FIELD TESTS
MODIFICATIONS

SOFTWARE
PROBLEMS

SEL 810A COMPUTER REPAIR TIPS

A. CHECK POWER SUPPLY VOLTAGES

(1) There are (6) six power supplies that provide (22) twenty two separate voltages to the computer and interface. (Refer to the (2) two page listing under power supplies in your diagnostic (3) three ring binder).

(2) If voltage is low - disconnect load leads to supply - Did voltage return to normal? If not, check power supply. Instructions for testing power supply load regulation, line regulation and ripple are provided in the Technical Manual, General Purpose Computer, Pages 5-3 to 5-9. If voltage returned to normal, check each load for low resistance.

(3) Check AC ripple with flat meter. (Refer to specifications under power supply in your diagnostic (3) three ring binder).

B. CHECK ALL MUFFIN FANS FOR OPERATION

C. INTERMITTANT MAINFRAME AND MEMORY PROBLEMS

(1) Check for spread card pins and appliance connector loose pins.

(A) Start mainframe exerciser program - with insulated tool, rake pins on rear of mainframe while someone is watching control panel for program halt. If program halts, remove card and very carefully close all pins on card.

(B) While running mainframe diagnostic vary 3.6 volts on Model 221 power supply from 3 to 4 volts. Vary voltage slowly. Let program run 5-10 minutes at 3 and 4 volts.

(C) Tap all appliance connectors while running mainframe diagnostic and observing control panel for a halt condition. Repair appliance connector or remove connector and solder leads.

(D) Memory problems - Refer to my memo of April 4, 1977 listing procedures for isolating memory problems. Read instructions carefully when using CLT # 10 Memory Diagnostic.

D. I/O HOLD CONDITION

Determine the interface to computer causing problem.

(1) Teletype
(2) Input-Outputs
(3) Analog-Digital Converter
(4) Modem Interface

(a). Check voltages to interface and hand shaking signals.

(b). One common problem to teletype is low voltage due to appliance connectors. Check voltage at teletype interface.

E. FIELD DC OFF

(1) Check 12 volt power supply in computer interface cabinet.

F. TAPE READER PROBLEMS

(1) If smoke from some source set off Halon in computer room, always clean smut from tape reader lamp.

(2) Check low speed (teletype reader) reader on quarterly basis for proper operation.

CLT/rml
cc: D. J. Noerrlinger
M. B. Roker
V. E. Dake

NGPL

INTER-OFFICE CORRESPONDENCE

DATE March 13, 1973

SUBJECT Computer & Interface Spare Parts Revision.

TO
R. D. Kelly
J. R. Saar
V. E. Dake
Ed Skanes
L. G. Gillis
T. C. Losh
E. L. Bergeson
J. J. Sneddeker
R. D. Pilcher
R. E. Praeuner
F. E. Bailey
C. T. Lowman

FROM Mr. M. J. Findling

Attached is a copy of the Computer and Interface spare parts with the newly revised Page 3 and a copy of the Computer and Interface semiconductor substitute List with the newly revised Page 2. Due to the actual circuits utilized in the Computer systems as received being of later design than indicated by the early Computer Manuals on which the original parts List was based, 2 I.C.'s were not included in the original Computer and Interface spare parts listing. Each District Technician will be receiving two each of the newly listed integrated circuits for addition to his Computer and Interface spare parts kit.

MJF/gr
cc: Mr. V. K. Patrick
Mr. C. L. Thompson
Mr. R. L. Jepsen
Mr. M. G. Strasen
Mr. M. B. Roker
Mr. C. J. Langdale

Attach:

COMPUTER AND INTERFACE
SPARE PARTS

Quantity	Diode	Substitutes	Equipment
1	1N192		C
1	1N482A		C
1	1N718		C
1	1N747		H
1	1N749A		C
1	1N752A		C
1	1N753A		C
1	1N754A		C
1	1N759A		C
1	1N825		C
3	1N914		C-P
1	1N958		H
1	1N966B		C
1	1N1183A		C
1	1N2069A		H
1	1N2977B		C
1	1N3022B	2A12B	P
1	1N3666		H
1	1N4001		C
1	1N4003	D142	M
4	1N4004	HC-70/SD-2	C-P-M
1	1N4009		C
1	1N4720A		C
1	1N4734		P
1	1N4740A		C
1	1N4744A		C
1	1N4747A		C
1	1N4750		C
1	FD333	RCA #SK3030	C
1	FD6666		C
2	MR1120		C
1	1D12A (12V Zenar)		M

Quantity	Transistors	Substitutes	Equipment
1	2N404		C
1	2N598		H
1	2N706A		M
1	2N718		M
1	2N930		C
1	2N1305		H
1	2N1309		H
1	2N1375		M
1	2N1499A		C
1	2N1539		P
1	2N1545		H
1	2N1808	2N3947	C
1	2N2063A		M
1	2N2102		C
1	2N2160		C
2	2N2369A		C

C = Computer and Interface
H = High Speed Tape Reader
P = Parabam Digital Clock
M = RFL Data Modem

COMPUTER AND INTERFACE
SPARE PARTS

Quantity	Transistors	Substitutes	Equipment
1	2N2405	NS2129 (National)	C
1	2N2665		C
1	2N2714		C
1	2N3134		C
1	2N3251	Motorola No. SS678	C
1	2N3503	2N2905A	C
1	2N3566		P
1	2N3638		C-P
1	2N3641		P
1	2N3642		P
1	2N3643		P
1	2N3644		P
1	2N3645		C
1	2N3725	S18415/2N2846	C
1	2N3771		C
1	2N3772		C
1	2N3903		M
1	2N3904		C
1	2N3905		M
1	2N3906		C
2	2N3947	Motorola No. SS677	C
1	2N3958		C
1	2N4044		C
1	2N4168	MCR2305-2	C
1	2N5036		C
1	2N5458	MPF104	C
1	3N166	FS19385	C
1	MCR2918-1	MCR1308-1/MCR3918-1	C
1	MJ3701		C
1	40346 (RCA)		P
1	40250 (RCA)		C
1	40251 (RCA)		P
1	TA2651 (RCA)	2N4036/2N2904A	C
1	F1226 (Union Carbide)		C
1	BD1129 (Union Carbide)		C
1	F1465 (Union Carbide)		C
1	SDT9232 (Solitron)	2N3772	C
1	SDT9724 (Solitron)	2N3771	C
1	S18858 (Fairchild)	2N2405	C

C = Computer and Interface
H = High Speed Tape Reader

P = Parabam Digital Clock
M = RFL Data Modem

COMPUTER AND INTERFACE SPARE PARTS

Quantity	Integrated Circuits	Substitutes	Equipment
2	U5B990029 (Fairchild)	MC700G (Motorola)	C
2	U5B990729 (Fairchild)	MC707G (Motorola)	C
2	U5B991429 (Fairchild)	MC714G (Motorola)	C
2	U5F991529 (Fairchild)	MC715G (Motorola)	C
2	U5F992629 (Fairchild)	MC726G (Motorola)	C
2	U5F992729 (Fairchild)	MC727G (Motorola)	C
2	U5B771039 (Fairchild)	MC1710CG (Motorola)	C
2	U5F771139 (Fairchild)		C
3	MC724P (Motorola)		C
3	MC725P (Motorola)		C
2	MC726P (Motorola)		C
2	MC785P (Motorola)		C
2	MC786P (Motorola)		C
2	MC789P (Motorola)		C
2	MC790P (Motorola)		C
2	MC792P (Motorola)		C
2	MC799P (Motorola)		C
2	SF113-03 (Sylvania)	RF113D (Ray)/MC474L (Motorola)	C
2	SG223-03 (Sylvania)	RG223D (Ray)/MC2051L (Motorola)	C
2	SG243-03 (Sylvania)	RG243D (Ray)/MC2053L (Motorola)	C
2	SM23-03 (Sylvania)	RM23-03 (Ray)/MC4029L (Motorola)	C
2	SM33-03 (Sylvania)	RM33-03 (Ray)/MC4031L (Motorola)	C
2	SM43-03 (Sylvania)	RM43-03 (Ray)/MC4032L (Motorola)	C
2	UC4001C (Union Carbide)		C
2	SG222 (Sylvania)	MC2001L (Motorola)	C
2	SG263 (Sylvania)	MC2055L (Motorola)	C

Quantity	Special Modules	Substitutes	Equipment
1	Flip-Flop Module-Parabam #23264		P

Quantity	Relays	Substitutes	Equipment
1	HGJ2MT51211501 (C.P. Clare)	HGQ2MT5104	C
1	HGJM51111501 (C.P. Clare)	HGQM5104	C
1	Clareed No. CRTN-1010		C
1	Adams & Westlake No. AWDA-15351		C

C = Computer and Interface
H = High Speed Tape Reader

P = Parabam Digital Clock
M = RFL Data Modem

COMPUTER AND INTERFACE
SEMI CONDUCTOR
SUBSTITUTE LIST

1. DIODES

NUMBER	SUBSTITUTE
2A12B	1N3022B
HC-70	1N4004
D142	1N4003
SD-2	1N4003/1N4004
1D12A	1N4406/1N4742

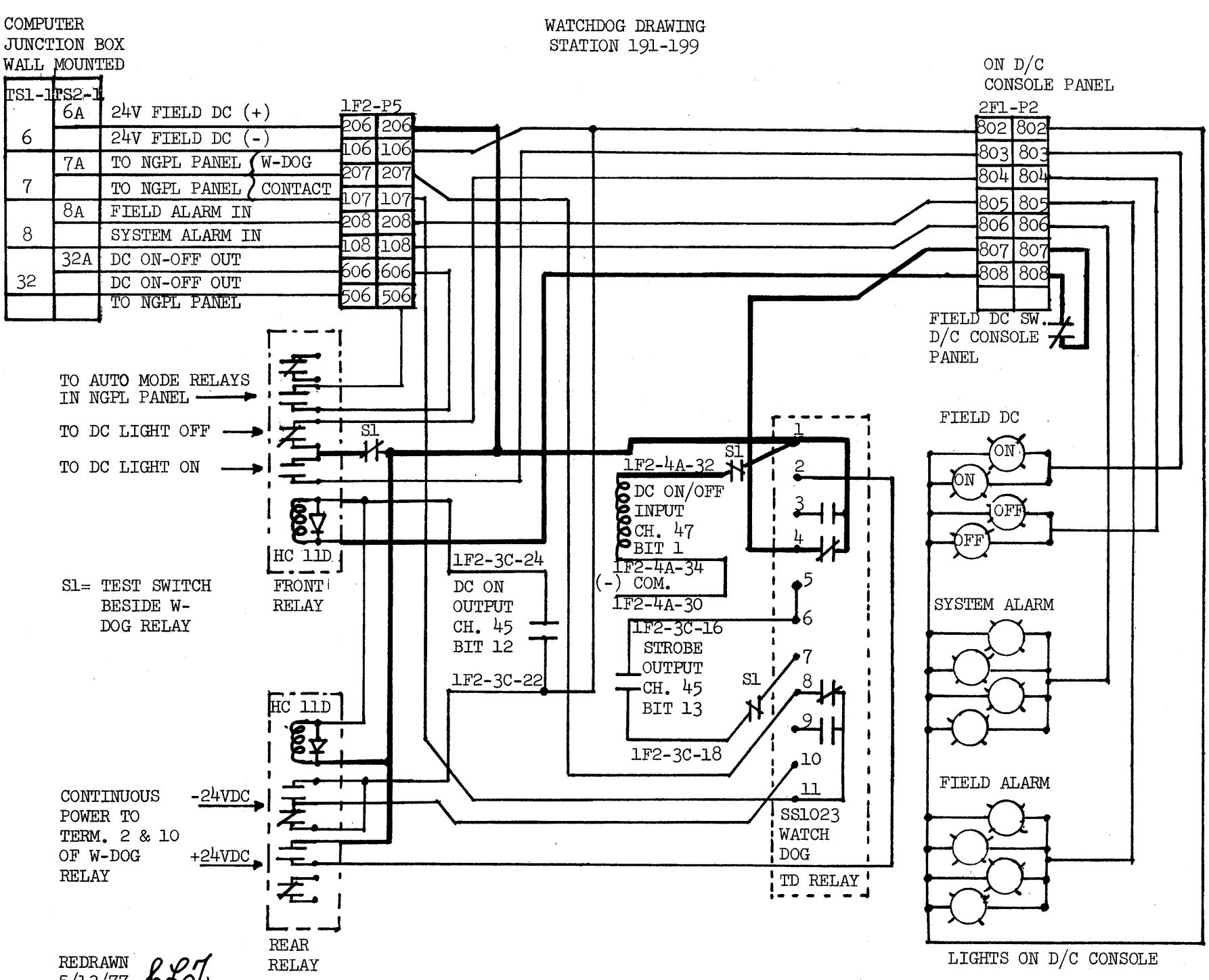
2. TRANSISTORS

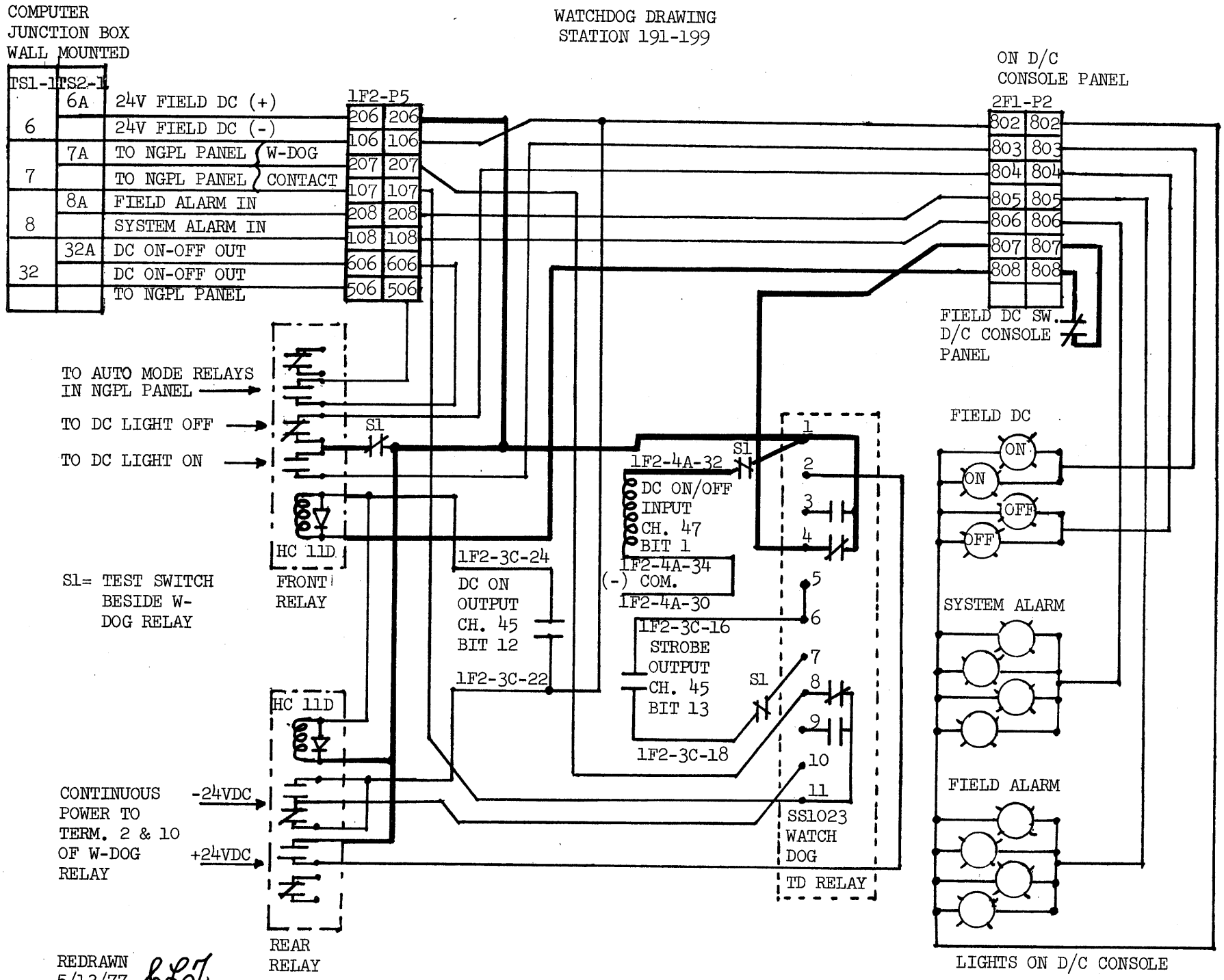
NUMBER	SUBSTITUTE
2N1808	2N3947
2N3503	2N2905A
MCR2305-2	2N4168
MCR1308-1	MCR2918-1/MCR3918-1
MPF104	2N5458
NS2129	2N2405
S18415	2N3725/2N2846
S18858	2N2405
FS19385	3N166
SDT9232	2N3772
SDT9724	2N3771
SS677	2N3947
SS678	2N3251
TA2651	2N4036/2N2904A

COMPUTER AND INTERFACE
SEMI CONDUCTOR
SUBSTITUTE LIST Cont'd.

3. INTEGRATED CIRCUITS

NUMBER	SUBSTITUTE
U5B990029 (Fairchild)	MC700G (Motorola)
U5B990729 (Fairchild)	MC707G (Motorola)
U5B991429 (Fairchild)	MC714G (Motorola)
U5B991529 (Fairchild)	MC715G (Motorola)
U5B992629 (Fairchild)	MC726G (Motorola)
U5B992729 (Fairchild)	MC727G (Motorola)
U5B771039 (Fairchild)	MC1710CG (Motorola)
SF113-03 (Sylvania)	MC474L,P (Motorola)/RF113D (Raytheon)
SG223-03 (Sylvania)	MC2051L,P (Motorola)/RG223D (Raytheon)
SG243-03 (Sylvania)	MC2053L,P (Motorola)/RG243D (Raytheon)
SM23-03 (Sylvania)	MC4029L (Motorola)/RM23-03 (Raytheon)
SM33-03 (Sylvania)	MC4031L (Motorola)/RM33-03 (Raytheon)
SM43-03 (Sylvania)	MC4032L (Motorola)/RM43-03 (Raytheon)
SG222-03 (Sylvania)	MC2001L (Motorola)
SG263-03 (Sylvania)	MC2055L (Motorola)


COMPUTER
JUNCTION BOX
WALL MOUNTED
TS1-1
TS2-1
6A
24V FIELD DC (+)
6
24V FIELD DC (-)
7A
TO NGPL PANEL W-DOG
7
TO NGPL PANEL CONTACT
8A
FIELD ALARM IN
8
SYSTEM ALARM IN
32A
DC ON-OFF OUT
32
DC ON-OFF OUT
TO NGPL PANEL
1F2-P5
206 206
106 106
207 207
107 107
208 208
108 108
606 606
506 506
WATCHDOG DRAWING
STATION 191-199
ON D/C
CONSOLE PANEL
2F1-P2
802 802
803 803
804 804
805 805
806 806
807 807
808 808
FIELD DC SW.
D/C CONSOLE
PANEL
TO AUTO MODE RELAYS
IN NGPL PANEL
TO DC LIGHT OFF
TO DC LIGHT ON
S1
HC 11D
FRONT
RELAY
S1= TEST SWITCH
BESIDE W-
DOG RELAY
1F2-3C-24
DC ON
OUTPUT
CH. 45
BIT 12
1F2-3C-22
1F2-4A-32
DC ON/OFF
INPUT
CH. 47
BIT 1
1F2-4A-34
(-) COM.
1F2-4A-30
1F2-3C-16
STROBE
OUTPUT
CH. 45
BIT 13
1F2-3C-18
S1
1
2
3
4
5
6
7
8
9
10
11
SS1023
WATCH
DOG
TD RELAY
FIELD DC
ON
ON
OFF
OFF
SYSTEM ALARM
FIELD ALARM
LIGHTS ON D/C CONSOLE
HC 11D
REAR
RELAY
CONTINUOUS
POWER TO
TERM. 2 & 10
OF W-DOG
RELAY
-24VDC
+24VDC
REDRAWN
5/13/77 GLZ


COMPUTER
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6A
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TO NGPL PANEL CONTACT
8A
FIELD ALARM IN
8
SYSTEM ALARM IN
32A
DC ON-OFF OUT
32
DC ON-OFF OUT
TO NGPL PANEL
WATCHDOG DRAWING
STATION 191-199
1F2-P5
206 206
106 106
207 207
107 107
208 208
108 108
606 606
506 506
ON D/C
CONSOLE PANEL
2F1-P2
802 802
803 803
804 804
805 805
806 806
807 807
808 808
FIELD DC SW.
D/C CONSOLE
PANEL
TO AUTO MODE RELAYS
IN NGPL PANEL
TO DC LIGHT OFF
TO DC LIGHT ON
S1
HC 11D
FRONT
RELAY
S1= TEST SWITCH
BESIDE W-
DOG RELAY
1F2-3C-24
DC ON
OUTPUT
CH. 45
BIT 12
1F2-3C-22
1F2-4A-32
DC ON/OFF
INPUT
CH. 47
BIT 1
1F2-4A-34
(-) COM.
1F2-4A-30
1F2-3C-16
STROBE
OUTPUT
CH. 45
BIT 13
1F2-3C-18
S1
1
2
3
4
5
6
7
8
9
10
11
SS1023
WATCH
DOG
TD RELAY
FIELD DC
ON
ON
OFF
OFF
SYSTEM ALARM
FIELD ALARM
HC 11D
REAR
RELAY
CONTINUOUS
POWER TO
TERM. 2 & 10
OF W-DOG
RELAY
-24VDC
+24VDC
LIGHTS ON D/C CONSOLE
REDRAWN
5/13/77

G-1-7/63

NGPL

INTER – OFFICE CORRESPONDENCE

DATE June 29, 1973

SUBJECT SEL 810A Computer, Short Loop, Test Programs.

TO
R. D. Kelly
J. R. Saar
V. E. Dake
Ed Skanes
T. C. Losh
E. L. Bergeson
J. J. Sneddeker
R. D. Pilcher
R. E. Praeuner
F. E. Bailey
C. T. Lowman
P. C. Luce
G. L. Brannan
W. J. Allen
L. G. Gillis

FROM Martin J. Findling

The following short loop "thumb-in" test programs and test procedures may be of assistance when trouble shooting the Computer.

1. Test all lights - light the Transfer Register and transfer to the Program Counter and "A", "B", and Instruction Registers.

2. Interchange "A" and "B".

Memory Location	Instruction Machine	Assembler
0	000006	(IAB)
1	111000	(BRU*-1)

"A" Accumulator = 0's
"B" Accumulator = 1's
Single cycle and run to make sure 1's and 0's alternate in the accumulators.

3. Load Control Switches, Store "A", and Load "B".

Memory Location	Instruction Machine	Assembler
0	000031	LCS
1	030004	STA 4
2	020004	LBA 4
3	110000	BRU 0

Start program and make sure all bits, 1's & 0's, will load into "B" accumulator using the Load Control Switches.

4. Output to the TTY Console.

Memory Location	Instruction Machine	Assembler
0	000031	LCS
1	001016	LSL 8
2	170101	AOP 1,W
3	110000	BRU *-3

Set Load Control Switches for octal 000207 (TTY bell) and start program. The teletype console bell should sound.

5. Memory Test - Test Prog. Step #1 loads memory and test Prog. Step #2 checks memory.

Step #1.

Memory Location	Instruction Machine	Assembler
0	034004	STA 4,1
1	000026	IBS
2	110000	BRU *-2
3	110000	BRU *-3

Set desired test pattern in "A" accumulator and start program. The program will store the test pattern in all memory locations except 1 through 4.

Step #2.

Memory Location	Instruction Machine	Assembler
0	014010	LAA 10,1
1	150010	CMA 10
2	000000	HLT
3	110005	BRU *+2
4	000000	HLT
5	000026	IBS
6	000000	HLT
7	110000	BRU *-7
10	Same test pattern as "A" accumulator in STEP #1.	

Start the program, when the program stops, the "B" accumulator should contain octal 037770 for successful test. If a memory error occurs, the address of the memory location which failed will be the contents of the "B" accumulator plus octal 10.

6. Check Parity Light on Control Panel.
   1. Remove card 14F.
   2. Enter octal 000002 in memory location 0.
   3. Replace card 14F.
   4. Display memory location 0.
   5. Parity light should illuminate.

7. Check Overflow Light on Control Panel.

Memory Location	Instruction Machine	Assembler
0	010003	LAA 3
1	050003	AMA 3
2	000000	HLT
3	100000	DATA

Start program and overflow light should illuminate.

8. Test External Unit Test Loop.

Memory Location	Instruction	
	Machine	Assembler
0	000031	LCS
1	030003	STA 3
2	130240	TEU 40
3	000000	DATA
4	110006	BRU *+2
5	110000	BRU 0
6	170501	MØP 1
7	103400	TTY BELL (207)
10	110000	BRU 0

Start program. Raising each sense switch should cause the teletype bell to ring with the exception of sense switches 0, 1, & 3. To check sense switches 0, 1, & 3 use the following procedure.

1. Set sense switch "0" and push the Set Point Execute switch, the TTY bell should ring.
2. Set sense switch 1 and tap or otherwise trip the high room temperature alarm on the wall mounted alarm thermostat, the TTY bell should ring.
3. Set sense switch 3 and push the Active Alarm Recall switch, the TTY bell should ring.

The foregoing test loops with the exception of the TEU Test #8 were suggested by Mr. Tom McGovern of SEL. These tests check many of the gates and data links in the Computer and is especially useful for testing if the diagnostic tapes will not load properly.

If you have any questions please call me.

MJF/gr
cc: Mr. V. K. Patrick
Mr. C. L. Thompson
Mr. M. G. Strasen
Mr. R. L. Jepsen
Mr. W. H. Smith
Mr. M. B. Roker
Mr. C. J. Langdale

G-1 1/72

Look

NGPL

INTER-OFFICE CORRESPONDENCE

DATE September 4, 1975

SUBJECT Computer Test Program

TO All Communications
"Computer" Technicians

FROM Mr. C. L. Thompson

Due to various problems occuring on the I/O bus and with teletype print out, the following thumb in program may be helpful in isolating the problem.

The program connects the teletype interrupts (input and output) to the standard priority interrupts in the computer. The program will input from any key on the teletype and print the character or number utilizing both interrupts.

After entering program, operate single cycle switch twice to turn off teletype motor.

Press start once and program should turn on teletype motor and advance to location '12-'13 and wait for an input from the teletype key board. Typing the character "0" and the number "0" will test data input bit lines 0-7 and output bits 8-15 on the I/O bus. If these characters do not print correctly, determine the data bit that is faulting. Following the print out of a character or a number, the octal representation will be displayed in the "A" accumulator.

If the program halts at a location other than '12 or '13 review the instruction causing the halt. The program will always return to this location unless a fault in hardware occurs.

Call me if you have trouble diagnosing a fault.

Place this information in the program binder under the tab labeled, Power Fail, A/D and TTy.

CLT/plb

cc: M. E. Nider
M. J. Findling
D. J. Noerrlinger
C. J. Langdale
M. B. Roker
File

PROGRAM COUNTER	LOCATION	OPERATION	ADDRESS INDEX	OCTAL INSTRUCTION	COMMENTS
0		CEU	1,W	130101	
1		DATA	'400	000400	Turn Off TTy Motor
2		LAA	INPT	010032	
3		STA*	A1	032033	
4		LAA	OTPT	010034	
5		STA*	B1	032035	
6		CEU	1,W	130101	Enable TTy Interrupts,
7		DATA	'72200	072200	Key Board and Motor
10		PIE		130600	Enable Computer Inpt
11		DATA	'10001	010001	Interrupt (Loc 8A)
12		NOP		000033	
13		BRU	*-1	110012	Wait for Interrupt
14	TYPE	DAC	**	000000	
15		AIP	1,W	170301	
16		LSL	8	001016	
17		PIE		130600	Enable Computer OTPT
20		DATA	'10002	010002	Interrupt (Loc 8A)
21		TOI		000035	Turn Off Interrupt
22		BRU*	TYPE	112014	BRU to Loc 12-13
23	PRNT	DAC	**	000000	
24		AOP	1,W	170101	
25		RSL	8	001015	
26		PID		130601	Disable OTPT Interrupt
27		DATA		010002	(Loc 8A)
30		TOI		000035	Turn Off Interrupt
31		BRU*	PRNT	112023	BRU to Loc 12-13
32	INPT	DAC	TYPE	000014	
33	A1	DATA	'1016	001016	
34	OTPT	DAC	PRNT	000023	
35	B1	DATA	'1017	001017	

IDENTIFICATION: Memory Test Diagnostic Program OCT #10

AUTHOR: Carl L. Thompson
Natural Gas Pipeline Company of America
Communications Division

COMPLETED: March 18, 1977

PURPOSE: To assist the Communication Technicians with maintenance and repair of the computer memory section.

COMPUTER: 810A

STORAGE: 331 Octal Locations

This program should be loaded in the good memory section (lower 8K or upper 8K) to check the failing or defective section. Load as follows.

Locations '20000-'37777 Failing (Upper 8K)
Enter '36060 in Program Counter
'6000 in "A" Accumulator

Insert tape in reader and press start switch twice.

With upper 8K failing it may be necessary to enter manual bootstrap and load the 8K loader tape in the lower 8K of memory.

The bootstrap for the 8K loader is the same as for 16K except for instruction '16 and '17 as follows.

Octal Location	8K Coding	16K Coding
16	117671	137671
17	017673	037673

To load the diagnostic tape,
Enter '16060 in Program Counter
'6000 in "A" Accumulator

Insert tape in reader and press start switch twice.

Start program at '6000 location and select the bit pattern for test using control panel switches.

Location 0-'17777 Failing (Lower 8K)
Enter '36060 in Program Counter
'20000 in "A" Accumulator

Insert tape in reader and press start switch twice.

Start program at '20000 location and select the bit pattern for test using control panel switches.

To commence test for either memory you should place all 16 switches in the raised position.

The program writes data into one memory location at a time then reads (extracts) the data to compare with the data that was written. If a bit was added or dropped, the program will initiate the printing.

1. Memory location of failure
2. Data as read from memory (errors)
3. Data as written into memory (good data)
   (See sample printout attached)

Let the program print errors, 100 locations or more, then study printed data closely for:

1. Locations that are failing
2. Data - is same bit or bits failing each time?

Refer to the memory trouble shooting guide for the most common memory problems. The trouble shooting guide is attached.

A parity error will cause the program to halt without printing information. You may jumper 13F24 to ground to inhibit parity halt signal and permit printing of information to analyze.

Testing of the upper 8K of memory will destroy the 16K loader program. After tests are complete the manual bootstrap will be automatically loaded by pressing teletype key "B". After teletype prints; "Bootstrap Loaded, Enter 16K Loader" you may insert the 16K loader tape, master clear and then press start switch twice to load.

Memory Troubleshooting Guide

A. Dropping all bits in all addresses
   1. Possible Cause: Missing +3.6 Volts
   2. Missing +28 Volts or +18.4 Volts. Check +28v and +18.4v outputs on card 8269 at 5K16 and 5K22 respectively.
   3. Missing or low read or write currents from current driver card (8959)

B. Dropping one bit in all addresses
   1. Possible Cause: Memory Data Register circuit faulty. Check data register circuit (8272-1), cycle memory with ONE's. The output to inhibit driver or inhibit driver selector should be 0 volts.
   2. Inhibit driver circuit faulty. Check inhibit driver circuits on (8269-1) and (8272).
   3. Sense amplifier circuit faulty. Check sense amplifier (8962) outputs.

C. Dropping one bit in all addresses of either the upper or lower 4K of an 8K memory
   1. Possible Cause: Inhibit driver circuit faulty. Check as prescribed in B1 above.
   2. Inhibit selector circuit faulty. Check inhibit selector circuit (8275)

D. Picking up all bits in all addresses
   1. Possible Cause: Missing -6 volts

E. Picking up one bit in all addresses
   1. Possible Cause: Data register faulty. Check data register circuit (8272) by depressing console clear switch. Output of circuit should be +V.
   2. Inhibit driver faulty.
      (a) Check inhibit driver by cycling ZERO's throughout memory. The inhibit current should be sufficient to cancel the write current.
   3. Sense Amplifier faulty. Check sense amp (8962) output.

F. Picks up one bit in all addresses of either the upper or lower 4K of an 8K Memory.
   1. Possible Cause: Inhibit driver faulty. Check inhibit driver circuit (8269-1) and (8272-1)
   2. Inhibit selector faulty. Check inhibit selector (8275) and (8272-1)

G. Picks up or drops random bits at random addresses
   1. Possible Cause: Core stack line currents are too high or low. Check the core stack common line currents from the current driver circuits when loading all ones during consecutive addressing. The waveforms should appear as shown in Figure 4.

2. Threshold voltage high or low. Refer to the adjustment procedures for card 8277. Unload strobe monostable may require adjustment. Refer to the adjustment procedure for card 8270.

H. Dropping bits in one address of every eighth address
   1. Possible Cause: The XWR line driver switch (8273) corresponding to the addresses that are dropping bits is faulty.
   2. Read/Write matrix corresponding to the XWR line driver circuits is faulty.

I. Dropping bits in eight addresses of every 64 addresses.
   1. The XC line driver switch (8273) corresponding to the addresses that are dropping bits is faulty. Example: Addresses $(0010)_8$ through $(0017)_8$ or $(0110)_8$ through $(0117)_8$ etc. Line driver switch XC1. Replace or repair card.
   2. Read/Write matrix corresponding to the XC line driver circuits is faulty. Replace or repair card.

J. Dropping bits in 64 addresses of every 512 addresses.
   1. The YWR line driver switch corresponding to the addresses that are dropping bits is faulty. Example: Addresses $(0000)_8$ - $(0077)_8$ - $(1000)_8$ - $(1077)_8$, etc. Line driver switch YWR 0. Replace or repair card.
   2. Read/Write matrix corresponding to the YWR line driver circuits is faulty. Replace or repair card.

K. Droppings bits in 512 addresses of every 4K or 8K of memory.
   1. The YC line driver switch corresponding to the addresses that are dropping bits is faulty. Example: Addresses $(5000)_8$ through $(5777)_8$. Line driver switch YC 5 in the 4K. Addresses $(15,000)_8$ through $(15,777)_8$. Line driver switch YC 13 in the 8K. Replace or repair card.
   2. Read/Write matrix corresponding to the YC line driver circuits is faulty. Replace or repair card.

L. Droppings all bits in one address of every 64, or 64 addresses in every 4K or 8K of memory.
   1. Diode in core stack bad. With all bits in one address of 64 being dropped, the common line (XC) which has a bad diode, will not appear as normal when the address is selected. Normal read/write common line currents are shown in Figure 4.

      With bits in 64 addresses, of a 4K memory unit or an 8K memory unit being dropped, the common line (YC) will not appear as normal.

SAMPLE PROGRAM PRINTOUT

```
21204 0000000000100000
      0000000011111111

20764 0000000000100001
      0000000011111111

25504 0000000000011000
      0000000011111111

30675 0000000000000001
      0000000011111111

25617 0000000000100000   DATA W/ERRORS
      0000000011111111   GOOD DATA

                         MEMORY LOCATION
```

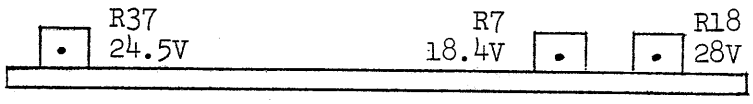
BOOTSTRAP LOADED, ENTER 16K LOADER

MEMORY VOLTAGES - ADJUSTABLE

The common or ground lead to all voltages in memory are tied to a common ground block (copper bar) located between memory H and K card location, rear side.

The following voltages originate from Model 222 power supply.

8269 Line Driver, Current and Inhibit Driver Regulator, Location 6K



6K2 = 24.5V Adjust R37

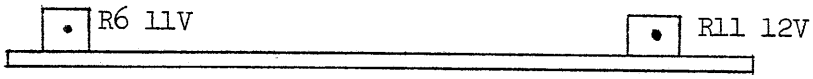
6K10 = 28V Adjust R18

6K 18 = 18.4V Adjust R7

Other Cards that voltages affect

15H20	= 24.5V	8H8	= 28V	5K22	= 18.4V
16H20	= 24.5V	9H8	= 28V		
17H20	= 24.5V	10H8	= 28V		
18H20	= 24.5V	11H8	= 28V		
19H20	= 24.5V	12H8	= 28V		
19H24	= 24.5V	5K16	= 28V		

8277, 12 Volt and Threshold Regulator, Location 6L



6L28	= 12V Adjust R11		6L6	= 11V Adjust R6	
4K22	= 12V		1L15	= 11V	
1L1	= 12V		2L15	= 11V	
2L1	= 12V		4L15	= 11V	
4L1	= 12V				
6H24	= 12V				
7H24	= 12V				
20H14	= 12V				

MEMORY VOLTAGES - NON ADJUSTABLE

MODEL 222 POWER SUPPLY

Use the common ground block (copper bar) between memory H and K card plane, rear side.

4K19 = (-)6V

4K20 = 16V

6K40 = 35V

Collector Case of Q1 (Inside Memory Cover) = 35V

A. 8270 Memory Timing Adjustment

Cycle memory with all ones as follows

1. Place all ones in T Register
2. Raise memory enter switch
3. Ground 3C18 to 3C2 in computer mainframe
4. Depress memory step switch
5. Connect Chan. 1 scope probe to 6H30 and sync the scope (-). Connect Chan. 2 to 6H38.
6. Adjust R19 until a delay of approx. 520 nanoseconds occurs between the leading edge of negative going pulse at 6H30 and the leading edge of positive going pulse at 6H38.

Oscilloscope settings
V/D = .1V
T/D = .1 microsec.

Mode Trigger: Red = Ch 1 only
Black = Alternate

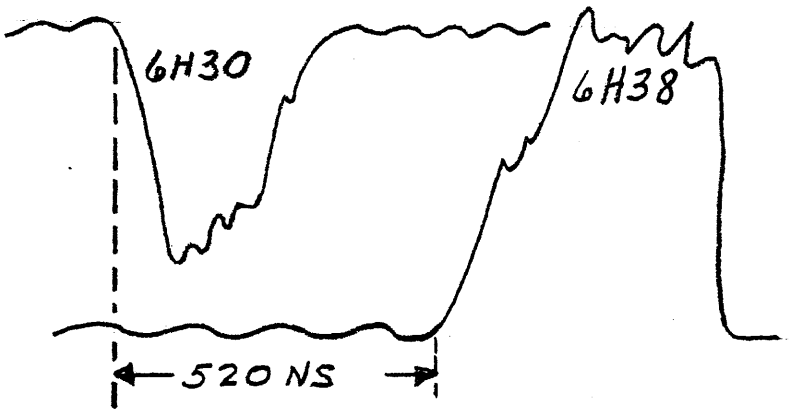


FIGURE 1

B. 8962 Sense Amplifier

The adjustment of the 8270 card controls the strobing of the sense amplifiers during the read portion of a memory cycle. Check the output pulse of all sense amplifiers for a clean leading edge at the following terminals.

Terminal
1L4, 1L6, 1L8, 1L10, 1L12
2L4, 2L6, 2L8, 2L10, 2L12
3L4, 3L6, 3L8, 3L10, 3L12
4L4, 4L6

Terminal 1L4-1L12 = Bit 0-4
2L4-2L12 = Bit 5-9
3L4-3L12 = Bit 10-14
414 = Bit 15
4L6 = Parity Bit

Oscilloscope Settings
V/D = .1V
T/D = .1 microsecond
Mode trigger:
Red = Ch 1 only
Black = Ch 1

Sense Amp Pulse Clean Leading Edge

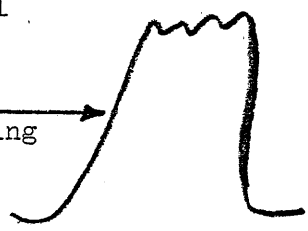


FIGURE 2

C. 8959 Dual Current Driver X and Y Read and Write Currents

Voltages on card 8269 must be adjusted before making adjustments on this card.

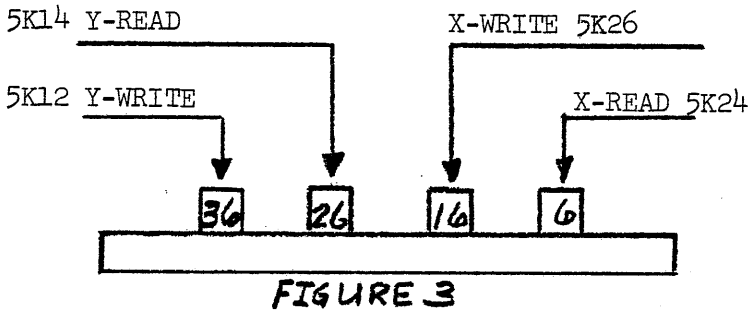
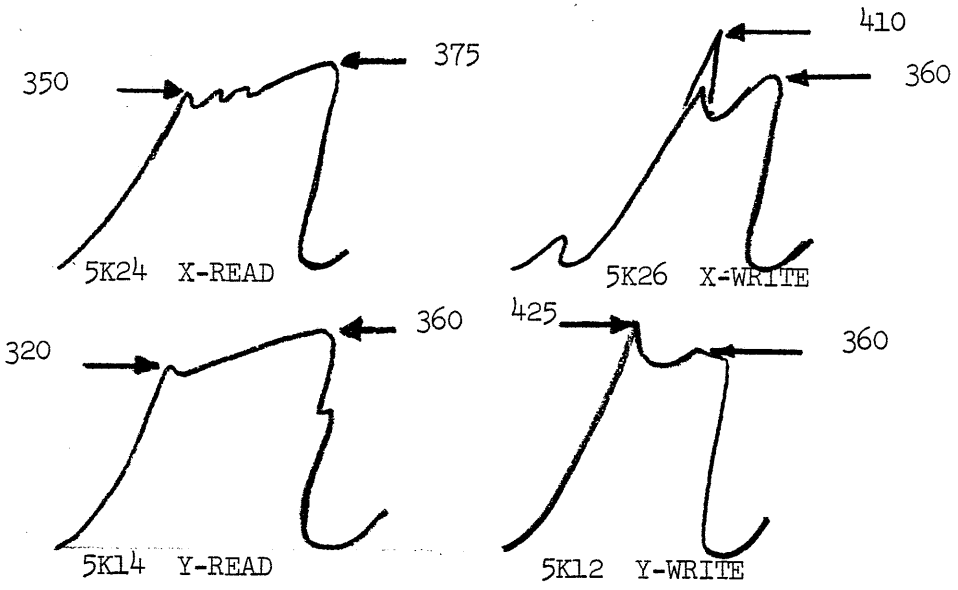


FIGURE 3

Oscilloscope Settings
V/D = .1V
T/D = .2 microseconds

Mode Trigger: Red = Ch 1 only
Black = Ch 1

With current probe adjust amplitude for 360 ma while loading ones in memory. Refer to A for cycling ones.



