; data errors will go to reject pocket.

F. SECTION 5 - FACTUAL SORT (Full data checking)

Section 5 operates the same as Section 3 except for the pocketing of documents. This section pockets to the value in the field and character position requested by the operator in parameter A3 and determined by DTSTOO.

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