The write and read currents at 106 are adjusted per the above sketch.

```
EJ
 14064 00665
EJ
 14655 00665
EJ
 14655 00665
0001                    * * * * * * * * * * * * * * * * * * * * * * * * **
0002                    *    MEMORY TEST DIAGNOSTIC PROGRAM  CLT 10     *
0003                    *                                                *
0004                    *    PRESS LETTER B TO AUTOMATICALLY LOAD        *
0005                    *    MANUAL BOOT STRAP IF TESTING UPPER 8K.      *
0006                    *                                                *
0007                    *    PREPARED BY CARL L THOMPSON 3/18/77         *
0008                    * * * * * * * * * * * * * * * * * * * * * * * * **
0009  00000 00000000          REL
0010  00000 01100257          LAA  CNTQ           DAC STRT
0011  00001 15100260          CMA  CNTR           INH INTRUP IN UPPER 8K
0012  00002 11100005          BRU  *+3
0013  00003 11100004          BRU  *+1
0014  00004 11100020          BRU  UPER
0015  00005 01100276          LAA  INPT           DAC TYPE
0016  00006 03300275          STA* IRUP           '1016
0017  00007 00130101          CEU  1,W
0018  00010 00062000          DATA '62000
0019  00011 00130600          PIE
0020  00012 00010001          DATA '10001
0021  00013 01100260          LAA  CNTR           '20000
0022  00014 03100243          STA  CNTC           LOWEST LOC TO TST
0023  00015 01100262          LAA  CNTU           '37777
0024  00016 03100244          STA  CNTE           HIGHEST LOC TO TST
0025  00017 11100024          BRU  STRT
0026  00020 01100263 UPER     LAA  CNTV           1
0027  00021 03100243          STA  CNTC           LOWEST LOC TO TST
0028  00022 01100264          LAA  CNTW           '17777
0029  00023 03100244          STA  CNTE           HIGHEST LOC TO TST
0030  00024 00000033 STRT     NOP
0031  00025 02100243          LBA  CNTC
0032  00026 00000033 BEGN     NOP
0033  00027 01100267          LAA  NEG2
0034  00030 03100241          STA  CNTA
0035  00031 00000031 LCS      LCS
0036  00032 03100252          STA  CNTK
0037  00033 03400000          STA  0,1
0038  00034 15400000          CMA  0,1
0039  00035 11100052          BRU  ADRS
0040  00036 11100040          BRU  *+2
0041  00037 11100052          BRU  ADRS
0042  00040 00000033          NOP
0043  00041 00000026          IBS
0044  00042 00000033          NOP
0045  00043 00000004          TBA
0046  00044 15100244          CMA  CNTE
0047  00045 11100050          BRU  *+3            TST NXT LOC
```

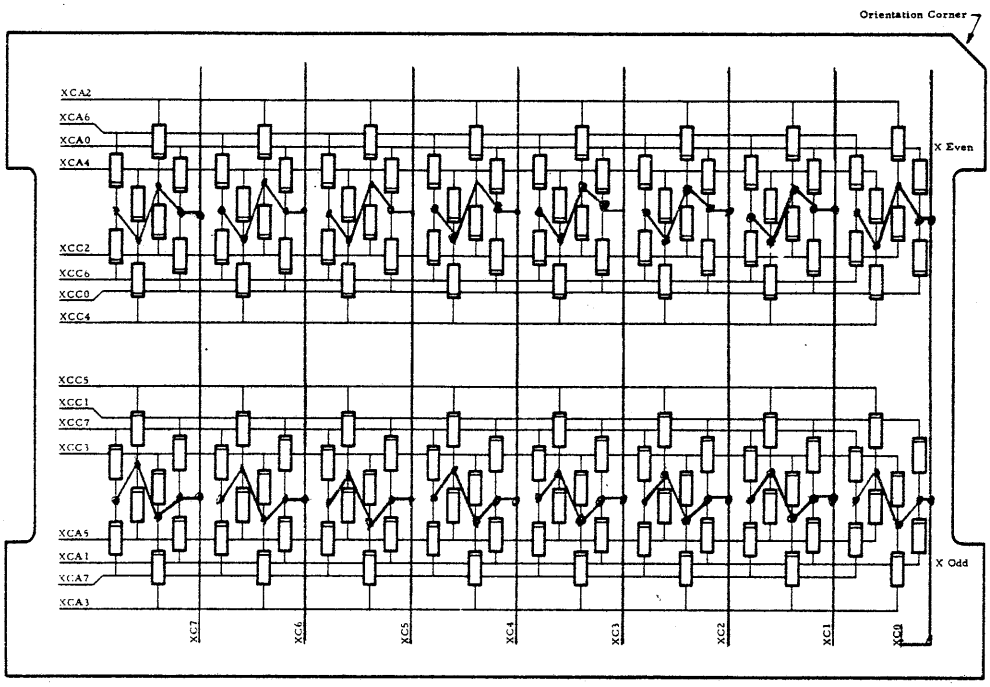
```
0048  00046 11100024       BRU  STRT          TST 8K AGAIN
0049  00047 00000000       HLT
0050  00050 00000033       NOP
0051  00051 11100031       BRU  LCS           TST NXT LOC
0052  00052 12100140 ADRS   SPB  CRLF          PRNT ADRS OF FAILURE
0053  00053 04100274       STB  SAVE
0054  00054 01100272       LAA  NEG5
0055  00055 03100246       STA  CNTG
0056  00056 00000003       CLA
0057  00057 00000413       FLL  4
0058  00060 11100063       BRU  *+3
0059  00061 00000003 CLA    CLA
0060  00062 00000313       FLL  3
0061  00063 05100251       AMA  CNTJ          '260
0062  00064 00001016       LSL  8
0063  00065 00170001       AOP  1
0064  00066 11100065       BRU  *-1
0065  00067 14100246       IMS  CNTG          -5 CNTR
0066  00070 11100061       BRU  CLA
0067  00071 12100133       SPB  SPCE
0068  00072 01300274       LAA* SAVE
0069  00073 02100242       LBA  CNTB          =-16
0070  00074 00000021 SAS    SAS                ARANG-PRNT DATA
0071  00075 11100100       BRU  ONE           A1 IS NEG=1
0072  00076 11100107       BRU  ZERO          A1 AND A=0
0073  00077 11100107       BRU  ZERO          A1 IS 0 AND A GREATER/0
0074  00100 00170401 ONE    MOP  1
0075  00101 00130400       DATA '130400
0076  00102 11100100       BRU  *-2
0077  00103 00000116 SHFT   LSL  1
0078  00104 00000026       IBS
0079  00105 11100074       BRU  SAS
0080  00106 11100113       BRU  TEST          TYPE GOOD-BAD DATA
0081  00107 00170401 ZERO   MOP  1
0082  00110 00130000       DATA '130000       ZERO
0083  00111 11100107       BRU  *-2
0084  00112 11100103       BRU  SHFT
0085  00113 12100140 TEST   SPB  CRLF
0086  00114 14100241       IMS  CNTA
0087  00115 11100117       BRU  *+2
0088  00116 11100126       BRU  REPT
0089  00117 02100273       LBA  NEG6
0090  00120 12100133       SPB  SPCE
0091  00121 00000026       IBS
0092  00122 11100120       BRU  *-2
0093  00123 00000033       NOP
0094  00124 00000031       LCS
0095  00125 11100073       BRU  SAS-1
```

```
0096  00126 00000033 REPT NOP
0097  00127 02100274       LBA  SAVE
0098  00130 00000026       IBS
0099  00131 00000033       NOP
0100  00132 11100026       BRU  BEGN
0101  00133 00000000 SPCE HLT
0102  00134 00170401       MOP  1
0103  00135 00120000       DATA '120000
0104  00136 11100134       BRU  *-2
0105  00137 11300133       BRU* SPCE
0106  00140 00000000 CRLF HLT
0107  00141 00170401       MOP  1
0108  00142 00106400       DATA '106400
0109  00143 11100141       BRU  *-2
0110  00144 00170401       MOP  1
0111  00145 00105000       DATA '105000
0112  00146 11100144       BRU  *-2
0113  00147 11300140       BRU* CRLF
0114  00150 00000000 TYPE HLT
0115  00151 00170301       AIP  1,W
0116  00152 15100255       CMA  CNTN
0117  00153 11100204       BRU  RONG
0118  00154 11100156       BRU  *+2
0119  00155 11100204       BRU  RONG
0120  00156 01100247       LAA  CNTH          -17
0121  00157 03100250       STA  CNTI          INDEX CNTR
0122  00160 02100254       LBA  CNTM          0
0123  00161 01500221       LAA  BOOT,1        BOOTSTRAP
0124  00162 03400000       STA  0,1
0125  00163 00000026       IBS
0126  00164 00000033       NOP
0127  00165 14100250       IMS  CNTI          INDEX CNTR
0128  00166 11100161       BRU  *-5
0129  00167 02100247       LBA  CNTH          =-17
0130  00170 12100140       SPB  CRLF
0131  00171 01500320       LAA  TBLA+17,1     ENTER 16K LOADER
0132  00172 12100214       SPB  TTY
0133  00173 00000026       IBS
0134  00174 11100171       BRU  *-3
0135  00175 12100140       SPB  CRLF
0136  00176 00130101       CEU  1,W
0137  00177 00001000       DATA '1000
0138  00200 00130601       PID
0139  00201 00010001       DATA '10001
0140  00202 00000035       TOI
0141  00203 11300265       BRU* CNTX
0142  00204 02100256 RONG LBA  CNTP          -9
0143  00205 12100140       SPB  CRLF
```

```
0144  00206 01500331       LAA   TBLB+9,1       WRONG KEY
0145  00207 12100214       SPB   TTY
0146  00210 00000026       IBS
0147  00211 11100206       BRU   *-3
0148  00212 00000035       TOI
0149  00213 11300261       BRU*  CNTS
0150  00214 00000000 TTY    HLT
0151  00215 00170101       AOP   1,W
0152  00216 00001016       LSL   8
0153  00217 00170101       AOP   1,W
0154  00220 11300214       BRU*  TTY
0155  00221 00130101 BOOT   CEU   1,W             BOOTSTRAP
0156  00222 00004000       DATA  '4000
0157  00223 00170301       AIP   1,W
0158  00224 00000022       SAZ
0159  00225 00111006       DATA  '111006
0160  00226 00111002       DATA  '111002
0161  00227 00170301 READ   AIP   1,W
0162  00230 00001016       LSL   8
0163  00231 00174301       AIP   1,W,R
0164  00232 00033016       DATA  '033016
0165  00233 00000022       SAZ
0166  00234 00000026       IBS
0167  00235 00113017       DATA  '113017
0168  00236 00111006       DATA  '111006
0169  00237 00137671       DATA  '137671
0170  00240 00037673       DATA  '037673
0171  00241 00000000 CNTA   DATA  0               -2 CNTR
0172  00242 00177760 CNTB   DATA  -16
0173  00243 00020000 CNTC   DATA  '20000          LOWEST MEM LOC F/TST
0174  00244 00037777 CNTE   DATA  '037777         HIGHEST MEM LOC F/TST
0175  00245 35400274 CNTF   DAC   SAVE
0176  00246 00000000 CNTG   DATA  0               -5 CNTR
0177  00247 00177757 CNTH   DATA  -17
0178  00250 00000000 CNTI   DATA  0
0179  00251 00000260 CNTJ   DATA  '260
0180  00252 00000000 CNTK   DATA  0
0181  00253 00000000 CNTL   DATA  0
0182  00254 00000000 CNTM   DATA  0
0183  00255 00000302 CNTN   DATA  '000302         B
0184  00256 00177767 CNTP   DATA  -9
0185  00257 35400024 CNTQ   DAC   STRT
0186  00260 00020000 CNTR   DATA  '20000
0187  00261 35400024 CNTS   DAC   STRT
0188  00262 00037777 CNTU   DATA  '37777
0189  00263 00000001 CNTV   DATA  1
0190  00264 00017777 CNTW   DATA  '17777
0191  00265 35400266 CNTX   DAC   CNTY
```

```
0192  00266 00000000 CNTY HLT
0193  00267 00177776 NEG2 DATA -2              TYPE 2 BINARY NOS
0194  00270 00177775 NEG3 DATA -3
0195  00271 00177774 NEG4 DATA -4
0196  00272 00177773 NEG5 DATA -5
0197  00273 00177772 NEG6 DATA -6
0198  00274 00000000 SAVE DATA 0               ADRS OF ERROR
0199  00275 00001016 IRUP DATA '1016
0200  00276 35400150 INPT DAC  TYPE
0201  00277 00141317 TBLA DATA ''BOOTSTRAP LOADED, ENTER 16K LOADER''
0201  00300 00147724
0201  00301 00151724
0201  00302 00151301
0201  00303 00150240
0201  00304 00146317
0201  00305 00140704
0201  00306 00142704
0201  00307 00126240
0201  00310 00142716
0201  00311 00152305
0201  00312 00151240
0201  00313 00130666
0201  00314 00145640
0201  00315 00146317
0201  00316 00140704
0201  00317 00142722
0202  00320 00153722 TBLB DATA ''WRONG KEY, PRESS B''
0202  00321 00147716
0202  00322 00143640
0202  00323 00145705
0202  00324 00154654
0202  00325 00120320
0202  00326 00151305
0202  00327 00151723
0202  00330 00120302
0203  00331 70400000       END
       UPER    00020
       STRT    00024
       BEGN    00026
       LCS     00031
       ADRS    00052
       CLA     00061
       SAS     00074
       ONE     00100
       SHFT    00103
       ZERO    00107
       TEST    00113
       REPT    00126
```

	SPCE	00133
	CRLF	00140
	TYPE	00150
	RONG	00204
	TTY	00214
	BOOT	00221
	READ	00227
	CNTA	00241
	CNTB	00242
	CNTC	00243
	CNTE	00244
	CNTF	00245
	CNTG	00246
	CNTH	00247
	CNTI	00250
	CNTJ	00251
	CNTK	00252
	CNTL	00253
	CNTM	00254
	CNTN	00255
	CNTP	00256
	CNTQ	00257
	CNTR	00260
	CNTS	00261
	CNTU	00262
	CNTV	00263
	CNTW	00264
	CNTX	00265
	CNTY	00266
	NEG2	00267
	NEG3	00270
	NEG4	00271
	NEG5	00272
	NEG6	00273
	SAVE	00274
	IRUP	00275
	INPT	00276
	TBLA	00277
	TBLB	00320
ERRORS	0000	00000



X DIODE MATRIX DECODE BOARD ASSEMBLY

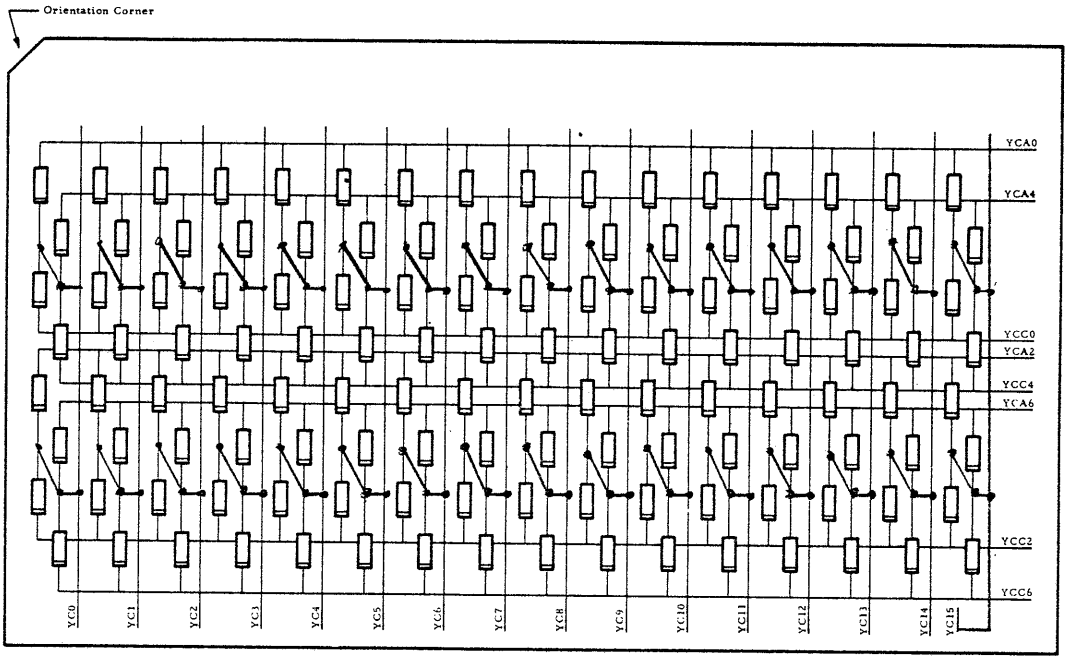
When locating diodes note orientation corner.

XCA = READ
XCC = WRITE

All diodes are Ampex 013-715

BOTTOM BOARD

X Diode Board Layout



Y EVEN DIODE MATRIX DECODE BOARD ASSEMBLY

When locating diodes
note orientation corner.

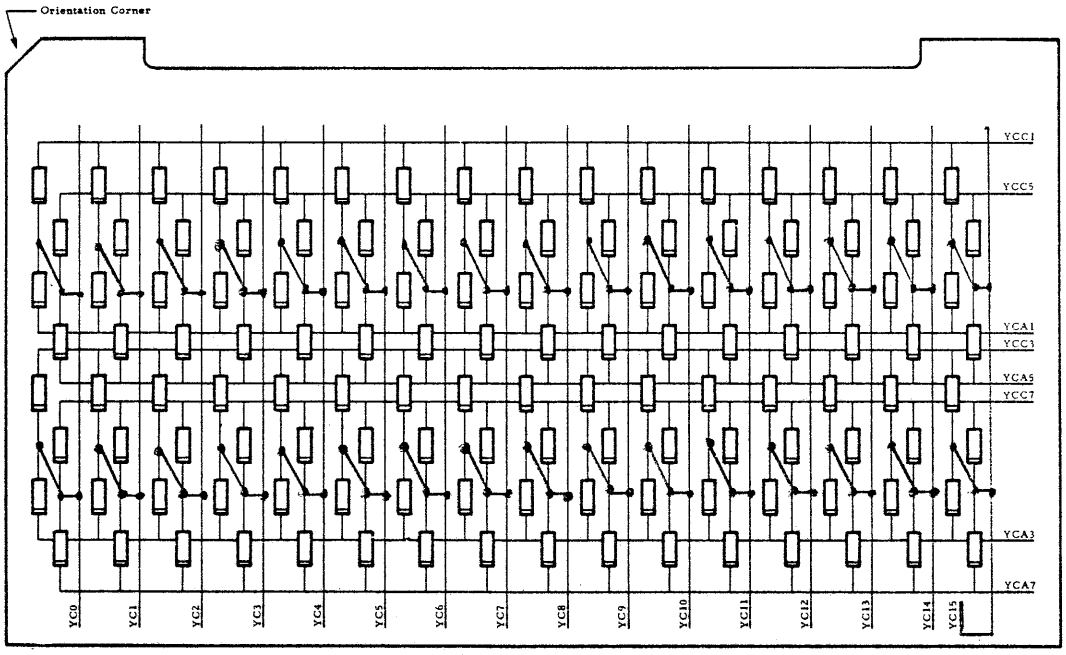
YCA = READ

YCC = WRITE

All diodes are Ampex 013-715

TOP BOARD

Y Even Diode Board Layout



Y ODD DIODE MATRIX DECODE BOARD ASSEMBLY

When locating diodes
note orientation corner.

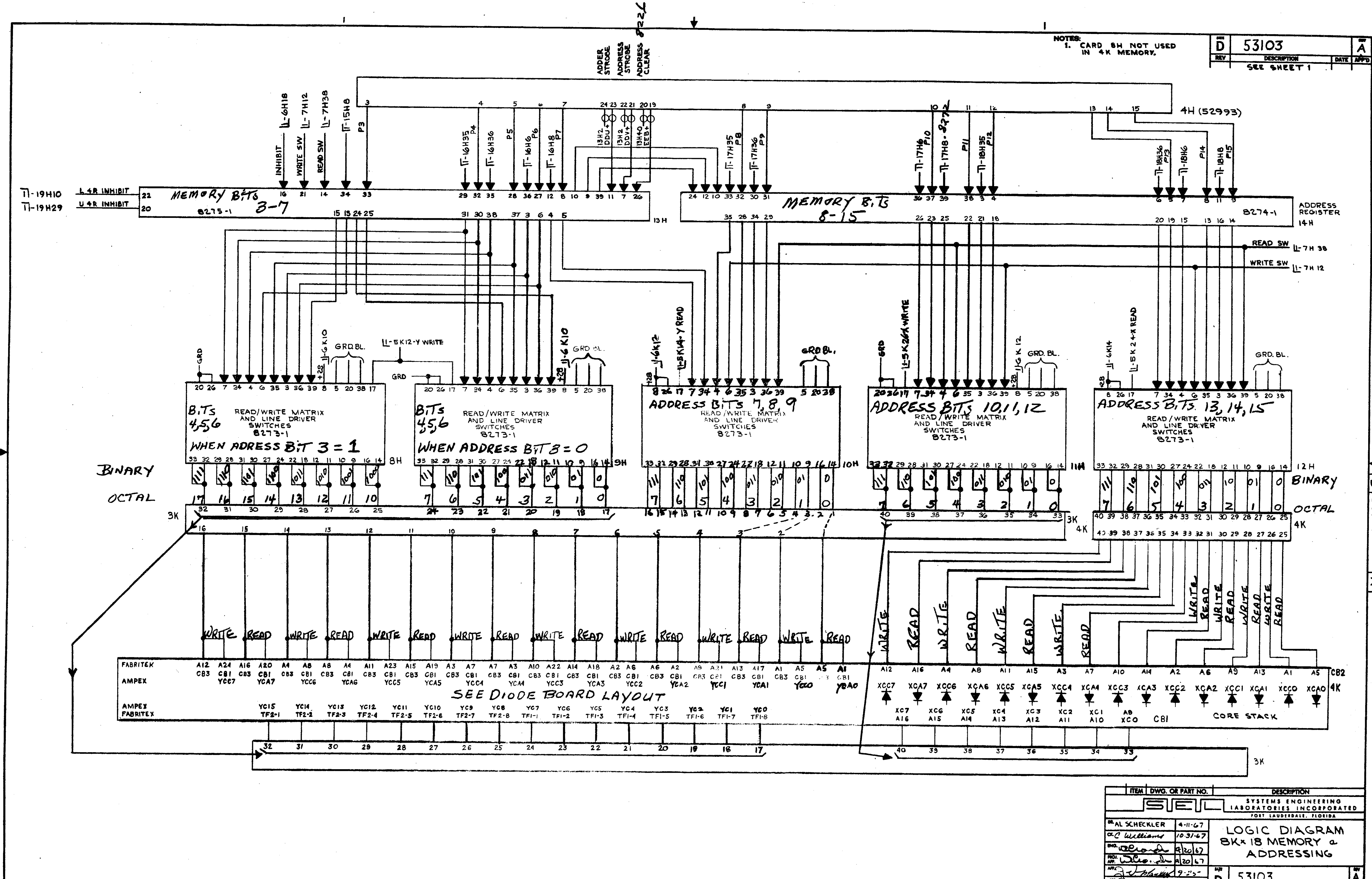
YCA = READ

YCC = WRITE

All diodes are Ampex 013-715

MIDDLE BOARD

Y Odd Diode Board Layout


NOTES:
1. CARD 8H NOT USED IN 4K MEMORY.
D 53103 A
SEE SHEET 1
ADDER STROBE
ADDRESS STROBE
ADDRESS CLEAR
4H (52993)
INHIBIT
WRITE SW
READ SW
L 4R INHIBIT
U 4R INHIBIT
MEMORY BITS 3-7
8275-1
13H
MEMORY BITS 8-15
8274-1
ADDRESS REGISTER
14H
READ SW
WRITE SW
GRD
GRD BL.
BITS 4,5,6
READ/WRITE MATRIX AND LINE DRIVER SWITCHES
8273-1
WHEN ADRESS BIT 3 = 1
8H
WHEN ADDRESS BIT 8 = 0
9H
ADDRESS BITS 7,8,9
10H
ADDRESS BITS 10,11,12
11H
ADDRESS BITS 13,14,15
12H
BINARY
OCTAL
3K
4K
WRITE
READ
FABRITEK
AMPEX
SEE DIODE BOARD LAYOUT
CORE STACK
CB2
CB1
LOGIC DIAGRAM
8K x 18 MEMORY & ADDRESSING
SYSTEMS ENGINEERING LABORATORIES INCORPORATED
FORT LAUDERDALE, FLORIDA
AL SCHECKLER 4-11-67
C Williams 10-31-67
D 53103 A
SHEET 2 OF 5

MAINFRAME VOLTAGES

MODEL 221 POWER SUPPLY

3.6V Bus = 3.6V

17E1 = 5V
17E2 gnd

MODEL 222 POWER SUPPLY

9G26 = 40V
9G2 gnd

15G4 = 40V
9G2 gnd

9G20 = 16V
9G2 gnd

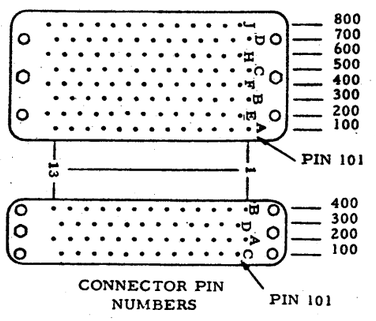
CONTROL PANEL

156 = 21V
157 gnd

CHECK AND ADJUST VOLTAGE AT POWER SUPPLY

I/O BUS SIGNALS

COMPUTER													I/O BUS SIGNALS	COMM. SYN. MODEM				
LOGIC CARD INFORMATION												P1-P2 I/O Cable		P1-P2 I/O Cable	CARD			
Location	Signal Pin	Number	Signal Pin	Location	Signal Pin	Number	Signal Pin	Location	Signal Pin	Number	Signal Pin				Signal Pin	Number	Signal Pin	Location
				9E	11	Prog. Reg. 8217	3	9C	12	CD 8705	10	310	Data Trans Instr. MIP MOP AIP AOP →	310	23	CT 100069	24	30A
				12C		I-O Instr. Dec. 8216	7	9C	13	CD 8705	9	410		410		CT 100069	26	30A
12C		I-O Instr. Dec. 8216	4	7C	8	Inverter 8545	6	9C	18	CD 8705	14	311	Test Instr. TEU →	311	25	CT 100069	30	30A
				11C		I-O Instr. Dec. 8225	21	9C	26	CD 8705	11	411		411		CT 100069	36	30A
								2A		8242	15	312	Command Instr. CEU →	312	29	CD 83278	67	28A
								2A		8242	17	412		412		CT 100069	38	30A
				12C		I-O Instr. Dec. 8216	15	9C	6	CD 8705	27	313	Command Inst. Sync →	313	35	CD 83278	63	28A
13D		Shift Cntr. 8209	18	24D	25	Dig. Buffer 8749	22	10C	24	CD 8705	25	413		413		CT 100069	40	30A
				12C		I-O Instr. Dec. 8216	18	10C	26	CD 8705	3	503	← Unit Input Interrupt	503	72	CT 100069	42	30A
				11C		I-O Instr. Timing 8225	20	9C	24	CD 8705	2	603		603		CT 100069	44	30A
				11C		I-O Instr. Timing 8225	12	9C	18	CD 8705	27	504	← Unit Output Interrupt	504	64	CD 83278	44	30A
				19D	4	A Zero Detect 8232	8	9C	4	CD 8705	28	604		604		CT 100069	46	30A
				11C		I-O Instr. Timing 8225	7	6C	21	CT 8615	8	509	Input Instruction →	509	37	CT 100069	48	30A
				11C		I-O Instr. Timing 8225	8	6C	23	CT 8615	7	609		609		CT 100069	46	30A
				11C		I-O Instr. Timing 8225	9	6C	19	CT 8615	22	510	Wait Flag →	510	39	CD 83278	21	28A
											23	610		610		CT 100069	42	30A
											27	511	CL8-CL16Timing →	511	41	CT 100069	44	30A
											25	611		611		CT 100069	48	30A
											22	512	Computer Data Here + CDH →	512	43	CT 100069	48	30A
											23	612		612				
											20	513	Computer Data Accepted + CDA →	513	45	100069	46	30A
											19	613		613				
											3	709	Master Clear ICB + →	709	47	100069	48	30A
											5	809		809		CD 83278	21	28A
											22	710	← Unit Test Return UTR +	710	22			
											26	810		810				
											24	711	← Unit Sync Return USR +	711	26	83278	23	28A
											28	811		811				
											20	712	← Unit Data Accepted UDA +	712	32	83278	31	28A
											25	812		812				



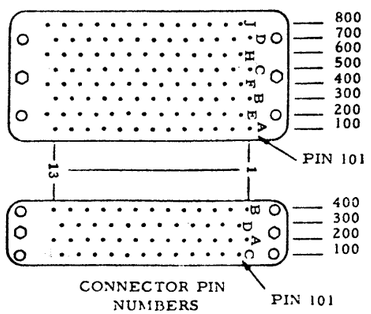
I/O BUS SIGNALS
COMPUTER TO
MODEM CLT

I/O BUS SIGNALS

COMPUTER					COMM SYN MODEM				
CARD			P1-P2 I/O Cable		P1-P2 I/O Cable	CARD			
Location	Number	Signal Pin Out				Signal Pin	Number	Signal Pin	Location
15F	8201	27	101	Data Bit 0 In-Out	101	7	100069	8	29A
			201						
15F	8201	3	102	Data Bit 1 In-Out	102	9	100069	10	29A
			202						
16F	8201	27	103	Data Bit 2 In-Out	103	11	100069	12	29A
			203						
16F	8201	3	104	Data Bit 3 In-Out	104	13	100069	14	29A
			204						
17F	8201	27	105	Data Bit 4 In-Out	105	15	100069	16	29A
			205						
17F	8201	3	106	Data Bit 5 In-Out	106	21	100069	22	29A
			206						
18F	8201	27	107	Data Bit 6 In-Out	107	23	100069	24	29A
			207						
18F	8201	3	108	Data Bit 7 In-Out	108	25	100069	26	29A
			208						
10C	8705	3	109	Unit Mach Bit 15	109	7	100069	8	30A
		5	209						
10C	8705	8	110	Unit Mach Bit 14	110	9	100069	10	30A
		7	210						
10C	8705	10	111	Unit Mach Bit 13	111	11	100069	12	30A
		9	211						
10C	8705	14	112	Unit Mach Bit 12	112	13	100069	14	30A
		11	212						
10C	8705	15	113	Unit Mach Bit 11	113	15	100069	16	30A
		17	213						
19F	8201	27	301	Data Bit 8 In-Out	301	29	100069	30	29A
			401						
19F	8201	3	302	Data Bit 9 In-Out	302	35	100069	36	29A
			402						
20F	8201	27	303	Data Bit 10 In-Out	303	37	100069	38	29A
			403						
20F	8201	3	304	Data Bit 11 In-Out	304	39	100069	40	29A
			404						
21F	8201	27	305	Data Bit 12 In-Out	305	41	100069	42	29A
			405						
21F	8201	3	306	Data Bit 13 In-Out	306	43	100069	44	29A
			406						
22F	8201	27	307	Data Bit 14 In-Out	307	45	100069	46	29A
			407						
22F	8201	3	308	Data Bit 15 In-Out	308	47	100069	48	29A
			408						
10C	8705	20	309	Unit Mach Bit 10	309	21	100069	22	30A
		19	409						

I/O BUS SIGNALS

COMPUTER													I/O BUS SIGNALS	A/D CONVERTER				
LOGIC CARD INFORMATION												P1-P2 I/O Cable		P1-P2 I/O Cable	CARD			
Location	Signal Pin	Number	Signal Pin	Location	Signal Pin	Number	Signal Pin	Location	Signal Pin	Number	Signal Pin				Signal Pin	Number	Signal Pin	Location
				9E	11	Prog. Reg. 8217	3	9C	12	CD 8705	10	310	Data Trans Instr. MIP MOP AIP AOP ►	310	19	83270	22	11A
				12C		I-O Instr. Dec. 8216	7	9C	13	CD 8705	9	410		410				
											14	311	Test Instr. TEU ►	311	Not	Used		
12C		I-O Instr. Dec. 8216	4	7C	8	Inverter 8545	6	9C	18	CD 8705	11	411		411				
											15	312	Command Instr. CEU ►	312	17	83270	24	11A
				11C		I-O Instr. Dec. 8225	21	9C	26	CD 8705	17	412		412				
											27	313	Command Inst. Sync ►	313	16	83270	37	11A
											25	413		413				
								8A		8242	3	503	◄ Unit Input Interrupt	503	24	83271	20	12A
											2	603		603				
								8A		8242	27	504	◄ Unit Output Interrupt	504	21	83271	18	12A
				12C		I-O Instr. Dec. 8216	15	9C	6	CD 8705	28	604		604				
											8	509	Input Instruction ►	509	14	83270	28	11A
13D		Shift Cntr. 8209	18	24D	25	Dig. Buffer 8749	22	10C	24	CD 8705	7	609		609				
											22	510	Wait Flag ►	510	13	83270	33	11A
				12C		I-O Instr. Dec. 8216	18	10C	26	CD 8705	23	610		610				
											27	511	CL8-CL16Timing ►	511	12	83270	30	11A
				11C		I-O Instr. Timing 8225	20	9C	24	CD 8705	25	611		611				
											22	512	Computer Data Here + CDH ►	512	11	83270	31	11A
				11C		I-O Instr. Timing 8225	12	9C	18	CD 8705	23	612		612				
											20	513	Computer Data Accepted + CDA ►	513	10	83270	32	11A
				19D	4	A Zero Detect 8232	8	9C	4	CD 8705	19	613		613				
											3	709	Master Clear ICB + ►	709	9	83270	29	11A
				11C		I-O Instr. Timing 8225	7	6C	21	CT 8615	5	809		809				
											22	710	◄ Unit Test Return UTR +	710	19	83270	37	11A
				11C		I-O Instr. Timing 8225	8	6C	23	CT 8615	26	810		810				
											24	711	◄ Unit Sync Return USR +	711	38	83270	20	11A
				11C		I-O Instr. Timing 8225	9	6C	19	CT 8615	28	811		811				
											20	712	◄ Unit Data Accepted UDA +	712	39	83270	21	11A
											25	812		812				

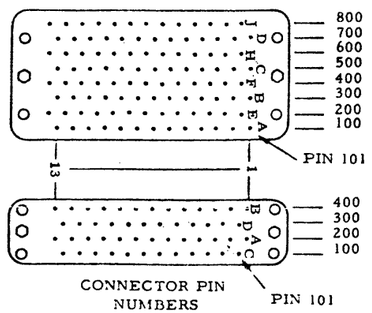


I/O BUS SIGNALS
COMPUTER TO
A/D CONV. CLT

COMPUTER					A/D CONVERTER				
CARD			P1-P2 I/O Cable		P1-P2 I/O Cable	CARD			
Location	Number	Signal Pin Out				Signal Pin	Number	Signal Pin	Location
15F	8201	27	101	Data Bit 0 In-Out	101	Not	Used		
			201						
15F	8201	3	102	Data Bit 1 In-Out	102	Not	Used		
			202						
16F	8201	27	103	Data Bit 2 In-Out	103	Not	Used		
			203						
16F	8201	3	104	Data Bit 3 In-Out	104	Not	Used		
			204						
17F	8201	27	105	Data Bit 4 In-Out	105	28	83271	9	12A
			205						
17F	8201	3	106	Data Bit 5 In-Out	106	26	83271	22	12A
			206						
18F	8201	27	107	Data Bit 6 In-Out	107	10	83271	35	12A
			207						
18F	8201	3	108	Data Bit 7 In-Out	108	12	83271	23	12A
			208						
10C	8705	3	109	Unit Mach Bit 15	109	8	83270	34	11A
		5	209						
10C	8705	8	110	Unit Mach Bit 14	110	7	83270	27	11A
		7	210						
10C	8705	10	111	Unit Mach Bit 13	111	6	83270	36	11A
		9	211						
10C	8705	14	112	Unit Mach Bit 12	112	5	83270	25	11A
		11	212						
10C	8705	15	113	Unit Mach Bit 11	113	4	83270	38	11A
		17	213						
19F	8201	27	301	Data Bit 8 In-Out	301	14	83271	32	12A
			401						
19F	8201	3	302	Data Bit 9 In-Out	302	16	83271	30	12A
			402						
20F	8201	27	303	Data Bit 10 In-Out	303	39	83271	5	12A
			403						
20F	8201	3	304	Data Bit 11 In-Out	304	38	83271	6	12A
			404						
21F	8201	27	305	Data Bit 12 In-Out	305	8	83271	26	12A
			405						
21F	8201	3	306	Data Bit 13 In-Out	306	6	83271	36	12A
			406						
22F	8201	27	307	Data Bit 14 In-Out	307	4	83271	37	12A
			407						
22F	8201	3	308	Data Bit 15 In-Out	308	3	83271	38	12A
			408						
10C	8705	20	309	Unit Mach Bit 10	309	3	83270	23	11A
		19	409						

I/O BUS SIGNALS

COMPUTER													I/O BUS SIGNALS	TTY AND READER				
LOGIC CARD INFORMATION												P1-P2 I/O Cable		P1-P2 I/O Cable	CARD			
Location	Signal Pin	Number	Signal Pin	Location	Signal Pin	Number	Signal Pin	Location	Signal Pin	Number	Signal Pin				Signal Pin	Number	Signal Pin	Location
										CD	10	310	Data Trans Instr. MIP MOP AIP AOP ►	310	16	CT 8615	15	5A
				9E	11	Prog. Reg. 8217	3	9C	12	8705	9	410		410	25			
										CD	14	311	Test Instr. TEU ►	311	Not Used			
				12C		I-O Instr. Dec. 8216	7	9C	13	8705	11	411		411				
12C		I-O Instr. Dec. 8216	4							CD	15	312	Command Instr. CEU ►	312	8	CT 8615	7	5A
				7C	8	Inverter 8545	6	9C	18	8705	17	412		412	3	CT 8615	13	5A
										CD	27	313	Command Inst. Sync ►	313	14			
				11C		I-O Instr. Dec. 8225	21	9C	26	8705	25	413		413	25	CD 8614	16	18A
											3	503	◄ Unit Input Interrupt	503	15			
								8A		8242	2	603		603	17	CD 8614	13	18A
											27	504	◄ Unit Output Interrupt	504	14			
										CD	28	604		604	11	CT 8615	23	5A
				12C		I-O Instr. Dec. 8216	15	9C	6	8705	8	509	Input Instruction ►	509	24			
		Shift Cntr.				Dig. Buffer				CD	7	609		609	27	CT		
13D		8209	18	24D	25	8749	22	10C	24	8705	22	510	Wait Flag ►	510	20	8615	19	5A
										CD	23	610		610	26	CT		
				12C		I-O Instr. Dec. 8216	18	10C	26	8705	27	511	CL8-CL16Timing ►	511	18	8615	17	5A
										CD	25	611		611	26	CT		
				11C		I-O Instr. Timing 8225	20	9C	24	8705	22	512	Computer Data Here + CDH ►	512	10	8615	9	5A
										CD	23	612		612	5	CT		
				11C		I-O Instr. Timing 8225	12	9C	18	8705	20	513	Computer Data Accepted + CDA ►	513	22	8615	21	5A
										CD	19	613		613	27	CT		
				19D	4	A Zero Detect 8232	8	9C	4	8705	3	709	Master Clear ICB + ►	709	12	8615	11	5A
										CT	5	809		809	5	CD		
				11C		I-O Instr. Timing 8225	7	6C	21	8615	22	710	◄ Unit Test Return UTR +	710	27	8614	26	18A
										CT	26	810		810	25	CD		
				11C		I-O Instr. Timing 8225	8	6C	23	8615	24	711	◄ Unit Sync Return USR +	711	22	8614	24	18A
										CT	28	811		811	23	CD		
				11C		I-O Instr. Timing 8225	9	6C	19	8615	20	712	◄ Unit Data Accepted UDA +	712	20	8614	18	18A
											25	812		812	19			



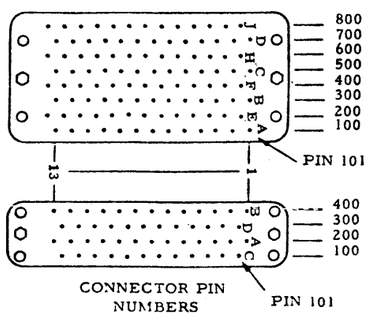
I/O BUS SIGNALS
COMPUTER TO
TELETYPE CLT

I/O BUS SIGNALS

COMPUTER					TTY AND READER				
CARD			P1-P2 I/O Cable		P1-P2 I/O Cable	CARD			
Location	Number	Signal Pin Out				Signal Pin	Number	Signal Pin	Location
15F	8201	27	101	Data Bit 0 In-Out	101	10	CT 8615	9	7A
			201			5			
15F	8201	3	102	Data Bit 1 In-Out	102	12	CT 8615	11	7A
			202			5			
16F	8201	27	103	Data Bit 2 In-Out	103	14	CT 8615	13	7A
			203						
16F	8201	3	104	Data Bit 3 In-Out	104	16	CT 8615	15	7A
			204						
17F	8201	27	105	Data Bit 4 In-Out	105	8	CT 8615	17	7A
			205						
17F	8201	3	106	Data Bit 5 In-Out	106	20	CT 8615	19	7A
			206						
18F	8201	27	107	Data Bit 6 In-Out	107	22	CT 8615	21	7A
			207						
18F	8201	3	108	Data Bit 7 In-Out	108	24	CT 8615	23	7A
			208						
10C	8705	3	109	Unit Mach Bit 15	109	22	U. DEC 8711	TP3 27	4A
		5	209						
10C	8705	8	110	Unit Mach Bit 14	110	20	U. DEC 8711		4A
		7	210						
10C	8705	10	111	Unit Mach Bit 13	111	17	U. DEC 8711		4A
		9	211						
10C	8705	14	112	Unit Mach Bit 12	112	15	U. DEC 8711		4A
		11	212						
10C	8705	15	113	Unit Mach Bit 11	113	12	U. DEC 8711		4A
		17	213						
19F	8201	27	301	Data Bit 8 In-Out	301	27	CD 8705	26	3A
			401			25			
19F	8201	3	302	Data Bit 9 In-Out	302	22	CD 8705	24	3A
			402			23			
20F	8201	27	303	Data Bit 10 In-Out	303	20	CD 8705	18	3A
			403			19			
20F	8201	3	304	Data Bit 11 In-Out	304	15	CD 8705	16	3A
			404			17			
21F	8201	27	305	Data Bit 12 In-Out	305	14	CD 8705	13	3A
			405			11			
21F	8201	3	306	Data Bit 13 In-Out	306	10	CD 8705	12	3A
			406			9			
22F	8201	27	307	Data Bit 14 In-Out	307	8	CD 8705	6	3A
			407			7			
22F	8201	3	308	Data Bit 15 In-Out	308	3	CD 8705	4	3A
			408			5			
10C	8705	20	309	Unit Mach Bit 10	309	9	U. DEC 8711		4A
		19	409						

I/O BUS SIGNALS

COMPUTER													I/O BUS SIGNALS	TEU AND DISPLAY CONTROL				
LOGIC CARD INFORMATION												P1-P2 I/O Cable		P1-P2 I/O Cable	CARD			
Location	Signal Pin	Number	Signal Pin	Location	Signal Pin	Number	Signal Pin	Location	Signal Pin	Number	Signal Pin				Signal Pin	Number	Signal Pin	Location
				9E	11	Prog. Reg. 8217	3	9C	12	CD 8705	10	310	Data Trans Instr. MIP MOP AIP AOP →	310	24	CT 8615	23	10B
				12C		I-O Instr. Dec. 8216	7	9C	13	CD 8705	9	410		410	28	CT 8615	9	12B
											14	311	Test Instr. TEU →	311	10			
12C		I-O Instr. Dec. 8216	4	7C	8	Inverter 8545	6	9C	18	CD 8705	11	411		411	3			
											15	312	Command Instr. CEU →	312	Not Used			
				11C		I-O Instr. Dec. 8225	21	9C	26	CD 8705	17	412		412		CT 8615	7	12B
											27	313	Command Inst. Sync →	313	8			
											25	413		413	2			
											3	503	← Unit Input Interrupt	503	Not Used			
											2	603		603				
											27	504	← Unit Output Interrupt	504	Not Used			
				12C		I-O Instr. Dec. 8216	15	9C	6	CD 8705	28	604		604				
											8	509	Input Instruction →	509	Not Used			
13D		Shift Cntr. 8209	18	24D	25	Dig. Buffer 8749	22	10C	24	CD 8705	7	609		609				
											22	510	Wait Flag →	510	Not Used			
				12C		I-O Instr. Dec. 8216	18	10C	26	CD 8705	23	610		610		CT 8615	11	12B
											27	511	CL8-CL16Timing →	511	12			
				11C		I-O Instr. Timing 8225	20	9C	24	CD 8705	25	611		611	3	CT 8615	4	12B
											22	512	Computer Data Here + CDH →	512	6			
				11C		I-O Instr. Timing 8225	12	9C	18	CD 8705	23	612		612	2			
											20	513	Computer Data Accepted + CDA →	513	Not Used			
				19D	4	A Zero Detect 8232	8	9C	4	CD 8705	19	613		613		CT 8615	21	10B
											3	709	Master Clear ICB + →	709	22			
				11C		I-O Instr. Timing 8225	7	6C	21	CT 8615	5	809		809	27	CD ~~8705~~	18	14B
											22	710	← Unit Test Return UTR +	710	20			
				11C		I-O Instr. Timing 8225	8	6C	23	CT 8615	26	810		810	23	CD ~~8705~~	26	14B
											24	711	← Unit Sync Return USR +	711	27			
				11C		I-O Instr. Timing 8225	9	6C	19	CT 8615	28	811		811	28	CD ~~8705~~	24	14B
											20	712	← Unit Data Accepted UDA +	712	22			
											25	812		812	25	8615		



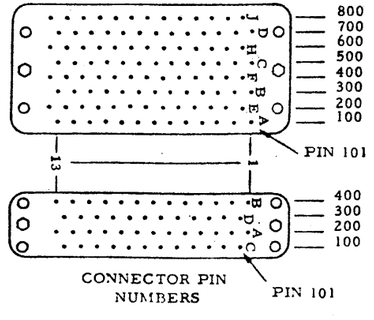
I/O BUS SIGNALS
COMPUTER TO
TEU & DISPLAY
CONTROL

I/O BUS SIGNALS

COMPUTER					TEU & DISPLAY CONTROL				
CARD			P1-P2 I/O Cable		P1-P2 I/O Cable	CARD			
Location	Number	Signal Pin Out				Signal Pin	Number	Signal Pin	Location
15F	8201	27	101	Data Bit 0 In-Out	101	24	CT 8615	23	11B
			201			28			
15F	8201	3	102	Data Bit 1 In-Out	102	22	CT 8615	21	11B
			202			27			
16F	8201	27	103	Data Bit 2 In-Out	103	20	CT 8615	19	11B
			203			26			
16F	8201	3	104	Data Bit 3 In-Out	104	18	CT 8615	17	11B
			204			25			
17F	8201	27	105	Data Bit 4 In-Out	105	16	CT 8615	15	11B
			205			25			
17F	8201	3	106	Data Bit 5 In-Out	106	14	CT 8615	13	11B
			206			5			
18F	8201	27	107	Data Bit 6 In-Out	107	12	CT 8615	11	11B
			207			3			
18F	8201	3	108	Data Bit 7 In-Out	108	10	CT 8615	9	11B
			208			3			
10C	8705	3	109	Unit Mach Bit 15	109	22	U. DEC 8711		13B
		5	209			19			
10C	8705	8	110	Unit Mach Bit 14	110	20	U. DEC 8711		13B
		7	210			19			
10C	8705	10	111	Unit Mach Bit 13	111	17	U. DEC 8711		13B
		9	211			14			
10C	8705	14	112	Unit Mach Bit 12	112	15	U. DEC 8711		13B
		11	212			14			
10C	8705	15	113	Unit Mach Bit 11	113	12	U. DEC 8711		13B
		17	213			11			
19F	8201	27	301	Data Bit 8 In-Out	301	8	CT 8615	7	11B
			401			2			
19F	8201	3	302	Data Bit 9 In-Out	302	6	CT 8615	4	11B
			402			2			
20F	8201	27	303	Data Bit 10 In-Out	303	24	CT 8615	23	12B
			403			28			
20F	8201	3	304	Data Bit 11 In-Out	304	22	CT 8615	21	12B
			404			27			
21F	8201	27	305	Data Bit 12 In-Out	305	20	CT 8615	19	12B
			405			27			
21F	8201	3	306	Data Bit 13 In-Out	306	18	CT 8615	17	12B
			406			26			
22F	8201	27	307	Data Bit 14 In-Out	307	16	CT 8615	15	12B
			407			26			
22F	8201	3	308	Data Bit 15 In-Out	308	14	CT 8615	13	12B
			408			25			
10C	8705	20	309	Unit Mach Bit 10	309	9	U. DEC 8711		13B
		19	409			11			

I/O BUS SIGNALS

COMPUTER													I/O BUS SIGNALS	DIGITAL INPUT – OUTPUT				
LOGIC CARD INFORMATION												P1-P2 I/O Cable		P1-P2 I/O Cable	CARD			
Location	Signal Pin	Number	Signal Pin	Location	Signal Pin	Number	Signal Pin	Location	Signal Pin	Number	Signal Pin				Signal Pin	Number	Signal Pin	Location
				9E	11	Prog. Reg. 8217	3	9C	12	CD 8705	10	310	Data Trans Instr. MIP MOP AIP AOP ►	310	22	83161		2B
				12C		I-O Instr. Dec. 8216	7	9C	13	CD 8705	9	410		410	19	Not Used		
											14	311	Test Instr. TEU ►	311				
12C		I-O Instr. Dec. 8216	4	7C	8	Inverter 8545	6	9C	18	CD 8705	11	411		411				
											15	312	Command Instr. CEU ►	312	34	83161		2B
				11C		I-O Instr. Dec. 8225	21	9C	26	CD 8705	17	412		412	37			
											27	313	Command Inst. Sync ►	313	32	83161		2B
											25	413		413	37			
												503	◄ Unit Input Interrupt	503	Not	Used		
												603		603				
												504	◄ Unit Output Interrupt	504	Not	Used		
				12C		I-O Instr. Dec. 8216	15	9C	6	CD 8705	8	509	Input Instruction ►	509	24	83161		2B
13D		Shift Cntr. 8209	18	24D	25	Dig. Buffer 8749	22	10C	24	CD 8705	7	609		609	23			
											22	510	Wait Flag ►	510	28	83161		2B
				12C		I-O Instr. Dec. 8216	18	10C	26	CD 8705	23	610		610	29			
											27	511	CL8-CL16Timing ►	511	20	83161		2B
				11C		I-O Instr. Timing 8225	20	9C	24	CD 8705	25	611		611	19			
											22	512	Computer Data Here + CDH ►	512	30	83161		2B
				11C		I-O Instr. Timing 8225	12	9C	18	CD 8705	23	612		612	29			
											20	513	Computer Data Accepted + CDA ►	513	36	83161		2B
				19D	4	A Zero Detect 8232	8	9C	4	CD 8705	19	613		613	39			
											3	709	Master Clear ICB + ►	709	38	83161		2B
				11C		I-O Instr. Timing 8225	7	6C	21	CT 8615	5	809		809	39			
											22	710	◄ Unit Test Return UTR +	710	4	83161		2B
				11C		I-O Instr. Timing 8225	8	6C	23	CT 8615	26	810		810	5			
											24	711	◄ Unit Sync Return USR +	711	6	83161		2B
				11C		I-O Instr. Timing 8225	9	6C	19	CT 8615	28	811		811	7			
											20	712	◄ Unit Data Accepted UDA +	712	8	83161		2B
											25	812		812				

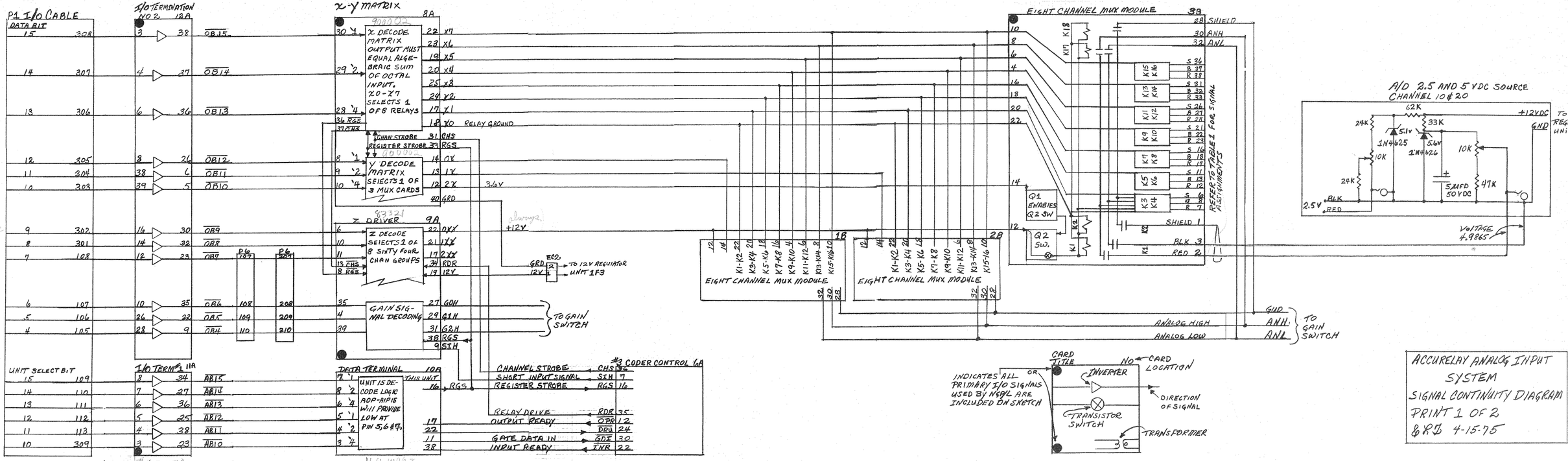


I/O BUS SIGNALS
COMPUTER TO
DIGITAL I/O

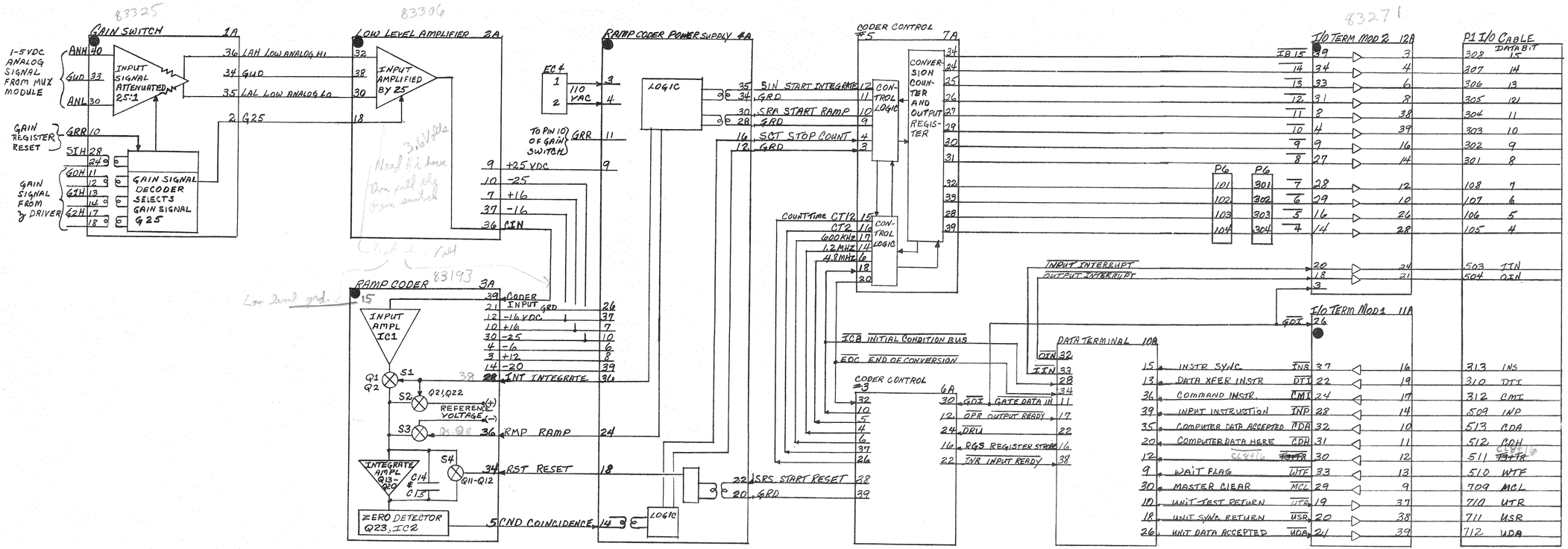
COMPUTER					DIGITAL INPUT-OUTPUT				
CARD			P1-P2 I/O Cable		P1-P2 I/O Cable	CARD			
Location	Number	Signal Pin Out				Signal Pin	Number	Signal Pin	Location
15F	8201	27	101	Data Bit 0 In	101	30	83160	32	1F1 4B
			201			31			
15F	8201	3	102	Data Bit 1 In	102	26	83160	33	4B
			202			27			
16F	8201	27	103	Data Bit 2 In	103	24	83160	34	4B
			203			25			
16F	8201	3	104	Data Bit 3 In	104	20	83160	35	4B
			204			21			
17F	8201	27	105	Data Bit 4 In	105	18	83160	5	4B
			205			16			
17F	8201	3	106	Data Bit 5 In	106	14	83160	4	4B
			206			15			
18F	8201	27	107	Data Bit 6 In	107	12	83160	7	4B
			207			13			
18F	8201	3	108	Data Bit 7 In	108	8	83160	6	4B
			208			9			
10C	8705	3	109	Unit Mach Bit 15	109	32	83137		1B
		5	209			33			
10C	8705	8	110	Unit Mach Bit 14	110	30	83137		1B
		7	210			31			
10C	8705	10	111	Unit Mach Bit 13	111	28	83137		1B
		9	211			29			
10C	8705	14	112	Unit Mach Bit 12	112	34	83137		1B
		11	212			35			
10C	8705	15	113	Unit Mach Bit 11	113	38	83137		1B
		17	213			39			
19F	8201	27	301	Data Bit 8 In	301	30	83160	32	3B
			401			31			
19F	8201	3	302	Data Bit 9 In	302	26	83160	33	3B
			402			27			
20F	8201	27	303	Data Bit 10 In	303	24	83160	34	3B
			403			25			
20F	8201	3	304	Data Bit 11 In	304	20	83160	35	3B
			404			21			
21F	8201	27	305	Data Bit 12 In	305	18	83160	5	3B
			405			16			
21F	8201	3	306	Data Bit 13 In	306	16	83160	4	3B
			406			15			
22F	8201	27	307	Data Bit 14 In	307	12	83160	7	3B
			407			13			
22F	8201	3	308	Data Bit 15 In	308	8	83160	6	3B
			408			9			
10C	8705	20	309	Unit Mach Bit 10	309	36	83137		1B
		19	409			37			

I/O BUS SIGNALS

COMPUTER					DIGITAL INPUT-OUTPUT				
CARD			P1-P2 I/O Cable		P1-P2 I/O Cable	CARD			
Location	Number	Signal Pin Out				Signal Pin	Number	Signal Pin	Location
15F	8201	27	101	Data Bit 0 Out	101	30	83160	28	4B
			201			31			
15F	8201	3	102	Data Bit 1 Out	102	26	83160	29	4B
			202			27			
16F	8201	27	103	Data Bit 2 Out	103	24	83160	22	4B
			203			25			
16F	8201	3	104	Data Bit 3 Out	104	20	83160	23	4B
			204			21			
17F	8201	27	105	Data Bit 4 Out	105	18	83160	16	4B
			205			16			
17F	8201	3	106	Data Bit 5 Out	106	14	83160	17	4B
			206			15			
18F	8201	27	107	Data Bit 6 Out	107	12	83160	10	4B
			207			13			
18F	8201	3	108	Data Bit 7 Out	108	8	83160	11	4B
			208			9			
10C	8705	3	109	Unit Mach Bit 15	109	32	83137		1B
		5	209			33			
10C	8705	8	110	Unit Mach Bit 14	110	30	83137		1B
		7	210			31			
10C	8705	10	111	Unit Mach Bit 13	111	28	83137		1B
		9	211			29			
10C	8705	14	112	Unit Mach Bit 12	112	34	83137		1B
		11	212			35			
10C	8705	15	113	Unit Mach Bit 11	113	38	83137		1B
		17	213			39			
19F	8201	27	301	Data Bit 8 Out	301	30	83160	28	3B
			401			31			
19F	8201	3	302	Data Bit 9 Out	302	26	83160	29	3B
			402			27			
20F	8201	27	303	Data Bit 10 Out	303	24	83160	22	3B
			403			25			
20F	8201	3	304	Data Bit 11 Out	304	20	83160	23	3B
			404			21			
21F	8201	27	305	Data Bit 12 Out	305	18	83160	16	3B
			405			16			
21F	8201	3	306	Data Bit 13 Out	306	16	83160	17	3B
			406			15			
22F	8201	27	307	Data Bit 14 Out	307	12	83160	10	3B
			407			13			
22F	8201	3	308	Data Bit 15 Out	308	8	83160	11	3B
			408			9			
10C	8705	20	309	Unit Mach Bit 10	309	36	83137		1B
		19	409			37			



ACCURELAY ANALOG INPUT SYSTEM
SIGNAL CONTINUITY DIAGRAM
PRINT 1 OF 2
&RD 4-15-75



ACCURELAY ANALOG INPUT SYSTEM
SIGNAL CONTINUITY DIAGRAM
PRINT 2 OF 2
682 4-15-75

NO PRESS SETPOINT - ALRM CLR
*** LOCAL SETPT ***
DISCH PRESS 0712

12 11
11 13 32

STA ON -REMOTE MODE
LOC/STDBY CONTROL - ALRM CLR

12 11
11 14 00

RESUME ALM TO MSTR

12 11
13 38 04

UNAUTHORIZED ENTRY

12 11
13 39 28

UNAUTHORIZED ENTRY- ALRM CLR

12 11
14 12 41

UNAUTHORIZED ENTRY

12 11
14 13 06

UNAUTHORIZED ENTRY- ALRM CLR

LC
EJ
10061 00047

CHANNEL NO	TOTAL TESTS	IN RANGE	OUT OF RANGE
00	00051	00051	00000
01	00051	00000	00051
02	00051	00000	00051
03	00051	00000	00051
04	00051	00000	00051
05	00051	00000	00051
06	00051	00000	00051
07	00051	00000	00051
10	00051	00051	00000
11	00051	00000	00051
12	00051	00000	00051
13	00051	00000	00051
14	00051	00000	00051
15	00051	00000	00051
16	00051	00000	00051
17	00051	00000	00051
20	00051	00051	00000
21	00051	00000	00051
22	00051	00000	00051
23	00051	00000	00051
24	00051	00000	00051
25	00050	00000	00050
26	00050	00000	00050

NGPL

INTER-OFFICE CORRESPONDENCE

DATE March 13, 1973

SUBJECT Operating Instructions SEL 810A
Computer Acceptance Test.

TO R. D. Kelly, E. L. Bergeson, J. R. Saar, J. J. Sneddeker, V. E. Dake, R. D. Pilcher, Ed Skanes, R. E. Praeuner, L. G. Gillis, F. E. Bailey, T. C. Losh, C. T. Lowman

FROM Mr. M. J. Findling

Each data control Station utilizing the SEL 810A Computer system should have a large Computer test program tape titled SEL 810A Acceptance Tests or Main Frame Diagnostic or Composite Diagnostics. This long diagnostic test program, which will be referred to as the Composite Diagnostic Test program, consists of the following individual diagnostic programs interconnected into one composite diagnostic program tape.

1. Main Frame Exerciser.
2. Load/Store/Register Change Test.
3. Arithmetic Test.
4. Multiply Test.
5. Divide Test.
6. Instruction Simulation & Comparison Test.
7. Compare Memory to A, a sign Test.
8. MEMDEX Test (Memory Test).
9. Memory Worst Case Test.

Each of these diagnostic tests as part of the Composite Diagnostic Test program runs for a specified length of time or specified number of cycles before going to the next diagnostic program on the tape resulting in a run time of approximately 3 hours for the entire Composite Diagnostic Program. The Load/ Store/Register Change Test program runs for 46 successful cycles and the Instruction Simulation & Comparison Test runs for 15 successful cycles.

The Composite Diagnostic Test program tape is loaded via the standard (not modified) boot-strap listed below.

STANDARD BINARY BOOTSTRAP

Octal Loc.	Coding
0	130101

STANDARD BINARY BOOTSTRAP CONT'D

Octal Loc.	Coding
1	004000
2	170301
3	000022
4	111006
5	111002
6	170301
7	001016
10	174301
11	033016
12	000022
13	000026
14	113017
15	111006
16	107671
17	007673

After loading the Composite Diagnostic program will immediately type out the sense switch setting instructions and the start information. This type out also indicates a run time of approximately 1.5 hours which is in error. As indicated by the type out, sense switch 3 is set to test 8K of memory and sense switches 2 and 3 are set to test 16K of memory. The program is then started by simply depressing the start switch. From then on the program is completely automatic typing out which dianostic test is being loaded and indicating when the test has been completed. After the last diagnostic test on the tape, memory worst case test, the program will type out " ABS loader will now be loaded" ; however, due to a quirk in the program, the loader programs are not loaded into memory.

If you have any questions regarding the operation of the Composite Diagnostic program or do not have a copy of the Composite Diagnostic program tape at the Data Control Stations please call me.

It is suggested that you place this Memo in the back of your program descriptions Manual for easy reference when you desire to run the long Composite Diagnostic program.

MJF/gr
cc: Mr. V. K. Patrick
Mr. C. L. Thompson
Mr. R. L. Jepsen
Mr. M. G. Strasen
Mr. C. J. Langdale
Mr. M. B. Roker

#A CLT #1

PROGRAM DESCRIPTION

IDENTIFICATION: Analog-to-Digital Converter Diagnostic Program

AUTHOR: Carl L. Thompson, Natural Gas Pipeline Company of America, Communications Division

ISSUED: March 30, 1976 -- Revised August 1, 1976

PURPOSE: To assist the Communication Technicians with maintenance and repair of the analog-to-digital converter system.

COMPUTER: 810A

STORAGE: 1620 Octal Locations

LOADING PROCEDURE: Relocatable loader 16K modified
Program counter Enter '36060
"A" Accumulator Enter '6000
"B" Accumulator = 0

This program consists of four (4) diagnostics.

Insert tape in reader and press start twice.

1. Replace analog signal cable (104 pin connector) on rear of output relay panel with A/D jumper connector. Insert connector phone plug into the 2.5 volt test jack.

   The A/D jumper connector parallels all A/D inputs with 2.5 volts for test purposes except for channel 00 and 20. Channel 00 is tested for ground potential and 20 is tested for 4.986 volts.

2. Start program at '7100 to adjust 2.5 and 4.9865 test voltage. Set sense switch 11 and adjust 5 volt pot. until teletype bell rings continuously. The "B" Accumulator should contain '7764. Reset switch 11. Set sense switch 12 and adjust 2.5 volt pot. until teletype bell rings continuously. The "B" Accumulator should contain '4000. Reset switch 12. Recheck 5 volt adjustment.

   This completes the adjustment for the diagnostics. The following diagnostics utilize priority input interrupt.

3. Program Location '6000.

This program automatically tests each of 24 relays once (Card Location 1B, 2B & 3B) each second. The voltage through each relay contact is tested for a range of 7 millivolts with the results stored in a table. To print results of test, momentarily set control panel switch 15. A relay that tests out of range should be replaced. Keep in mind, if several relays on the same card test out of range, inspect the common pair of relays K17 & K18 before replacement.

The program will automatically print the results after 8191 tests; a test period of approximately 2 hours and 15 minutes.

This program will display a value of all A/D channels in the nixie displays except for channel 00. Select an octal channel number 1-7, 10-17, 20-27 with switch under the display. Channel '20 should display a reading of 771 to 773. Channels 1-'27 should display a reading of 500 to 502. A variation from these readings will indicate errors for the channel displayed. The display will read zero if an illegal channel is selected. The displays are updated once per second.

4. Program Location '7200

This program tests individual relays once per second by selecting the channel number using control switches. If the relay tests out of range ($\pm$7 mv) the teletype bell will ring. The "B" Accumulator will display the octal value of test.

5. Program Location '7500

This program will print the octal and volts value of the signal using the control switches for channel selection. After starting the program the table heading will be printed. Select a channel number with control switches and press start. You must re-press start after each line is printed.

NOTE: When completed return A/D signal cable to original connector. Check the 2.500 and 4.986 test voltage with a differential voltmeter. The readings should not vary more than 10-15 millivolts if the A/D system is properly calibrated.

TABLE 1

ANALOG CHANNEL FUNCTION ASSIGNMENT

ANALOG CHANNEL	LOCATION RELAY	LOCATION CARD	FUNCTION NUMBER	A/D RANGE	FUNCTION DESCRIPTION
00	K1-2	1B			Zero Test Voltage
01	K3-4	1B	41	200-400	Fuel Gas Pressure
02	K5-6	1B	21	400-800	Fuel Diff. Pressure - Unit 1
03	K7-8	1B	65	0-150	Suction Temperature - Unit 2
04	K9-10	1B	44	400-800	Suction Pressure - Unit 2
05	K11-12	1B			
06	K13-14	1B	22	400-800	Fuel Diff. Pressure - Unit 2
07	K15-16	1B	63	-20-200	Atmospheric Temperature
10	K1-2	2B			Half Scale Test Voltage (2.505 VDC)
11	K3-4	2B	56	0-150	Mainline Discharge Temperature
12	K5-6	2B	50	0-150	Mainline Suction Temperature
13	K7-8	2B	67	700-1100	Exhaust Temperature - Unit 1
14	K9-10	2B	68	700-1100	Exhaust Temperature - Unit 2
15	K11-12	2B	42	-20-200	Fuel Gas Temperature
16	K13-14	2B	11	0-6000	RPM - Unit 2
17	K15-16	2B	64	-20-200	Suction Temperature - Unit 1
20	K1-2	3B			Full Scale Test Voltage (4.986 VDC)
21	K3-4	3B	43	400-800	Suction Pressure - Unit 1
22	K5-6	3B			
23	K7-8	3B	07	400-800	Mainline Discharge Pressure
24	K9-10	3B	00	400-800	Mainline Suction Pressure
25	K11-12	3B	08	400-800	Station Discharge Pressure
26	K13-14	3B	10	0-6000	RPM - Unit 1
27	K15-16	3B			

Station program samples each function once per second. Test voltages are sampled every 10 seconds. If value is out of range, program will sample value each second for 5 seconds. If still out of range it will print A/D failure.

SAMPLE PRINTOUT OF A/D DIAGNOSTIC

CHANNEL NO	TOTAL TESTS	IN RANGE	OUT OF RANGE
00	00442	00442	00000
01	00442	00442	00000
02	00442	00442	00000
03	00442	00442	00000
04	00442	00442	00000
05	00442	00442	00000
06	00442	00442	00000
07	00442	00442	00000
10	00442	00442	00000
11	00442	00442	00000
12	00442	00442	00000
13	00442	00442	00000
14	00442	00442	00000
15	00442	00442	00000
16	00442	00442	00000
17	00441	00441	00000
20	00441	00441	00000
21	00441	00441	00000
22	00441	00441	00000
23	00441	00441	00000
24	00441	00441	00000
25	00441	00441	00000
26	00441	00441	00000
27	00441	00441	00000

CHAN NO	OCTAL VALUE	VOLTS VALUE	OCTAL VALUE	VOLTS VALUE	OCTAL VALUE	VOLTS VALUE	OCTAL VALUE	VOLTS VALUE
01	4002	2.503	4002	2.503	4002	2.503	4002	2.503
03	4002	2.503	4002	2.503	4002	2.503	4002	2.503
02	4002	2.503	4002	2.503	4002	2.503	4002	2.503
06	4002	2.503	4002	2.503	4002	2.503	4002	2.503
05	4002	2.503	4002	2.503	4002	2.503	4002	2.503
15	4002	2.503	4002	2.503	4002	2.503	4002	2.503
25	4002	2.503	4002	2.503	4002	2.503	4002	2.503
21	4002	2.503	4002	2.503	4002	2.503	4002	2.503
11	4002	2.503	4002	2.503	4002	2.503	4002	2.503
20	7764	4.986	7764	4.986	7764	4.986	7764	4.986
24	4002	2.503	4002	2.503	4002	2.503	4002	2.503

```
0001                    **** **** ************************************
0002                    *    A-D DIAGNOSTIC
0003                    *
0004                    *    LOC '6000 TSTS EA OF 24 RLYS EA SECOND. VOL-
0005                    *    TAGE THRU RLY TESTED F/RANGE OF 7 MV. RESULT
0006                    *    STORED IN TBLE. SET SW 15 TO PRNT TABLE.
0007                    *    PROGRAM WILL AUTOMATICALLY PRINT RESULTS
0008                    *    AFTER 8191 TESTS.
0009                    *    SELECT A-D CHAN FOR NIXIE DISPLAY. VOLTAGE
0010                    *    IS SCALED              AT 7.4 MV PER
0011                    *    UNIT. CH 00 WILL NOT BE DISPLAYED. CH 20
0012                    *    SHOULD READ 771-773, ALL OTHERS TO READ
0013                    *    500-502.
0014                    *    LOC '7100 ADJ 2.5 AND 4.986 TST VOLTAGE. SET
0015                    *    SW 12,ADJ 2.5V POT TILL TTY BELL RINGS.SET
0016                    *    SW 11 ADJ 5V POT TILL TTY BELL RINGS. RE-
0017                    *    CHECK 2.5 VOLTS.
0018                    *    LOC '7200 SELECT CH NO W/CONTROL SW. RELAYS
0019                    *    TESTED ONCE PER SEC. TTY BELL WILL RING IF
0020                    *    OUT OF RANGE.
0021                    *    LOC '7500 WILL PRINT OCTAL-VOLTS VALUE OF
0022                    *    CHAN SELECTED BY CONTROL SW. PRESS START
0023                    *    AFTER EACH LINE.
0024                    *    PREPARED BY CARL L. THOMPSON 3-5-76
0025                    *    REVISED 8-1-76
0026                    ********************************************
0027  00000 00000000          REL
0028  00000 12100210          SPB  CLER          CLR ALL TBLS
0029  00001 01100772          LAA  CNTY          INTR SUBROUTINE ADDR
0030  00002 03300771          STA* CNTX          LOC '1016
0031  00003 00170240 STAR     AIP  '40           INPT SEC
0032  00004 11100003          BRU  *-1
0033  00005 03100770          STA  CNTW          STORE F/COMPARE
0034  00006 00170240 SEC      AIP  '40           INPT SEC
0035  00007 11100006          BRU  *-1
0036  00010 15100770          CMA  CNTW          HAVE SEC CHANGED
0037  00011 11100013          BRU  *+2
0038  00012 11100006          BRU  SEC
0039  00013 03100770          STA  CNTW
0040  00014 14101000 BEGN     ~~IMS  CTYP~~ NOP
0041  00015 14101000          IMS  CTYP
0042  00016 11100020          BRU  *+2
0043  00017 12100142          SPB  PRNT          PRNT AFTER 8192 TSTS
0044  00020 00130417 STRT     SNS  '17
0045  00021 12100142          SPB  PRNT
0046  00022 01100773          LAA  CNT1          CNT OF 1
0047  00023 05500602          AMA  TBLA,1
```

```
0048  00024 03500602       STA  TBLA,1        TOTAL TSTS EA CHANNEL
0049  00025 00130015       CEU  '15
0050  00026 00060000       DATA '60000        INPT INTR
0051  00027 11100025       BRU  *-2
0052  00030 00130600       PIE
0053  00031 00010001       DATA '10001        GRP 1 LEVEL 1
0054  00032 01500551       LAA  CH1,1
0055  00033 00170015       AOP  '15
0056  00034 11100033       BRU  *-1
0057  00035 00000033       NOP
0058  00036 11100035       BRU  *-1           WT FOR INTRUP
0059  00037 25400000 INPT   DAC  **            INTRUP SUBROUTINE CHK
0060  00040 00130015       CEU  '15
0061  00041 00020000       DATA '20000
0062  00042 11100040       BRU  *-2
0063  00043 00170215       AIP  '15
0064  00044 11100043       BRU  *-1
0065  00045 03100762       STA  CNTG          ANALOG VOL
0066  00046 03500451       STA  CH2,1         NIXI DSPLA MODE
0067  00047 01500551       LAA  CH1,1
0068  00050 15000000       CMA  =0            CH 00
0069  00051 11100053       BRU  *+2
0070  00052 11100070       BRU  ZERO
0071  00053 15000020       CMA  ='20          CH 20
0072  00054 11100056       BRU  *+2
0073  00055 11100057       BRU  TWTY
0074  00056 11100101       BRU  UTER          TST OTHER CHS
0075  00057 01100762 TWTY   LAA  CNTG          ANALOG VOL
0076  00060 15007772       CMA  ='7772        4.9938V
0077  00061 11100062       BRU  *+1
0078  00062 11100064       BRU  *+2
0079  00063 11100115       BRU  ERR
0080  00064 15007756       CMA  ='7756        4.9792V
0081  00065 11100115       BRU  ERR
0082  00066 11100067       BRU  *+1
0083  00067 11100111       BRU  GOOD
0084  00070 01100762 ZERO   LAA  CNTG
0085  00071 15077760       CMA  ='177760
0086  00072 11100115       BRU  ERR
0087  00073 11100074       BRU  *+1
0088  00074 11100075       BRU  *+1
0089  00075 15000017       CMA  ='17
0090  00076 11100077       BRU  *+1
0091  00077 11100111       BRU  GOOD
0092  00100 11100115       BRU  ERR
0093  00101 01100762 UTER   LAA  CNTG          ANALOG VOL
0094  00102 15004007       CMA  ='4007        2.509V
0095  00103 00000033       NOP                OK
```

```
0096  00104 11100106       BRU  *+2          OK
0097  00105 11100107       BRU  *+2          OUT OF RANGE
0098  00106 15003771       CMA  ='3771       2.492V
0099  00107 11100115       BRU  ERR
0100  00110 00000033       NOP               OK
0101  00111 01100773 GOOD  LAA  CNT1         OK CNT OF 1
0102  00112 05500632       AMA  TBLB,1       GOOD TSTS
0103  00113 03500632       STA  TBLB,1       TOTAL GOOD TSTS
0104  00114 11100120       BRU  NUCH         INITIALIZE F/NEW CHAN TST
0105  00115 01100773 ERR   LAA  CNT1         CNT OF 1
0106  00116 05500662       AMA  TBLC,1       TST OUT OF RANGE
0107  00117 03500662       STA  TBLC,1
0108  00120 00000026 NUCH  IBS
0109  00121 00000033       NOP
0110  00122 01500551       LAA  CH1,1        CK FOR CH 24 '30
0111  00123 15100765       CMA  CNTT         CNT OF 24
0112  00124 11100134       BRU  NEXT         TST NEXT CH BRU TO STRT
0113  00125 00000033       NOP               RESTART TST OF CH 01
0114  00126 12100321       SPB  NIXN         DSPLA DATA IN NIXI
0115  00127 00000003       CLA
0116  00130 00000005       TAB
0117  00131 01100766       LAA  CNTU         GO TO SEC F/RESTRT
0118  00132 03100037       STA  INPT
0119  00133 11100140       BRU  *+5
0120  00134 01100764 NEXT  LAA  CNTS         BRU TO STRT TST NXT CHAN
0121  00135 03100037       STA  INPT
0122  00136 00130601       PID
0123  00137 00010001       DATA '10001
0124  00140 00000035       TOI
0125  00141 11300037       BRU* INPT
0126  00142 25400000 PRNT  DAC  **           PRNT TBLE AND DATA
0127  00143 01060000       LAA  ='160000     = CNT OF 8191
0128  00144 03101000       STA  CTYP
0129  00145 12100303       SPB  CRLF
0130  00146 02077755       LBA  =-19
0131  00147 01500735       LAA  TBLD+19,1    HEADING OF TBL
0132  00150 12100276       SPB  TTYO
0133  00151 00000026       IBS
0134  00152 11100147       BRU  *-3
0135  00153 12100303       SPB  CRLF
0136  00154 02077755       LBA  =-19
0137  00155 01500760       LAA  TBLE+19,1    HEADING OF TBLE
0138  00156 12100276       SPB  TTYO
0139  00157 00000026       IBS
0140  00160 11100155       BRU  *-3
0141  00161 12100303       SPB  CRLF
0142  00162 12100303       SPB  CRLF
0143  00163 01077750       LAA  =-24
```

```
0144  00164 03100761       STA  CNTA
0145  00165 01500551 AGAN  LAA  CH1,1
0146  00166 12100251       SPB  CHNO
0147  00167 01500602       LAA  TBLA,1          NO OF TESTS
0148  00170 12100223       SPB  TSTS            CONV AND PRNT DEC NO
0149  00171 01500632       LAA  TBLB,1          TESTS IN RANGE
0150  00172 12100223       SPB  TSTS            CONV AND PRNT DEC NO
0151  00173 01077777       LAA  =-1
0152  00174 03100777       STA  CNT6            SKIP SPC3 IN TSTS
0153  00175 01500662       LAA  TBLC,1          TESTS OUT OF RANGE
0154  00176 12100223       SPB  TSTS
0155  00177 00000026       IBS
0156  00200 00000033       NOP
0157  00201 12100303       SPB  CRLF
0158  00202 14100761       IMS  CNTA            =-24 ALL CHS
0159  00203 11100165       BRU  AGAN
0160  00204 12100210       SPB  CLER            CLR ALL TBLS
0161  00205 01100763       LAA  CNTR            DAC STAR
0162  00206 03100142       STA  PRNT
0163  00207 11300142       BRU* PRNT
0164  00210 25400000 CLER  DAC  **              CLR ALL TBLS
0165  00211 00000003       CLA
0166  00212 03100760       STA  TEMP            CLR TEMP B INDEX
0167  00213 02077750       LBA  =-24
0168  00214 03500632       STA  TBLA+24,1       CLR TBLE
0169  00215 03500662       STA  TBLB+24,1
0170  00216 03500712       STA  TBLC+24,1
0171  00217 03500501       STA  CH2+24,1
0172  00220 00000026       IBS
0173  00221 11100214       BRU  *-5
0174  00222 11300210       BRU* CLER
0175  00223 25400000 TSTS  DAC  **              CONVERT OCTAL TO DEC
0176  00224 04100760       STB  TEMP
0177  00225 00000005       TAB
0178  00226 01077773       LAA  =-5
0179  00227 03100776       STA  CNT5            PRINT 5 NOS
0180  00230 00000003       CLA
0181  00231 11100234       BRU  *+3
0182  00232 00000003 CNTH  CLA
0183  00233 07000012       MPY  =10             '12
0184  00234 10023420       DIV  =10000          '23420
0185  00235 05000260       AMA  ='260
0186  00236 00001016       LSL  8
0187  00237 00170101       AOP  1,W
0188  00240 14100776       IMS  CNT5
0189  00241 11100232       BRU  CNTH
0190  00242 14100777       IMS  CNT6            -1 F/TBLC ONLY
0191  00243 11100245       BRU  *+2
```

```
0192  00244 11100247       BRU   *+3
0193  00245 12100311       SPB   SPC3
0194  00246 12100311       SPB   SPC3
0195  00247 02100760       LBA   TEMP
0196  00250 11300223       BRU*  TSTS
0197  00251 25400000 CHNO  DAC   **              NEXT 17 STATEMENTS ARRANGE
0198  00252 04100760       STB   TEMP            AND OUTPUT CH NO
0199  00253 00000005       TAB
0200  00254 01020240       LAA   ='120240        2 SPCS
0201  00255 00170101       AOP   1,W
0202  00256 00001016       LSL   8
0203  00257 00170101       AOP   1,W
0204  00260 00000003       CLA
0205  00261 00001513       FLL   13
0206  00262 05000260       AMA   ='260
0207  00263 00001016       LSL   8
0208  00264 00170101       AOP   1,W
0209  00265 00000003       CLA
0210  00266 00000313       FLL   3
0211  00267 05000260       AMA   ='260
0212  00270 00001016       LSL   8
0213  00271 00170101       AOP   1,W
0214  00272 12100311       SPB   SPC3
0215  00273 12100311       SPB   SPC3
0216  00274 02100760       LBA   TEMP
0217  00275 11300251       BRU*  CHNO
0218  00276 25400000 TTYO  DAC   **
0219  00277 00170101       AOP   1,W
0220  00300 00001016       LSL   8
0221  00301 00170101       AOP   1,W
0222  00302 11300276       BRU*  TTYO
0223  00303 25400000 CRLF  DAC   **
0224  00304 00170501       MOP   1,W
0225  00305 00106400       DATA  '106400
0226  00306 00170501       MOP   1,W
0227  00307 00105000       DATA  '105000
0228  00310 11300303       BRU*  CRLF
0229  00311 25400000 SPC3  DAC   **              OUTPUT 3 SPACES
0230  00312 01020240       LAA   ='120240
0231  00313 00170101       AOP   1,W
0232  00314 00001016       LSL   8
0233  00315 00170101       AOP   1,W
0234  00316 00170501       MOP   1,W
0235  00317 00120000       DATA  '120000
0236  00320 11300311       BRU*  SPC3
0237                  *  NEXT 170 STATEMENTS DSPLA DATA IN NIXES.
0238  00321 00000000 NIXN  HLT
0239  00322 01077776       LAA   =-2
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0240  00323 03100511       STA  NIXJ          CNTR F/AIP44,A0P41
0241  00324 01077775       LAA  ='177775
0242  00325 03100504       STA  NIXD          DSPLA 3 NIX AND EXIT
0243  00326 02077750 NIXZ   LBA  =-24
0244  00327 00170243       AIP  '43           INPT S5,6,7
0245  00330 11100327       BRU  *-1
0246  00331 00001016       LSL  8
0247  00332 00001015       RSL  8
0248  00333 15500551       CMA  CH3+24,1      CK SW F/CH NO
0249  00334 11100336       BRU  *+2
0250  00335 11100342       BRU  *+5
0251  00336 00000026       IBS
0252  00337 11100333       BRU  *-4
0253  00340 00000003       CLA
0254  00341 11100415       BRU  NIXI          INVALID CH NO
0255  00342 01500501       LAA  CH2+24,1      DATA F/CH SELECTED
0256  00343 00000022       SAZ
0257  00344 11100346       BRU  NIXY
0258  00345 11100415       BRU  NIXI          NO DATA, CLR NIXI
0259  00346 00000316 NIXY   LSL  3
0260  00347 00000005       TAB
0261  00350 00000003       CLA
0262                       *    TO SCALE AND DISPLAY VALUES AT 400-800 PSI
0263                       *    CHANGE DIV TO '122 AND AMA TO '621. 2.5V
0264                       *    WILL EQUAL 600 PSI.
0265  00351 10000074       DIV  ='74
0266  00352 05000344       AMA  ='344
0267  00353 03100503       STA  NIXC
0268  00354 01077772       LAA  =-6           CNTR
0269  00355 03100502       STA  NIXB          CONVERT 5 NOS
0270  00356 00000003       CLA
0271  00357 02100503       LBA  NIXC          DATA FOR NIXIE
0272  00360 11100363       BRU  NIXQ
0273  00361 00000003 REPT   CLA
0274  00362 07000012       MPY  ='12
0275  00363 10023420 NIXQ   DIV  ='23420
0276  00364 14100502       IMS  NIXB
0277  00365 00000033       NOP
0278  00366 03100513       STA  NIXL
0279  00367 01100502       LAA  NIXB          CK CNTR F/UTH DIGIT
0280  00370 15100506       CMA  NIXF          177775 HND DIGIT
0281  00371 11100361       BRU  REPT
0282  00372 11100401       BRU  LSL8
0283  00373 15100507       CMA  NIXG          177776 TENS DIGIT
0284  00374 00000000       HLT
0285  00375 11100405       BRU  LSL4
0286  00376 15100510       CMA  NIXH          177777 UNITS DIGIT
0287  00377 00000000       HLT
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0288  00400 11100412       BRU   LSL
0289  00401 01100513 LSL8  LAA   NIXL          ARRANGE H DIGIT F/OPT
0290  00402 00001016       LSL   8
0291  00403 03100512       STA   NIXK
0292  00404 11100361       BRU   REPT
0293  00405 01100513 LSL4  LAA   NIXL          ARRANGE T DIGIT F/OPT
0294  00406 00000416       LSL   4
0295  00407 05100512       AMA   NIXK
0296  00410 03100512       STA   NIXK
0297  00411 11100361       BRU   REPT
0298  00412 01100513 LSL   LAA   NIXL          ARRANGE U DIGIT F/OPT
0299  00413 05100512       AMA   NIXK
0300  00414 03100512       STA   NIXK
0301  00415 00170040 NIXI  AOP   '40           OPT TO LEFT,R AND C NIX
0302  00416 11100415       BRU   *-1
0303  00417 14100504       IMS   NIXD          DSPLA 3 NIX THEN EXIT
0304  00420 11100422       BRU   *+2
0305  00421 11100441       BRU   NIXM          EXIT DSPLA ROUTINE
0306  00422 14100511       IMS   NIXJ          AIP44,AOP41 C NIX
0307  00423 11100425       BRU   *+2
0308  00424 11100434       BRU   NIXP
0309  00425 01000001       LAA   =1
0310  00426 05100327       AMA   NIXZ+1        CHG TO AIP44
0311  00427 03100327       STA   NIXZ+1
0312  00430 01000002       LAA   =2
0313  00431 05100415       AMA   NIXI          CHG TO AOP42
0314  00432 03100415       STA   NIXI
0315  00433 11100326       BRU   NIXZ          CK NXT DSPLA
0316  00434 01100516 NIXP  LAA   NOP
0317  00435 03100331       STA   NIXZ+3
0318  00436 01100515       LAA   AOP1          AOP 41
0319  00437 03100415       STA   NIXI
0320  00440 11100326       BRU   NIXZ          CK NXT DSPLA
0321  00441 00000033 NIXM  NOP
0322  00442 01100514       LAA   LSLA          LSL 8
0323  00443 03100331       STA   NIXZ+3
0324  00444 01100517       LAA   AIP           43
0325  00445 03100327       STA   NIXZ+1
0326  00446 01100520       LAA   AOP           40
0327  00447 03100415       STA   NIXI
0328  00450 11300321       BRU*  NIXN
0329  00451 00000030 CH2   BSS   24
0330  00501 00177773 NIXA  DATA  '177773
0331  00502 00000000 NIXB  DATA  0
0332  00503 00004000 NIXC  DATA  '4000
0333  00504 00000000 NIXD  DATA  0
0334  00505 00000000 NIXE  DATA  0
0335  00506 00177775 NIXF  DATA  '177775
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0336  00507 00177776 NIXG DATA '177776
0337  00510 00177777 NIXH DATA '177777
0338  00511 00000000 NIXJ DATA 0
0339  00512 00000000 NIXK DATA 0
0340  00513 00000000 NIXL DATA 0
0341  00514 00001016 LSLA LSL  8
0342  00515 00170041 AOP1 AOP  '41
0343  00516 00000033 NOP  NOP
0344  00517 00170243 AIP  AIP  '43
0345  00520 00170040 AOP  AOP  '40
0346  00521 00000143 CH3  DATA 99,01,02,03,04,05,06,07,16,17,18,19,20
0346  00522 00000001
0346  00523 00000002
0346  00524 00000003
0346  00525 00000004
0346  00526 00000005
0346  00527 00000006
0346  00530 00000007
0346  00531 00000020
0346  00532 00000021
0346  00533 00000022
0346  00534 00000023
0346  00535 00000024
0347  00536 00000025      DATA 21,22,23,32,33,34,35,36,37,38,39
0347  00537 00000026
0347  00540 00000027
0347  00541 00000040
0347  00542 00000041
0347  00543 00000042
0347  00544 00000043
0347  00545 00000044
0347  00546 00000045
0347  00547 00000046
0347  00550 00000047
0348  00551 00000000 CH1  DATA 00,01,02,03,04,05,06,07,08,09,10,11,12
0348  00552 00000001
0348  00553 00000002
0348  00554 00000003
0348  00555 00000004
0348  00556 00000005
0348  00557 00000006
0348  00560 00000007
0348  00561 00000010
0348  00562 00000011
0348  00563 00000012
0348  00564 00000013
0348  00565 00000014
0349  00566 00000015      DATA 13,14,15,16,17,18,19,20,21,22,23,24
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0349  00567 00000016
0349  00570 00000017
0349  00571 00000020
0349  00572 00000021
0349  00573 00000022
0349  00574 00000023
0349  00575 00000024
0349  00576 00000025
0349  00577 00000026
0349  00600 00000027
0349  00601 00000030
0350  00602 00000030 TBLA BSS   '30            TOTAL NO OF TSTS
0351  00632 00000030 TBLB BSS   '30            NO OF GOOD TST
0352  00662 00000030 TBLC BSS   '30            NO OF BAD TST
0353  00712 00141710 TBLD DATA  ''CHANNEL   TOTAL        IN        OUT OF'
0353  00713 00140716
0353  00714 00147305
0353  00715 00146240
0353  00716 00120240
0353  00717 00152317
0353  00720 00152301
0353  00721 00146240
0353  00722 00120240
0353  00723 00120240
0353  00724 00120240
0353  00725 00144716
0353  00726 00120240
0353  00727 00120240
0353  00730 00120240
0353  00731 00120317
0353  00732 00152724
0353  00733 00120317
0353  00734 00143240
0354  00735 00120240 TBLE DATA ''  NO       TESTS       RANGE       RANGE'
0354  00736 00147317
0354  00737 00120240
0354  00740 00120240
0354  00741 00120240
0354  00742 00152305
0354  00743 00151724
0354  00744 00151640
0354  00745 00120240
0354  00746 00120240
0354  00747 00120322
0354  00750 00140716
0354  00751 00143705
0354  00752 00120240
0354  00753 00120240
```

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0354  00754 00120240
0354  00755 00151301
0354  00756 00147307
0354  00757 00142640
0355  00760 00000000 TEMP  DATA 0              TEMP STORE OF B ACCUM
0356  00761 00000000 CNTA  DATA 0
0357  00762 00000000 CNTG  DATA 0
0358  00763 35400003 CNTR  DAC  STAR
0359  00764 35400020 CNTS  DAC  STRT
0360  00765 00000030 CNTT  DATA 24
0361  00766 35400006 CNTU  DAC  SEC
0362  00767 00000000 CNTV  DATA 0              TEMP CNTR UNIT SEC
0363  00770 00000000 CNTW  DATA 0              UNITS OF TIME CNTR
0364  00771 00001016 CNTX  DATA '1016          INPT INTRUP
0365  00772 35400037 CNTY  DAC  INPT           INTR SUBROUTINE ADDR
0366  00773 00000001 CNT1  DATA 1
0367  00774 00000000 CNT3  DATA 0              NEG 3
0368  00775 00000000 CNT4  DATA 0              NEG 4
0369  00776 00000000 CNT5  DATA 0              TEMP STA F/ -5
0370  00777 00000000 CNT6  DATA 0
0371  01000 00160000 CTYP  DATA '160000        CNTR F/AUTO PRNT
0372  01100 70001100       ORG  '1100
0373                  *          FOR ADJUSTMENT OF TEST VOLTAGE SET
0374                  *          SENSE SW 10,20 AND ADJUST POTS UNTIL
0375                  *          TTY BELL RINGS CONTINUOUSLY. B ACCUM
0376                  *          WILL CONTAIN '4000 FOR 2.5V AND '7764
0377                  *          FOR 4.9865V
0378  01100 00000031 LCS   LCS
0379  01101 00170115       AOP  '15,W
0380  01102 00170315       AIP  '15,W
0381  01103 03101135       STA  LOCA
0382  01104 00000005       TAB
0383  01105 00000031       LCS
0384  01106 15101131       CMA  C10
0385  01107 11101111       BRU  *+2
0386  01110 11101115       BRU  CM10
0387  01111 15101132       CMA  C20
0388  01112 11101114       BRU  *+2
0389  01113 11101121       BRU  CM20
0390  01114 11101100       BRU  LCS
0391  01115 01101135 CM10  LAA  LOCA
0392  01116 15101133       CMA  C400
0393  01117 11101121       BRU  *+2
0394  01120 11101126       BRU  BELL
0395  01121 01101135 CM20  LAA  LOCA
0396  01122 15101134       CMA  C776
0397  01123 11101125       BRU  *+2
0398  01124 11101126       BRU  BELL
```

```
0399  01125 11101100       BRU  LCS
0400  01126 01003400 BELL  LAA  ='103400
0401  01127 00170101       AOP  1,W
0402  01130 11101100       BRU  LCS
0403  01131 00000010 C10   DATA '10
0404  01132 00000020 C20   DATA '20
0405  01133 00004000 C400  DATA '4000
0406  01134 00007764 C776  DATA '7764
0407  01135 00000000 LOCA  DATA 0
0408                 *       RELAY TESTED FOR RANGE OF 7MV EA SEC.
0409                 *       SELECT CHAN WITH CONTROL SWITCH. TTY
0410                 *       BELL WILL RING IF RELAY TESTS OUT OF
0411                 *       RANGE.
0412  01200 70001200       ORG  '1200
0413  01200 01101321       LAA  CNTK          INTRUP ROUTINE ADDR
0414  01201 03300771       STA* CNTX          LOC '1016
0415  01202 00170240 STR1  AIP  '40           INPT SEC
0416  01203 11101202       BRU  *-1
0417  01204 03100770       STA  CNTW          STORE F/COMPARE
0418  01205 00170240 SECS  AIP  '40           INPT SEC
0419  01206 11101205       BRU  *-1
0420  01207 15100770       CMA  CNTW          HAVE SEC CHANGED
0421  01210 11101212       BRU  *+2
0422  01211 11101205       BRU  SECS
0423  01212 03100770       STA  CNTW
0424  01213 00000033 BIGN  NOP
0425  01214 00000033       NOP
0426  01215 00000033       NOP
0427  01216 00130015       CEU  '15
0428  01217 00060000       DATA '60000        INPT INTR
0429  01220 11101216       BRU  *-2
0430  01221 00130600       PIE
0431  01222 00010001       DATA '10001        GRP 1 LEVEL 1
0432  01223 00000031       LCS
0433  01224 03101322       STA  CHAN          CHAN NO
0434  01225 00170015       AOP  '15
0435  01226 11101225       BRU  *-1
0436  01227 00000033       NOP
0437  01230 11101227       BRU  *-1           WT FOR INTRUP
0438  01231 00000033       NOP
0439  01232 00000033       NOP
0440  01233 25400000 ENPT  DAC  **           INTRUP SUBROUTINE
0441  01234 00130015       CEU  '15
0442  01235 00020000       DATA '20000
0443  01236 11101234       BRU  *-2
0444  01237 00170215       AIP  '15
0445  01240 11101237       BRU  *-1
0446  01241 03100762       STA  CNTG          ANALOG VOL
```

```
0447  01242 01101322       LAA  CHAN
0448  01243 15000000       CMA  =0            CH 00
0449  01244 11101246       BRU  *+2
0450  01245 11101264       BRU  ZZRO
0451  01246 15000020       CMA  ='20          CH 20
0452  01247 11101251       BRU  *+2
0453  01250 11101252       BRU  TWNY
0454  01251 11101300       BRU  UTTR
0455  01252 01100762 TWNY  LAA  CNTG          ANALOG VOL
0456  01253 00000005       TAB
0457  01254 15007772       CMA  ='7772        4.9938V
0458  01255 11101256       BRU  *+1
0459  01256 11101260       BRU  *+2
0460  01257 11101312       BRU  EROR
0461  01260 15007756       CMA  ='7756        4.9792V
0462  01261 11101312       BRU  EROR
0463  01262 11101263       BRU  *+1
0464  01263 11101314       BRU  OK
0465  01264 01100762 ZZRO  LAA  CNTG
0466  01265 00000005       TAB
0467  01266 15077760       CMA  ='177760
0468  01267 11101312       BRU  EROR
0469  01270 11101271       BRU  *+1
0470  01271 11101272       BRU  *+1
0471  01272 15000017       CMA  ='17
0472  01273 11101274       BRU  *+1
0473  01274 11101314       BRU  OK
0474  01275 11101312       BRU  EROR
0475  01276 00000033       NOP
0476  01277 00000033       NOP
0477  01300 01100762 UTTR  LAA  CNTG          ANALOG VOL
0478  01301 00000005       TAB
0479  01302 15004006       CMA  ='4006        2.5073V
0480  01303 00000033       NOP                OK
0481  01304 11101306       BRU  *+2           OK
0482  01305 11101307       BRU  *+2           OUT OF RANGE
0483  01306 15003772       CMA  ='3772        2.4926V
0484  01307 11101312       BRU  EROR
0485  01310 00000033       NOP                OK
0486  01311 11101314       BRU  OK
0487  01312 01003400 EROR  LAA  ='103400      BELL
0488  01313 00170101       AOP  1,W
0489  01314 01101320 OK    LAA  CNTJ          GO TO SECS F/RESTRT
0490  01315 03101233       STA  ENPT
0491  01316 00000035       TOI
0492  01317 11301233       BRU* ENPT
0493  01320 35401205 CNTJ  DAC  SECS
0494  01321 35401233 CNTK  DAC  ENPT
```

```
0495  01322 00000000 CHAN DATA 0
0496                 *       AFTER TABLE HEADING IS PRINTED SELECT
0497                 *       CHAN USING CONTROL SW AND PRESS START.
0498                 *       CONVERTS ANALOG VOL TO BINARY, PRINTS
0499                 *       OCTAL VALUE, CONVERTS AND PRINTS EQUIV-
0500                 *       ALENT VALUE IN VOLTAGE.
0501                 *   CARL L THOMPSON  APRIL 24,1975
0502  01500 70001500       ORG  '1500
0503  01500 01101752       LAA  CNTB          NPT ADDR
0504  01501 03300771       STA* CNTX          1016
0505  01502 01101760       LAA  DIGT          PRNT HEADING 1 TIME ONLY
0506  01503 00000022       SAZ
0507  01504 11101524       BRU  DEGT
0508  01505 12100303       SPB  CRLF
0509  01506 02077742       LBA  =-30
0510  01507 01501714       LAA  NUMA+30,1     HEADING FOR DATA
0511  01510 12100276       SPB  TTYO
0512  01511 00000026       IBS
0513  01512 11101507       BRU  *-3
0514  01513 12100303       SPB  CRLF          CARRIAGE RETURN LINE FEED
0515  01514 02077742       LBA  =-30
0516  01515 01501752       LAA  NUMB+30,1     HEADING FOR DATA
0517  01516 12100276       SPB  TTYO
0518  01517 00000026       IBS
0519  01520 11101515       BRU  *-3
0520  01521 01000001       LAA  =1
0521  01522 03101760       STA  DIGT          PRNT HEADING 1 TIME ONLY
0522  01523 12100303       SPB  CRLF
0523  01524 00000033 DEGT  NOP
0524  01525 00000000       HLT
0525  01526 00000033       NOP
0526  01527 00000033       NOP
0527  01530 12100303 STR   SPB  CRLF
0528  01531 01077774       LAA  =-4           CNTR FOR OUTPUTTING
0529  01532 03101753       STA  CNTC          DATA 4 TIMES
0530  01533 00000031       LCS                ARRANGE AND OUTPUT
0531  01534 12101621       SPB  CNO
0532  01535 01077775 OUPT  LAA  =-3
0533  01536 03101755       STA  CNTE          CNTR-CONVERT OCTAL NO B/A
0534  01537 00130115       CEU  '15,W
0535  01540 00060000       DATA '60000        ENABLE INPUT INTERRUPT
0536  01541 00130600       PIE
0537  01542 00010001       DATA '10001        ENABLE GRP 1 LEVEL 1
0538  01543 00000031       LCS
0539  01544 00170115       AOP  '15,W
0540  01545 00000033       NOP
0541  01546 11101545       BRU  *-1
0542  01547 14101753 A101  IMS  CNTC          CNTR F/4 SETS OF DATA
```

```
0543  01550 11101535       BRU  OUPT
0544  01551 00000000       HLT
0545  01552 11101530       BRU  STR
0546  01553 00000000 NPT   HLT
0547  01554 00130115       CEU  '15,W
0548  01555 00020000       DATA '20000          RESET DISABLE INPT INTRUP
0549  01556 00130601       PID
0550  01557 00010001       DATA '10001          DISABLE GRP 1 LEVEL 1
0551  01560 00170715       MIP  '15,W           INPUT A/D VALUE
0552  01561 00000000 VALU  DATA 0
0553  01562 02101561       LBA  VALU            PUT OCTAL DATA
0554  01563 00000003       CLA
0555  01564 00000713       FLL  7
0556  01565 12101642       SPB  TTY
0557  01566 00000313 MORE  FLL  3
0558  01567 12101642       SPB  TTY
0559  01570 14101755       IMS  CNTE
0560  01571 11101566       BRU  MORE
0561  01572 12101650       SPB  SPC2
0562  01573 01077775       LAA  =-3             NEXT 14 STATEMENTS CON-
0563  01574 03101756       STA  CNTF            VERT OCTAL DATA TO A-
0564  01575 02101561       LBA  VALU            VOLTAGE VALUE AND OUTPUT-
0565  01576 00000003       CLA                  ON TTY
0566  01577 03101561       STA  VALU            CLEAR DATA REGISTER
0567  01600 10001463       DIV  ='1463
0568  01601 12101642       SPB  TTY
0569  01602 01027000       LAA  ='127000        LAA WITH A DECIMAL
0570  01603 00170101       AOP  1,W
0571  01604 00000003       CLA
0572  01605 07000012 AGN   MPY  ='12
0573  01606 10001463       DIV  ='1463
0574  01607 12101642       SPB  TTY
0575  01610 14101756       IMS  CNTF
0576  01611 11101605       BRU  AGN
0577  01612 12101650       SPB  SPC2
0578  01613 00170501       MOP  1,W             OUTPUT 1 SPACE
0579  01614 00120000       DATA '120000
0580  01615 01101757       LAA  A102
0581  01616 03101553       STA  NPT
0582  01617 00000035       TOI
0583  01620 11301553       BRU* NPT
0584  01621 00000000 CNO   HLT                  NEXT 16 STATEMENTS
0585  01622 00000005       TAB                  ARRANGE AND OUPT CH NO
0586  01623 12101650       SPB  SPC2            OUTPUT 2 SPACES
0587  01624 00000003       CLA
0588  01625 00001513       FLL  13              LEFT SHIFT 13 SPCS
0589  01626 05000260       AMA  ='260
0590  01627 00001016       LSL  8
```

```
0591  01630 00170101       AOP  1,W
0592  01631 00000003       CLA
0593  01632 00000313       FLL  3              LEFT SHIFT 3 SPCS
0594  01633 05000260       AMA  ='260
0595  01634 00001016       LSL  8
0596  01635 00170101       AOP  1,W
0597  01636 12101650       SPB  SPC2           OUTPUT 2 SPACES
0598  01637 00170501       MOP  1,W            OUTPUT 1 SPACE
0599  01640 00120000       DATA '120000
0600  01641 11301621       BRU* CNO
0601  01642 00000000 TTY   HLT
0602  01643 05000260       AMA  ='260
0603  01644 00001016       LSL  8
0604  01645 00170101       AOP  1,W
0605  01646 00000003       CLA
0606  01647 11301642       BRU* TTY
0607  01650 00000000 SPC2  HLT
0608  01651 01020240       LAA  ='120240
0609  01652 00170101       AOP  1,W
0610  01653 00001016       LSL  8
0611  01654 00170101       AOP  1,W
0612  01655 11301650       BRU* SPC2
0613  01656 00141710 NUMA  DATA ''CHAN  OCTAL  VOLTS  OCTAL  VOLTS  OCTA
0613  01657 00140716
0613  01660 00120240
0613  01661 00147703
0613  01662 00152301
0613  01663 00146240
0613  01664 00120326
0613  01665 00147714
0613  01666 00152323
0613  01667 00120240
0613  01670 00147703
0613  01671 00152301
0613  01672 00146240
0613  01673 00120326
0613  01674 00147714
0613  01675 00152323
0613  01676 00120240
0613  01677 00147703
0613  01700 00152301
0613  01701 00146240
0613  01702 00120326
0613  01703 00147714
0613  01704 00152323
0614  01705 00120240       DATA ''  OCTAL  VOLTS''
0614  01706 00147703
0614  01707 00152301
```

```
0614  01710 00146240
0614  01711 00120326
0614  01712 00147714
0614  01713 00152323
0615  01714 00120240 NUMB DATA ''  NO   VALUE  VALUE  VALUE  VALUE  VALE
0615  01715 00147317
0615  01716 00120240
0615  01717 00153301
0615  01720 00146325
0615  01721 00142640
0615  01722 00120326
0615  01723 00140714
0615  01724 00152705
0615  01725 00120240
0615  01726 00153301
0615  01727 00146325
0615  01730 00142640
0615  01731 00120326
0615  01732 00140714
0615  01733 00152705
0615  01734 00120240
0615  01735 00153301
0615  01736 00146325
0615  01737 00142640
0615  01740 00120326
0615  01741 00140714
0615  01742 00152705
0616  01743 00120240       DATA ''  VALUE  VALUE''
0616  01744 00153301
0616  01745 00146325
0616  01746 00142640
0616  01747 00120326
0616  01750 00140714
0616  01751 00152705
0617  01752 35401553 CNTB  DAC  NPT
0618  01753 00177774 CNTC  DATA -4              NEG 4 CNTR
0619  01754 00000000 CNTD  DATA 0
0620  01755 00000000 CNTE  DATA 0               CNTR-CONVERT OCTAL NO B/A
0621  01756 00000000 CNTF  DATA 0               CONVERT OCTAL TO VOLTS
0622  01757 35401547 A102  DAC  A101
0623  01760 00000000 DIGT  DATA 0
0624  01761 70400000       END
        STAR    00003
        SEC     00006
        BEGN    00014
        STRT    00020
        INPT    00037
        TWTY    00057
```

ZERO	00070
UTER	00101
GOOD	00111
ERR	00115
NUCH	00120
NEXT	00134
PRNT	00142
AGAN	00165
CLER	00210
TSTS	00223
CNTH	00232
CHNO	00251
TTYO	00276
CRLF	00303
SPC3	00311
NIXN	00321
NIXZ	00326
NIXY	00346
REPT	00361
NIXQ	00363
LSL8	00401
LSL4	00405
LSL	00412
NIXI	00415
NIXP	00434
NIXM	00441
CH2	00451
NIXA	00501
NIXB	00502
NIXC	00503
NIXD	00504
NIXE	00505
NIXF	00506
NIXG	00507
NIXH	00510
NIXJ	00511
NIXK	00512
NIXL	00513
LSLA	00514
AOP1	00515
NOP	00516
AIP	00517
AOP	00520
CH3	00521
CH1	00551
TBLA	00602
TBLB	00632
TBLC	00662

TBLD	00712
TBLE	00735
TEMP	00760
CNTA	00761
CNTG	00762
CNTR	00763
CNTS	00764
CNTT	00765
CNTU	00766
CNTV	00767
CNTW	00770
CNTX	00771
CNTY	00772
CNT1	00773
CNT3	00774
CNT4	00775
CNT5	00776
CNT6	00777
CTYP	01000
LCS	01100
CM10	01115
CM20	01121
BELL	01126
C10	01131
C20	01132
C400	01133
C776	01134
LOCA	01135
STR1	01202
SECS	01205
BIGN	01213
ENPT	01233
TWNY	01252
ZZR0	01264
UTTR	01300
ER0R	01312
0K	01314
CNTJ	01320
CNTK	01321
CHAN	01322
DEGT	01524
STR	01530
0UPT	01535
A101	01547
NPT	01553
VALU	01561
MORE	01566
AGN	01605

```
         CNO      01621
         TTY      01642
         SPC2     01650
         NUMA     01656
         NUMB     01714
         CNTB     01752
         CNTC     01753
         CNTD     01754
         CNTE     01755
         CNTF     01756
         A102     01757
         DIGT     01760
ERRORS   0000     00000
```

SIGNAL CONTINUITY DIAGRAM
ACCURELAY ANALOG INPUT SYSTEM

The signal continuity diagram connects the input and output signals of all 14 individual logic cards. The brief description of signal flow and module operation will provide the maintenance technician with a working knowledge of system operation and assist in the expedient location of a defective module.

The following theory of operation is based on inputting data from Analog Channel '20 with the following program:

FIGURE 1.

LOCATION	OPERATION	ADDRESS FIELD	16 BIT COMP. INSTRUCTION	DESCRIPTION
0	LCS		000031	LOAD CONTROL SWITCH SET SWITCH NO.11 FOR CH.20
1	AOP	'15,W	170115	ACCUMULATOR WORD OUT PUT TO A/D
2	AIP	'15,W	170315	ACCUMULATOR WORD INPUT FROM A/D
3	TAB		000005	TRANSFER A ACCUMULATOR TO B ACCUMULATOR

Since all control and data signals between the computer and any peripheral device travel via the common I/O Bus, it is necessary to assign a separate address code to each unit (teletype unit, input-output unit, modem, A/D, etc.) to permit the exchange of data between units in a uniform and controlled manner.

A description of decoding the unit address and analog channel number follows:

A. Unit Address Decoding.

Octal 15 is the assigned unit address for the A/D system.

Refer to Signal Continuity Diagram Number 1 for the following theory of operation.

Using the program of Figure 1, addressed to Unit '15, a Logic 1 will appear on Unit Select Bits 12, 13 and 15 at Connector P1, Terminal 112, 111 and 109 as shown in Figure 2.

FIGURE 2.

BIT NUMBER	10	11	12	13	14	15
OCTAL 15 =	0	0	1	1	0	1

I/O TERMINATION MODULE

Each Logic 1 bit is inverted by the I/O Termination Module to a Logic 0. Any signal with a line drawn above it (as AB12, AB13, AB15) is a Logic 0 if true.

DATA TERMINAL

Decoding of Unit '15 by this module connects the unit to the computer and initiates signal (RGS) Register Strobe to Coder Control No. 3 Pin 16, Z Driver Pin 38 and X-Y Matrix Modules Pin 33.

Signals developed in Coder Control No. 3, which are required to decode the analog channel numbers are:

Channel Strobe (CHS) Pin 36
Short Input (SIH) Pin 7
Relay Drive (RDR) Pin 35

These signals will be referred to in the following discussion of decoding the analog channel number.

B. Analog Channel Number Decoding

The analog channel number will not be decoded without the proper decoding of the unit address.

Referring to the four statement program, Figure 1, Sense Switch Number 11 has been set in order to address analog channel '20 as displayed in Figure 3.

FIGURE 3.

BIT NUMBER	7	8	9	10	11	12	13	14	15
OCTAL 20 =	0	0	0	0	1	0	0	0	0

A Logic 1 will appear on Data Bit 11, Terminal 304 of P1 Connector. The bit is inverted in I/O Termination Module 2 and appears at Pin 9 of the Y Decoder Logic in the X, Y Matrix Module.

Note that Figure 3 contains bits 7-15, a total of 9 bits. Each Octal Group (7, 8, 9) (10, 11, 12) (13, 14, 15) is significant and must be decoded to provide the proper signal to operate the relay assigned to Analog Channel '20.

X Decode Matrix
Octal Group, Bits 13, 14, 15

With reference to Figure 3, these bits are not set, therefore when signals CHS, Channel Strobe (Pin 31) and RGS, Register Strobe (Pin 33), strobe the contents of the X Decode Matrix a relay ground signal is applied at Pin 22 (X0). The output of the X Decode Matrix must always equal the sum of the Octal Input. A zero signal in produces a relay ground signal at X0 out. (a true signal at Bits 13, 14 and 15 = '7, would produce a relay ground at Pin 18, X7).

The output signal of the X Decode Matrix selects one of 8 relays on the Eight Channel Mux Module Card.

Y Decode Matrix
Octal Group, Bits 10, 11, 12

With reference to Figure 3, Bit 11 is true, therefore we have a low (0) at Pin 9 of the Y Decode Matrix. Signals CHS and RGS strobe the contents of the Y Decode Matrix, generating a Logic 1 (3.6v) at Pin 12 (2X). The output 2X equals the sum of the Octal 2 Input. The Y Decode Matrix selects one of the 3 Mux Relay Cards.

Z Decode Matrix
Octal Group, Bits 7, 8, 9

These bits are applied to the Z Decode Matrix and since Natural's capacity of analog channels does not exceed 64 channel groups, these bits are always zero (Ref. Figure 3). Signals CHS and RGS strobe the contents of the Z Decode Matrix into AND gates where the RDR, Relay Driver gates a 12 VDC signal to Output Terminal 22 (0XX).

The three signals required to operate the A/D Relay assigned to Channel '20 are now enabled.

1. Relay ground, Pin [redacted] of X Decode Matrix
2. Logic 1 (3.6v), Pin 12 of Y Decode Matrix
3. +12 VDC, Pin 22 of Z Decode Matrix

Tracing these signals, the Relay Ground is applied to Pin 22 on each Mux Module Card.

The Logic 1 (3.6v) is applied to Pin 14 of Mux Module Card location 3B only.

The +12 VDC is applied to Pin 12 of each Mux Module Card.

8 CHANNEL MUX MODULE

The analog signals are always present at the input of these cards regardless of the state of the computer.

Refer to Table 1 for input signal assignments.

To gate a signal to the A/D converter it is necessary to operate 4 relays on the Mux Module Card, two associated with each analog signal and a set of common relays, K17 and K18.

The three signals enabled above to input data from Channel '20 perform the following functions.

The 3.6v signal input to Pin 14 turns on transistor Q1 permitting Q2 transistor to turn on (close switch) applying 12 VDC from Input Pin 12 to coil of K1, K2, K17 and K18. The relay ground at Input Pin 22 completes continuity to the relay coils for operation.

The analog signal (4.9865 VDC) at Pin 2 and 3 is gated to Output Pins 30 and 32 and applied to the Gain Switch on Print Number 2. In addition, the Gain Signals GOH, G1H and G2H developed in the Z Driver Module are applied to the Gain Switch. The Gain Signals originate from Bits 4, 5 and 6 of the Analog Data instruction word. These bits enter the Z Driver at Pins 35, 4 and 39. Logic in the Gain Signal Decoder is strobed by (RGS) Register Strobe and (SIH) Short Input, initiating an output signal at Pins 27, 29 and 31. This data enters the Gain Switch, Print No. 2, at Pins 11, 13 and 17.

Refer to Print Number 2.

GAIN SWITCH

Decoding the Gain Signals $\overline{\text{GOH}}$, $\overline{\text{G1H}}$ and $\overline{\text{G2H}}$ in the Gain Switch provides a gain factor of 25 to the Low Level Amplifier at Input Pin 18.

The 4.9865V signal (ANL) Analog Low and (ANH) Analog High from the 8 Channel Mux Module is applied to Input Pins 30 and 40. The signal is attenuated 25:1 and appears on Output Pins 35 and 36 labeled as (LAL) Low Analog Lo and (LAH) Low Analog Hi.

LOW LEVEL AMPLIFIER

The Low Level Amplifier receives signal LAL and LAH at Pin 30 and 32 along with the Gain Signal of 25 at Pin 18.

The signal is amplified by a gain of 25 and applied to the input of the Ramp Coder Module at Pin 39.

RAMP CODER AND CODER CONTROL NO. 3

The Coder Control No. 3 will not be directly referred to although it provides timing and various signals as listed for coding and conversion.

The (CIN) Coder Input Signal from the Low Level Amplifier is applied to Input Amplifier IC1 of Ramp Coder.

The (INT) Integrate Signal at Terminal 38 initiated at (CT2) Count Time 2 turns on (closes) Input Switch S1 (Q1 and Q2). In addition INT turns on (closes) the (+) Reference Voltage Switch S2 (Q21 and Q22).

The Integration Capacitors C14 and C15, are charged to a negative voltage by the Integration Amplifier summing the Analog Input and the Positive Reference Voltage.

The (RMP) Ramp Command at Terminal 36 is initiated at end of integration period at (CT12) Count Time 12 and generates two commands.

1. Opens Switch S1 and S2 (removing Analog and Positive Reference Voltage) and closing Switch S3, applying the Negative Reference Voltage to the Integration Amplifier.

2. Commands the Binary Counter in Coder Control #5 to start counting.

The Integration Capacitors C14 and C15 are now discharged (ramped) by the Integration Amplifier until the Zero Detector senses a zero volt potential. The ramp time is directly proportional to the relative amplitude of the Analog Input Voltage.

At zero volt the (CND) Coincidence Signal at Pin 5 in Ramp Coder is initiated through the Isolation Transformer in the Ramp Coder Power Supply generating (SCT) Stop Count Signal to Coder Control No. 5, Pin 4.

The SCT Signal stops the Conversion Counter and causes the initiation of (EOC) End of Conversion which in turn generates (SRS) Start Reset Signal in Coder Control No. 3.

The SRS Signal causes the RMP Signal to Ramp Coder to go low removing the Negative Reference Voltage from the Integration Amplifier.

The (RST) Reset Signal to Ramp Coder turns on (closes) Switch S4 connecting the input of Integration Amplifier to its output and remains in this condition until another (INT) Integrate Signal is received.

At the end of the conversion cycle, the Binary Counter in Coder Control #5 contains the digital representation of the Analog Input Signal within Bits 4 through 15. Referring to Figure 1, the AIP statement inputs the data to the computer and the TAB statement transfers the data to the B Accumulator. The B Accumulator should display an octal value of 7764 within a plus or minus of Octal 10.

Assuming the B Accumulator contains Octal 7764, a true low (0) would appear on output of Coder Control No. 5 at Pins 39, 28, 33, 32, 31, 30, 29, 27 and 25. These signals would be inverted in the I/O Termination Module No. 2 initiating a high (1) on Bits 4 through 11 and 13 to the P1 I/O Cable and then to the computer.

PRIORITY INTERRUPT

The station program utilizes the input interrupt which is generated in the Data Terminal Module at Pin 33, by the (EOC) End of Conversion signal from Coder Control No. 5.

The new A/D maintenance diagnostic program also incorporates this interrupt for test purposes.

DATA TERMINAL

This unit is designed to answer and return standard timing signals to the computer that occur for all Input/Output instructions.

The Terminal Pin locations for each signal are listed on the print for the I/O Cable, I/O Termination Module 1 and the Data Terminal unit.

Definition of each signal follows:

1. DTI, Data Transfer Instruction

This signal indicates an AIP, AOP, MIP, MOP instruction is being executed and is present for the duration of the instruction.

2. CMI, Command Instruction

This signal indicates that a CEU instruction is being executed and is present for the duration of the instruction.

3. INS, Instruction Sync

This signal permits the unit to interrogate its unit code lines and in turn answer via the USR line. The signal is present until the unit answers.

4. USR, Unit Sync Return

This signal indicates the unit has recognized the INS and remains until the computer removes the INS signal.

5. INP, Input Instruction

This signal identifies the direction of data transfer and is present for the duration of the DTI signal.

6. WTF, Wait Flag

This signal indicates the instruction being executed contains the wait flag. This flag inhibits the unit from answering via the USR signal until the unit is ready to perform the desired instruction. The signal is present for the duration of the instruction.

7. CDH, Computer Data Here

This signal indicates that the computer has recognized the USR and the UTR signals. The CDH signal notifies the unit that the data bits are present on the I/O Bus and can be interrogated or loaded into the output register. The CDH signal remains until the unit answers on its UDA line.

8. UTR, Unit Test Return

This signal indicates the status of the unit after receipt of the INS signal from computer. If the unit is capable of performing the required instruction, the UTR line is enabled permitting the computer program a "skip" on the next instruction. The UTR signal is present until the INS signal is removed.

9. UDA, Unit Data Accepted

This signal indicates the unit has accepted the data word present on the I/O Bus, and notifies the computer that the UTR is valid and can be interrogated. The signal is present until the CDH signal is removed.

10. CDA, Computer Data Accepted

This signal indicates the computer has accepted data from the unit as the result of an AIP or MIP instruction. The signal remains until the unit removes the UDA signal which caused it.

11. MCL, Master Clear

This signal is activated by the CLEAR switch on the computer control panel and also by the ICB (Initial Condition Bus) when power is turned on. In the case of the CLEAR switch, the line is a DC level and remains activated as long as the switch is depressed. The ICB condition enables the master clear line for approximately 1 second.

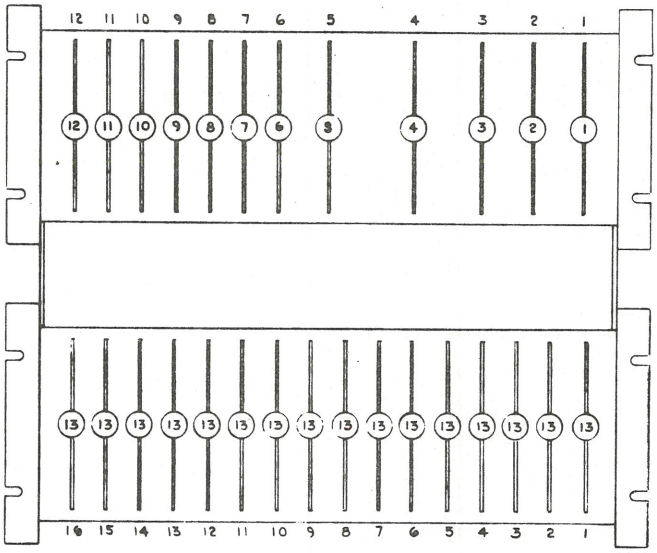
TABLE 1

ANALOG CHANNEL FUNCTION ASSIGNMENT

ANALOG CHANNEL	LOCATION RELAY	LOCATION CARD	FUNCTION NUMBER	A/D RANGE	FUNCTION DESCRIPTION
00	K1-2	1B			Zero Test Voltage
01	K3-4	1B	41	200-400	Fuel Gas Pressure
02	K5-6	1B	21	400-800	Fuel Diff. Pressure - Unit 1
03	K7-8	1B	65	0-150	Suction Temperature - Unit 2
04	K9-10	1B	44	400-800	Suction Pressure - Unit 2
05	K11-12	1B			
06	K13-14	1B	22	400-800	Fuel Diff. Pressure - Unit 2
07	K15-16	1B	63	-20-200	Atmospheric Temperature
10	K1-2	2B			Half Scale Test Voltage (2.505 VDC)
11	K3-4	2B	56	0-150	Mainline Discharge Temperature
12	K5-6	2B	50	0-150	Mainline Suction Temperature
13	K7-8	2B	67	700-1100	Exhaust Temperature - Unit 1
14	K9-10	2B	68	700-1100	Exhaust Temperature - Unit 2
15	K11-12	2B	42	-20-200	Fuel Gas Temperature
16	K13-14	2B	11	0-6000	RPM - Unit 2
17	K15-16	2B	64	-20-200	Suction Temperature - Unit 1
20	K1-2	3B			Full Scale Test Voltage (4.986 VDC)
21	K3-4	3B	43	400-800	Suction Pressure - Unit 1
22	K5-6	3B			
23	K7-8	3B	07	400-800	Mainline Discharge Pressure
24	K9-10	3B	00	400-800	Mainline Suction Pressure
25	K11-12	3B	08	400-800	Station Discharge Pressure
26	K13-14	3B	10	0-6000	RPM - Unit 1
27	K15-16	3B			

Station program samples each function once per second. Test voltages are sampled every 10 seconds. If value is out of range, program will sample value each second for 5 seconds. If still out of range it will print A/D failure.

INDEX AND CARD LOCATION	DESCRIPTION	PART NUMBER
2R4 -1	Gain Switch	160-083325-001
2R4 -2	Low Level Amplifier	160-083306-001
2R4 -3	Ramp Coder	160-083193-003
2R4 -4	Ramp Coder, Power Supply	160-083194-001
2R4 -5	Not Used	



2R4 -6	Coder Control Number 3	160-083326-001
2R4 -7	Coder Control Number 5	160-100009-003
2R4 -8	X, Y Matrix	160-900002-001
2R4 -9	Z Driver	160-083321-001
2R4 -10	Data Terminal	160-100003-048
2R4 -11	I/O Terminal Module 1	160-083270-001
2R4 -12	I/O Terminal Module 2	160-083271-001
2R4 -13	Mercury Relay Multiplexer	160-100015

Analog Input System Card Location (Unit 2R4)

Table 6-10. Three-Input NOR

Fig. & Index No.	Description	Reference Designator	Manufacturer	Part No.	Qty.
6-10	Schematic & Assembly Three NOR		SEL	8504-1	1
-1	• PCB (For Rev. See 149-051860-000)		SEL	704	1
-2	• Wire-Solid Copper, Tinned		SEL	AWG 24	AR
-3	• Terminal		CTC	2043B	7
-4	• Unipad		SEL	C11925	3
	• Capacitor-0.1μf +80-20%, 10V	C1	CRL	UK10-104	1
	• Integrated Circuit	IC1, IC2 IC3	Fairchild	91529	3
	• Integrated Circuit (Note 4)	IC1, IC2 IC3	SEL	A52040-65	X

#2 CONTROL PANEL
TEU

CLT #2

IDENTIFICATION: Control Panel, TEU and Inhibit Alarm to Chicago, Diagnostic

AUTHOR: Carl L. Thompson
Communications Division
Natural Gas Pipeline Company of America

COMPLETED: ~~February 16, 1977~~ 1-21-77

COMPUTER: SEL 810A or 810B

STORAGE: 742 Octal Locations

LOADING PROCEDURE: Relocatable Loader, Program Counter = '36060
"A" Accumulator = '6000 "B" Accumulator = 0

This diagnostic consists of four programs as follows.

Test External Unit, TEU Channel
'40 Bits 0-3
'6000 Starting Location

The program continuously monitors for a "not ready" (abnormal) condition.

Pressing the set point execute switch will initiate the printing of "S" until released.

Pressing the recall switch will initiate the printing of "R" until released.

Pressing the warn switch (Hi Temp) beside watchdog relay will initiate the printing of "W" until released.

Pressing the OFF switch (Hi Temp Shutdown) beside watchdog relay will initiate the printing of "0".

Check Switch Contacts and Associated Logic for Nixie Switches S5, 6, 7 and S8
'6200 Starting Location

The program will display the switch position of S5, 6 and 7 in their associated nixie and update once per second.

To display one switch only, set sense switch corresponding to nixie switch number.

To display set point switch S8, set sense switch number 8. The units, tens and hundreds digit will appear in the right nixie and the thousand digit will appear in the center nixie.

Check Nixie Tubes
'6400 Starting Location

The program will display seconds from the clock at one second intervals.

Inhibit Alarm Transmission to Chicago
'6430 Starting Location
'6430

After starting program enter function 72 under the right nixie and enter a count up to a maximum of 120 in the set point switch, SW8.

Press set point execute switch. The program will test for function 72 and a valid time (maximum of 120) in set point switch. If both are valid the program will turn on the alarm inhibit light and display the delay time in any nixie with a function of 72.

The time displayed in the nixie is tested in seconds rather than minutes. At the end of delay time the program will turn off the alarm inhibit light and initiate printing of;

"Alarms Will Be Transmitted To Chicago"

If a function other than 72 is selected under right nixie before start of the program, the program will initiate printing of;

"Select Function 72, Execute Set Point"

If a count more than 120 is displayed in the set point switch before start of the program, the program will initiate the printing of;

"Reduce Count In SW8 to 120, Execute Set Point"

```
0001                    ************************************************
0002                    *      TEST EXTERNAL UNIT, TEU CH '40 BITS 0-3 *
0003                    *   LOCATION '6000                             *
0004                    *   PRESS SETPOINT EXECUTE SW AND PROGRAM      *
0005                    *   WILL PRINT S UNTIL RELEASED.               *
0006                    *   PRESS RECALL SW AND PROGRAM WILL PRINT R   *
0007                    *   UNTIL RELEASED.                            *
0008                    *   PRESS WARN SW (HI TEMP) BESIDE WATCH DOG   *
0009                    *   RELAY AND PROGRAM WILL PRINT W.            *
0010                    *   PRESS OFF SW (HI TEMP SHUTDOWN) BESIDE WATCH
0011                    *   DOG RELAY AND PROGRAM WILL PRINT 0.        *
0012                    *                                              *
0013                    *   LOCATION '6200                             *
0014                    *      CHECK SWITCH CONTACTS AND ASSOC. LOGIC  *
0015                    *      FOR NIXIE SWITCHES S5,6,7 AND S8.       *
0016                    *   PROGRAM WILL DISPLAY SW POSITION OF S5,6   *
0017                    *   AND S7 IN ASSOC. NIXIE ONCE EACH SECOND.   *
0018                    *   TO DISPLAY ONE SWITCH ONLY, SET SENSE SW   *
0019                    *   CORRESPONDING TO NIXIE SWITCH NO.          *
0020                    *   TO DISPLAY SETPOINT SW S8, SET SENSE SW NO 8,
0021                    *   THE UNITS TENS AND HNDS WILL APPEAR IN RIGHT
0022                    *   NIXIE AND THOUS DIGIT WILL APPEAR IN CENTER*
0023                    *   NIXIE.                                     *
0024                    *                                              *
0025                    *   LOCATION '6400                             *
0026                    *      CHECK NIXIE TUBES                       *
0027                    *   PROGRAM WILL DISPLAY SECONDS FROM CLOCK IN *
0028                    *   NIXIES AT ONE SECOND INTERVALS.            *
0029                    *    LOCATION '6430                            *
0030                    *    INHIBIT ALARM TRANSMISSION TO CHICAGO     *
0031                    *                                              *
0032                    *    PROG WILL TST FOR FUNCT 72 AND VALID TIME *
0033                    *    (MAX 120) IN SW8. IF BOTH VALID IT WILL   *
0034                    *    TURN ON ALARM INHIBIT LIGHT AND DISPLAY   *
0035                    *    DELAY TIME IN NIX WITH FUNCT 72. TIME IS  *
0036                    *    TESTED IN SEC RATHER THAN MINUTES.        *
0037                    *                                              *
0038                    *    PREPARED BY CARL L THOMPSON  1-21-77      *
0039                    ************************************************
0040  00000 00000000          REL
0041  00000 12100054          SPB  CRLF
0042  00001 01077717          LAA  ='177717      PRINT 60 CHAR PER LINE
0043  00002 03100062          STA  CNTR
0044  00003 00000033    STRT  NOP
0045  00004 00130240          TEU  '40
0046  00005 00100000          DATA '100000       SET POINT EXEC
0047  00006 11100022          BRU  SETP
```

```
0048  00007 00130240       TEU   '40
0049  00010 00040000       DATA  '40000        HI TEMP SHUT DOWN
0050  00011 11100027       BRU   OFF
0051  00012 00130240       TEU   '40
0052  00013 00020000       DATA  '20000        HI TEMP WARNING
0053  00014 11100016       BRU   *+2
0054  00015 11100032       BRU   WARN
0055  00016 00130240       TEU   '40
0056  00017 00010000       DATA  '10000        ALARM RECALL
0057  00020 11100035       BRU   RECL
0058  00021 11100003       BRU   STRT
0059  00022 01051400 SETP  LAA   ='151400      PRINT S
0060  00023 12100042       SPB   AOP
0061  00024 00170543       MOP   '43,W
0062  00025 00100000       DATA  '100000       RESET ST PT EXEC
0063  00026 11100003       BRU   STRT
0064  00027 01047400 OFF   LAA   ='147400      PRINT 0
0065  00030 12100042       SPB   AOP
0066  00031 11100003       BRU   STRT
0067  00032 01053400 WARN  LAA   ='153400      PRINT W
0068  00033 12100042       SPB   AOP
0069  00034 11100003       BRU   STRT
0070  00035 01051000 RECL  LAA   ='151000      PRINT R
0071  00036 12100042       SPB   AOP
0072  00037 00170543       MOP   '43,W
0073  00040 00004000       DATA  '4000         RESET ALARM RECALL
0074  00041 11100003       BRU   STRT
0075  00042 00000000 AOP   HLT
0076  00043 14100063       IMS   CNTA          COUNTER F/DLY
0077  00044 11100045       BRU   *+1           CHANGE TO BRU -1 F/DLY
0078  00045 00170101       AOP   1,W
0079  00046 14100062       IMS   CNTR
0080  00047 11300042       BRU*  AOP
0081  00050 01077717       LAA   ='177717
0082  00051 03100062       STA   CNTR
0083  00052 12100054       SPB   CRLF
0084  00053 11300042       BRU*  AOP
0085  00054 00000000 CRLF  HLT
0086  00055 00170501       MOP   1,W
0087  00056 00106400       DATA  '106400
0088  00057 00170501       MOP   1,W
0089  00060 00105000       DATA  '105000
0090  00061 11300054       BRU*  CRLF
0091  00062 00000000 CNTR  DATA  0
0092  00063 00000000 CNTA  DATA  0
0093                       ************************************************
0094  00200 70000200       ORG   '200
0095  00200 00170340       AIP   '40,W         INPT SEC
```

```
0096  00201 03100271       STA  CMPR          STORE F/COMPARE
0097  00202 00170340 BEGN  AIP  '40,W         INPT SEC
0098  00203 15100271       CMA  CMPR
0099  00204 11100206       BRU  *+2
0100  00205 11100202       BRU  BEGN
0101  00206 03100271       STA  CMPR
0102  00207 00130410       SNS  8             SETPOINT SW S8
0103  00210 11100233       BRU  STPT
0104  00211 00130405       SNS  5             LEFT SW S5
0105  00212 11100242       BRU  LEFT
0106  00213 00130406       SNS  6             CNTR SW S6
0107  00214 11100252       BRU  CNIX
0108  00215 00130407       SNS  7             RIGHT SW S7
0109  00216 11100261       BRU  RITE
0110  00217 00170343       AIP  '43,W         INPT S5 LEFT SW
0111  00220 00000416       LSL  4
0112  00221 00000415       RSL  4
0113  00222 00170140       AOP  '40,W         DSPLA S5 IN L NIX
0114  00223 00170344       AIP  '44,W         INPT S6 CNTR SW
0115  00224 00001015       RSL  8
0116  00225 00170141       AOP  '41,W         DSPLA S6 IN C NIX
0117  00226 00170344       AIP  '44,W         INPT S7 RIGHT SW
0118  00227 00001016       LSL  8
0119  00230 00001015       RSL  8
0120  00231 00170142       AOP  '42,W         DISPLA S7 IN R NIX
0121  00232 11100202       BRU  BEGN
0122  00233 00000003 STPT  CLA
0123  00234 00170140       AOP  '40,W         CLR LEFT NIX
0124  00235 00170345       AIP  '45,W         INPT S8 SETPT SW
0125  00236 00170142       AOP  '42,W         DSPLA UTH S8 IN R NIX
0126  00237 00001415       RSL  12
0127  00240 00170141       AOP  '41,W         DSPLA THOU OF S8 IN C NIX
0128  00241 11100202       BRU  BEGN
0129  00242 00000003 LEFT  CLA
0130  00243 00170141       AOP  '41,W         CLR C NIX
0131  00244 00170142       AOP  '42,W         CLR R NIX
0132  00245 00170343       AIP  '43,W         INPT S5
0133  00246 00000416       LSL  4
0134  00247 00000415       RSL  4
0135  00250 00170140       AOP  '40,W         OUPT TO L NIX
0136  00251 11100202       BRU  BEGN
0137  00252 00000003 CNIX  CLA
0138  00253 00170140       AOP  '40,W         CLR L NIX
0139  00254 00170142       AOP  '42,W         CLR R NIX
0140  00255 00170344       AIP  '44,W         INPT S6
0141  00256 00001015       RSL  8
0142  00257 00170141       AOP  '41,W         OUPT TO C NIX
0143  00260 11100202       BRU  BEGN
```

```
0144  00261  00000003 RITE CLA
0145  00262  00170140      AOP   '40,W          CLR L NIX
0146  00263  00170141      AOP   '41,W          CLR C NIX
0147  00264  00170344      AIP   '44,W          INPT S7
0148  00265  00001016      LSL   8
0149  00266  00001015      RSL   8
0150  00267  00170142      AOP   '42,W          OUPT TO R NIX
0151  00270  11100202      BRU   BEGN
0152  00271  00000000 CMPR DATA  0
0153                      ************************************************
0154  00400  70000400      ORG   '400
0155  00400  00170340      AIP   '40,W          INPUT SEC
0156  00401  00001416      LSL   12             SAVE UNITS ONLY
0157  00402  03100424      STA   DATA           STA F/COMPARE
0158  00403  00170340 BIGN AIP   '40,W
0159  00404  00001416      LSL   12
0160  00405  15100424      CMA   DATA           CK F/1 SEC CHNG
0161  00406  11100410      BRU   *+2
0162  00407  11100403      BRU   BIGN           WAIT F/NXT SEC
0163  00410  03100424      STA   DATA
0164  00411  00000415      RSL   4
0165  00412  03100423      STA   TEMP
0166  00413  00000415      RSL   4
0167  00414  05100423      AMA   TEMP
0168  00415  00000415      RSL   4
0169  00416  05100423      AMA   TEMP
0170  00417  00170140      AOP   '40,W
0171  00420  00170141      AOP   '41,W
0172  00421  00170142      AOP   '42,W
0173  00422  11100403      BRU   BIGN
0174  00423  00000000 TEMP DATA  0
0175  00424  00000000 DATA DATA  0
0176                      ************************************************
0177  00430  70000430      ORG   '430
0178  00430  00000003      CLA
0179  00431  03100650      STA   LOCA
0180  00432  11100447      BRU   RSET
0181  00433  14100652 HOME IMS   LOCC
0182  00434  11100433      BRU   *-1
0183  00435  00130240      TEU   '40
0184  00436  00100000      DATA  '100000        SET PT EXEC
0185  00437  11100441      BRU   *+2
0186  00440  11100435      BRU   HOME+2
0187  00441  00170344      AIP   '44,W          SW 7
0188  00442  00001016      LSL   8              SHIFT SW6 OFF
0189  00443  15071000      CMA   ='71000        SW7=FUNCT 72
0190  00444  11100446      BRU   *+2
0191  00445  11100456      BRU   *+9
```

```
0192  00446 12100623       SPB   FNCT          WRONG FNCT NO
0193  00447 01000000 RSET  LAA   ='100000
0194  00450 00170143       AOP   '43,W         RESET SET PT
0195  00451 00000003       CLA
0196  00452 00170140       AOP   '40,W
0197  00453 00170141       AOP   '41,W         CLR NIX
0198  00454 00170142       AOP   '42,W         CLR NIX
0199  00455 11100433       BRU   HOME
0200  00456 00170345       AIP   '45,W         SW8 F/INHIBIT TIME
0201  00457 03100651       STA   LOCB
0202  00460 00000021       SAS                 ADD F/INQUISITIVE TECHN
0203  00461 11100467       BRU   EROR
0204  00462 11100463       BRU   *+1
0205  00463 11100464       BRU   *+1
0206  00464 15000440       CMA   ='440         TIME MORE THAN 120
0207  00465 11100466       BRU   *+1
0208  00466 11100471       BRU   *+3           ='440 OR 120
0209  00467 12100613 EROR  SPB   SORY
0210  00470 11100447       BRU   RSET
0211  00471 01001000       LAA   ='101000
0212  00472 00170143       AOP   '43,W         RSET ST PT-TRN ON LIGHT
0213  00473 01100651       LAA   LOCB
0214  00474 11100477       BRU   *+3
0215  00475 01100651 AGAN  LAA   LOCB
0216  00476 06000001       SMA   =1            SUBT 1 F/CNT
0217  00477 03100651       STA   LOCB
0218  00500 00000022       SAZ
0219  00501 11100503       BRU   *+2
0220  00502 11100604       BRU   OFFF          TRN OFF LIGHT
0221  00503 00001016       LSL   8
0222  00504 15077400       CMA   ='177400      CK F/INVALID BCD
0223  00505 11100507       BRU   *+2
0224  00506 11100574       BRU   SUBX          SUBT '146
0225  00507 00000416       LSL   4
0226  00510 15070000       CMA   ='170000      CK F/INVALID BCD
0227  00511 11100513       BRU   *+2
0228  00512 11100600       BRU   SUB6          SUBT 6
0229  00513 00000033 AOPP  NOP
0230  00514 00170343       AIP   '43,W         LFT NIX
0231  00515 00001016       LSL   8
0232  00516 06071000       SMA   ='071000
0233  00517 00000022       SAZ
0234  00520 11100522       BRU   *+2
0235  00521 11100525       BRU   A40
0236  00522 00000003       CLA
0237  00523 00170140       AOP   '40,W         CLR NIX
0238  00524 11100527       BRU   *+3
0239  00525 01100651 A40   LAA   LOCB
```

```
0240  00526 00170140       AOP   '40,W
0241  00527 00170344       AIP   '44,W          CNTR NIX
0242  00530 00001015       RSL   8
0243  00531 06000162       SMA   ='162
0244  00532 00000022       SAZ
0245  00533 11100535       BRU   *+2
0246  00534 11100540       BRU   A41
0247  00535 00000003       CLA
0248  00536 00170141       AOP   '41,W          CLR NIX
0249  00537 11100542       BRU   *+3
0250  00540 01100651 A41   LAA   LOCB
0251  00541 00170141       AOP   '41,W
0252  00542 00170344       AIP   '44,W          RT NIX
0253  00543 00001016       LSL   8
0254  00544 06071000       SMA   ='071000
0255  00545 00000022       SAZ
0256  00546 11100550       BRU   *+2
0257  00547 11100553       BRU   A42
0258  00550 00000003       CLA
0259  00551 00170142       AOP   '42,W          CLR NIX
0260  00552 11100555       BRU   *+3
0261  00553 01100651 A42   LAA   LOCB
0262  00554 00170142       AOP   '42,W
0263  00555 01100650       LAA   LOCA
0264  00556 00000022       SAZ
0265  00557 11100563       BRU   TIME
0266  00560 00170340       AIP   '40,W          INPT SEC
0267  00561 03100653       STA   LOCD
0268  00562 14100650       IMS   LOCA
0269  00563 00130240 TIME  TEU   '40
0270  00564 00100000       DATA  '100000
0271  00565 11100441       BRU   HOME+6
0272  00566 00170340       AIP   '40,W
0273  00567 15100653       CMA   LOCD
0274  00570 11100572       BRU   *+2
0275  00571 11100563       BRU   TIME
0276  00572 03100653       STA   LOCD
0277  00573 11100475       BRU   AGAN
0278  00574 01100651 SUBX  LAA   LOCB           SUBT '146
0279  00575 06000146       SMA   ='146
0280  00576 03100651       STA   LOCB
0281  00577 11100513       BRU   AOPP
0282  00600 01100651 SUB6  LAA   LOCB           SUBT 6
0283  00601 06000006       SMA   =6
0284  00602 03100651       STA   LOCB
0285  00603 11100513       BRU   AOPP
0286  00604 00000003 OFFF  CLA                  TRN OFF LITE, CLR NIX
0287  00605 00170140       AOP   '40,W
```

```
0288  00606 00170141       AOP   '41,W
0289  00607 00170142       AOP   '42,W
0290  00610 00170143       AOP   '43,W
0291  00611 12100633       SPB   RESM
0292  00612 11100447       BRU   RSET
0293  00613 00000000 SORY   HLT                    CNT IN SW 8 OVER 120
0294  00614 12100054       SPB   CRLF
0295  00615 02077756       LBA   =-18
0296  00616 01500676       LAA   TBLA+18,1
0297  00617 12100643       SPB   TTY
0298  00620 00000026       IBS
0299  00621 11100616       BRU   *-3
0300  00622 11300613       BRU*  SORY
0301  00623 00000000 FNCT   HLT                    SW 7 NOT 72
0302  00624 12100054       SPB   CRLF
0303  00625 02077757       LBA   =-17
0304  00626 01500717       LAA   TBLB+17,1
0305  00627 12100643       SPB   TTY
0306  00630 00000026       IBS
0307  00631 11100626       BRU   *-3
0308  00632 11300623       BRU*  FNCT
0309  00633 00000000 RESM   HLT
0310  00634 12100054       SPB   CRLF
0311  00635 02077755       LBA   =-19
0312  00636 01500742       LAA   TBLC+19,1
0313  00637 12100643       SPB   TTY
0314  00640 00000026       IBS
0315  00641 11100636       BRU   *-3
0316  00642 11300633       BRU*  RESM
0317  00643 00000000 TTY    HLT
0318  00644 00170101       AOP   1,W
0319  00645 00001016       LSL   8
0320  00646 00170101       AOP   1,W
0321  00647 11300643       BRU*  TTY
0322  00650 00000000 LOCA   DATA  0
0323  00651 00000000 LOCB   DATA  0
0324  00652 00000000 LOCC   DATA  0
0325  00653 00000000 LOCD   DATA  0
0326  00654 00151305 TBLA   DATA  ''REDUCE CNT IN SW8 TO 120,EXEC SET-PT''
0326  00655 00142325
0326  00656 00141705
0326  00657 00120303
0326  00660 00147324
0326  00661 00120311
0326  00662 00147240
0326  00663 00151727
0326  00664 00134240
0326  00665 00152317
```

```
0326  00666 00120261
0326  00667 00131260
0326  00670 00126305
0326  00671 00154305
0326  00672 00141640
0326  00673 00151705
0326  00674 00152255
0326  00675 00150324
0327  00676 00151705 TBLB DATA ''SELECT FUNCT 72, EXECUTE SET POINT''
0327  00677 00146305
0327  00700 00141724
0327  00701 00120306
0327  00702 00152716
0327  00703 00141724
0327  00704 00120267
0327  00705 00131254
0327  00706 00120305
0327  00707 00154305
0327  00710 00141725
0327  00711 00152305
0327  00712 00120323
0327  00713 00142724
0327  00714 00120320
0327  00715 00147711
0327  00716 00147324
0328  00717 00140714 TBLC DATA ''ALARMS WILL BE TRANSMITTED TO CHICAGO'
0328  00720 00140722
0328  00721 00146723
0328  00722 00120327
0328  00723 00144714
0328  00724 00146240
0328  00725 00141305
0328  00726 00120324
0328  00727 00151301
0328  00730 00147323
0328  00731 00146711
0328  00732 00152324
0328  00733 00142704
0328  00734 00120324
0328  00735 00147640
0328  00736 00141710
0328  00737 00144703
0328  00740 00140707
0328  00741 00147640
0329  00742 70400000       END
       STRT     00003
       SETP     00022
       OFF      00027
```

```
        WARN    00032
        RECL    00035
        AOP     00042
        CRLF    00054
        CNTR    00062
        CNTA    00063
        BEGN    00202
        STPT    00233
        LEFT    00242
        CNIX    00252
        RITE    00261
        CMPR    00271
        BIGN    00403
        TEMP    00423
        DATA    00424
        HOME    00433
        RSET    00447
        EROR    00467
        AGAN    00475
        AOPP    00513
        A40     00525
        A41     00540
        A42     00553
        TIME    00563
        SUBX    00574
        SUB6    00600
        OFFF    00604
        SORY    00613
        FNCT    00623
        RESM    00633
        TTY     00643
        LOCA    00650
        LOCB    00651
        LOCC    00652
        LOCD    00653
        TBLA    00654
        TBLB    00676
        TBLC    00717
ERRORS  0000    00000
```

#2

IDENTIFICATION: Inhibit Alarm Transmission To Chicago
Diagnostic Program

AUTHOR: Carl L. Thompson
Natural Gas Pipeline Company of America
Communications Division

ACCEPTED: January 21, 1977

COMPUTER: SEL 810A or 810B

STORAGE: 305 Octal Locations

LOADING
PROCEDURE: Relocatable Loader, Program Counter = '36060
"A" Accumulator = "6000 "B" Accumulator = 0

Enter '6000 in the program counter and press start switch twice.

After starting program enter function 72 under the right nixie and enter a count up to a maximum of 120 in the set point switch, SW8.

Press set point execute switch. The program will test for function 72 and a valid time (maximum of 120) in set point switch. If both are valid the program will turn on the alarm inhibit light and display the delay time in any nixie with a function of 25.72

The time displayed in the nixie is tested in seconds rather than minutes. At the end of delay time the program will turn off the alarm inhibit light and initiate printing of;

"Alarms Will Be Transmitted To Chicago"

If a function other than 72 is selected under right nixie before start of the program, the program will initiate printing of;

"Select Function 72, Execute Set Point"

If a count more than 120 is displayed in the set point switch before start of the program, the program will initiate the printing of;

"Reduce Count In SW8 to 120, Execute Set Point"

```
0001                    ***********************************************
0002                    *    INHIBIT ALARM TRANSMISSION TO CHICAGO     *
0003                    *                                              *
0004                    *    PROG WILL TST FOR FUNCT 72 AND VALID TIME *
0005                    *    (MAX 120) IN SW8. IF BOTH VALID IT WILL   *
0006                    *    TURN ON ALARM INHIBIT LIGHT AND DISPLAY   *
0007                    *    DELAY TIME IN NIX WITH FUNCT 25. TIME IS  *
0008                    *    TESTED IN SEC RATHER THAN MINUTES.        *
0009                    *                                              *
0010                    *    PREPARED BY. CARL L THOMPSON  1-21-77     *
0011                    ***********************************************
0012  00000 00000000          REL
0013  00000 00000003          CLA
0014  00001 03100213          STA   LOCA
0015  00002 11100017          BRU   RSET
0016  00003 14100215 HOME     IMS   LOCC
0017  00004 11100003          BRU   *-1
0018  00005 00130240          TEU   '40
0019  00006 00100000          DATA  '100000          SET PT EXEC
0020  00007 11100011          BRU   *+2
0021  00010 11100005          BRU   HOME+2
0022  00011 00170344          AIP   '44,W            SW 7
0023  00012 00001016          LSL   8                SHIFT SW6 OFF
0024  00013 15071000          CMA   ='71000          SW7=FUNCT 72
0025  00014 11100016          BRU   *+2
0026  00015 11100022          BRU   *+5
0027  00016 12100160          SPB   FNCT             WRONG FNCT NO
0028  00017 01000000 RSET     LAA   ='100000
0029  00020 00170143          AOP   '43,W            RESET SET PT
0030  00021 11100003          BRU   HOME
0031  00022 00170345          AIP   '45,W            SW8 F/INHIBIT TIME
0032  00023 03100214          STA   LOCB
0033  00024 15000440          CMA   ='440            TIME MORE THAN 120
0034  00025 11100026          BRU   *+1
0035  00026 11100031          BRU   *+3              ='440 OR 120
0036  00027 12100150          SPB   SORY
0037  00030 11100017          BRU   RSET
0038  00031 01001000          LAA   ='101000
0039  00032 00170143          AOP   '43,W            RSET ST PT-TRN ON LIGHT
0040  00033 01100214          LAA   LOCB
0041  00034 11100037          BRU   *+3
0042  00035 01100214 AGAN     LAA   LOCB
0043  00036 06000001          SMA   =1               SUBT 1 F/CNT
0044  00037 03100214          STA   LOCB
0045  00040 00000022          SAZ
0046  00041 11100043          BRU   *+2
0047  00042 11100141          BRU   OFFF             TRN OFF LIGHT
```

```
0048  00043 00001016       LSL  8
0049  00044 15077400       CMA  ='177400       CK F/INVALID BCD
0050  00045 11100047       BRU  *+2
0051  00046 11100131       BRU  SUBX           SUBT '146
0052  00047 00000416       LSL  4
0053  00050 15070000       CMA  ='170000       CK F/INVALID BCD
0054  00051 11100053       BRU  *+2
0055  00052 11100135       BRU  SUB6           SUBT 6
0056  00053 00000033 AOP   NOP
0057  00054 00170343       AIP  '43,W          LFT NIX
0058  00055 00001016       LSL  8
0059  00056 06022400       SMA  ='022400
0060  00057 00000022       SAZ
0061  00060 11100062       BRU  *+2
0062  00061 11100065       BRU  A40
0063  00062 00000003       CLA
0064  00063 00170140       AOP  '40,W          CLR NIX
0065  00064 11100067       BRU  *+3
0066  00065 01100214 A40   LAA  LOCB
0067  00066 00170140       AOP  '40,W
0068  00067 00170344       AIP  '44,W          CNTR NIX
0069  00070 00001015       RSL  8
0070  00071 06000045       SMA  ='45
0071  00072 00000022       SAZ
0072  00073 11100075       BRU  *+2
0073  00074 11100100       BRU  A41
0074  00075 00000003       CLA
0075  00076 00170141       AOP  '41,W          CLR NIX
0076  00077 11100102       BRU  *+3
0077  00100 01100214 A41   LAA  LOCB
0078  00101 00170141       AOP  '41,W
0079  00102 00170344       AIP  '44,W          RT NIX
0080  00103 00001016       LSL  8
0081  00104 06022400       SMA  ='022400
0082  00105 00000022       SAZ
0083  00106 11100110       BRU  *+2
0084  00107 11100113       BRU  A42
0085  00110 00000003       CLA
0086  00111 00170142       AOP  '42,W          CLR NIX
0087  00112 11100115       BRU  *+3
0088  00113 01100214 A42   LAA  LOCB
0089  00114 00170142       AOP  '42,W
0090  00115 01100213       LAA  LOCA
0091  00116 00000022       SAZ
0092  00117 11100123       BRU  TIME
0093  00120 00170340       AIP  '40,W          INPT SEC
0094  00121 03100216       STA  LOCD
0095  00122 14100213       IMS  LOCA
```

```
0096  00123 00170340 TIME AIP  '40,W          INPT SEC
0097  00124 15100216      CMA  LOCD
0098  00125 11100127      BRU  *+2
0099  00126 11100123      BRU  TIME
0100  00127 03100216      STA  LOCD
0101  00130 11100035      BRU  AGAN
0102  00131 01100214 SUBX LAA  LOCB          SUBT '146
0103  00132 06000146      SMA  ='146
0104  00133 03100214      STA  LOCB
0105  00134 11100053      BRU  AOP
0106  00135 01100214 SUB6 LAA  LOCB          SUBT 6
0107  00136 06000006      SMA  =6
0108  00137 03100214      STA  LOCB
0109  00140 11100053      BRU  AOP
0110  00141 00000003 OFFF CLA                TRN OFF LITE, CLR NIX
0111  00142 00170140      AOP  '40,W
0112  00143 00170141      AOP  '41,W
0113  00144 00170142      AOP  '42,W
0114  00145 00170143      AOP  '43,W
0115  00146 12100170      SPB  RESM
0116  00147 11100003      BRU  HOME
0117  00150 00000000 SORY HLT                CNT IN SW 8 OVER 120
0118  00151 12100205      SPB  CRLF
0119  00152 02077756      LBA  =-18
0120  00153 01500241      LAA  TBLA+18,1
0121  00154 12100200      SPB  TTY
0122  00155 00000026      IBS
0123  00156 11100153      BRU  *-3
0124  00157 11300150      BRU* SORY
0125  00160 00000000 FNCT HLT                SW 7 NOT 72
0126  00161 12100205      SPB  CRLF
0127  00162 02077757      LBA  =-17
0128  00163 01500262      LAA  TBLB+17,1
0129  00164 12100200      SPB  TTY
0130  00165 00000026      IBS
0131  00166 11100163      BRU  *-3
0132  00167 11300160      BRU* FNCT
0133  00170 00000000 RESM HLT
0134  00171 12100205      SPB  CRLF
0135  00172 02077755      LBA  =-19
0136  00173 01500305      LAA  TBLC+19,1
0137  00174 12100200      SPB  TTY
0138  00175 00000026      IBS
0139  00176 11100173      BRU  *-3
0140  00177 11300170      BRU* RESM
0141  00200 00000000 TTY  HLT
0142  00201 00170101      AOP  1,W
0143  00202 00001016      LSL  8
```

```
0144  00203 00170101        AOP   1,W
0145  00204 11300200        BRU*  TTY
0146  00205 00000000 CRLF   HLT
0147  00206 00170501        MOP   1,W
0148  00207 00106400        DATA  '106400
0149  00210 00170501        MOP   1,W
0150  00211 00105000        DATA  '105000
0151  00212 11300205        BRU*  CRLF
0152  00213 00000000 LOCA   DATA  0
0153  00214 00000000 LOCB   DATA  0
0154  00215 00000000 LOCC   DATA  0
0155  00216 00000000 LOCD   DATA  0
0156  00217 00151305 TBLA   DATA  ''REDUCE CNT IN SW8 TO 120,EXEC SET-PT''
0156  00220 00142325
0156  00221 00141705
0156  00222 00120303
0156  00223 00147324
0156  00224 00120311
0156  00225 00147240
0156  00226 00151727
0156  00227 00134240
0156  00230 00152317
0156  00231 00120261
0156  00232 00131260
0156  00233 00126305
0156  00234 00154305
0156  00235 00141640
0156  00236 00151705
0156  00237 00152255
0156  00240 00150324
0157  00241 00151705 TBLB   DATA  ''SELECT FUNCT 72, EXECUTE SET POINT''
0157  00242 00146305
0157  00243 00141724
0157  00244 00120306
0157  00245 00152716
0157  00246 00141724
0157  00247 00120267
0157  00250 00131254
0157  00251 00120305
0157  00252 00154305
0157  00253 00141725
0157  00254 00152305
0157  00255 00120323
0157  00256 00142724
0157  00257 00120320
0157  00260 00147711
0157  00261 00147324
0158  00262 00140714 TBLC   DATA  ''ALARMS WILL BE TRANSMITTED TO CHICAGO''
```

```
0158  00263 00140722
0158  00264 00146723
0158  00265 00120327
0158  00266 00144714
0158  00267 00146240
0158  00270 00141305
0158  00271 00120324
0158  00272 00151301
0158  00273 00147323
0158  00274 00146711
0158  00275 00152324
0158  00276 00142704
0158  00277 00120324
0158  00300 00147640
0158  00301 00141710
0158  00302 00144703
0158  00303 00140707
0158  00304 00147640
0159  00305 70400000        END
       HOME    00003
       RSET    00017
       AGAN    00035
       AOP     00053
       A40     00065
       A41     00100
       A42     00113
       TIME    00123
       SUBX    00131
       SUB6    00135
       OFFF    00141
       SORY    00150
       FNCT    00160
       RESM    00170
       TTY     00200
       CRLF    00205
       LOCA    00213
       LOCB    00214
       LOCC    00215
       LOCD    00216
       TBLA    00217
       TBLB    00241
       TBLC    00262
ERRORS 0000    00000
```

SELECT FUNCT 72, EXECUTE SET POINT

REDUCE CNT IN SW8 TO 120, EXEC SET-PT

ALARMS WILL BE TRANSMITTED TO CHICAGO

CLT #3

PROGRAM DESCRIPTION

IDENTIFICATION: Interrupt Diagnostics
- A. Teletype Input-Output Interrupts
- B. A/D Input Interrupt
- C. Modem Receive-Transmit Interrupts
- D. Power Fail-Auto Restart Interrupt

AUTHOR: Carl L. Thompson
Natural Gas Pipeline Company of America
Communications Division

ISSUED: September 9, 1976

PURPOSE: To Assist the Communication Technicians with Maintenance and Repair of Peripheral and Mainframe Interrupt Problems. This Program Tests the Interrupt Logic of each Peripheral Device as well as the Interrupt Logic in the Computer Mainframe.

COMPUTER: 810A

STORAGE: 656 Octal Locations

LOADING PROCEDURE: Relocatable Loader 16K, Modified
Program Counter --- Enter '36060
"A" Accumulator --- Enter '6000
"B" Accumulator --- Enter 0

Insert tape in reader and press start twice.

PROGRAM LOCATION '6000

This program consists of three diagnostics. Each diagnostic is called up through the teletype keyboard as follows.

After starting program at location '6000, type the following characters for the interrupt to be tested.

A. Type "T" for the teletype input and output interrupts. If both interrupts are operational the following data will be printed by the teletype each time the "T" is typed.
T------Input Interrupt Group 1, Level 1
T-----Output Interrupt Group 1, Level 2

Typing the letter "T" generates the input interrupt and induces the program to branch to the input interrupt subroutine which initiates the printing of "T------Input Interrupt Group 1, Level 1". This subroutine enables the output interrupt. The output interrupt induces the program to branch to the output interrupt subroutine which initiates the printing of "T------ Output Interrupt Group 1, Level 2". The program then returns to location '14, '15 and waits for another input from the teletype keyboard.

B. Type "A" for the A/D Interrupt

Typing the letter "A" induces the program to branch to the A/D subroutine. This routine enables the input interrupt, outputs channel '10 to the A/D (unit 15) and waits for an interrupt to be generated. Each time the interrupt is generated the program will print "A------Input Interrupt Group 1, Level 1". The program permits the interrupt to be generated ten (10) times then branches back to location '14, '15 and waits for another input from the teletype keyboard.

C. Type "M" for the Modem Interrupt

The modem and interface equipment must be operational and receiving messages from the master station in Chicago to operate this program.

Typing the letter "M" permits the program to enable the modem receive interrupt. When a message, from the master station, is received and addressed to your station, the receive interrupt will be generated inducing the program to branch to the receive (input) interrupt subroutine which initiates the printing of "M------ Receive Interrupt Group 0, Level 1". After printing this information the program enables the transmit (output) interrupt. This interrupt is generated almost immediately, inducing the program to branch to the transmit subroutine which initiates the printing of "M------***xmit Interrupt Group 0, Level 2". The program permits the interrupt to be generated ten (10) times, then branches back to location '14, '15 and waits for another input from the teletype keyboard. The transmit program <u>will not</u> transmit data to Chicago.

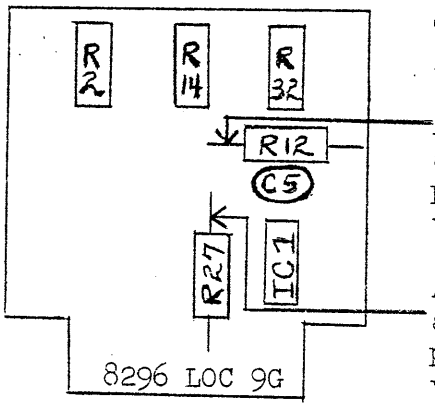
This program will print the "Receive and "Transmit" interrupt ten (10) times.

PROGRAM LOCATION '6500

Power Fail-Auto Restart Adjustment Program.

1. Using an iron vane voltmeter, Weston Model 433 or equivalent, connected to the outlet in bottom of computer mainframe, adjust the solatron voltage regulator for a reading of 117 to 118 volts.

2. Turn power off to computer and install the powerstat variable transformer in series with the computer mainframe AC cord. Remove card 8296, location 9G, and re-install on an extender board. Turn power on and adjust potentiometer R2 and R14 as follows.



Set scope volts/Div to 50mv and Time Div & delay time to 1ms, Auto trigger.

Adj. R2 for a positive going pulse at this point with 110VAC to computer mainframe using powerstat variable transformer.

Adj. R14 for a positive going pulse at this point with 105VAC to computer mainframe using powerstat variable transformer.

R32 is not used by NGPL.

Start program at '6500 and slowly raise and lower AC voltage to computer with powerstat variable transformer to confirm that program halts at 105VAC input and starts or attempts to start at 110VAC.

3. Turn off AC power, disconnect powerstat variable transformer, turn on AC power and re-check for 117 to 118VAC.

4. Make adjustments on card 8245, location 10G as follows. Restart program at location '6500. Turn power off from computer and after 2-5 seconds turn power on. Check the "B" Accumulator for a reading of '100 to '105.

   If the "B" Accumulator is less than '100 the teletype will print;

   Increase R2 on 8245 at location G10.

If the "B" Accumulator is greater than '105 the teletype will print;

Decrease R2 on 8245 at location G10.

If the "B" Accumulator is equal to or between '100 to '105 the teletype will print;

R2 adjustment on 8245 is OK.

Turn power off and on a number of times (at least 10) after this adjustment is complete. If adjustments are correct and the power fail-auto restart logic is operational, the program should come up running without a failure.

Return system to normal operation.

```
0001                    ************************************************
0002                    *     INTERRUPT DIAGNOSTIC
0003                    *
0004                    *     LOCATION '6000
0005                    *     TYPE T FOR TELETYPE IN-OUTPUT INTERRUPTS
0006                    *     PROGRAM SHOULD PRINT THE FOLLOWING EACH
0007                    *     TIME T IS TYPED
0008                    *     T------ INPUT INTERRUPT GROUP 1, LEVEL 1
0009                    *     T------OUTPUT INTERRUPT GROUP 1, LEVEL 2
0010                    *     TYPE A FOR A/D INTERRUPT, PROGRAM SHOULD
0011                    *     PRINT THE FOLLOWING TEN TIMES.
0012                    *     A------INPUT INTERRUPT GROUP 1, LEVEL 1
0013                    *     TYPE M FOR MODEM INTERRUPT, PROGRAM
0014                    *     SHOULD PRINT THE FOLLOWING TEN TIMES.
0015                    *     M------RECEIVE INTERRUPT GROUP 0, LEVEL 1
0016                    *     M------***XMIT INTERRUPT GROUP 0, LEVEL 2
0017                    *
0018                    *     LOCATION '6500
0019                    *     POWER FAIL-AUTO RESTART
0020                    *     AFTER ADJUSTMENT OF 8296 START PROG. TURN
0021                    *     PWR OFF TO COMP, WT 1-5 SEC TURN PWR ON.
0022                    *     IF B ACCUM = (1) LESS THAN '100 (2) '100-
0023                    *     '105 (3) MORE THAN '105, THE TTY WILL PRINT
0024                    *     (1) INCREASE R2 ON 8245, LOC G10
0025                    *     (2) R2 ADJUSTMENT ON 8245 IS OK.
0026                    *     (3) DECREASE R2 ON 8245, LOC G10
0027                    *
0028                    *     PREPARED BY CARL L THOMPSON 8-26-76
0029                    ************************************************
0030  00000 00000000          REL
0031  00000 01100200 BEGN LAA  INPT          DAC TYPE
0032  00001 03300201      STA* IRUP          '1016
0033  00002 01100202      LAA  OTP1          DAC PRNT
0034  00003 03300203      STA* ORUP          '1017
0035  00004 00130001      CEU  1
0036  00005 00072000      DATA '72000
0037  00006 11100004      BRU  *-2
0038  00007 00000033 WATE NOP
0039  00010 01100215      LAA  CNT4          TBLA
0040  00011 03100110      STA  CHNG
0041  00012 00130600      PIE
0042  00013 00010001      DATA '10001        INPT INTRUP GRP 1 LEV 1
0043  00014 00000033      NOP
0044  00015 11100014      BRU  *-1           WT F/INTR F/TTY KEY BD
0045  00016 00000033 WAIT NOP
0046  00017 00130600      PIE
0047  00020 00010002      DATA '10002        OTPT INTRUP GRP 1 LEV 2
```

```
0048  00021 00000033       NOP
0049  00022 11100021       BRU  *-1            WT F/OTPT INTRUP
0050  00023 00000000 TYPE  HLT
0051  00024 00170201       AIP  1
0052  00025 11100024       BRU  *-1
0053  00026 03100221       STA  CNT8
0054  00027 15100207       CMA  TMP1           '324 T F/TTY
0055  00030 11100032       BRU  *+2
0056  00031 11100043       BRU  A3
0057  00032 11100033       BRU  *+1
0058  00033 15100211       CMA  TMP3           '315 M F/MODEM
0059  00034 11100036       BRU  *+2
0060  00035 11100050       BRU  A4             INIT F/MODEM SUB
0061  00036 11100037       BRU  *+1
0062  00037 15100210       CMA  TMP2           '301 ALPHA A F/A-D
0063  00040 11100042       BRU  *+2
0064  00041 11100053       BRU  A2             INIT F/A-D SUBROUTINE
0065  00042 11100055       BRU  A1
0066  00043 00000033 A3    NOP
0067  00044 12100074       SPB  ITYP
0068  00045 01100212       LAA  CNT1           DAC WAIT
0069  00046 03100023       STA  TYPE
0070  00047 11100055       BRU  A1
0071  00050 01100412 A4    LAA  CNTJ           DAC MODEM
0072  00051 03100023       STA  TYPE
0073  00052 11100055       BRU  A1
0074  00053 01100217 A2    LAA  CNT6           DAC ALOG
0075  00054 03100023       STA  TYPE
0076  00055 00000035 A1    TOI
0077  00056 11300023       BRU* TYPE
0078  00057 00000000 PRNT  HLT
0079  00060 00130601       PID
0080  00061 00010002       DATA '10002
0081  00062 00170401       MOP  1
0082  00063 00120000       DATA '120000        SPC
0083  00064 11100062       BRU  *-2
0084  00065 01100214       LAA  CNT3           TBLB
0085  00066 03100110       STA  CHNG           CHNG TBLA TO TBLB
0086  00067 12100074       SPB  ITYP
0087  00070 01100213       LAA  CNT2           DAC WATE
0088  00071 03100057       STA  PRNT
0089  00072 00000035       TOI
0090  00073 11300057       BRU* PRNT
0091  00074 00000000 ITYP  HLT
0092  00075 12100170       SPB  CRLF
0093  00076 01100221       LAA  CNT8
0094  00077 00001016       LSL  8
0095  00100 00170001       AOP  1
```

```
0096  00101 11100100       BRU  *-1
0097  00102 02077775       LBA  =-3
0098  00103 01500207       LAA  DASH+3,1        6 DASHES
0099  00104 12100161       SPB  TTY0
0100  00105 00000026       IBS
0101  00106 11100103       BRU  *-3
0102  00107 02077757       LBA  =-17
0103  00110 01500244 CHNG   LAA  TBLA+17,1      TBLA, TBLB, TBLC, TBLD
0104  00111 12100161       SPB  TTY0
0105  00112 00000026       IBS
0106  00113 11100110       BRU  *-3
0107  00114 11300074       BRU* ITYP
0108  00115 00000033 ALOG   NOP
0109  00116 00130015       CEU  '15
0110  00117 00060000       DATA '60000
0111  00120 11100116       BRU  *-2
0112  00121 01100222       LAA  INP1            DAC B2
0113  00122 03300201       STA* IRUP            '1016
0114  00123 01077765       LAA  =-11
0115  00124 03100413       STA  CNTK            EXECUTE INTRUP 10 TIMES
0116  00125 00000033 B1     NOP
0117  00126 14100413       IMS  CNTK
0118  00127 11100131       BRU  *+2
0119  00130 11100140       BRU  B3
0120  00131 00130600       PIE
0121  00132 00010001       DATA '10001          GRP 1 LEV 1
0122  00133 01100216       LAA  CNT5            CH '10
0123  00134 00170015       AOP  '15
0124  00135 11100134       BRU  *-1
0125  00136 00000033       NOP
0126  00137 11100136       BRU  *-1             WT F/INTRUP
0127  00140 00000033 B3     NOP
0128  00141 00130015       CEU  '15
0129  00142 00020000       DATA '20000          DISCON A/D INTRUP
0130  00143 11100141       BRU  *-2
0131  00144 00130601       PID
0132  00145 00010001       DATA '10001
0133  00146 11100000       BRU  BEGN
0134  00147 00000000 B2     HLT
0135  00150 00130601       PID
0136  00151 00010001       DATA '10001
0137  00152 01100215       LAA  CNT4            TBLA
0138  00153 03100110       STA  CHNG
0139  00154 12100074       SPB  ITYP
0140  00155 01100220       LAA  CNT7            DAC B1
0141  00156 03100147       STA  B2
0142  00157 00000035       TOI
0143  00160 11300147       BRU* B2
```

```
0144  00161 00000000 TTYO HLT
0145  00162 00170001       AOP  1
0146  00163 11100162       BRU  *-1
0147  00164 00001016       LSL  8
0148  00165 00170001       AOP  1
0149  00166 11100165       BRU  *-1
0150  00167 11300161       BRU* TTYO
0151  00170 00000000 CRLF HLT
0152  00171 00170401       MOP  1
0153  00172 00106400       DATA '106400
0154  00173 11100171       BRU  *-2
0155  00174 00170401       MOP  1
0156  00175 00105000       DATA '105000
0157  00176 11100174       BRU  *-2
0158  00177 11300170       BRU* CRLF
0159  00200 35400023 INPT DAC  TYPE
0160  00201 00001016 IRUP DATA '1016
0161  00202 35400057 OTP1 DAC  PRNT
0162  00203 00001017 ORUP DATA '1017
0163  00204 00126655 DASH DATA ''-------''
0163  00205 00126655
0163  00206 00126655
0164  00207 00000324 TMP1 DATA '324          T F/TTY
0165  00210 00000301 TMP2 DATA '301
0166  00211 00000315 TMP3 DATA '315          M F/MODEM
0167  00212 35400016 CNT1 DAC  WAIT
0168  00213 35400007 CNT2 DAC  WATE
0169  00214 01500265 CNT3 LAA  TBLB+17,1
0170  00215 01500244 CNT4 LAA  TBLA+17,1
0171  00216 00000010 CNT5 DATA '10
0172  00217 35400115 CNT6 DAC  ALOG
0173  00220 35400125 CNT7 DAC  B1
0174  00221 00000000 CNT8 DATA 0            TEMP F/TYPED CHAR
0175  00222 35400147 INP1 DAC  B2
0176  00223 00120311 TBLA DATA '' INPUT INTERRUPT GROUP 1, LEVEL 1''
0176  00224 00147320
0176  00225 00152724
0176  00226 00120311
0176  00227 00147324
0176  00230 00142722
0176  00231 00151325
0176  00232 00150324
0176  00233 00120307
0176  00234 00151317
0176  00235 00152720
0176  00236 00120261
0176  00237 00126240
0176  00240 00146305
```

```
0176  00241 00153305
0176  00242 00146240
0176  00243 00130640
0177  00244 00147725 TBLB DATA ''OUTPUT INTERRUPT GROUP 1, LEVEL 2''
0177  00245 00152320
0177  00246 00152724
0177  00247 00120311
0177  00250 00147324
0177  00251 00142722
0177  00252 00151325
0177  00253 00150324
0177  00254 00120307
0177  00255 00151317
0177  00256 00152720
0177  00257 00120261
0177  00260 00126240
0177  00261 00146305
0177  00262 00153305
0177  00263 00146240
0177  00264 00131240
0178  00265 00151305 TBLC DATA ''RECEIVE INTERRUPT GROUP 0, LEVEL 1''
0178  00266 00141705
0178  00267 00144726
0178  00270 00142640
0178  00271 00144716
0178  00272 00152305
0178  00273 00151322
0178  00274 00152720
0178  00275 00152240
0178  00276 00143722
0178  00277 00147725
0178  00300 00150240
0178  00301 00130254
0178  00302 00120314
0178  00303 00142726
0178  00304 00142714
0178  00305 00120261
0179  00306 00125252 TBLD DATA ''***XMIT INTERRUPT GROUP 0, LEVEL 2''
0179  00307 00125330
0179  00310 00146711
0179  00311 00152240
0179  00312 00144716
0179  00313 00152305
0179  00314 00151322
0179  00315 00152720
0179  00316 00152240
0179  00317 00143722
0179  00320 00147725
```

```
0179  00321 00150240
0179  00322 00130254
0179  00323 00120314
0179  00324 00142726
0179  00325 00142714
0179  00326 00120262
0180  00327 00000033 MODM NOP
0181  00330 01100402       LAA  CBTA          DAC REC
0182  00331 03300403       STA* CBTB          '1002
0183  00332 01100404       LAA  CBTC          DAC XMIT
0184  00333 03300405       STA* CBTD          '1003
0185  00334 01077765       LAA  =-11
0186  00335 03100413       STA  CNTK          EXECUTE INTRUP 10 TIMES
0187  00336 00130014 STRT   CEU  '14
0188  00337 00001000       DATA '1000
0189  00340 11100336       BRU  *-2
0190  00341 14100413       IMS  CNTK
0191  00342 11100344       BRU  *+2
0192  00343 11100000       BRU  BEGN
0193  00344 00130600       PIE
0194  00345 00000001       DATA 1
0195  00346 00000033       NOP
0196  00347 11100346       BRU  *-1           WT F/REC INTRUP
0197  00350 00000033       NOP
0198  00351 00000033 C1    NOP
0199  00352 00130600       PIE
0200  00353 00000002       DATA 2
0201  00354 00000033       NOP
0202  00355 11100354       BRU  *-1           WT F/XMT INTRUP
0203  00356 00000000 RECV   HLT
0204  00357 00130601       PID
0205  00360 00000001       DATA 1
0206  00361 01100406       LAA  CBTF          TBLC
0207  00362 03100110       STA  CHNG
0208  00363 12100074       SPB  ITYP
0209  00364 01100407       LAA  CNTG          DAC C1
0210  00365 03100356       STA  RECV
0211  00366 00000035       TOI
0212  00367 11300356       BRU* RECV
0213  00370 00000000 XMIT   HLT
0214  00371 00130601       PID
0215  00372 00000002       DATA 2
0216  00373 01100410       LAA  CNTH          TBLD
0217  00374 03100110       STA  CHNG
0218  00375 12100074       SPB  ITYP
0219  00376 01100411       LAA  CNTI          DAC STRT
0220  00377 03100370       STA  XMIT
0221  00400 00000035       TOI
```

```
0222  00401 11300370       BRU* XMIT
0223  00402 35400356 CBTA  DAC  RECV
0224  00403 00001002 CBTB  DATA '1002
0225  00404 35400370 CBTC  DAC  XMIT
0226  00405 00001003 CBTD  DATA '1003
0227  00406 01500306 CBTF  LAA  TBLC+17,1
0228  00407 35400351 CNTG  DAC  C1
0229  00410 01500327 CNTH  LAA  TBLD+17,1
0230  00411 35400336 CNTI  DAC  STRT
0231  00412 35400327 CNTJ  DAC  MODM
0232  00413 00000000 CNTK  DATA 0              -10 CNTR
0233  00414 35400000 CNTL  DAC  BEGN
0234                 ************************************************
0235                 *    POWER FAIL DIAGNOSTIC
0236                 ************************************************
0237  00500 70000500       ORG  '500
0238  00500 01100564 BIGN  LAA  PDN            PWR DN SUBROUTINE
0239  00501 03300566       STA* INTR           LOC '1000
0240  00502 00000003       CLA
0241  00503 03100570       STA  CNTA           TIMER F/PWR DN
0242  00504 00000033       NOP
0243  00505 11100504       BRU  *-1            WT F/105V OR LESS
0244  00506 00000000 PRDN  HLT                 105V OR LESS
0245  00507 01100565       LAA  PUP            PWR UP SUBROUTINE
0246  00510 03300566       STA* INTR           LOC '1000
0247  00511 14100570       IMS  CNTA           TIMER F/PWR DN
0248  00512 11100511       BRU  *-1
0249  00513 00000000       HLT
0250  00514 00000000 PRUP  HLT                 110V OR MORE
0251  00515 01100564       LAA  PDN
0252  00516 03300566       STA* INTR
0253  00517 01100567       LAA  DAC            DAC CHEK
0254  00520 03100514       STA  PRUP
0255  00521 00000035       TOI
0256  00522 11300514       BRU* PRUP
0257  00523 00000033 CHEK  NOP
0258  00524 01100570       LAA  CNTA           PWR DN TIMER
0259  00525 15100572       CMA  CNTC           '100
0260  00526 11100536       BRU  INCR           INCR CNT
0261  00527 11100530       BRU  *+1            OK
0262  00530 15100571       CMA  CNTB,          '105
0263  00531 11100532       BRU  *+1            OK
0264  00532 11100541       BRU  OKAY           OK
0265  00533 01100574       LAA  CNTE           DECREASE CNT
0266  00534 03100546       STA  MSGE+3
0267  00535 11100543       BRU  MSGE
0268  00536 01100573 INCR  LAA  CNTD           INCR CNT
0269  00537 03100546       STA  MSGE+3
```

```
0270  00540 11100543       BRU  MSGE
0271  00541 01100575 OKAY  LAA  CNTF          CNT OK
0272  00542 03100546       STA  MSGE+3
0273  00543 00000033 MSGE  NOP
0274  00544 12100170       SPB  CRLF
0275  00545 02077762       LBA  =-14
0276  00546 00000000       HLT                INCR-DECR OR CNT OK
0277  00547 12100555       SPB  TTYO
0278  00550 00000026       IBS
0279  00551 11100546       BRU  *-3
0280  00552 02100570       LBA  CNTA          PWR DN TIMER
0281  00553 12100170       SPB  CRLF
0282  00554 11100500       BRU  BIGN
0283  00555 00000000 TTYO  HLT
0284  00556 00170001       AOP  1
0285  00557 11100556       BRU  *-1
0286  00560 00001016       LSL  8
0287  00561 00170001       AOP  1
0288  00562 11100561       BRU  *-1
0289  00563 11300555       BRU* TTYO
0290  00564 35400506 PDN   DAC  PRDN
0291  00565 35400514 PUP   DAC  PRUP
0292  00566 00001000 INTR  DATA '1000
0293  00567 35400523 DAC   DAC  CHEK
0294  00570 00000000 CNTA  DATA 0
0295  00571 00000105 CNTB  DATA '105
0296  00572 00000100 CNTC  DATA '100
0297  00573 01500614 CNTD  LAA  TBL1+14,1     INCR CNT
0298  00574 01500632 CNTE  LAA  TBL2+14,1     DECR CNT
0299  00575 01500650 CNTF  LAA  TBL3+14,1     CNT OK
0300  00576 00144716 TBL1  DATA ''INCREASE R2 ON 8245, LOC G10''
0300  00577 00141722
0300  00600 00142701
0300  00601 00151705
0300  00602 00120322
0300  00603 00131240
0300  00604 00147716
0300  00605 00120270
0300  00606 00131264
0300  00607 00132654
0300  00610 00120314
0300  00611 00147703
0300  00612 00120307
0300  00613 00130660
0301  00614 00142305 TBL2  DATA ''DECREASE R2 ON 8245, LOC G10''
0301  00615 00141722
0301  00616 00142701
0301  00617 00151705
```

```
0301   00620 00120322
0301   00621 00131240
0301   00622 00147716
0301   00623 00120270
0301   00624 00131264
0301   00625 00132654
0301   00626 00120314
0301   00627 00147703
0301   00630 00120307
0301   00631 00130660
0302   00632 00151262 TBL3 DATA ''R2 ADJUSTMENT ON 8245 IS OK.''
0302   00633 00120301
0302   00634 00142312
0302   00635 00152723
0302   00636 00152315
0302   00637 00142716
0302   00640 00152240
0302   00641 00147716
0302   00642 00120270
0302   00643 00131264
0302   00644 00132640
0302   00645 00144723
0302   00646 00120317
0302   00647 00145656
0303   00650 70400000       END
        BEGN    00000
        WATE    00007
        WAIT    00016
        TYPE    00023
        A3      00043
        A4      00050
        A2      00053
        A1      00055
        PRNT    00057
        ITYP    00074
        CHNG    00110
        ALOG    00115
        B1      00125
        B3      00140
        B2      00147
        TTYO    00161
        CRLF    00170
        INPT    00200
        IRUP    00201
        OTP1    00202
        ORUP    00203
        DASH    00204
        TMP1    00207
```

```
        TMP2    00210
        TMP3    00211
        CNT1    00212
        CNT2    00213
        CNT3    00214
        CNT4    00215
        CNT5    00216
        CNT6    00217
        CNT7    00220
        CNT8    00221
        INP1    00222
        TBLA    00223
        TBLB    00244
        TBLC    00265
        TBLD    00306
        MODM    00327
        STRT    00336
        C1      00351
        RECV    00356
        XMIT    00370
        CBTA    00402
        CBTB    00403
        CBTC    00404
        CBTD    00405
        CBTF    00406
        CNTG    00407
        CNTH    00410
        CNTI    00411
        CNTJ    00412
        CNTK    00413
        CNTL    00414
        BIGN    00500
        PRDN    00506
        PRUP    00514
        CHEK    00523
        INCR    00536
        OKAY    00541
        MSGE    00543
        TTYO    00555
        PDN     00564
        PUP     00565
        INTR    00566
        DAC     00567
        CNTA    00570
        CNTB    00571
        CNTC    00572
        CNTD    00573
        CNTE    00574


        CNTF    00575
        TBL1    00576
        TBL2    00614
        TBL3    00632
ERRORS  0000    00000
```

PROGRAM DESCRIPTION

IDENTIFICATION: Input-Output Controller Diagnostic

AUTHOR: Carl L. Thompson
Natural Gas Pipeline Company of America
Communications Division

ISSUED: April 21, 1976

PURPOSE: To assist the Communication Technician with maintenance and repair of the I/O controller

COMPUTER: SEL 810A

STORAGE: 1156 Octal Locations

LOADING PROCEDURE: Relocatable Loader, 16K Modified
Program Counter, Enter '36060
"A" Accumulator, Enter '6000
"B" Accumulator = 0

Insert program tape in reader and press start twice.

Review the following operating procedures before starting program at location '6000.

I/O CONTROLLER PROGRAM

Program permits testing I/O controller logic, input and output relays without danger of upsetting station operation.

The I/O controller is located in interface cabinet number one (1) and contains logic and relay cards per the attached Exhibit Number 3. The input and output channel numbers vary at some stations, therefore your station may not contain the full complement of logic cards on the exhibit.

The program energizes each output relay, one relay at a time, in the auto mode. Utilizing a special test jumper cable, the contacts of the output relay energize an input relay coil. The program records the closed or open contact of the input relay. A defective relay or logic circuit can be easily identified and repaired.

The program is modified through the teletype keyboard as follows:

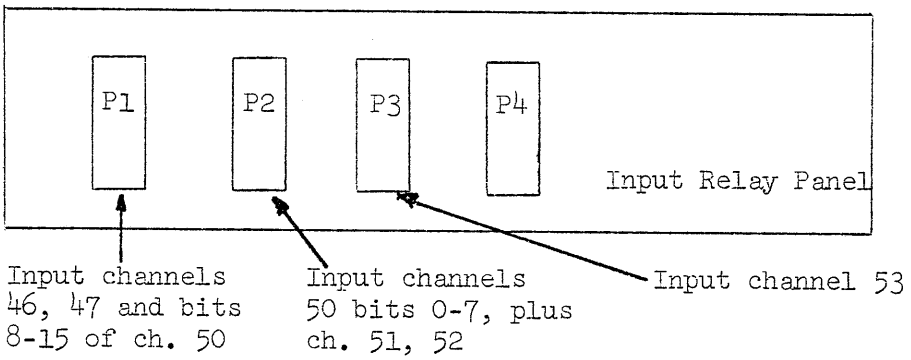
As each number is typed, the program will print the channels under test.

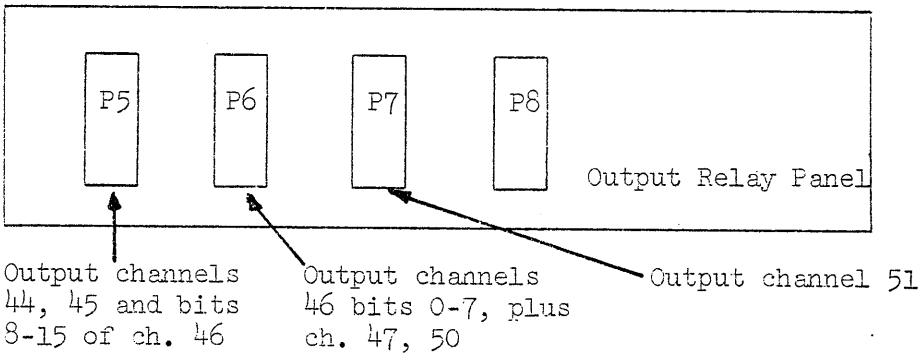
TABLE 1

STATION APPLICABLE	TYPE CHARACTER	PROGRAM MODIFIED FOR TESTING AS FOLLOWS
All	1	Test input chan. 46 with output chan. 44.
All	2	Test input chan. 47 with output chan. 45.
All	3	Test input chan. 50 with output chan. 46, Bits 8-15.
All	4	Test input chan. 50 with output chan. 46, Bits 0-7.
Sta. 191-199 & 113	5	Test input chan. 51 with output chan. 44.
Sta. 167, 168, 169 & Chicago	6	Test input chan. 51 with output chan. 47.
Station 169 & Chicago	7	Test input chan. 52 with output chan. 50.
Station 169 & Chicago	8	Test input chan. 53 with output chan. 51.
All	L	Convert from auto mode to LCS mode. Select bit number by setting corresponding control switch.
All	C	Convert from LCS to auto mode.
All	H	Program will halt on detecting an error and display the bit under test in the "A" Accumulator and the error in the "B" Accumulator.
All	G	Inhibit halt on error.
All	P	Print test results.

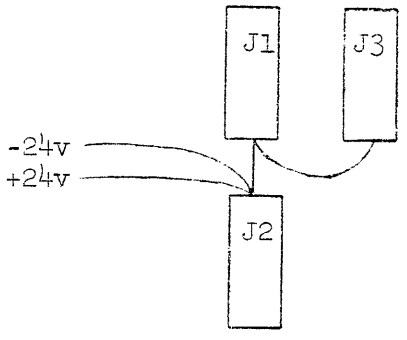
To commence testing, proceed as follows:

1. Remove 6, I/O cables connected to P1, P2, P3, P5, P6 and P7, from the rear of input and output relay panel. The cable connectors are labeled as follows:

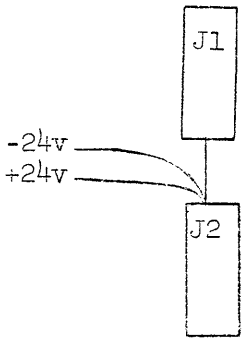




2. Connect the special jumper cable as follows:



For Station
191-199 & 113



For Station
167, 168, 169 & Chicago

The jumper cable connectors are labeled J1-J3 as shown above.

a. Connect J1 to P1 and J2 to P5 for first sequence of tests.

b. Connect the DC leads to 24 volts as labeled.

c. Start program at location '6000.

3. Press Number 1 on teletype keyboard. The following message will be typed.

Test Input Ch. 46, Output Ch. 44.

The program will test the 16 I/O relays associated with these channels until a program change is made through the teletype keyboard.

To print log of tests press the letter "P" on teletype.

By typing the number 2 on the teletype keyboard (refer to Table 1) tests can be made for input channel 47, with output channel 45.

By typing the number 3, tests can be made for input channel 50 with output channel 46, bits 8-15. The test jumper cable must be changed to test remaining channels as follows:

4. For Station 191-199 and 113

a. Remove J1 from P1.

b. Connect J3 to P2.

c. Press number 5 on teletype keyboard to test input channel 51 with output channel 44. Following the completion of this test;

d. Remove J3 from P2.

e. Connect J1 to P2.

f. Move J2 to P6.

g. Press number 4 on teletype keyboard to test input channel 50 with output channel 46, bits 0-7.

5. For Station 167, 168, 169 & Chicago

a. Remove J1 from P1.

b. Connect J1 to P2.

c. Remove J2 from P5.

d. Connect J2 to P6.

Test remaining channels as listed in Table 1.

Please note that Station 169 utilizes input channel 53 and output channel 51. To test these channels the jumper cable must be moved to P3 and P7 respectively.

DETAIL OF PROGRAM MODIFICATION THROUGH TELETYPE KEYBOARD

L = Load Control Switch Mode

In this mode, one or more relays may be tested at one time. The "A" Accumulator will always display the bit position (relay) under test and the "B" Accumulator will display the results of the test. This mode is very useful in diagnosing a problem or testing a suspected faulty input or output operation.

Important Note: An output relay, once energized, will remain energized until you reset the bit for that relay or master clear the computer.

C = Auto Mode

This mode automatically tests each relay of the channel selected from Table 1. Each relay is tested individually at approximately $\frac{1}{2}$ second intervals for an open or closed condition. The results of each relay test is stored in a table.

H = Halt

By typing the letter "H" the program will halt on detecting an error and will display the bit under test in the "A" Accumulator and the error in the "B" Accumulator.

G = Inhibit Halt on Error

Typing the letter "G" will inhibit the program from halting on an error.

P = Print

By typing the letter "P" the program will print the results of the test from the auto mode only. A sample of print-out is attached.

If a character is printed other than those listed in Table 1, the program will print "Invalid Request".

The program will normally operate in the auto mode and will not halt on an error after the initial loading of program. To change this mode of operation, type the characters described above.

INPUT-OUTPUT CONTROLLER INTERFACE UNIT

EXHIBIT NO. 3

1F1 A

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
83142 -005	83142 -005	83142 -005	83142 -005	83142 -005	83142 -005	83142 -006	83142 -006	83142 -006	83142 -006					
0-7	8-15	0-7	8-15	0-7	8-15	0-7	8-15	0-7	8-15					
Ch50 51	Ch50 51	Ch46 47	Ch46 47	Ch44 45	Ch44 45	Ch42 43	Ch42	Ch40 41	Ch40 41					
Word Output Unit														

1F1 B

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
83150 -11D	83150 -11D	83150 -11D	83150 -11D	83150 -3D	83150 -3D	83150 -3D	83150 -3D	83150 -3D	83150 -3D		83160 8 Bit Term	83160 8 Bit Term	83161 Sync Logic	83137 Unit Decode
0-7	8-15	0-7	8-15	0-7	8-15	0-7	8-15	0-7	8-15		0-7	8-15		
50-51	50-51	46-47	46-47	44-45	44-45	43	42-43	40-41	40-41					
Word Input Unit														

1F2 A

12	11	10	9	8	7	6	5	4	3	2	1
100011 Input Relay	100011	100011	100011	100011	100011	100011	100011	100011	100011	100011	100011
0-7	8-15	0-7	8-15	0-7	8-15	0-7	8-15	0-7	8-15	0-7	8-15
53	53	52	52	51	51	50	50	47	47	46	46

1F2 C

12	11	10	9	8	7	6	5	4	3	2	1
100012 Output Relay	100012	100012	100012	100012	100012	100012	100012	100012	100012	100012	100012
0-7	8-15	0-7	8-15	0-7	8-15	0-7	8-15	0-7	8-15	0-7	8-15
51	51	50	50	47	47	46	46	45	45	44	44

```
LC
EJ
 07156 00107

TURN OFF SWITCH S1 NEXT TO WATCH DOG RELAY.
UNPLUG DISPLAY RELAY CARDS ABOVE WATCH DOG RELAY.
PRESS THE NUMBER ON TTY ASSIGNED TO THE CHANNEL FOR TEST.

1
TEST INPUT CH 46, OUTPUT CH 44


2
TEST INPUT CH 47, OUTPUT CH 45

3
 TEST IN CH 50 OUT CH 46 BITS 8-15

4
 TEST IN CH 50 OUT CH 46 BITS 0-7

5
TEST INPUT CH 51, OUTPUT CH 44

6
TEST INPUT CH 51, OUTPUT CH 47

7
TEST INPUT CH 52, OUTPUT CH 50

8
TEST INPUT CH 53, OUTPUT CH 51

9

INVALID REQUEST

1
TEST INPUT CH 46, OUTPUT CH 44

P

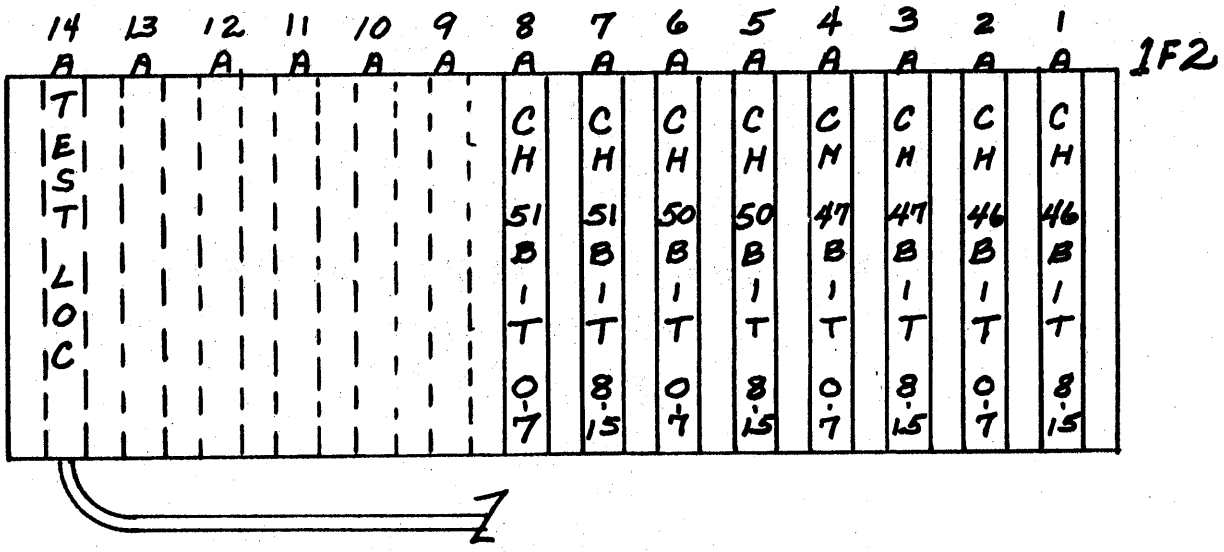
TOTAL TESTS = 00009

BIT    GOOD TESTS
0       00009
1       00009
2       00009
3       00009
4       00009
5       00009
6       00009
7       00009
8       00009
9       00008
10      00008
11      00008
12      00008
13      00008
14      00008
15      00008
```

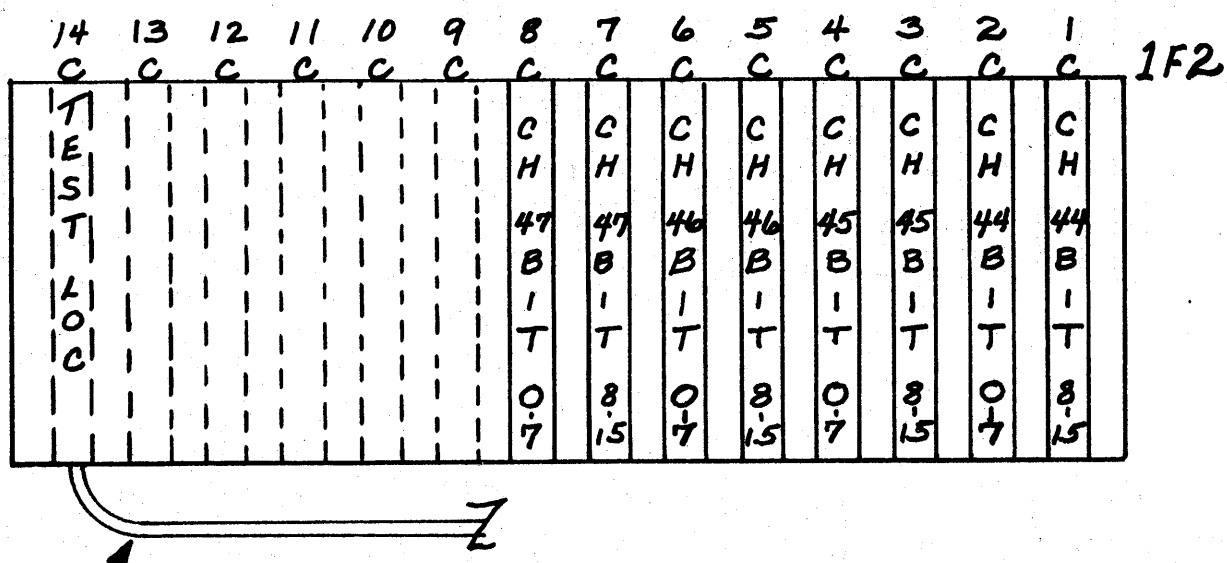
INPUT AND OUTPUT RELAY CARD LOCATIONS

FIGURE I

INPUT RELAY UNIT



OUTPUT RELAY UNIT

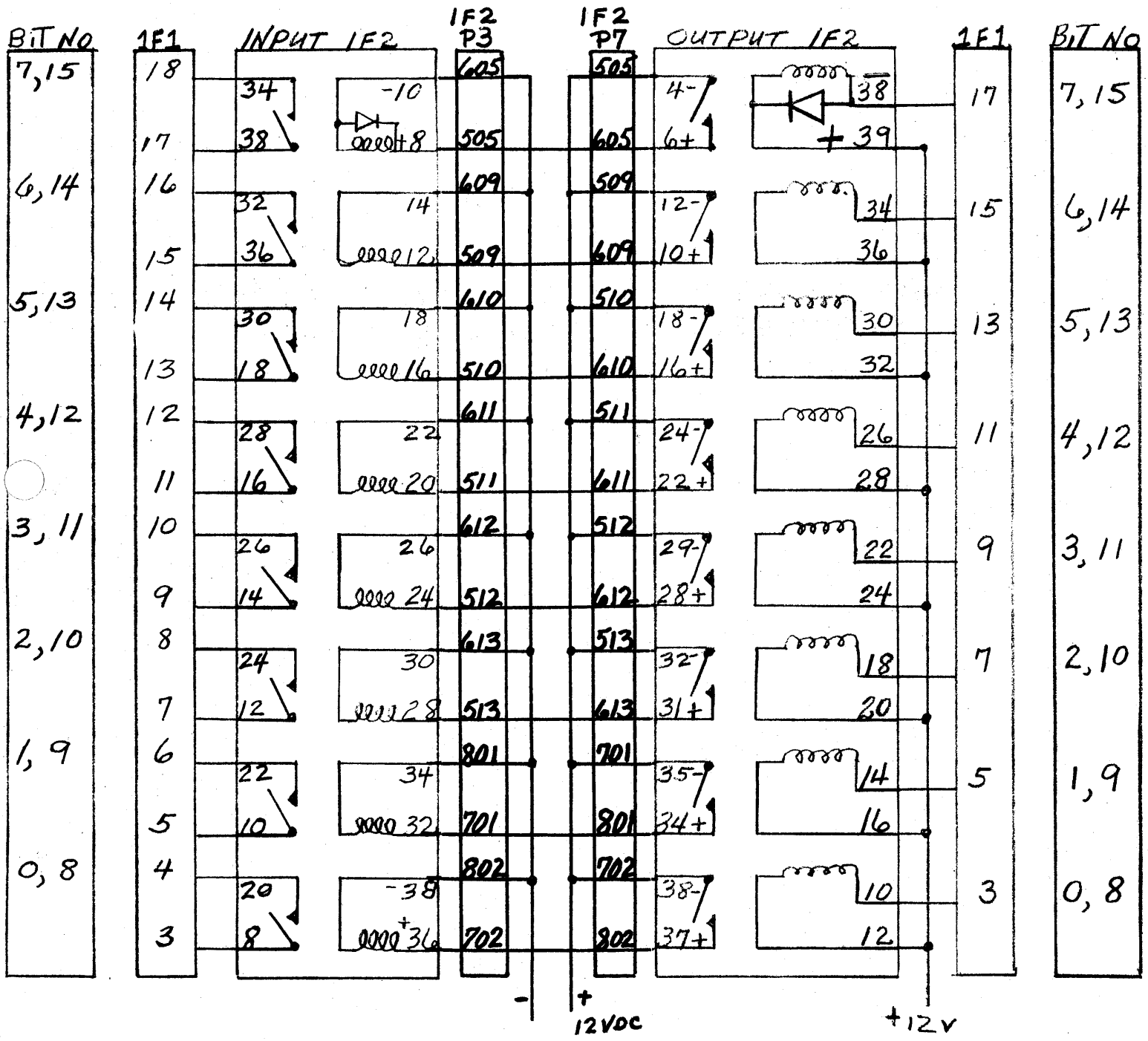


CONNECT JUMPER CABLE BETWEEN CARD AT LOCATION 14 AND CONNECTER CABLE FROM CHANNEL NO. AND SWITCH POSITION UNDER TEST.

6/17/74

WIRING DIAGRAM OF INPUT AND OUTPUT RELAY CARD INCLUDING JUMPER CABLE

FIGURE II

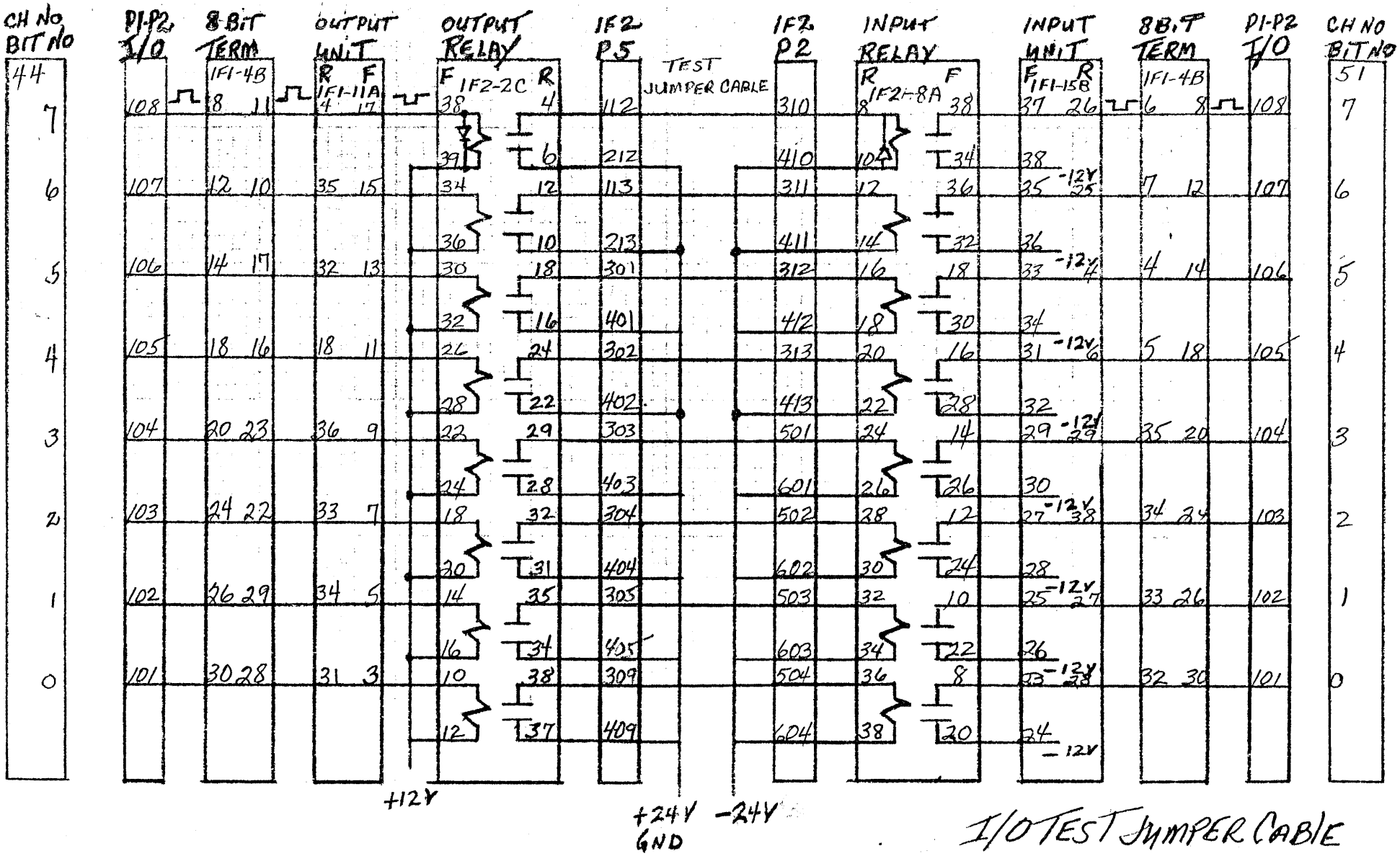


JUMPER CABLE FOR TEST LOCATION 14A AND 14C

8LJ 6/17/74

```
0001                    ******************************************
0002                    *  CARL L THOMPSON                       *
0003                    *  COMMUNICATIONS DIVISION               *
0004                    *  NATURAL GAS PIPELINE COMPANY OF AMERICA *
0005                    *  BEATRICE,NEBRASKA 68310               *
0006                    *                                        *
0007                    *  TEST OUTPUT AND INPUT LOGIC           *
0008                    *  JUNE 6,1974                           *
0009                    ******************************************
0010  00000 00000000        REL
0011  00000A00000000   24                          IDENTIFY # 24 CARD PUNCH
0012  00001 01040000 STRT  LAA   ='040000         TURN SYSTEM ON
0013  00002 00170143       AOP   '43,W
0014  00003 01077774       LAA   =-4
0015  00004 03100364       STA   CNT6
0016  00005 01077770       LAA   =-8
0017  00006 03100366       STA   CNT8            CNT FOR FINAL TEST
0018  00007 01100367       LAA   T1
0019  00010 03100356       STA   CNTA
0020  00011 01100370       LAA   T2
0021  00012 03100357       STA   CNTB
0022  00013 12100276       SPB   CRLF
0023  00014 02077736       LBA   =-34
0024  00015 01500443 A1     LAA   MSGA+34,1       SUBR F/TEST SPECIFIC CH
0025  00016 12100335       SPB   TTY
0026  00017 00000026       IBS
0027  00020 11100015       BRU   A1
0028  00021 02100662       LBA   STRZ            START ADDR SUBROUTINE
0029  00022 12100330       SPB   MASK            CLEAR START ADDRESS
0030  00023 12100342       SPB   SUB             CONV 3 DIGIT ADDRESS B/D
0031  00024 12100276       SPB   CRLF
0032  00025 02077771       LBA   =-7
0033  00026 01500451 A3     LAA   MSGC+7,1        AOP 46,W AT 15XXX
0034  00027 12100335       SPB   TTY
0035  00030 00000026       IBS
0036  00031 11100026       BRU   A3
0037  00032 02100705       LBA   AO              LOCATION AOP 46,W
0038  00033 12100330       SPB   MASK            CLR ADDRESS OF AOP 46,W
0039  00034 12100342       SPB   SUB             CONV 3 DIGIT ADDRESS B/D
0040  00035 12100276       SPB   CRLF
0041  00036 02077771       LBA   =-7
0042  00037 01500460 A4     LAA   MSGD+7,1        AIP 51,W AT 15XXX
0043  00040 12100335       SPB   TTY
0044  00041 00000026       IBS
0045  00042 11100037       BRU   A4
0046  00043 02100716       LBA   AI              LOCATION OF AIP 51,W
0047  00044 12100330       SPB   MASK            CLEAR ADDRESS OF AIP 51

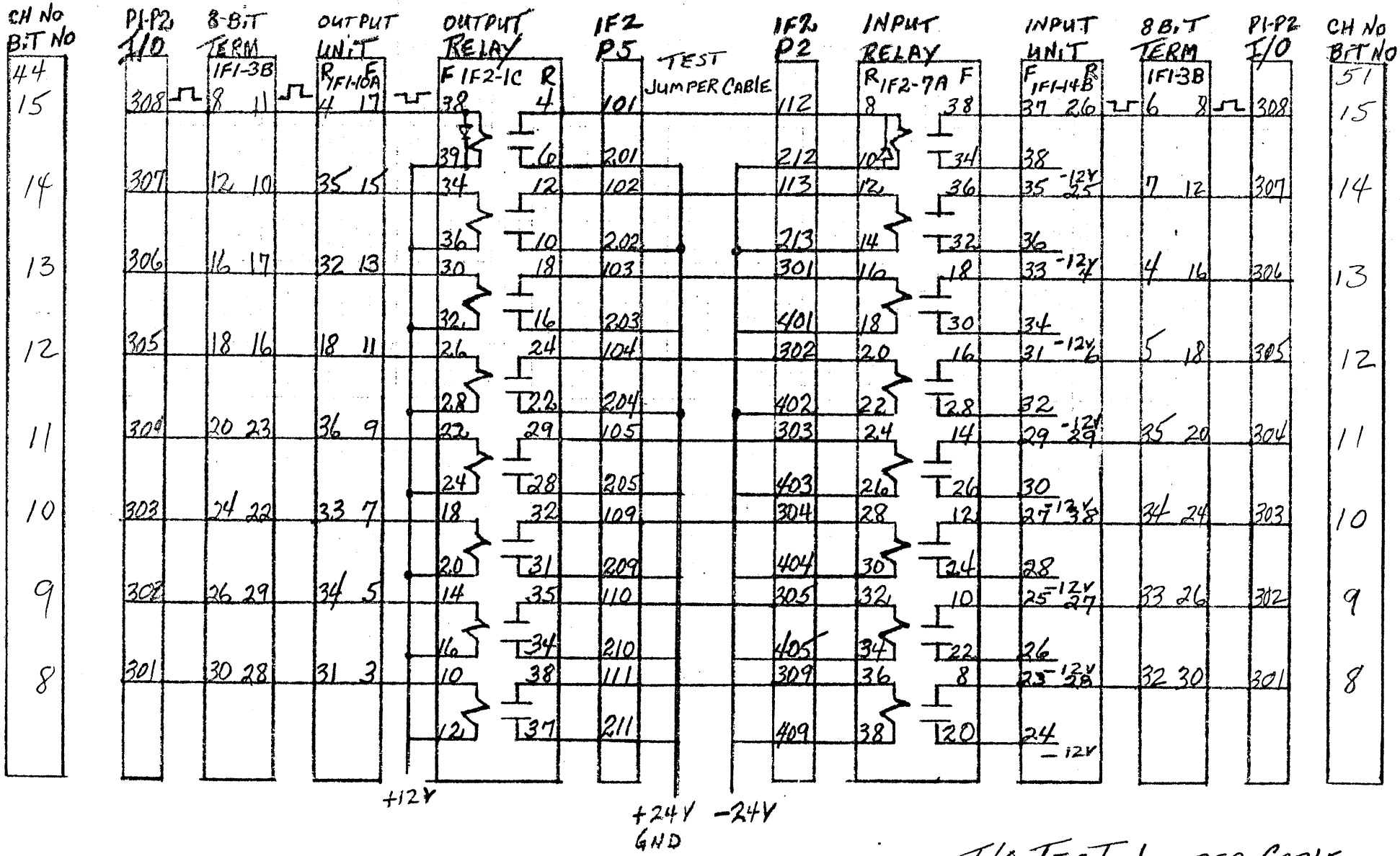
0048  00045 12100342       SPB   SUB             CONV 3 DIGIT ADDRESS B/D
0049  00046 12100276       SPB   CRLF
0050  00047 02077771       LBA   =-7
0051  00050 01500467 A5     LAA   MSGE+7,1        SWITCH TEST AT 15XXX
0052  00051 12100335       SPB   TTY
0053  00052 00000026       IBS
0054  00053 11100050       BRU   A5
0055  00054 02100740       LBA   SW              LOCATION OF SWITCH TEST
0056  00055 12100330       SPB   MASK            CLEAR ADDR OF SW TEST
```



F = FRONT CONNECTOR
R = REAR CONNECTOR
⎍ = HIGH WHEN TRUE
⎎ = LOW WHEN TRUE

I/O TEST JUMPER CABLE FOR TESTING OUTPUT CHANNEL 44 AND INPUT CHANNEL 51.

BB2 9-23-



F = FRONT CONNECTOR

R = REAR CONNECTOR

⎍ = HIGH WHEN TRUE

⎓ = LOW WHEN TRUE

I/O TEST JUMPER CABLE FOR TESTING OUTPUT CH. 44 AND INPUT CHANNEL 51.

SK2 9-3-76

```
0001                    ************************************************
0002                    *     I/O CONTROLLER DIAGNOSTIC
0003                    *
0004                    *     1= AOP 44, AIP 46                    P1-P5
0005                    *     2= AOP 45, AIP 47                    P1-P5
0006                    *     3= AOP 46, AIP 50 BITS 8-15          P1-P5
0007                    *     4= AOP 46, AIP 50 BITS 0-7           P2-P6
0008                    *     5= AOP 44, AIP 51                    P2-P5
0009                    *     6= AOP 47, AIP 51                    P2-P6
0010                    *     7= AOP 50, AIP 52                    P2-P6
0011                    *     8= AOP 51, AIP 53                    P3-P7
0012                    *     C=CLEAR LCS MODE
0013                    *     G=INHIBIT HALT ON ERROR
0014                    *     H=HALT PROGRAM ON EROR ''A''=OK ''B''=EROR
0015                    *     L=LCS, TEST BIT WITH CONTROL PANEL SWITCH
0016                    *     P=PRINT TEST RESULTS
0017                    *     PREPARED BY CARL L THOMPSON  4-15-76   2.15
0018                    ************************************************
0019  00000 00000000          REL
0020  00000 00130600          PIE
0021  00001 00010001          DATA '10001
0022  00002 00130101          CEU  1,W
0023  00003 00062000          DATA '62000
0024  00004 01100576          LAA  TTYI
0025  00005 03300617          STA* I016
0026  00006 01040000          LAA  ='40000          TRN SYS ON
0027  00007 00170143          AOP  '43,W
0028  00010 12100557          SPB  CLIR
0029  00011 01101111          LAA  ZERO
0030  00012 00000022          SAZ
0031  00013 11100042          BRU  BEGN
0032  00014 12100433          SPB  CRLF
0033  00015 12100433          SPB  CRLF
0034  00016 02077752          LBA  =-22             NXT 18 PRNT PRELIMINARY
0035  00017 01501023          LAA  TBLH+22,1        INSTRUCTIONS
0036  00020 12100426          SPB  TTYO
0037  00021 00000026          IBS
0038  00022 11100017          BRU  *-3
0039  00023 12100433          SPB  CRLF
0040  00024 02077747          LBA  =-25
0041  00025 01501054          LAA  TBLH+47,1
0042  00026 12100426          SPB  TTYO
0043  00027 00000026          IBS
0044  00030 11100025          BRU  *-3
0045  00031 12100433          SPB  CRLF
0046  00032 02077743          LBA  =-29
0047  00033 01501111          LAA  TBLH+76,1
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0048  00034 12100426       SPB   TTY0
0049  00035 00000026       IBS
0050  00036 11100033       BRU   *-3
0051  00037 12100433       SPB   CRLF
0052  00040 01000001       LAA   =1              TYPE INSTR 1 TIME ONLY
0053  00041 03101111       STA   ZERO
0054  00042 00000033 BEGN  NOP
0055  00043 00000033       NOP
0056  00044 11100043       BRU   *-1
0057  00045 00000033       NOP
0058  00046 00000033 STRT  NOP
0059  00047 00130001       CEU   1
0060  00050 00062000       DATA  '62000
0061  00051 00000033       NOP
0062  00052 01040000       LAA   ='40000
0063  00053 00170143       AOP   '43,W
0064  00054 02077760 LBA    LBA   =-16            OR LBA=-8
0065  00055 01000001       LAA   =1
0066  00056 05100621       AMA   TBLA            NO OF TESTS
0067  00057 03100621       STA   TBLA
0068  00060 01500666 LAA    LAA   BITS+16,1
0069  00061 00000033 AGAN  NOP                   OR LCS
0070  00062 03101155       STA   CHEK
0071  00063 00170144 AOP    AOP   '44,W
0072  00064 00000033       NOP
0073  00065 14101114       IMS   NEG1
0074  00066 11100065       BRU   *-1
0075  00067 00000033       NOP
0076  00070 00170346 AIP    AIP   '46,W
0077  00071 03101113       STA   TEMP
0078  00072 00000033       NOP                   OR BRU LOCS F/LGS
0079  00073 01101155       LAA   CHEK
0080  00074 15101113       CMA   TEMP
0081  00075 11100077       BRU   *+2
0082  00076 11100100       BRU   *+2
0083  00077 11100104       BRU   EROR
0084  00100 01000001       LAA   =1
0085  00101 05500642 AMA    AMA   TBLB+16,1
0086  00102 03500642 STA    STA   TBLB+16,1       STORE GOOD TSTS
0087  00103 11100112       BRU   DLY
0088  00104 04100615 EROR  STB   CNT0
0089  00105 02101113       LBA   TEMP            EROR
0090  00106 00000033 HALT  NOP                   OR HALT F/H
0091  00107 02100615       LBA   CNT0
0092  00110 00000033       NOP
0093  00111 00000033       NOP
0094  00112 00000033 DLY    NOP
```

```
0096  00114 00000026       IBS
0097  00115 11100060       BRU   LAA
0098  00116 11100046       BRU   STRT          RE-STRT TST
0099  00117 00000033 LOCS  NOP                 USED F/LCS ONLY
0100  00120 01040000       LAA   ='40000
0101  00121 00170143       AOP   '43,W
0102  00122 02101113       LBA   TEMP
0103  00123 01101155       LAA   CHEK
0104  00124 15101113       CMA   TEMP
0105  00125 11100127       BRU   *+2
0106  00126 11100132       BRU   *+4
0107  00127 00000033       NOP
0108  00130 00000033 HOLT  NOP                 OR HALT F/H
0109  00131 00000033       NOP
0110  00132 14101112       IMS   NTHO
0111  00133 11100132       BRU   *-1
0112  00134 11100060       BRU   LAA
0113  00135 25400000 TTYR  DAC   **
0114  00136 12100433       SPB   CRLF
0115  00137 00170301       AIP   1,W
0116  00140 03100577       STA   CNTA
0117  00141 00001016       LSL   8
0118  00142 00170101       AOP   1,W
0119  00143 12100433       SPB   CRLF
0120  00144 01100577       LAA   CNTA
0121  00145 15000314       CMA   ='314         L=LCS
0122  00146 11100150       BRU   *+2
0123  00147 11100220       BRU   LCSS
0124  00150 15000303       CMA   ='303         C=CLEAR LCS MODE
0125  00151 11100153       BRU   *+2
0126  00152 11100225       BRU   CLER
0127  00153 15000320       CMA   ='320         P=PRINT TSTS
0128  00154 11100156       BRU   *+2
0129  00155 11100215       BRU   PRNT
0130  00156 15000307       CMA   ='307         G=GO
0131  00157 11100161       BRU   *+2
0132  00160 11100231       BRU   GO
0133  00161 15000310       CMA   ='310         H=HALT
0134  00162 11100164       BRU   *+2
0135  00163 11100235       BRU   STOP
0136  00164 15000261       CMA   ='261         =1 AOP 44, AIP 46
0137  00165 11100167       BRU   *+2
0138  00166 11100241       BRU   ONE
0139  00167 15000262       CMA   ='262         =2 AOP 45, AIP 47
0140  00170 11100172       BRU   *+2
0141  00171 11100252       BRU   TOO
0142  00172 15000263       CMA   ='263         =3 AOP 46, AIP 50 0-7
0143  00173 11100175       BRU   *+2
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0144  00174 11100263       BRU  THRE
0145  00175 15000264       CMA  ='264          =4 AOP 46, AIP 50 8-15
0146  00176 11100200       BRU  *+2
0147  00177 11100276       BRU  FOUR
0148  00200 15000265       CMA  ='265          =5 AOP 44, AIP 51
0149  00201 11100203       BRU  *+2
0150  00202 11100315       BRU  FIVE
0151  00203 15000266       CMA  ='266          =6 AOP 47, AIP 51
0152  00204 11100206       BRU  *+2
0153  00205 11100326       BRU  SIX
0154  00206 15000267       CMA  ='267          =7 AOP 50, AIP 52
0155  00207 11100211       BRU  *+2
0156  00210 11100337       BRU  SEVN
0157  00211 15000270       CMA  ='270          =8 AOP 51, AIP 53
0158  00212 11100214       BRU  *+2
0159  00213 11100350       BRU  EGHT
0160  00214 11100411       BRU  INVL           INVALID REQUEST
0161  00215 01101122 PRNT  LAA  CNTS           DAC PRIT
0162  00216 03100135       STA  TTYR
0163  00217 11100423       BRU  TOI+3
0164  00220 01101115 LCSS  LAA  LCS
0165  00221 03100061       STA  AGAN
0166  00222 01101116       LAA  BRU
0167  00223 03100072       STA  AIP+2
0168  00224 11100420       BRU  TOI
0169  00225 01100616 CLER  LAA  NOP
0170  00226 03100072       STA  AIP+2
0171  00227 03100061       STA  AGAN
0172  00230 11100420       BRU  TOI
0173  00231 01100616 GO    LAA  NOP
0174  00232 03100106       STA  HALT
0175  00233 03100130       STA  HOLT
0176  00234 11100420       BRU  TOI
0177  00235 00000003 STOP  CLA
0178  00236 03100130       STA  HOLT
0179  00237 03100106       STA  HALT
0180  00240 11100420       BRU  TOI
0181  00241 01100607 ONE   LAA  CNTI           AOP 44
0182  00242 03100063       STA  AOP
0183  00243 01100610       LAA  CNTJ           AIP '46,W
0184  00244 03100070       STA  AIP
0185  00245 01101133       LAA  OU4            OUT CH 44
0186  00246 03100735       STA  TBLE+14
0187  00247 01101144       LAA  IN6            IN CH 46
0188  00250 03100726       STA  TBLE+7
0189  00251 11100372       BRU  ALL            TST 16 BITS
0190  00252 01100600 TOO   LAA  CNTB           AOP 45
0191  00253 03100063       STA  AOP
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0192  00254 01100601        LAA  CNTC        AIP '47,W
0193  00255 03100070        STA  AIP
0194  00256 01101134        LAA  OU5         OUT CH 45
0195  00257 03100735        STA  TBLE+14
0196  00260 01101145        LAA  IN7         IN CH 47
0197  00261 03100726        STA  TBLE+7
0198  00262 11100372        BRU  ALL         TST 16 BITS
0199  00263 01100602 THRE   LAA  CNTD        AOP 46 8-15
0200  00264 03100063        STA  AOP
0201  00265 01100603        LAA  CNTE        AIP 50 8-15
0202  00266 03100070        STA  AIP
0203  00267 01101146        LAA  CNT2        8- F/BIT
0204  00270 03100715        STA  TBLD+15     TST IN CH OUT CH BIT 0-0
0205  00271 01101147        LAA  CNT3        15 F/BIT
0206  00272 03100716        STA  TBLD+16
0207  00273 01101117        LAA  CNTP        LAA BITS+16,1
0208  00274 03100060        STA  LAA
0209  00275 11100361        BRU  PART
0210  00276 01101150 FOUR   LAA  CNT4        AOP 46 0-7
0211  00277 03100063        STA  AOP
0212  00300 01101151        LAA  CNT5        AIP 50 0-7
0213  00301 03100070        STA  AIP
0214  00302 01101152        LAA  CNT6        0- F/BIT
0215  00303 03100715        STA  TBLD+15     TST IN CH OUT CH BIT 0-0
0216  00304 01101153        LAA  CNT7        7 SPC F/BIT
0217  00305 03100716        STA  TBLD+16
0218  00306 01101154        LAA  CNT8        LAA BITS+8,1
0219  00307 03100060        STA  LAA
0220  00310 01100605        LAA  CNTG        AMA TBLB +8,1
0221  00311 03100101        STA  AMA
0222  00312 01100606        LAA  CNTH        STA TBLB+8,1
0223  00313 03100102        STA  STA
0224  00314 11100361        BRU  PART
0225  00315 01101124 FIVE   LAA  CNTU        AOP 44
0226  00316 03100063        STA  AOP
0227  00317 01101125        LAA  CNTV        AIP 51
0228  00320 03100070        STA  AIP
0229  00321 01101133        LAA  OU4         OUT CH 44
0230  00322 03100735        STA  TBLE+14
0231  00323 01101141        LAA  IN1         IN CH 51
0232  00324 03100726        STA  TBLE+7
0233  00325 11100372        BRU  ALL         TST 16 BITS
0234  00326 01101126 SIX    LAA  CNTW        AOP 47
0235  00327 03100063        STA  AOP
0236  00330 01101125        LAA  CNTV        AIP 51
0237  00331 03100070        STA  AIP
0238  00332 01101136        LAA  OU7         OUT CH 43
0239  00333 03100735        STA  TBLE+14
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```
0240  00334 01101141       LAA  IN1          IN CH 51
0241  00335 03100726       STA  TBLE+7
0242  00336 11100372       BRU  ALL          TST 16 BITS
0243  00337 01101127 SEVN  LAA  CNTX         AOP 50
0244  00340 03100063       STA  AOP
0245  00341 01101130       LAA  CNTY         AIP 52
0246  00342 03100070       STA  AIP
0247  00343 01101137       LAA  OU8          OUT CH 50
0248  00344 03100735       STA  TBLE+14
0249  00345 01101142       LAA  IN2          IN CH 52
0250  00346 03100726       STA  TBLE+7
0251  00347 11100372       BRU  ALL          TST 16 BITS
0252  00350 01101131 EGHT  LAA  CNTZ         AOP 51
0253  00351 03100063       STA  AOP
0254  00352 01101132       LAA  CNT1         AIP 53
0255  00353 03100070       STA  AIP
0256  00354 01101140       LAA  OU9          OUT CH 51
0257  00355 03100735       STA  TBLE+14
0258  00356 01101143       LAA  IN3          IN CH 53
0259  00357 03100726       STA  TBLE+7
0260  00360 11100372       BRU  ALL          TST 16 BITS
0261  00361 00000033 PART  NOP
0262  00362 01100604       LAA  CNTF         LBA=-8
0263  00363 03100054       STA  LBA          LBA=-8
0264  00364 02077757       LBA  =-17
0265  00365 01500717       LAA  TBLD+17,1
0266  00366 12100426       SPB  TTY0
0267  00367 00000026       IBS
0268  00370 11100365       BRU  *-3
0269  00371 11100420       BRU  T0I
0270  00372 00000033 ALL   NOP
0271  00373 01100612       LAA  CNTL         STA TBLB+16,1
0272  00374 03100102       STA  STA
0273  00375 01100611       LAA  CNTK         AMA TBLB+16,1
0274  00376 03100101       STA  AMA
0275  00377 01100614       LAA  CNTN         LBA=-16
0276  00400 03100054       STA  LBA
0277  00401 01101117       LAA  CNTP         LAA BITS+16,1
0278  00402 03100060       STA  LAA
0279  00403 02077761       LBA  =-15
0280  00404 01500736       LAA  TBLE+15,1    TST IN CH XX OUT CH XX
0281  00405 12100426       SPB  TTY0
0282  00406 00000026       IBS
0283  00407 11100404       BRU  *-3
0284  00410 11100420       BRU  T0I
0285  00411 12100433 INVL  SPB  CRLF
0286  00412 02077770       LBA  =-8
0287  00413 01500676       LAA  TBLC+8,1     INVALID REQ
```

```
0288  00414 12100426       SPB   TTYO
0289  00415 00000026       IBS
0290  00416 11100413       BRU   *-3
0291  00417 11100423       BRU   TOI+3
0292  00420 12100557 TOI    SPB   CLIR
0293  00421 01100613       LAA   CNTM          BRU TO STRT
0294  00422 03100135       STA   TTYR
0295  00423 12100433       SPB   CRLF
0296  00424 00000035       TOI
0297  00425 11300135       BRU*  TTYR
0298  00426 00000000 TTYO   HLT
0299  00427 00170101       AOP   1,W
0300  00430 00001016       LSL   8
0301  00431 00170101       AOP   1,W
0302  00432 11300426       BRU*  TTYO
0303  00433 00000000 CRLF   HLT
0304  00434 00170501       MOP   1,W
0305  00435 00106400       DATA  '106400
0306  00436 00170501       MOP   1,W
0307  00437 00105000       DATA  '105000
0308  00440 11300433       BRU*  CRLF
0309  00441 00000000 TSTS   HLT                 CONV OCTAL TO DEC
0310  00442 04101113       STB   TEMP
0311  00443 00000005       TAB
0312  00444 01077773       LAA   =-5
0313  00445 03100615       STA   CNTO
0314  00446 00000003       CLA
0315  00447 11100452       BRU   *+3
0316  00450 00000003 CLA    CLA
0317  00451 07000012       MPY   =10
0318  00452 10023420       DIV   =10000
0319  00453 05000260       AMA   ='260
0320  00454 00001016       LSL   8
0321  00455 00170101       AOP   1,W
0322  00456 14100615       IMS   CNTO
0323  00457 11100450       BRU   CLA
0324  00460 02101113       LBA   TEMP
0325  00461 11300441       BRU*  TSTS
0326  00462 00000000 BINO   HLT                 ARRANGE AND OPT BIT NO
0327  00463 04101113       STB   TEMP
0328  00464 00000005       TAB
0329  00465 00000003       CLA
0330  00466 01101120       LAA   CNTQ          F/PRNT 0-9 BITS
0331  00467 00000022       SAZ
0332  00470 11100472       BRU   *+2
0333  00471 11100505       BRU   TWO           F/PRINT 10-15 BITS
0334  00472 00000003       CLA
0335  00473 00001513       FLL   13
```

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0336  00474 05000260        AMA   ='260
0337  00475 00001016        LSL   8
0338  00476 00170101        AOP   1,W
0339  00477 00170501        MOP   1,W
0340  00500 00120000        DATA  '120000
0341  00501 14101120        IMS   CNTQ
0342  00502 00000033        NOP
0343  00503 02101113        LBA   TEMP
0344  00504 11300462        BRU*  BINO
0345  00505 00001513  TWO   FLL   13              PRNT BITS 10-15
0346  00506 05000260        AMA   ='260
0347  00507 00001016        LSL   8
0348  00510 00170101        AOP   1,W
0349  00511 00000313        FLL   3
0350  00512 05000260        AMA   ='260
0351  00513 00001016        LSL   8
0352  00514 00170101        AOP   1,W
0353  00515 02101113        LBA   TEMP
0354  00516 11300462        BRU*  BINO
0355  00517 00000033  PRIT  NOP
0356  00520 02077771        LBA   =-7
0357  00521 01500745        LAA   TBLF+7,1        PRNT HEADING OF TBLF
0358  00522 12100426        SPB   TTYO
0359  00523 00000026        IBS
0360  00524 11100521        BRU   *-3
0361  00525 01100621        LAA   TBLA            TOTAL TSTS
0362  00526 12100441        SPB   TSTS
0363  00527 12100433        SPB   CRLF
0364  00530 12100433        SPB   CRLF
0365  00531 02077770        LBA   =-8
0366  00532 01500755        LAA   TBLG+8,1        BIT GOOD TST
0367  00533 12100426        SPB   TTYO
0368  00534 00000026        IBS
0369  00535 11100532        BRU   *-3
0370  00536 12100433        SPB   CRLF
0371  00537 01077766        LAA   =-10
0372  00540 03101120        STA   CNTQ            =-10 F/BITS 0-9
0373  00541 01077760        LAA   =-16
0374  00542 03101121        STA   CNTR
0375  00543 01500755  MORE  LAA   TBLI,1          CHAN NO
0376  00544 12100462        SPB   BINO
0377  00545 12100566        SPB   SPCS
0378  00546 01500622        LAA   TBLB,1          GOOD TSTS
0379  00547 12100441        SPB   TSTS
0380  00550 12100433        SPB   CRLF
0381  00551 00000026        IBS
0382  00552 00000033        NOP
0383  00553 14101121        IMS   CNTR
```

```
0384  00554 11100543       BRU  MORE
0385  00555 12100557       SPB  CLIR
0386  00556 11100046       BRU  STRT
0387  00557 00000000 CLIR  HLT
0388  00560 02077757       LBA  =-17
0389  00561 00000003       CLA
0390  00562 03500642       STA  TBLA+17,1      CLR TST TBLE
0391  00563 00000026       IBS
0392  00564 11100562       BRU  *-2
0393  00565 11300557       BRU* CLIR
0394  00566 00000000 SPCS  HLT                 5 SPACES
0395  00567 01077773       LAA  =-5
0396  00570 03101123       STA  CNTT
0397  00571 01020000       LAA  ='120000
0398  00572 00170101       AOP  1,W
0399  00573 14101123       IMS  CNTT
0400  00574 11100571       BRU  *-3
0401  00575 11300566       BRU* SPCS
0402  00576 35400135 TTYI  DAC  TTYR
0403  00577 00000000 CNTA  DATA 0
0404  00600 00170145 CNTB  DATA '170145
0405  00601 00170347 CNTC  DATA '170347
0406  00602 00170146 CNTD  DATA '170146
0407  00603 00170350 CNTE  DATA '170350        AIP CH 50
0408  00604 02077770 CNTF  LBA  =-8
0409  00605 05500632 CNTG  AMA  TBLB+8,1
0410  00606 03500632 CNTH  STA  TBLB+8,1
0411  00607 00170144 CNTI  DATA '170144
0412  00610 00170346 CNTJ  DATA '170346
0413  00611 05500642 CNTK  AMA  TBLB+16,1
0414  00612 03500642 CNTL  STA  TBLB+16,1
0415  00613 35400046 CNTM  DAC  STRT
0416  00614 02077760 CNTN  LBA  =-16
0417  00615 00000000 CNTO  DATA 0
0418  00616 00000033 NOP   NOP
0419  00617 00001016 I016  DATA '1016
0420  00620 00000000 HLT   HLT
0421  00621 00000000 TBLA  DATA 0               NO OF TSTS
0422  00622 00000024 TBLB  BSS  20              STORE GOOD TSTS
0423  00646 00100000 BITS  DATA '100000,'40000,'20000,'10000,'4000
0423  00647 00040000
0423  00650 00020000
0423  00651 00010000
0423  00652 00004000
0424  00653 00002000       DATA '2000,'1000,'400,'200,'100,'40,'20,'10
0424  00654 00001000
0424  00655 00000400
0424  00656 00000200
```

```
0424  00657 00000100
0424  00660 00000040
0424  00661 00000020
0424  00662 00000010
0425  00663 00000004        DATA 4,2,1
0425  00664 00000002
0425  00665 00000001
0426  00666 00144716 TBLC  DATA ''INVALID REQUEST''
0426  00667 00153301
0426  00670 00146311
0426  00671 00142240
0426  00672 00151305
0426  00673 00150725
0426  00674 00142723
0426  00675 00152240
0427  00676 00120324 TBLD  DATA '' TEST IN CH 50 OUT CH 46 BITS 0-7''
0427  00677 00142723
0427  00700 00152240
0427  00701 00144716
0427  00702 00120303
0427  00703 00144240
0427  00704 00132660
0427  00705 00120317
0427  00706 00152724
0427  00707 00120303
0427  00710 00144240
0427  00711 00132266
0427  00712 00120302
0427  00713 00144724
0427  00714 00151640
0427  00715 00130255
0427  00716 00133640
0428  00717 00152305 TBLE  DATA ''TEST INPUT CH 46, OUTPUT CH 44''
0428  00720 00151724
0428  00721 00120311
0428  00722 00147320
0428  00723 00152724
0428  00724 00120303
0428  00725 00144240
0428  00726 00132266
0428  00727 00126240
0428  00730 00147725
0428  00731 00152320
0428  00732 00152724
0428  00733 00120303
0428  00734 00144240
0428  00735 00132264
                      TBLF DATA ''TOTAL TESTS = ''
```

```
0429  00737 00152301
0429  00740 00146240
0429  00741 00152305
0429  00742 00151724
0429  00743 00151640
0429  00744 00136640
0430  00745 00141311 TBLG DATA ''BIT   GOOD TESTS''
0430  00746 00152240
0430  00747 00120240
0430  00750 00143717
0430  00751 00147704
0430  00752 00120324
0430  00753 00142723
0430  00754 00152323
0431  00755 00000000 TBLI DATA 0,'10,'20,'30,'40,'50,'60,'70,'100
0431  00756 00000010
0431  00757 00000020
0431  00760 00000030
0431  00761 00000040
0431  00762 00000050
0431  00763 00000060
0431  00764 00000070
0431  00765 00000100
0432  00766 00000110      DATA '110,'10,'11,'12,'13,'14,'15
0432  00767 00000010
0432  00770 00000011
0432  00771 00000012
0432  00772 00000013
0432  00773 00000014
0432  00774 00000015
0433  00775 00152325 TBLH DATA ''TURN OFF SWITCH S1 NEXT TO WATCH''
0433  00776 00151316
0433  00777 00120317
0433  01000 00143306
0433  01001 00120323
0433  01002 00153711
0433  01003 00152303
0433  01004 00144240
0433  01005 00151661
0433  01006 00120316
0433  01007 00142730
0433  01010 00152240
0433  01011 00152317
0433  01012 00120327
0433  01013 00140724
0433  01014 00141710
0434  01015 00120304      DATA '' DOG RELAY. ''
0434  01016 00147707
```

```
0434  01017 00120322
0434  01020 00142714
0434  01021 00140731
0434  01022 00127240
0435  01023 00152716      DATA ''UNPLUG DISPLAY RELAY CARDS ABOVE''
0435  01024 00150314
0435  01025 00152707
0435  01026 00120304
0435  01027 00144723
0435  01030 00150314
0435  01031 00140731
0435  01032 00120322
0435  01033 00142714
0435  01034 00140731
0435  01035 00120303
0435  01036 00140722
0435  01037 00142323
0435  01040 00120301
0435  01041 00141317
0435  01042 00153305
0436  01043 00120327      DATA '' WATCH DOG RELAY. ''
0436  01044 00140724
0436  01045 00141710
0436  01046 00120304
0436  01047 00147707
0436  01050 00120322
0436  01051 00142714
0436  01052 00140731
0436  01053 00127240
0437  01054 00150322      DATA ''PRESS THE NUMBER ON TTY ASSIGNED''
0437  01055 00142723
0437  01056 00151640
0437  01057 00152310
0437  01060 00142640
0437  01061 00147325
0437  01062 00146702
0437  01063 00142722
0437  01064 00120317
0437  01065 00147240
0437  01066 00152324
0437  01067 00154640
0437  01070 00140723
0437  01071 00151711
0437  01072 00143716
0437  01073 00142704
0438  01074 00120324      DATA '' TO THE CHANNEL FOR TEST. ''
0438  01075 00147640
0438  01076 00152310
```

```
0438  01077 00142640
0438  01100 00141710
0438  01101 00140716
0438  01102 00147305
0438  01103 00146240
0438  01104 00143317
0438  01105 00151240
0438  01106 00152305
0438  01107 00151724
0438  01110 00127240
0439  01111 00000000 ZERO  DATA 0
0440  01112 00000000 NTH0  DATA 0              DLY CNTR
0441  01113 00000000 TEMP  DATA 0              TEMP STORAGE
0442  01114 00000000 NEG1  DATA 0
0443  01115 00000031 LCS   LCS
0444  01116 11100117 BRU   BRU  LOCS
0445  01117 01500666 CNTP  LAA  BITS+16,1
0446  01120 00000000 CNTQ  DATA 0              PRNT
0447  01121 00000000 CNTR  DATA 0
0448  01122 35400517 CNTS  DAC  PRIT
0449  01123 00000000 CNTT  DATA 0
0450  01124 00170144 CNTU  AOP  '44,W
0451  01125 00170351 CNTV  AIP  '51,W
0452  01126 00170147 CNTW  AOP  '47,W
0453  01127 00170150 CNTX  AOP  '50,W
0454  01130 00170352 CNTY  AIP  '52,W
0455  01131 00170151 CNTZ  AOP  '51,W
0456  01132 00170353 CNT1  AIP  '53,W
0457  01133 00132264 0U4   DATA '132264        CH 44
0458  01134 00132265 0U5   DATA ''45''         CH 45
0459  01135 00132266 0U6   DATA ''46''         CH 46
0460  01136 00132267 0U7   DATA ''47''         CH 47
0461  01137 00132660 0U8   DATA ''50''         CH 50
0462  01140 00132661 0U9   DATA ''51''         CH 51
0463  01141 00132661 IN1   DATA '132661        CH 51
0464  01142 00132662 IN2   DATA ''52''         CH 52
0465  01143 00132663 IN3   DATA ''53''         CH 53
0466  01144 00132266 IN6   DATA ''46''         CH 46
0467  01145 00132267 IN7   DATA ''47''         CH 47
0468  01146 00134255 CNT2  DATA '134255        8-
0469  01147 00130665 CNT3  DATA '130665        15 F/BIT
0470  01150 00170146 CNT4  AOP  '46,W
0471  01151 00170350 CNT5  AIP  '50,W
0472  01152 00130255 CNT6  DATA '130255        0-
0473  01153 00133640 CNT7  DATA '133640        7 SPC F/BIT
0474  01154 01500656 CNT8  LAA  BITS+8,1
0475  01155 00000000 CHEK  DATA 0
0476  01156 70400000       END
```

BEGN	00042
STRT	00046
LBA	00054
LAA	00060
AGAN	00061
AOP	00063
AIP	00070
AMA	00101
STA	00102
EROR	00104
HALT	00106
DLY	00112
LOCS	00117
HOLT	00130
TTYR	00135
PRNT	00215
LCSS	00220
CLER	00225
GO	00231
STOP	00235
ONE	00241
TOO	00252
THRE	00263
FOUR	00276
FIVE	00315
SIX	00326
SEVN	00337
EGHT	00350
PART	00361
ALL	00372
INVL	00411
TOI	00420
TTYO	00426
CRLF	00433
TSTS	00441
CLA	00450
BINO	00462
TWO	00505
PRIT	00517
MORE	00543
CLIR	00557
SPCS	00566
TTYI	00576
CNTA	00577
CNTB	00600
CNTC	00601
CNTD	00602
CNTE	00603

CNTF	00604
CNTG	00605
CNTH	00606
CNTI	00607
CNTJ	00610
CNTK	00611
CNTL	00612
CNTM	00613
CNTN	00614
CNTO	00615
NOP	00616
IO16	00617
HLT	00620
TBLA	00621
TBLB	00622
BITS	00646
TBLC	00666
TBLD	00676
TBLE	00717
TBLF	00736
TBLG	00745
TBLI	00755
TBLH	00775
ZERO	01111
NTHO	01112
TEMP	01113
NEG1	01114
LCS	01115
BRU	01116
CNTP	01117
CNTQ	01120
CNTR	01121
CNTS	01122
CNTT	01123
CNTU	01124
CNTV	01125
CNTW	01126
CNTX	01127
CNTY	01130
CNTZ	01131
CNT1	01132
OU4	01133
OU5	01134
OU6	01135
OU7	01136
OU8	01137
OU9	01140
IN1	01141

```
         IN2      01142
         IN3      01143
         IN6      01144
         IN7      01145
         CNT2     01146
         CNT3     01147
         CNT4     01150
         CNT5     01151
         CNT6     01152
         CNT7     01153
         CNT8     01154
         CHEK     01155
ERRORS   0000     00000
```

PROGRAM DESCRIPTION

IDENTIFICATION: Synchronous Modem and Modem Interface Diagnostic Program

AUTHOR: Carl L. Thompson
Natural Gas Pipeline Compnay of America
Communications Division

ACCEPTED: June 30, 1975, Revised December 1, 1976

PURPOSE: To assist the Communications Technician with maintenance and repair of the Modem and Modem Interface equipment.

COMPUTER CONFIGURATION: Standard SEL 810A Computer

STORAGE: 1677 Octal Locations

LOADING PROCEDURE: Relocatable Loader, Program Counter = '36060
A Accumulator = '6000 B Accumulator = 0

Revisions to this program include the capability to test the modem with the sentry card in service. If the sentry card appears defective, remove card and re-install jumper "CC" in the RTS position to operate or test modem.

The transmission rate of speed can also be changed through the teletype keyboard. Follow instructions on Page 3.

Before starting program place the "ANALOG" switch on the rear of the Rixon Modem in the "LOOP BACK" position.

Enter '6000 in the program counter and press start switch twice. The program will then wait at location 6022-6023 for the stations sync word to be added through the teletype keyboard as follows.

Press the number or letter assigned this station below.

Letter or Number	Station Number	Letter or Number	Station Number
1	191	9	199
2	192	T	113
3	193	U	167
4	194	V	168
5	195	W	169
6	196	X	342
7	197	Y	343
8	198		

NOTE: Each time the program is re-started at location '6000, enter the station sync code or one of the following teletype keyboard functions in order to enable program.

The diagnostic consists of two programs.

1. COUNTING MODE

The sync word with one 16 bit data word is transmitted utilizing the transmit interrupt. Each data word is received utilizing the receive interrupt, then compared with the transmitted word and incremented before re-transmission. The program stores the number of transmissions, good received messages and errors for print-out by the operator. Following a print-out the memory location for each count is cleared.

The modem carrier sentry which monitors the carrier signal for approximately 32 seconds before removing carrier from circuit, is reset at 30 second intervals by program.

2. LCS, LOAD CONTROL SWITCH MODE

The sync word with one 16 bit data word is transmitted utilizing the transmit interrupt. Each data word is received utilizing the receive interrupt then compared with the transmitted word. Upon detection of an error the teletype bell will ring. No data is stored in this mode.

The transmitted word is formed by the panel control switches with the received word being displayed in the B Accumulator.

The teletype keyboard is utilized in changing the mode of the program including the print-out of data and control of the teletype motor. If an incorrect key is struck the program will print "INVALID KEY".

COUNTING MODE - KEY "C"

The program, on initial loading will operate in the counting mode. To return to the counting mode from LCS mode, press the letter "C".

LCS MODE - KEY "L"

To change the program from counting mode to LCS mode, press the letter "L".

DATA PRINT-OUT - KEY "D"

To print the number of transmissions, good messages and errors press the letter "D".

HALT PROGRAM ON ERROR - KEY "H"

To compare error with data word, press the letter "H". When the program detects an error it will halt and display the incorrect received word in the "A" Accumulator and the transmitted word in the "B" Accumulator. Press start to re-start program after a halt on error.

To remove the halt statement from the program press the "C" for counting mode or "L" if testing in the LCS mode.

INTERFACE TEST ONLY - KEY "I"

To test the interface equipment back-to-back, remove EIA modem cable from J1 and connect jumper plug. To utilize the modem clock, connect external leads of jumper plug to transmit (red wire to 104) and ground lead (white wire to 204).

TURN TELETYPE MOTOR OFF - KEY "O"

This is to be utilized in the counting mode only. Press the letter "O".

TURN TELETYPE MOTOR ON

Following turn off of motor, you must set panel control switch number 15 to turn motor on. The program will print data as under key "D" and disable the motor control function from switch 15.

NOTE: Upon completion of tests return "ANALOG" switch on the Rixon Modem to the operate position. Check with Gas Control to confirm that data is being received in Chicago.

PROGRAM TRANSMISSION RATE

To change the transmission rate of speed press the following keys.

Key "S" Slow Rate, 475 transmissions per minute.

Key "M" Medium Rate, 1900 transmissions per minute.

Key "F" Fast Rate, 3600 transmissions per minute.

DESCRIPTION OF POSSIBLE PROGRAM HALTS

1. Location '6022 - '6023. Program is waiting for the sync word or a program change via the teletype keyboard.

2. Location '6071 - '6073, '6074 - '6076. The TEU, "Test External Unit" statement tests if data modem is clear to send or if data carrier line is true. If these conditions are not true, the program will not advance. First check AC power to modem; analog test switch for loop back position; then review SEL manual, Volume 1, Paragraph 3-152 to 3-157 and 3-102 and 3-144.

3. Location '6101 - '6102. Transmit interrupt was not generated. Restart program at '6000. In order to enable program to continue testing for a transmit interrupt, change instruction at location '6101 from a NOP to an IMS as follows.

   NOP = '000033

   IMS = '141626 (Increment mem. at loc. '626 and skip). Restart program at '6000 and enter sync. code or an operation code via teletype. The program will continuously test for a transmit interrupt.

4. Location '6104 - '6105. Receive interrupt was not generated. Restart program at '6000. If a transmit interrupt is being generated but not a receive interrupt, change instruction at location '6104 from a NOP to an IMS using the same IMS instruction as noted for transmit interrupt under Item 3, and follow same instructions.

```
0001                    ***************************************************
0002                    *     SYNCHRONOUS MODEM INTERFACE DIAGNOSTIC
0003                    *     PREPARED BY CARL L THOMPSON 6-2-75
0004                    *     COMMUNICATION DIVISION
0005                    *     NATURAL GAS PIPELINE COMPANY OF AMERICA
0006                    *     REVISED 12-1-76
0007                    ***************************************************
0008  00000 00000000          REL
0009  00000 00130600          PIE
0010  00001 00010001          DATA '10001
0011  00002 00130101          CEU  1,W
0012  00003 00062000          DATA '62000         CON INPT INTRUP-KEY BRD
0013  00004 01100662          LAA  TTYI           ADDR OF TTYR SUBROUTINE
0014  00005 03301675          STA* I016
0015  00006 01101667          LAA  PWR1           ADDR PWR FL SUB-RUTNE
0016  00007 03301670          STA* PWR2           LOC '1000
0017  00010 01100561          LAA  CNTU           ADDRESS XMT SUBROUTINE
0018  00011 03300562          STA* CNTV           LOCATION '1003
0019  00012 01100545          LAA  CNTA
0020  00013 03300544          STA* CNT9           LOC '1002
0021  00014 01100664          LAA  PIE
0022  00015 03100214          STA  A301
0023  00016 01100642          LAA  A302           '10001
0024  00017 03100215          STA  A301+1
0025  00020 00000003          CLA
0026  00021 03100666          STA  ZERO           MOTR CONTROL TTY
0027  00022 00000033          NOP
0028  00023 11100022          BRU  *-1
0029  00024 00000033    A243  NOP
0030  00025 12101172          SPB  CLR            CLR TIME-XMISSION REG
0031  00026 00170642    BEGN  MIP  '42
0032  00027 00000000    MNTH  DATA 0              STORE MONTH
0033  00030 11100026          BRU  *-2
0034  00031 00170641          MIP  '41
0035  00032 00000000    DAY   DATA 0              STORE DAY
0036  00033 11100031          BRU  *-2
0037  00034 00170641          MIP  '41
0038  00035 00000000    HOUR  DATA 0              STORE HOUR
0039  00036 11100034          BRU  *-2
0040  00037 00170640          MIP  '40
0041  00040 00000000    MISE  DATA 0              STORE MIN AND SEC
0042  00041 11100037          BRU  *-2
0043  00042 00000033          NOP
0044  00043 00000033    STRT  NOP                 OR SNS 15
0045  00044 00000033          NOP                 OR BRU TO MOTR
0046  00045 12100120          SPB  CARR           RESET SENTRY
0047  00046 01100534          LAA  CNT1           CNTR XMT DELAY
```

```
0048  00047 03100535       STA  CNT2
0049  00050 00000003       CLA
0050  00051 03100560       STA  CNTQ          CNTR SYNC WORD
0051  00052 01100552       LAA  CNTF
0052  00053 03100626       STA  A136
0053  00054 00000033       NOP
0054  00055 00000033       NOP
0055  00056 00000033       NOP
0056  00057 00000033       NOP
0057  00060 00000033       NOP
0058  00061 00000033       NOP
0059  00062 00000033       NOP
0060  00063 00000033       NOP
0061  00064 00000033       NOP
0062  00065 00000033       NOP
0063  00066 00130014       CEU  '14
0064  00067 00005400       DATA '5400
0065  00070 11100066       BRU  *-2
0066  00071 00130214 A123  TEU  '14           OR BRU +6
0067  00072 00040000       DATA '40000        DATA SET CLR TO SND
0068  00073 11100071       BRU  *-2
0069  00074 00130214       TEU  '14
0070  00075 00020000       DATA '20000
0071  00076 11100074       BRU  *-2
0072  00077 00130600 A124  PIE
0073  00100 00000002       DATA 2
0074  00101 00000033       NOP                WT F/XMT INTR IMS A136
0075  00102 11100101       BRU  *-1
0076  00103 11100107       BRU  A241
0077  00104 00000033 A135  NOP                WT F/REC INTR
0078  00105 11100104       BRU  *-1
0079  00106 00000033       NOP
0080  00107 00000033 A241  NOP
0081  00110 14100537       IMS  CNT4          CHNG XMIT WORD
0082  00111 00000033       NOP
0083  00112 14100557       IMS  CNTL
0084  00113 00000033       NOP
0085  00114 14100535       IMS  CNT2
0086  00115 11100114       BRU  *-1
0087  00116 00000033       NOP
0088  00117 11100043       BRU  STRT
0089  00120 00000000 CARR  HLT                RESET SENTRY
0090  00121 01070000       LAA  ='170000
0091  00122 03100645       STA  A511
0092  00123 01100601       LAA  A3
0093  00124 00000022       SAZ
0094  00125 11100150       BRU  A4            INH CARR TRN OFF
0095  00126 00170240       AIP  '40           MIN-SEC
```

```
0096  00127 11100126       BRU  *-1
0097  00130 00001116       LSL  9              REMOVE MIN
0098  00131 00001115       RSL  9
0099  00132 15000051       CMA  ='51
0100  00133 11100152       BRU  A1
0101  00134 11100141       BRU  A2
0102  00135 15000131       CMA  ='131
0103  00136 11100152       BRU  A1
0104  00137 11100141       BRU  A2
0105  00140 11100152       BRU  A1
0106  00141 00130014 A2    CEU  '14
0107  00142 00002000       DATA '2000          CARRIER OFF
0108  00143 11100141       BRU  *-2
0109  00144 14100645       IMS  A511
0110  00145 11100144       BRU  *-1
0111  00146 01077700       LAA  ='177700
0112  00147 03100601       STA  A3             INH CARR TRN OFF
0113  00150 14100601 A4    IMS  A3
0114  00151 00000033       NOP
0115  00152 00000033 A1    NOP
0116  00153 11300120       BRU* CARR
0117                       ***********************************************
0118  00154 00000000 XMIT  HLT
0119  00155 03100656       STA  ASAV
0120  00156 04100655       STB  BSAV
0121  00157 00130601       PID
0122  00160 00010001       DATA '10001
0123  00161 01100560       LAA  CNTQ           EQUAL 0 FIRST ENTRY
0124  00162 00000022       SAZ
0125  00163 11100172       BRU  LCS1
0126  00164 01100633       LAA  A151           SYNC 46114
0127  00165 00170014       AOP  '14
0128  00166 11100165       BRU  *-1
0129  00167 01100632       LAA  A150           =-1
0130  00170 03100560       STA  CNTQ
0131  00171 11100216       BRU  A104
0132  00172 01100537 LCS1  LAA  CNT4           DATA WORD OR LCS
0133  00173 03100557       STA  CNTL           CK DATA WORD
0134  00174 00170014       AOP  '14
0135  00175 11100174       BRU  *-1
0136  00176 00130601       PID
0137  00177 00000002       DATA 2
0138  00200 00130600       PIE
0139  00201 00000001       DATA 1
0140  00202 01100631       LAA  A147           GO TO A135
0141  00203 03100154       STA  XMIT
0142  00204 00000033 A103  NOP                 OR BRU TO A104 F/LCS ***
0143  00205 01100554       LAA  CNTH           DBLE PRECESSION
```

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0144  00206 02100555       LBA  CNTI          TRANSMISSIONS
0145  00207 16100543       AMB  CNT8          DATA 1
0146  00210 00000007       CSB
0147  00211 05100536       AMA  CNT3          DATA 0
0148  00212 03100554       STA  CNTH
0149  00213 04100555       STB  CNTI
0150  00214 00130600 A301  PIE               OR NOP F/MTR OFF
0151  00215 00010001       DATA '10001       OR NOP
0152  00216 00000033 A104  NOP
0153  00217 01100656       LAA  ASAV
0154  00220 02100655       LBA  BSAV
0155  00221 00000035       TOI
0156  00222 11300154       BRU* XMIT
0157                       ************************************************
0158  00223 00000000 RECV  HLT
0159  00224 03100654       STA  SAVA
0160  00225 04100653       STB  SAVB
0161  00226 01100640 A303  LAA  A242          OR NOP F/TTY INTR
0162  00227 03100223       STA  RECV
0163  00230 00130601       PID
0164  00231 00000001       DATA 1
0165  00232 00170214       AIP  '14
0166  00233 11100232       BRU  *-1
0167  00234 03100637       STA  A181
0168  00235 01100637       LAA  A181
0169  00236 00000033 A114  NOP               OR TAB F-LCS
0170  00237 15100557       CMA  CNTL
0171  00240 11100242       BRU  *+2
0172  00241 11100251       BRU  A106
0173  00242 02100557       LBA  CNTL
0174  00243 00000033 A141  NOP               OR HALT
0175  00244 00000033 ERR   NOP               OR LAA W/BELL F/LCS
0176  00245 00000033       NOP               O AOP 1,W F/LCS
0177  00246 14100540       IMS  CNT5
0178  00247 00000033       NOP
0179  00250 11100262       BRU  A116
0180  00251 00000033 A106  NOP               OR BRU A116 F/LCS
0181  00252 01100541       LAA  CNT6         DBL PREC GOOD REPLY
0182  00253 02100542       LBA  CNT7
0183  00254 16100543       AMB  CNT8
0184  00255 00000007       CSB
0185  00256 05100536       AMA  CNT3
0186  00257 03100541       STA  CNT6
0187  00260 04100542       STB  CNT7
0188  00261 01100654       LAA  SAVA
0189  00262 00000033 A116  NOP
0190  00263 00130014       CEU  '14
0191  00264 00001000       DATA '1000
```

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0192  00265 11100263       BRU  *-2
0193  00266 00000033       NOP
0194  00267 00000033       NOP
0195  00270 00000035       TOI                  TRN OFF INTRUP
0196  00271 11300223       BRU* RECV
0197                       ********************************************
0198                       *    SUBROUTINE TO CHANGE OPR MODE VIA TTY KEBRD
0199  00272 00000000 TTYR  HLT
0200  00273 00130601       PID
0201  00274 00000001       DATA 1
0202  00275 03100651       STA  KEPA
0203  00276 04100652       STB  KEPB
0204  00277 01100663       LAA  NOP
0205  00300 03100226       STA  A303
0206  00301 03100227       STA  A303+1
0207  00302 00130600       PIE
0208  00303 00000001       DATA 1
0209  00304 00000033       NOP
0210  00305 00000033       NOP
0211  00306 00130014       CEU  '14
0212  00307 00003000       DATA '3000
0213  00310 11100306       BRU  *-2
0214  00311 01100537       LAA  CNT4            DATA
0215  00312 03100557       STA  CNTL            TEST LOC
0216  00313 00170201 A105  AIP  1
0217  00314 11100313       BRU  *-1
0218  00315 03100547       STA  CNTC
0219  00316 00001016       LSL  8
0220  00317 00170001       AOP  1
0221  00320 11100317       BRU  *-1
0222  00321 12101214       SPB  CRLF
0223  00322 01100547       LAA  CNTC
0224  00323 15100532       CMA  N271
0225  00324 11100461       BRU  SNK
0226  00325 11100461       BRU  SNK
0227  00326 15100533       CMA  N323
0228  00327 00000033       NOP
0229  00330 11100332       BRU  *+2
0230  00331 11100461       BRU  SNK
0231  00332 15100567       CMA  I               INTERFACE ONLY
0232  00333 11100335       BRU  *+2
0233  00334 11100336       BRU  *+2
0234  00335 11100341       BRU  *+4
0235  00336 01100623       LAA  A125
0236  00337 03100071       STA  A123
0237  00340 11100473       BRU  A122
0238  00341 15100566       CMA  H               HLT FOR REC ERR
0239  00342 11100344       BRU  *+2
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0240  00343 11100345       BRU  *+2
0241  00344 11100350       BRU  *+4
0242  00345 00000003       CLA
0243  00346 03100243       STA  A141
0244  00347 11100473       BRU  A122
0245  00350 15100572       CMA  S              SLO XMT RATE
0246  00351 11100353       BRU  *+2
0247  00352 11100354       BRU  *+2
0248  00353 11100357       BRU  *+4
0249  00354 01040000       LAA  ='140000
0250  00355 03100534       STA  CNT1
0251  00356 11100473       BRU  A122
0252  00357 15100571       CMA  M              MED XMT RATE
0253  00360 11100362       BRU  *+2
0254  00361 11100363       BRU  *+2
0255  00362 11100366       BRU  *+4
0256  00363 01070000       LAA  ='170000
0257  00364 03100534       STA  CNT1
0258  00365 11100473       BRU  A122
0259  00366 15100565       CMA  F              FAST XMT RATE
0260  00367 11100371       BRU  *+2
0261  00370 11100372       BRU  *+2
0262  00371 11100375       BRU  *+4
0263  00372 01077000       LAA  ='177000
0264  00373 03100534       STA  CNT1
0265  00374 11100473       BRU  A122
0266  00375 15100563       CMA  C              CNT MODE
0267  00376 11100400       BRU  *+2
0268  00377 11100404       BRU  A117
0269  00400 15100570       CMA  L              LCS
0270  00401 11100443       BRU  A113
0271  00402 11100422       BRU  A108
0272  00403 11100443       BRU  A113
0273  00404 01100663 A117  LAA  NOP
0274  00405 03100243       STA  A141
0275  00406 03100251       STA  A106
0276  00407 03100204       STA  A103
0277  00410 03100244       STA  ERR
0278  00411 03100245       STA  ERR+1
0279  00412 03100236       STA  A114
0280  00413 01100650       LAA  TEU
0281  00414 03100071       STA  A123
0282  00415 01100621       LAA  A119           LAA CNT4
0283  00416 03100172       STA  LCS1
0284  00417 01100641       LAA  A244           DAC A243
0285  00420 03100272       STA  TTYR
0286  00421 11100475       BRU  A126
0287  00422 01100614 A108  LAA  A109           BRU A104
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0288  00423 03100204       STA  A103
0289  00424 01100650       LAA  TEU
0290  00425 03100071       STA  A123
0291  00426 01100663       LAA  NOP
0292  00427 03100243       STA  A141
0293  00430 01100636       LAA  A167          BRU A116
0294  00431 03100251       STA  A106
0295  00432 01100620       LAA  A118          LCS
0296  00433 03100172       STA  LCS1
0297  00434 01100615       LAA  A111          LAA ='103400
0298  00435 03100244       STA  ERR
0299  00436 01100616       LAA  A112          AOP 1,W
0300  00437 03100245       STA  ERR+1
0301  00440 01100617       LAA  A115          TAB
0302  00441 03100236       STA  A114
0303  00442 11100473       BRU  A122
0304  00443 15100564 A113  CMA  D             TYPE DATA
0305  00444 11100452       BRU  A134
0306  00445 11100447       BRU  *+2
0307  00446 11100452       BRU  A134
0308  00447 01100622       LAA  A121          DAC ABC
0309  00450 03100272       STA  TTYR
0310  00451 11100475       BRU  A126
0311  00452 15100647 A134  CMA  OFF           TTY OFF
0312  00453 11100455       BRU  *+2
0313  00454 11100456       BRU  *+2
0314  00455 11100465       BRU  A515
0315  00456 01100625       LAA  A133          DAC MOTR
0316  00457 03100272       STA  TTYR
0317  00460 11100475       BRU  A126
0318  00461 12101015 SNK   SPB  SINK
0319  00462 01100641       LAA  A244          DAC A243
0320  00463 03100272       STA  TTYR
0321  00464 11100475       BRU  A126
0322  00465 02077772 A515  LBA  =-6
0323  00466 01500675       LAA  INVA+6,1
0324  00467 12101224       SPB  TTYO
0325  00470 00000026       IBS
0326  00471 11100466       BRU  *-3
0327  00472 11100473       BRU  A122
0328  00473 01100640 A122  LAA  A242          DAC A241
0329  00474 03100272       STA  TTYR
0330  00475 00000033 A126  NOP
0331  00476 00000033       NOP
0332  00477 00130601       PID
0333  00500 00000001       DATA 1
0334  00501 01100643       LAA  A304
0335  00502 03100226       STA  A303
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0336  00503 01100644        LAA  A305
0337  00504 03100227        STA  A303+1
0338  00505 01100651        LAA  KEPA
0339  00506 02100652        LBA  KEPB
0340  00507 00130600        PIE
0341  00510 00000001        DATA 1
0342  00511 00000035        TOI
0343  00512 11300272        BRU* TTYR
0344  00513 00170621 S191   DATA '170621
0345  00514 00170622 S192   DATA '170622
0346  00515 00170623 S193   DATA '170623
0347  00516 00170624 S194   DATA '170624
0348  00517 00170625 S195   DATA '170625
0349  00520 00170626 S196   DATA '170626
0350  00521 00170627 S197   DATA '170627
0351  00522 00170630 S198   DATA '170630
0352  00523 00170631 S199   DATA '170631
0353  00524 00170547 S167   DATA '170547
0354  00525 00170550 S168   DATA '170550
0355  00526 00170551 S169   DATA '170551
0356  00527 00171502 S342   DATA '171502
0357  00530 00171503 S343   DATA '171503
0358  00531 00170423 S113   DATA '170423
0359  00532 00000271 N271   DATA '271
0360  00533 00000323 N323   DATA '323
0361  00534 00177000 CNT1   DATA '177000
0362  00535 00000000 CNT2   DATA 0
0363  00536 00000000 CNT3   DATA 0
0364  00537 00000000 CNT4   DATA 0          DATA XMISSION WORD
0365  00540 00000000 CNT5   DATA 0          ERRORS
0366  00541 00000000 CNT6   DATA 0          GOOD REPLIES
0367  00542 00000000 CNT7   DATA 0          GOOD REPLIES
0368  00543 00000001 CNT8   DATA 1
0369  00544 00001002 CNT9   DATA '1002      REC INTRUP LOC
0370  00545 35400223 CNTA   DAC  RECV
0371  00546 00177777 CNTB   DATA '177777    RECEIVE CNTR
0372  00547 00000000 CNTC   DATA 0
0373  00550 00000000 CNTD   DATA 0
0374  00551 00000000 CNTE   DATA 0          XMT INTR FAIL
0375  00552 00140000 CNTF   DATA '140000    AIP RECV CNTR
0376  00553 00000000 CNTG   DATA 0
0377  00554 00000000 CNTH   DATA 0          NO OF XMISSIONS
0378  00555 00000000 CNTI   DATA 0          NO OF XMISSIONS
0379  00556 00000000 CNTJ   DATA 0          CNTR PRINT TESTS STRT-STP
0380  00557 00000000 CNTL   DATA 0
0381  00560 00000000 CNTQ   DATA 0
0382  00561 35400154 CNTU   DAC  XMIT
0383  00562 00001003 CNTV   DATA '1003      XMT INTERRUPT
```

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0384  00563 00000303 C     DATA '303
0385  00564 00000304 D     DATA '304
0386  00565 00000306 F     DATA '306
0387  00566 00000310 H     DATA '310
0388  00567 00000311 I     DATA '311
0389  00570 00000314 L     DATA '314
0390  00571 00000315 M     DATA '315
0391  00572 00000323 S     DATA '323
0392  00573 00000324 T     DATA '324
0393  00574 00000325 U     DATA '325
0394  00575 00000326 V     DATA '326
0395  00576 00000327 W     DATA '327
0396  00577 00000330 X     DATA '330
0397  00600 00000331 Y     DATA '331
0398  00601 00000000 A3    DATA 0
0399  00602 00000261 A11   DATA '261
0400  00603 00000262 A12   DATA '262
0401  00604 00000263 A13   DATA '263
0402  00605 00000264 A14   DATA '264
0403  00606 00000265 A15   DATA '265
0404  00607 00000266 A16   DATA '266
0405  00610 00000267 A17   DATA '267
0406  00611 00000270 A18   DATA '270
0407  00612 00000271 A19   DATA '271
0408  00613 00000000 A101  DATA 0
0409  00614 11100214 A109  BRU  A301
0410  00615 01003400 A111  LAA  ='103400
0411  00616 00170101 A112  AOP  1,W
0412  00617 00000005 A115  TAB
0413  00620 00000031 A118  LCS
0414  00621 01100537 A119  LAA  CNT4
0415  00622 35401423 A121  DAC  ABC
0416  00623 11100077 A125  BRU  A124
0417  00624 11101365 A132  BRU  MOTR
0418  00625 35401365 A133  DAC  MOTR
0419  00626 00000000 A136  DATA 0          WT FOR REC INTR
0420  00627 00000000 A137  DATA 0          REC INTR FAIL
0421  00630 00000000 A142  DATA 0          NO AIP FAULTS
0422  00631 35400104 A147  DAC  A135
0423  00632 00177777 A150  DATA '177777
0424  00633 00046114 A151  DATA '46114
0425  00634 35400043 A161  DAC  STRT
0426  00635 00000000 A165  DATA 0
0427  00636 11100262 A167  BRU  A116
0428  00637 00000000 A181  DATA 0
0429  00640 35400107 A242  DAC  A241
0430  00641 35400024 A244  DAC  A243
0431  00642 00010001 A302  DATA '10001
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0432  00643 01100640 A304 LAA  A242
0433  00644 03100223 A305 STA  RECV
0434  00645 00000000 A511 DATA 0
0435  00646 00000000 SPAC DATA 0
0436  00647 00000317 OFF  DATA '317          TTY OFF
0437  00650 00130214 TEU  TEU  '14
0438  00651 00000001 KEPA BSS  1
0439  00652 00000001 KEPB BSS  1
0440  00653 00000001 SAVB BSS  1
0441  00654 00000001 SAVA BSS  1
0442  00655 00000001 BSAV BSS  1
0443  00656 00000001 ASAV BSS  1
0444  00657 00000000 NEG4 DATA 0
0445  00660 00000000 NEG5 DATA 0
0446  00661 00000000 SPC6 DATA 0
0447  00662 35400272 TTYI DAC  TTYR
0448  00663 00000033 NOP  NOP
0449  00664 00130600 PIE  PIE
0450  00665 00130417 SNS  SNS  '17
0451  00666 00000000 ZERO DATA 0
0452  00667 00144716 INVA DATA ''INVALID KEY''
0452  00670 00153301
0452  00671 00146311
0452  00672 00142240
0452  00673 00145705
0452  00674 00154640
0453  00675 00000120 MEMO BSS  80
0454  01015 00000000 SINK HLT
0455  01016 15100602      CMA  A11
0456  01017 11101021      BRU  *+2
0457  01020 11101022      BRU  *+2
0458  01021 11101025      BRU  *+4
0459  01022 01100513      LAA  S191
0460  01023 03100633      STA  A151
0461  01024 11101166      BRU  OUT
0462  01025 15100603      CMA  A12
0463  01026 11101030      BRU  *+2
0464  01027 11101031      BRU  *+2
0465  01030 11101034      BRU  *+4
0466  01031 01100514      LAA  S192
0467  01032 03100633      STA  A151
0468  01033 11101166      BRU  OUT
0469  01034 15100604      CMA  A13
0470  01035 11101037      BRU  *+2
0471  01036 11101040      BRU  *+2
0472  01037 11101043      BRU  *+4
0473  01040 01100515      LAA  S193
0474  01041 03100633      STA  A151
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0475  01042 11101166      BRU  OUT
0476  01043 15100605      CMA  A14
0477  01044 11101046      BRU  *+2
0478  01045 11101047      BRU  *+2
0479  01046 11101052      BRU  *+4
0480  01047 01100516      LAA  S194
0481  01050 03100633      STA  A151
0482  01051 11101166      BRU  OUT
0483  01052 15100606      CMA  A15
0484  01053 11101055      BRU  *+2
0485  01054 11101056      BRU  *+2
0486  01055 11101061      BRU  *+4
0487  01056 01100517      LAA  S195
0488  01057 03100633      STA  A151
0489  01060 11101166      BRU  OUT
0490  01061 15100607      CMA  A16
0491  01062 11101064      BRU  *+2
0492  01063 11101065      BRU  *+2
0493  01064 11101070      BRU  *+4
0494  01065 01100520      LAA  S196
0495  01066 03100633      STA  A151
0496  01067 11101166      BRU  OUT
0497  01070 15100610      CMA  A17
0498  01071 11101073      BRU  *+2
0499  01072 11101074      BRU  *+2
0500  01073 11101077      BRU  *+4
0501  01074 01100521      LAA  S197
0502  01075 03100633      STA  A151
0503  01076 11101166      BRU  OUT
0504  01077 15100611      CMA  A18
0505  01100 11101102      BRU  *+2
0506  01101 11101103      BRU  *+2
0507  01102 11101106      BRU  *+4
0508  01103 01100522      LAA  S198
0509  01104 03100633      STA  A151
0510  01105 11101166      BRU  OUT
0511  01106 15100612      CMA  A19
0512  01107 11101111      BRU  *+2
0513  01110 11101112      BRU  *+2
0514  01111 11101115      BRU  *+4
0515  01112 01100523      LAA  S199
0516  01113 03100633      STA  A151
0517  01114 11101166      BRU  OUT
0518  01115 15100573      CMA  T
0519  01116 11101120      BRU  *+2
0520  01117 11101121      BRU  *+2
0521  01120 11101124      BRU  *+4
0522  01121 01100531      LAA  S113
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0523  01122 03100633       STA  A151
0524  01123 11101166       BRU  OUT
0525  01124 15100574       CMA  U
0526  01125 11101127       BRU  *+2
0527  01126 11101130       BRU  *+2
0528  01127 11101133       BRU  *+4
0529  01130 01100524       LAA  S167
0530  01131 03100633       STA  A151
0531  01132 11101166       BRU  OUT
0532  01133 15100575       CMA  V
0533  01134 11101136       BRU  *+2
0534  01135 11101137       BRU  *+2
0535  01136 11101142       BRU  *+4
0536  01137 01100525       LAA  S168
0537  01140 03100633       STA  A151
0538  01141 11101166       BRU  OUT
0539  01142 15100576       CMA  W
0540  01143 11101145       BRU  *+2
0541  01144 11101146       BRU  *+2
0542  01145 11101151       BRU  *+4
0543  01146 01100526       LAA  S169
0544  01147 03100633       STA  A151
0545  01150 11101166       BRU  OUT
0546  01151 15100577       CMA  X
0547  01152 11101154       BRU  *+2
0548  01153 11101155       BRU  *+2
0549  01154 11101160       BRU  *+4
0550  01155 01100527       LAA  S342
0551  01156 03100633       STA  A151
0552  01157 11101166       BRU  OUT
0553  01160 15100600       CMA  Y
0554  01161 11101163       BRU  *+2
0555  01162 11101164       BRU  *+2
0556  01163 11100313       BRU  A105
0557  01164 01100530       LAA  S343
0558  01165 03100633       STA  A151
0559  01166 00000033  OUT  NOP
0560  01167 00000033       NOP
0561  01170 00000033       NOP
0562  01171 11301015       BRU* SINK
0563  01172 00000000  CLR  HLT              CLEAR DATA REGISTERS
0564  01173 01100536       LAA  CNT3        ZERO DATA
0565  01174 03100540       STA  CNT5        CLEAR ERRORS
0566  01175 03100541       STA  CNT6        GOOD REPLY
0567  01176 03100542       STA  CNT7        GOOD REPLY
0568  01177 03100554       STA  CNTH        CLR XMISSIONS
0569  01200 03100555       STA  CNTI        CLR XMISSIONS
0570  01201 03100027       STA  MNTH        CLR MONTH
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0571  01202 03100032       STA  DAY          CLR DAY
0572  01203 03100035       STA  HOUR         CLA HOUR
0573  01204 03100040       STA  MISE         CLR MIN/SEC
0574  01205 03100627       STA  A137         RI FAIL
0575  01206 03100551       STA  CNTE         TI FAIL
0576  01207 11301172       BRU* CLR
0577  01210 12101172 A139  SPB  CLR
0578  01211 00000033       NOP
0579  01212 00000033       NOP
0580  01213 11100026       BRU  BEGN
0581  01214 00000000 CRLF  HLT                CARRIAGE RET LINE FEED
0582  01215 00170401       MOP  1
0583  01216 00106400       DATA '106400
0584  01217 11101215       BRU  *-2
0585  01220 00170401       MOP  1
0586  01221 00105000       DATA '105000
0587  01222 11101220       BRU  *-2
0588  01223 11301214       BRU* CRLF
0589  01224 00000000 TTYO  HLT                TYPE DATA
0590  01225 00170001       AOP  1
0591  01226 11101225       BRU  *-1
0592  01227 00001016       LSL  8
0593  01230 00170001       AOP  1
0594  01231 11101230       BRU  *-1
0595  01232 11301224       BRU* TTYO
0596  01233 00000000 TTY   HLT                CONV BINARY TO ASCII
0597  01234 05000260       AMA  ='260
0598  01235 00001016       LSL  8
0599  01236 00170001       AOP  1
0600  01237 11101236       BRU  *-1
0601  01240 00000003       CLA
0602  01241 11301233       BRU* TTY
0603  01242 00000000 SPC   HLT                1 SPACE
0604  01243 00170401       MOP  1
0605  01244 00120000       DATA '120000
0606  01245 11101243       BRU  *-2
0607  01246 00000003       CLA
0608  01247 11301242       BRU* SPC
0609  01250 00000000 FLL   HLT                ARRANGE TYPE CLK DATA
0610  01251 00000413       FLL  4
0611  01252 12101233       SPB  TTY
0612  01253 00000413       FLL  4
0613  01254 12101233       SPB  TTY
0614  01255 12101242       SPB  SPC
0615  01256 11301250       BRU* FLL
0616  01257 00000000 SUB1  HLT                PRINT DATE
0617  01260 12101214       SPB  CRLF
0618  01261 02077776       LBA  =-2
```

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0619  01262 01501641       LAA  DATE+2,1
0620  01263 12101224       SPB  TTYO
0621  01264 00000026       IBS
0622  01265 11101262       BRU  *-3
0623  01266 12101242       SPB  SPC
0624  01267 11301257       BRU* SUB1
0625  01270 00000000 SUB2  HLT                 PRINT MONTHS
0626  01271 00001413       FLL  12
0627  01272 12101233       SPB  TTY
0628  01273 00000413       FLL  4
0629  01274 12101233       SPB  TTY
0630  01275 12101242       SPB  SPC
0631  01276 11301270       BRU* SUB2
0632  01277 00000000 SUB3  HLT                 PRINT DAY-YEAR
0633  01300 12101250       SPB  FLL
0634  01301 02101676       LBA  YEAR
0635  01302 12101250       SPB  FLL
0636  01303 12101214       SPB  CRLF
0637  01304 11301277       BRU* SUB3
0638  01305 00000000 SUB4  HLT                 PRINT TIME
0639  01306 02077776       LBA  =-2
0640  01307 01501643       LAA  TIME+2,1
0641  01310 12101224       SPB  TTYO
0642  01311 00000026       IBS
0643  01312 11101307       BRU  *-3
0644  01313 12101242       SPB  SPC
0645  01314 11301305       BRU* SUB4
0646  01315 00000000 SUB5  HLT                 PRINT HOURS
0647  01316 00001013       FLL  8
0648  01317 00000003       CLA
0649  01320 12101250       SPB  FLL
0650  01321 11301315       BRU* SUB5
0651  01322 00000000 SUB6  HLT                 PRINT MIN.-SEC.
0652  01323 12101250       SPB  FLL
0653  01324 12101250       SPB  FLL
0654  01325 12101214       SPB  CRLF
0655  01326 11301322       BRU* SUB6
0656  01327 00000000 PWRF  HLT                 PWR FAIL SUBROUTINE
0657  01330 03101671       STA  PWR3          SAVE A REG
0658  01331 04101672       STB  PWR4          SAVE B REG
0659  01332 14101673       IMS  PWR5
0660  01333 00000033       NOP
0661  01334 01101674       LAA  PWR6          ADDR PWR UP SUB RUTNE
0662  01335 03301670       STA* PWR2          STORE AT '1000
0663  01336 00000000       HLT
0664  01337 00000000 PWRU  HLT                 PWR UP SUB RUTNE
0665  01340 01101667       LAA  PWR1          ADDR PWR FAIL SUB RUTNE
0666  01341 03301670       STA* PWR2          STORE AT '1000
```

```
0667  01342 01100534       LAA  CNT1          CNTR F/STABALIZE
0668  01343 03100550       STA  CNTD
0669  01344 14100550       IMS  CNTD
0670  01345 11101344       BRU  *-1
0671  01346 01100640       LAA  A242          DAC A241
0672  01347 03101327       STA  PWRF
0673  01350 00000033       NOP
0674  01351 00000033       NOP
0675  01352 00000033       NOP
0676  01353 00130114       CEU  '14,W
0677  01354 00005440       DATA '5440
0678  01355 00130600       PIE
0679  01356 00010001       DATA '10001
0680  01357 00130101       CEU  1,W
0681  01360 00062200       DATA '62200
0682  01361 01101671       LAA  PWR3          RELOAD A REG
0683  01362 02101672       LBA  PWR4          RELOAD B REG
0684  01363 00000035       TOI                TURN OFF INTRUP
0685  01364 11301327       BRU* PWRF
0686                  *     NEXT 20 STATEMENTS CONTROL TTY MOTOR
0687  01365 00130601 MOTR   PID
0688  01366 00010001       DATA '10001
0689  01367 01100666       LAA  ZERO
0690  01370 00000022       SAZ
0691  01371 11101407       BRU  A131
0692  01372 00130001       CEU  1
0693  01373 00001400       DATA '1400         TTY OFF-MODE CLR
0694  01374 11101372       BRU  *-2
0695  01375 01100665       LAA  SNS           SNS17
0696  01376 03100043       STA  STRT
0697  01377 01100624       LAA  A132          BRU MOTR
0698  01400 03100044       STA  STRT+1
0699  01401 01100663       LAA  NOP
0700  01402 03100214       STA  A301
0701  01403 03100215       STA  A301+1
0702  01404 01077777       LAA  =-1
0703  01405 03100666       STA  ZERO
0704  01406 11100025       BRU  BEGN-1
0705  01407 00130001 A131   CEU  1
0706  01410 00000200       DATA '200
0707  01411 11101407       BRU  *-2
0708  01412 01100664       LAA  PIE
0709  01413 03100214       STA  A301
0710  01414 01100642       LAA  A302          '10001
0711  01415 03100215       STA  A301+1
0712  01416 01100663       LAA  NOP
0713  01417 03100043       STA  STRT
0714  01420 03100044       STA  STRT+1
```

```
0715  01421 14100666       IMS  ZERO
0716  01422 00000033       NOP
0717  01423 00130601 ABC   PID
0718  01424 00010001       DATA '10001
0719  01425 00130001       CEU  1
0720  01426 00001000       DATA '1000          MODE CLR
0721  01427 11101425       BRU  *-2
0722  01430 12101214       SPB  CRLF
0723  01431 00130014       CEU  '14
0724  01432 00002000       DATA '2000          TURN CARRIER OFF
0725  01433 11101431       BRU  *-2
0726  01434 01077776       LAA  =-2
0727  01435 03100556       STA  CNTJ
0728  01436 02077772       LBA  =-6
0729  01437 01501631       LAA  STAR+6,1       TEST STARTED
0730  01440 12101224       SPB  TTYO
0731  01441 00000026       IBS
0732  01442 11101437       BRU  *-3
0733                  *  NEXT 58 STATEMENTS FETCH AND PRINT TIME AND
0734                  *  TRANSMISSION DATA
0735  01443 12101257 SUBS  SPB  SUB1           FETCH-PRINT DATA
0736  01444 02100027       LBA  MNTH           FETCH-PRINT MONTH
0737  01445 12101270       SPB  SUB2
0738  01446 02100032       LBA  DAY            FETCH-PRINT DAY-YEAR
0739  01447 12101277       SPB  SUB3
0740  01450 12101305       SPB  SUB4           FETCH-PRINT TIME
0741  01451 02100035       LBA  HOUR           FETCH-PRINT HOUR
0742  01452 12101315       SPB  SUB5
0743  01453 02100040       LBA  MISE           FETCH-PRINT MIN-SEC
0744  01454 12101322       SPB  SUB6
0745  01455 12101214       SPB  CRLF
0746  01456 14100556       IMS  CNTJ           PRINTED TEST STOPPED
0747  01457 11101464       BRU  A306
0748  01460 00130001       CEU  1
0749  01461 00062000       DATA '62000
0750  01462 11101460       BRU  *-2
0751  01463 11101210       BRU  A139
0752  01464 02077754 A306  LBA  =-20
0753  01465 01501667       LAA  HDNG+20,1
0754  01466 12101224       SPB  TTYO
0755  01467 00000026       IBS
0756  01470 11101465       BRU  *-3
0757  01471 12101214       SPB  CRLF
0758  01472 00170401       MOP  1
0759  01473 00120000       DATA '120000
0760  01474 11101472       BRU  *-2
0761  01475 01100554       LAA  CNTH           DBL PREC XMISSIONS
0762  01476 02100555       LBA  CNTI
```

```
0763  01477 10023420          DIV   =10000          STRT CONV BIN TO ASCII
0764  01500 04100555          STB   CNTI
0765  01501 00000005          TAB
0766  01502 12101567          SPB   CONV
0767  01503 02100555          LBA   CNTI
0768  01504 12101606          SPB   CONU
0769  01505 12101545          SPB   SPCS
0770  01506 01100541          LAA   CNT6
0771  01507 02100542          LBA   CNT7             DBL PREC GOOD REPLY
0772  01510 10023420          DIV   =10000          STRT CONV BIN TO ASCII
0773  01511 04100542          STB   CNT7
0774  01512 00000005          TAB
0775  01513 12101567          SPB   CONV
0776  01514 02100542          LBA   CNT7
0777  01515 12101606          SPB   CONU
0778  01516 12101545          SPB   SPCS
0779  01517 02100540          LBA   CNT5             ERRORS
0780  01520 12101567          SPB   CONV
0781  01521 12101214          SPB   CRLF
0782  01522 12101214          SPB   CRLF
0783                    *  NEXT 8 STATEMEBTS FETCH AND PRINT TIME AND
0784                    *  DATE TESTS STOPPED
0785  01523 00170242          AIP   '42
0786  01524 11101523          BRU   *-1
0787  01525 03100027          STA   MNTH
0788  01526 00170241          AIP   '41
0789  01527 11101526          BRU   *-1
0790  01530 03100032          STA   DAY
0791  01531 00170241          AIP   '41
0792  01532 11101531          BRU   *-1
0793  01533 03100035          STA   HOUR
0794  01534 00170240          AIP   '40
0795  01535 11101534          BRU   *-1
0796  01536 03100040          STA   MISE
0797  01537 02077772          LBA   =-6
0798  01540 01501637          LAA   STOP+6,1         TEST STOPPED
0799  01541 12101224          SPB   TTYO
0800  01542 00000026          IBS
0801  01543 11101540          BRU   *-3
0802  01544 11101443          BRU   SUBS
0803  01545 00000000    SPCS  HLT
0804  01546 01077771          LAA   =-7              8 SPACE SUB RUTNE
0805  01547 03100661          STA   SPC6
0806  01550 00170401          MOP   1
0807  01551 00120000          DATA  '120000          SPACE
0808  01552 11101550          BRU   *-2
0809  01553 14100661          IMS   SPC6
0810  01554 11101550          BRU   SPCS+3
```

```
0811  01555 11301545       BRU* SPCS
0812  01556 00000000 SPC4  HLT                  4 SPACES
0813  01557 01077774       LAA  =-4
0814  01560 03100646       STA  SPAC
0815  01561 00170401       MOP  1
0816  01562 00120000       DATA '120000
0817  01563 11101561       BRU  *-2
0818  01564 14100646       IMS  SPAC
0819  01565 11101561       BRU  SPC4+3
0820  01566 11301556       BRU* SPC4
0821  01567 00000000 CONV  HLT                  CONVERT BINARY TO ASCII
0822  01570 01077773       LAA  =-5
0823  01571 03100660       STA  NEG5
0824  01572 00000003       CLA
0825  01573 11101576       BRU  *+3
0826  01574 00000003       CLA
0827  01575 07000012       MPY  =10
0828  01576 10023420       DIV  =10000
0829  01577 05000260       AMA  ='260
0830  01600 00001016       LSL  8
0831  01601 00170001       AOP  1
0832  01602 11101601       BRU  *-1
0833  01603 14100660       IMS  NEG5
0834  01604 11101574       BRU  CONV+5
0835  01605 11301567       BRU* CONV
0836  01606 00000000 CONU  HLT                  CONVERT BIN TO ASCII
0837  01607 01077774       LAA  =-4
0838  01610 03100657       STA  NEG4
0839  01611 00000003       CLA
0840  01612 07000012       MPY  =10
0841  01613 10023420       DIV  =10000
0842  01614 05000260       AMA  ='260
0843  01615 00001016       LSL  8
0844  01616 00170001       AOP  1
0845  01617 11101616       BRU  *-1
0846  01620 14100657       IMS  NEG4
0847  01621 11101611       BRU  CONU+3
0848  01622 11301606       BRU* CONU
0849  01623 00152305 STAR  DATA ''TEST STARTED''
0849  01624 00151724
0849  01625 00120323
0849  01626 00152301
0849  01627 00151324
0849  01630 00142704
0850  01631 00152305 STOP  DATA ''TEST STOPPED''
0850  01632 00151724
0850  01633 00120323
0850  01634 00152317
```

```
0850  01635 00150320
0850  01636 00142704
0851  01637 00142301 DATE DATA ''DATE''
0851  01640 00152305
0852  01641 00152311 TIME DATA ''TIME''
0852  01642 00146705
0853  01643 00152322 HDNG DATA ''TRANSMISSIONS    GOOD REPLY''
0853  01644 00140716
0853  01645 00151715
0853  01646 00144723
0853  01647 00151711
0853  01650 00147716
0853  01651 00151640
0853  01652 00120240
0853  01653 00120307
0853  01654 00147717
0853  01655 00142240
0853  01656 00151305
0853  01657 00150314
0853  01660 00154640
0854  01661 00120240       DATA ''     ERRORS''
0854  01662 00120240
0854  01663 00120305
0854  01664 00151322
0854  01665 00147722
0854  01666 00151640
0855  01667 35401327 PWR1 DAC  PWRF
0856  01670 00001000 PWR2 DATA '1000          PI ADDR
0857  01671 00000001 PWR3 BSS  1              ASAV
0858  01672 00000001 PWR4 BSS  1              BSAV
0859  01673 00000000 PWR5 DATA 0              NO OF PWR FAILURES
0860  01674 35401337 PWR6 DAC  PWRU
0861  01675 00001016 I016 DATA '1016
0862  01676 00073400 YEAR DATA '73400
0863  01677 70400000       END
       A243    00024
       BEGN    00026
       MNTH    00027
       DAY     00032
       HOUR    00035
       MISE    00040
       STRT    00043

       A123    00071
       A124    00077
       A135    00104
       A241    00107
       CARR    00120
       A2      00141
```

PROGRAM DESCRIPTION

IDENTIFICATION: Teletype, I/O Bus, Mainframe Interface and Receive Interrupt Diagnostic

AUTHOR: Carl L. Thompson, Natural Gas Pipeline Company of America, Communications Division

ISSUED: May 16, 1976

PURPOSE: To assist the Communication Technicians with maintenance and repair of the teletype logic, I/O cable continuity, and the modem input interrupt logic. Program utilizes the input and output standard interrupts as well as the special modem receive input interrupt.

COMPUTER: 810A

STORAGE: 375 Octal Locations

LOADING PROCEDURE:

Relocatable Loader, 16K modified
Program counter, Enter '36060
"A" Accumulator, Enter '6000
"B" Accumulator = 0

Insert tape in reader and press start twice

This diagnostic consists of 2 programs

Program A

Start program at '6000

Program will print numbers continuously, 60 per line, until halted. An interrupt is generated for printing each number. After each line is printed the output interrupt is disabled and the teletype motor is turned off for approximately one second before re-initializing to print next line.

To print one character continuously, type the letter L. This will enable the load control switch mode permitting the selection of a character with control switches (0-7).

Example; to print the letter "A", set switches 0, 1, 7, which = '140400. All characters must be left justified as the "A" above for the load control switch mode. (Refer to table on Sheet 4).

To return to the auto mode of printing numbers, press the letter "A" on teletype.

To enable the modem receive interrupt, press the letter "R" on teletype. This function will permit testing the teletype output interrupt and the modem receive input interrupt together. Upon receipt of a valid addressed message, the receive interrupt will ge generated. Since the receive interrupt has priority over the teletype interrupt, the following program change will be initiated.

1. The interrupt logic will initiate a hardware store place and branch through the memory interface cards (8201).

2. Service to the teletype interrupt will be discontinued.

3. The modem receive interrupt will be serviced. Each time the receive interrupt subroutine is serviced, the teletype bell will ring. After completion of the receive interrupt routine the program will branch back to the teletype program location at the address of interruption and continue processing until completed.

The program should never halt until halted manually and there should never be a misprinted character if operating properly.

To disable the receive interrupt press the letter "S".

Program B

Start program at '6500

This program prints a character that is typed from the teletype keyboard.

Both the input and output standard interrupt is generated to print a character. By printing the letter "0" and the number "0" all 16 data bit lines will be utilized on the I/O bus.

Program Modifications Via Teletype Keyboard

TYPE CHARACTER	DESCRIPTION OF PROGRAM CHANGE
A = Auto Mode	Program will type numbers 1-9 continuously, 60 per line, until halted.
L = LCS Mode	Program will print one character continuously. The character must be selected by setting control switches 0-7. See attached list labeled LCS Mode for proper switch setting.
R = Rec. Interrupt	The receive interrupt will be enabled permitting the program to service the standard teletype output interrupt and the special receive input interrupt.
S = Rec. Interrupt	The receive interrupt will be disabled. The program will continue to operate in the "Auto" or "LCS" mode, whichever is selected.

The program will initiate a print-out of "invalid request" if a character is typed other than the 4 characters above.

LCS Mode Control Panel Switch Setting

A = '140400
B = '141000
C = '141400
D = '142000
E = '142400
F = '143000
G = '143400
H = '144000
I = '144400
J = '145000
K = '145400
L = '146000
M = '146400
N = '147000
O = '147400
P = '150000
Q = '150400
R = '151000
S = '151400
T = '152000
U = '152400
V = '153000
W = '153400
X = '154000
Y = '154400
Z = '155000

0 = '130000
1 = '130400
2 = '131000
3 = '131400
4 = '132000
5 = '132400
6 = '133000
7 = '133400
8 = '134000
9 = '134400

Space 120000
Bell 103400
Carriage Return 106400
Line Feed 105000

SAMPLE PRINTOUT OF TELETYPE DIAGNOSTIC

```
12345678912345678912345678912345678912345678912345678912345
12345678912345678912345678912345678912345678912345678912345
12345678912345678912345678912345678912345678912345678912345
12345678912345678912345678912345678912345678912345678912345
12345678912345678912345678912345678912345678912345678912345
1234567891234567891234567891234567891234L
88888888888888888888888888888888888888888888888888888888888
88888888888888888888888888888888888888888888888888888888888
00000000000000000000000000000000000000000000000000000000000
PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP
PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP
PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPB
INVALID REQUEST
PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP
PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPP
PPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPPA
12345678912345678912345678912345678912345678912345678912345
12345678912345678912345678912345678912345678912345678912345
12345678912345678912345678912345678912345678912345678912345
12345678912345678912345678912345678912345678912345678912345
12345678912345678912345678912345678912345678912345678912345
12345678912345678912345678912345678912345678912345678912345
12345678912345678912345678912345678912345678912345678912345
12345678912345678912345678912345678912345678912345678912345
12345678912345678912345678912345678912345678912345678912345
12345678912345678912345678912345678912345678912345678912345
123456789123456R
12345678912345678912345678912345678912345678912345678912345
12345678912345678912345678912345678912345678912345678912345
12345678912345678912345678912345678912345678912345678912345
12345678912345678912345678912345678912345678912345678912345
12345678912345678912345678912345678912345678912345678912345
123456789123456789123456789S
12345678912345678912345678912345678912345678912345678912345
12345678912345678912345678912345678912345678912345678912345
```

```
0001                    ************************************************
0002                    *          TELETYPE PROGRAM
0003                    *          PROGRAM WILL TYPE CONTINUOUSLY UNTIL
0004                    *          HALTED. AN INTERRUPT IS GENERATED
0005                    *          AFTER EACH CHARACTER IS PRINTED. TYPE
0006                    *          LETTER L TO CHANGE PROG TO LCS MODE.
0007                    *          TYPE LETTER A TO RETURN TO AUTO MODE.
0008                    *          TYPE LETTER R TO ENABLE REC INTERRUPT
0009                    *          TYPE LETTER S TO DISABLE REC INTERRUPT
0010                    *          PREPARED BY CARL L THOMPSON 5-15-76
0011                    ************************************************
0012  00000 00000000          REL
0013  00000 01100241          LAA  CNTD
0014  00001 03300257          STA* I017
0015  00002 01100242          LAA  CNTE
0016  00003 03300256          STA* I016
0017  00004 01100252          LAA  RECI
0018  00005 03300253          STA* RECL
0019  00006 00130600          PIE
0020  00007 00010001          DATA '10001
0021  00010 00000033          NOP
0022  00011 00000033          NOP
0023  00012 00000033    STRT  NOP
0024  00013 00000033          NOP                    OR PIE F/REC INTRUP
0025  00014 00000033          NOP                    OR DATA 1 REC INTRUP
0026  00015 00130014          CEU  '14
0027  00016 00001000          DATA '1000
0028  00017 11100015          BRU  *-2
0029  00020 14100236          IMS  CNTA
0030  00021 11100020          BRU  *-1
0031  00022 14100237          IMS  CNTB
0032  00023 11100022          BRU  *-1
0033  00024 00130001          CEU  1
0034  00025 00072200          DATA '72200
0035  00026 11100024          BRU  *-2
0036  00027 12100071          SPB  CRLF
0037  00030 02077705          LBA  =-59
0038  00031 01500353    LA0   LAA  TBLA+59,1
0039  00032 00130600          PIE
0040  00033 00010002          DATA '10002
0041  00034 00000033          NOP
0042  00035 11100034          BRU  *-1
0043  00036 00000000    PRNT  HLT
0044  00037 00130601          PID
0045  00040 00010001          DATA '10001
0046  00041 05000260          AMA  ='260
0047  00042 00001016          LSL  8
```

```
0048  00043 00170001       AOP  1
0049  00044 11100043       BRU  *-1
0050  00045 00000026       IBS
0051  00046 11100062       BRU  LAA
0052  00047 00130601       PID
0053  00050 00000001       DATA 1
0054  00051 00130601       PID
0055  00052 00010002       DATA '10002
0056  00053 01100240       LAA  CNTC          DAC STRT
0057  00054 03100036       STA  PRNT
0058  00055 14100251       IMS  CNTL
0059  00056 11100055       BRU  *-1
0060  00057 00130001       CEU  1
0061  00060 00072400       DATA '72400
0062  00061 11100057       BRU  *-2
0063  00062 01500353 LAA   LAA  TBLA+59,1
0064  00063 00000033       NOP
0065  00064 00000033       NOP
0066  00065 00130600       PIE
0067  00066 00010001       DATA '10001
0068  00067 00000035       TOI
0069  00070 11300036       BRU* PRNT
0070  00071 00000000 CRLF  HLT
0071  00072 00170401       MOP  1
0072  00073 00106400       DATA '106400
0073  00074 11100072       BRU  *-2
0074  00075 00170401       MOP  1
0075  00076 00105000       DATA '105000
0076  00077 11100075       BRU  *-2
0077  00100 11300071       BRU* CRLF
0078  00101 00000000 TYPE  HLT                INPT INTERRUPT ROUTINE
0079  00102 00130601       PID
0080  00103 00010002       DATA '10002
0081  00104 00000033       NOP
0082  00105 00000033       NOP
0083  00106 00130001       CEU  1
0084  00107 00062200       DATA '62200        CON INPT-TTY ON
0085  00110 11100106       BRU  *-2
0086  00111 00170201       AIP  1
0087  00112 11100111       BRU  *-1
0088  00113 00001016       LSL  8
0089  00114 00170001       AOP  1
0090  00115 11100114       BRU  *-1
0091  00116 15046000       CMA  ='146000
0092  00117 11100121       BRU  *+2
0093  00120 11100133       BRU  LCSS
0094  00121 15051000       CMA  ='151000
0095  00122 11100124       BRU  *+2
```

```
0096  00123 11100142       BRU  REC
0097  00124 15051400       CMA  ='151400
0098  00125 11100127       BRU  *+2
0099  00126 11100150       BRU  INHR
0100  00127 15040400       CMA  ='140400
0101  00130 11100132       BRU  *+2
0102  00131 11100156       BRU  AUTO
0103  00132 11100166       BRU  INVL          INVALID REQUEST
0104  00133 01100235 LCSS  LAA  LCS           CHG TO LCS MODE
0105  00134 03100031       STA  LAO
0106  00135 03100062       STA  LAA
0107  00136 01100234       LAA  NOP
0108  00137 03100041       STA  PRNT+3
0109  00140 03100042       STA  PRNT+4
0110  00141 11100174       BRU  TOI
0111  00142 00000033 REC   NOP
0112  00143 01100250       LAA  CNTK          PIE
0113  00144 03100013       STA  STRT+1
0114  00145 01000001       LAA  =1
0115  00146 03100014       STA  STRT+2
0116  00147 11100174       BRU  TOI
0117  00150 00130601 INHR  PID
0118  00151 00000001       DATA 1
0119  00152 01100234       LAA  NOP
0120  00153 03100013       STA  STRT+1
0121  00154 03100014       STA  STRT+2
0122  00155 11100174       BRU  TOI
0123  00156 01100243 AUTO  LAA  CNTF          CHG TO AUTO MODE
0124  00157 03100031       STA  LAO           LAA TBLA+59,1
0125  00160 03100062       STA  LAA
0126  00161 01100244       LAA  CNTG          AMA='260
0127  00162 03100041       STA  PRNT+3
0128  00163 01100245       LAA  CNTH          LSL 8
0129  00164 03100042       STA  PRNT+4
0130  00165 11100174       BRU  TOI
0131  00166 12100071 INVL  SPB  CRLF
0132  00167 02077770       LBA  =-8
0133  00170 01500371       LAA  TBLC+8,1      INVALID REQ
0134  00171 12100227       SPB  TTYO
0135  00172 00000026       IBS
0136  00173 11100170       BRU  *-3
0137  00174 00000033 TOI   NOP
0138  00175 01100240       LAA  CNTC          DAC STRT
0139  00176 03100101       STA  TYPE
0140  00177 00000033       NOP
0141  00200 00000033       NOP
0142  00201 00000033       NOP
0143  00202 00000035       TOI
```

```
0144  00203 11300101       BRU* TYPE
0145  00204 00000000 RECV  HLT
0146  00205 03100254       STA  SAVA
0147  00206 04100255       STB  SAVB
0148  00207 00130101       CEU  1,W
0149  00210 00072200       DATA '72200
0150  00211 00000033       NOP
0151  00212 00000033       NOP
0152  00213 00170214       AIP  '14
0153  00214 00000033       NOP
0154  00215 14100246       IMS  CNTI
0155  00216 00000033       NOP
0156  00217 01003400       LAA  ='103400
0157  00220 00170101       AOP  1,W
0158  00221 01100254       LAA  SAVA
0159  00222 02100255       LBA  SAVB
0160  00223 00000033       NOP
0161  00224 00000033       NOP
0162  00225 00000035       TOI
0163  00226 11300204       BRU* RECV
0164  00227 00000000 TTY0  HLT
0165  00230 00170101       AOP  1,W
0166  00231 00001016       LSL  8
0167  00232 00170101       AOP  1,W
0168  00233 11300227       BRU* TTY0
0169  00234 00000033 NOP   NOP
0170  00235 00000031 LCS   LCS
0171  00236 00000000 CNTA  DATA 0
0172  00237 00000000 CNTB  DATA 0
0173  00240 35400012 CNTC  DAC  STRT
0174  00241 35400036 CNTD  DAC  PRNT
0175  00242 35400101 CNTE  DAC  TYPE
0176  00243 01500353 CNTF  LAA  TBLA+59,1
0177  00244 05000260 CNTG  AMA  ='260
0178  00245 00001016 CNTH  LSL  8
0179  00246 00000000 CNTI  DATA 0
0180  00247 35400010 CNTJ  DAC  STRT-2
0181  00250 00130600 CNTK  PIE
0182  00251 00000000 CNTL  DATA 0
0183  00252 35400204 RECI  DAC  RECV
0184  00253 00001002 RECL  DATA '1002
0185  00254 00000000 SAVA  DATA 0
0186  00255 00000000 SAVB  DATA 0
0187  00256 00001016 I016  DATA '1016
0188  00257 00001017 I017  DATA '1017
0189  00260 00000001 TBLA  DATA 1,2,3,4,5,6,7,8,9,1,2,3,4,5,6,7,8,9
0189  00261 00000002
0189  00262 00000003
```

```
0189  00263 00000004
0189  00264 00000005
0189  00265 00000006
0189  00266 00000007
0189  00267 00000010
0189  00270 00000011
0189  00271 00000001
0189  00272 00000002
0189  00273 00000003
0189  00274 00000004
0189  00275 00000005
0189  00276 00000006
0189  00277 00000007
0189  00300 00000010
0189  00301 00000011
0190  00302 00000001        DATA 1,2,3,4,5,6,7,8,9,1,2,3,4,5,6,7,8,9
0190  00303 00000002
0190  00304 00000003
0190  00305 00000004
0190  00306 00000005
0190  00307 00000006
0190  00310 00000007
0190  00311 00000010
0190  00312 00000011
0190  00313 00000001
0190  00314 00000002
0190  00315 00000003
0190  00316 00000004
0190  00317 00000005
0190  00320 00000006
0190  00321 00000007
0190  00322 00000010
0190  00323 00000011
0191  00324 00000001        DATA 1,2,3,4,5,6,7,8,9,1,2,3,4,5,6,7,8,9
0191  00325 00000002
0191  00326 00000003
0191  00327 00000004
0191  00330 00000005
0191  00331 00000006
0191  00332 00000007
0191  00333 00000010
0191  00334 00000011
0191  00335 00000001
0191  00336 00000002
0191  00337 00000003
0191  00340 00000004
0191  00341 00000005
0191  00342 00000006
```

```
0191   00343 00000007
0191   00344 00000010
0191   00345 00000011
0192   00346 00000001        DATA 1,2,3,4,5,6,7,8,9,1,2
0192   00347 00000002
0192   00350 00000003
0192   00351 00000004
0192   00352 00000005
0192   00353 00000006
0192   00354 00000007
0192   00355 00000010
0192   00356 00000011
0192   00357 00000001
0192   00360 00000002
0193   00361 00144716 TBLC DATA ''INVALID REQUEST''
0193   00362 00153301
0193   00363 00146311
0193   00364 00142240
0193   00365 00151305
0193   00366 00150725
0193   00367 00142723
0193   00370 00152240
0194                  *          PROGRAM WILL INPUT FROM ANY KEY ON THE
0195                  *          TELETYPE KEY BOARD AND PRINT THE
0196                  *          CHARACTER OR NUMBER UTILIZING BOTH
0197                  *          STANDARD INTERRUPTS.
0198   00500 70000500       ORG   '500
0199   00500 01100530       LAA   INPT
0200   00501 03300256       STA*  I016
0201   00502 01100531       LAA   OUPT
0202   00503 03300257       STA*  I017
0203   00504 00130101       CEU   1,W
0204   00505 00072000       DATA  '72000
0205   00506 00130600       PIE                ENABLE INPT INTERRUPT
0206   00507 00010001       DATA  '10001
0207   00510 00000033       NOP                WAIT FOR OUPT INTERRUPT
0208   00511 11100510       BRU   *-1
0209   00512 00000000 TIPE  HLT
0210   00513 00170301       AIP   1,W          TYPE CHARACTER
0211   00514 00001016       LSL   8
0212   00515 00130600       PIE                ENABLE OUPT INTERRUPT
0213   00516 00010002       DATA  '10002
0214   00517 00000035       TOI
0215   00520 11300512       BRU*  TIPE
0216   00521 00000000 PRNN  HLT
0217   00522 00170101       AOP   1,W          PRINT CHARACTER
0218   00523 00001015       RSL   8
0219   00524 00130601       PID                DISABLE OUPT INTERRUPT
```

```
0220   00525 00010002        DATA '10002
0221   00526 00000035        TOI
0222   00527 11300521        BRU* PRNN
0223   00530 35400512 INPT   DAC  TIPE
0224   00531 35400521 OUPT   DAC  PRNN
0225   00532 70400000        END
         STRT     00012
         LAO      00031
         PRNT     00036
         LAA      00062
         CRLF     00071
         TYPE     00101
         LCSS     00133
         REC      00142
         INHR     00150
         AUTO     00156
         INVL     00166
         TOI      00174
         RECV     00204
         TTYO     00227
         NOP      00234
         LCS      00235
         CNTA     00236
         CNTB     00237
         CNTC     00240
         CNTD     00241
         CNTE     00242
         CNTF     00243
         CNTG     00244
         CNTH     00245
         CNTI     00246
         CNTJ     00247
         CNTK     00250
         CNTL     00251
         RECI     00252
         RECL     00253
         SAVA     00254
         SAVB     00255
         IO16     00256
         IO17     00257
         TBLA     00260
         TBLC     00361
         TIPE     00512
         PRNN     00521
         INPT     00530
         OUPT     00531
ERRORS   0000     00000
```

HIGH SPEED READER MODEL 2500
MAINTENANCE AND ADJUSTMENT PROCEDURES

POWER SUPPLY OUTPUT VOLTAGES

+ 15 Volts ± 1.0 Volt
- 15 Volts ± 1.0 Volt
+ 8.6 Volts ± 0.5 Volt
Refer to Figure 2 for checking the 15 Volts.
DC ground is not tied to chassis therefore connect ground 0v on Figure 2 or pin 19 of the test jumper plug.
The 8.6 Volts must be measured at the exciter lamp.
The slide wire adjusting resistor for lamp voltage is located on the right side of the drive motor. Adjust with an accurate meter.

LUBRICATION

Drive Motor - Add 2-3 drops of non detergent oil in front and rear holes semi-annually.

Clean pinch roller and capstan with lint free brush and N-AMYL alcohol.

PHOTO AMPLIFIER ADJUSTMENTS

Neutral Density Filter Method

1a. Remove cable connector 25A from teletype and connect high speed reader jumper plug to the cable.
1b. Remove cover from reader.
1c. Jumper S2, ready/load switch contacts under cover.
1d. Apply AC power to reader.
1e. Check lamp voltage (8.6v) and 15 volts as listed under power supply voltages then replace reader cover.
1f. Cover all nine photo diodes with neutral density filter.
1g. Adjust oscilloscope or DC volt meter for -15 volts, connect ground lead to jumper plug, pin 19 and probe to pin 9, sprocket signal.
1h. Adjust potentiometer R23 of sprocket channel circuit (see Figure 1 for R23) for an output of -15 volts.
1i. Slowly readjust R23 to point where sprocket output goes to 0 volts. Seek this point as accurate as possible.
1j. Repeat steps g, h and i for each data channel output located at pins 20 - 27 (Chan. 1 - 8).
1k. Perform output signal coincidence check, refer to 2l.

DUTY CYCLE METHOD (FULLY PUNCHED CIRCULAR TAPE)

2a. Remove cable connector 25A from teletype and connect high speed reader jumper plug to the cable.
2b. Remove cover from high speed reader.

2c. Apply AC power to reader.
2d. Check lamp voltage (8.6v) and 15 volts as listed under power supply voltages, then replace reader cover.
2e. Insert circular fully punched test tape* in reader. Tape should run when you enable ready load switch.
2f. Connect scope ground lead to jumper plug pin 19 and probe to pin 9, sprocket channel. Adjust scope for one full cycle of signal equal to 10 divisions of oscilloscope scale.
2g. Adjust potentiometer R23, sprocket channel for -15 volts 40% of cycle and zero 0 volts for 60% of cycle. (See Figure 3a.)
2h. Move scope probe to data channel 1, output signal at pin 27 of H.S. reader jumper plug.
2i. Adjust scope for one full cycle of signal equal to 10 divisions of scope scale.
2j. Adjust potentiometer R23 of data channel 1. (See Figure 1) so that signal is -15 volts 70% of cycle and 0 volts for 30% of cycle as displayed in Figure 3b.
2k. Repeat steps h, i and j for the seven remaining data channels on test plug.
2l. Output Signal Coincidence Check
This check verifies that the relative coincidence between the sprocket channel and data channel outputs is within the specified tolerance. Perform this test following any amplifier adjustments.

Connect the B channel of scope to the sprocket channel and move the A channel from data channel 1 through 8, observing the sprocket and data channel waveforms and compare the relative coincidence between the two while the reader is slewing a fully punched tape. See Figure 3c for allowable variations. If unable to meet these tolerances you may not be able to load the station program. Repair or return the reader to Station 106. Use the slow speed teletype reader for loading programs in the computer.

*NOTE: Test tape should be checked with tape gauge for correct hole spacing. If spacing is off, readjust tape punch and punch another tape by pressing Rept key then rub out (in this order). To adjust tape punch (Mod. 33 TTY) remove cover from punch and move spring, attached to on-off assembly, forward or backward on the knotched arm.

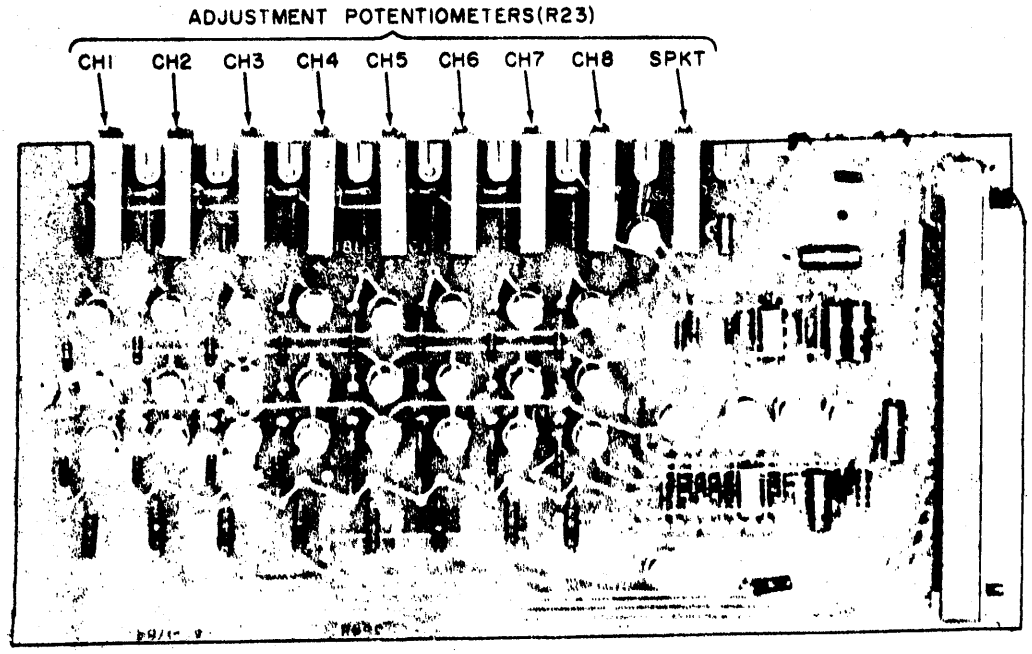


Figure 1. Amplifier Adjustment Locations

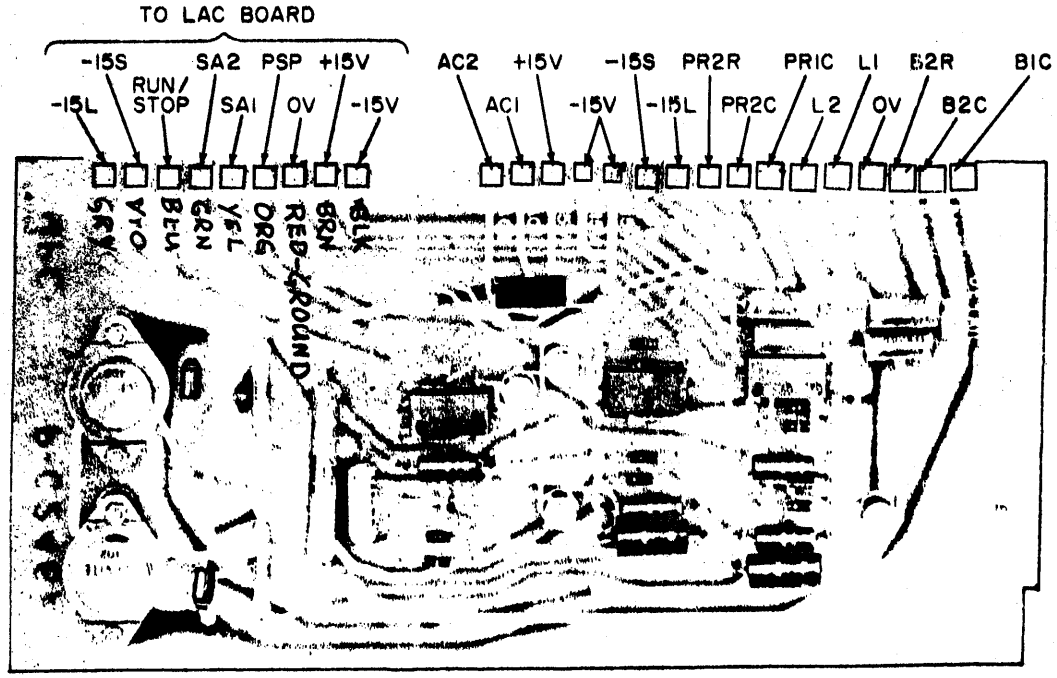


Figure 2. MPC Board Edgeboard Connections

FIGURE 3a.

Adjust the Oscilloscope to trigger on negative slope.
Uncalibrate the "Time Div., Delay Time" in order to display one full cycle on 10 divisions of scope scale.

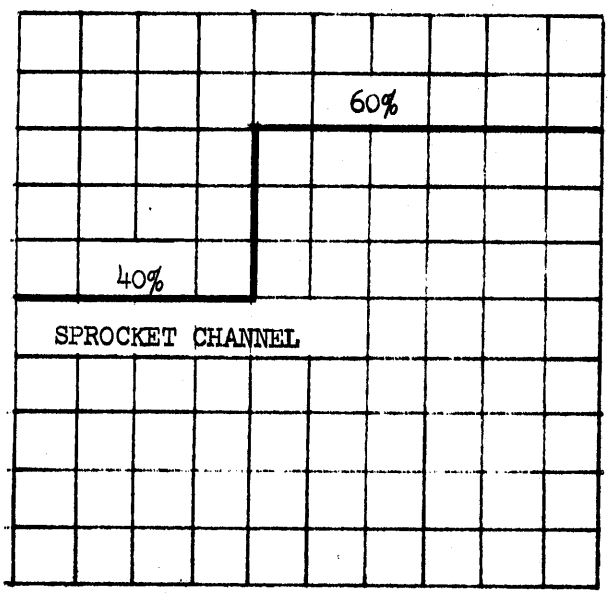


FIGURE 3b.

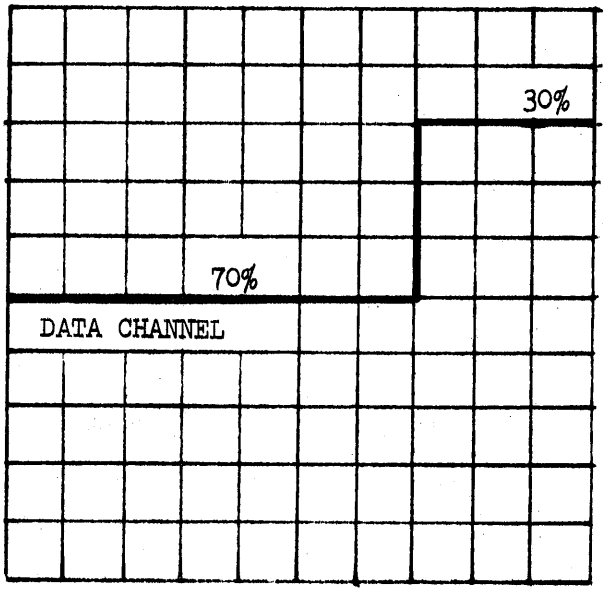
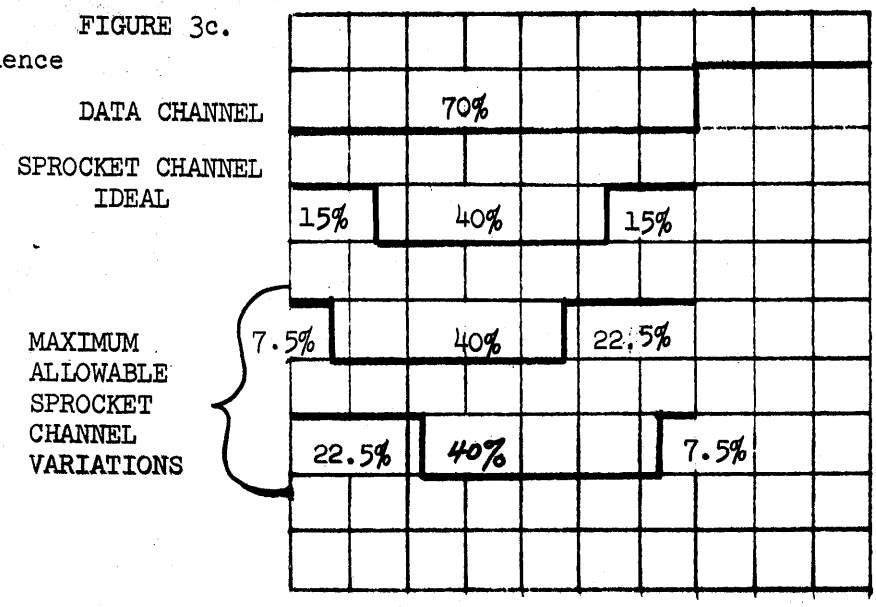


FIGURE 3c.

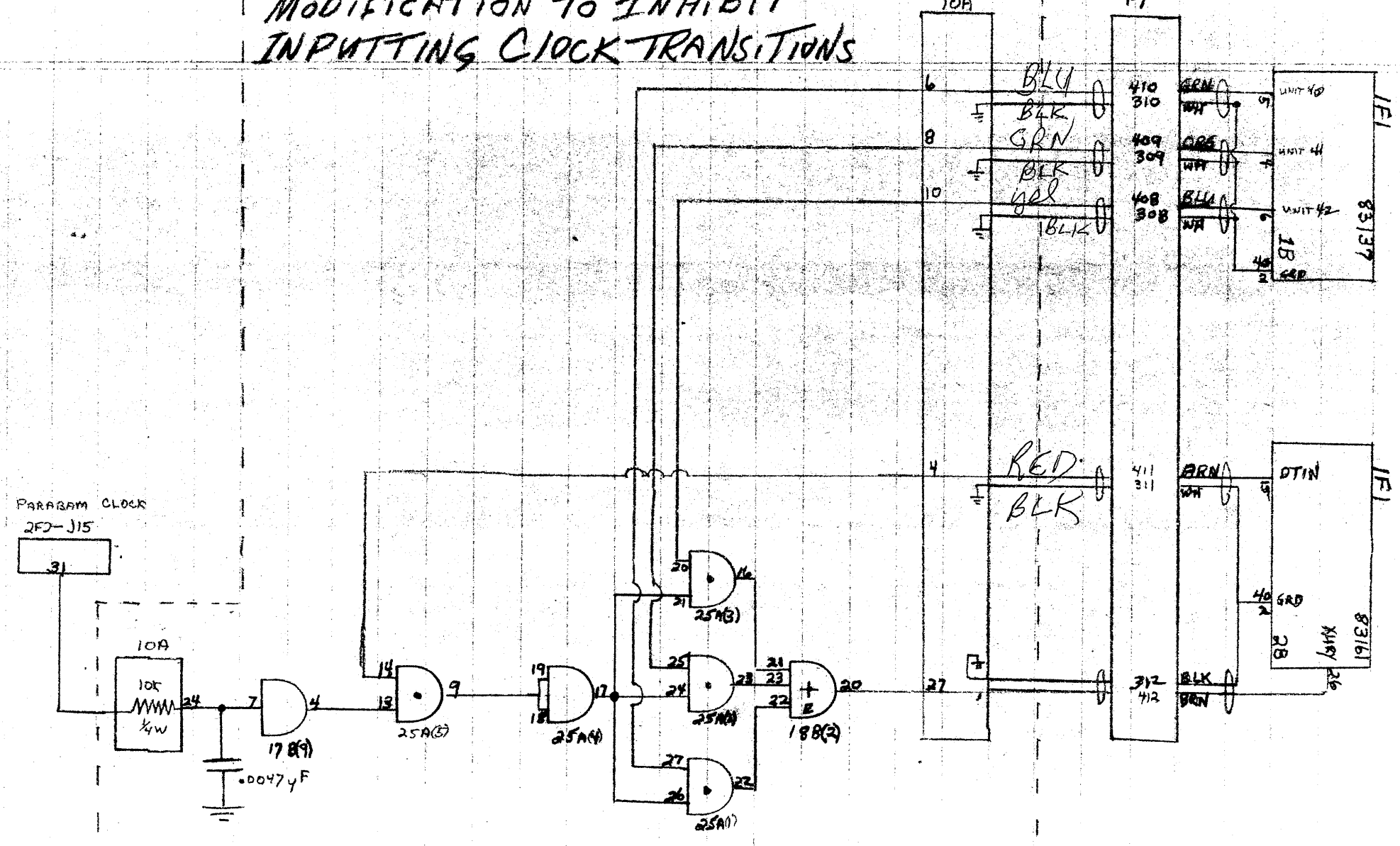
Relative coincidence of sprocket and data channel outputs.



#7 TRANSMISSION
MONITOR

LF2 2K3 1F1 EXM1011 5

MODIFICATION TO INHIBIT INPUTTING CLOCK TRANSITIONS



25A = 8522-1

R.J.K.
R.L.P.
C.L.T.

NGPL 8-13-76

CTT #9

PROGRAM DESCRIPTION

IDENTIFICATION: Input Status Monitor Program

AUTHOR: Carl L. Thompson
Natural Gas Pipeline Company of America
Communications Division

ISSUED: December 15, 1976

PURPOSE: To monitor and identify the status of fifty nine (59) inputs to the computer.

COMPUTER: SEL 810A

STORAGE: 3240 Octal Locations

LOADING PROCEDURE: Relocatable Loader, 16K Modified
Program Counter, Enter '36060
"A" Accumulator, Enter '6000
"B" Accumulator = 0

Insert program tape in reader and press start switch twice.

START PROGRAM AT LOCATION '6000

The program will identify and cause the teletype to print all true input signals associated with channel 46-51. Following the printing of input data, the program will then continuously monitor each true input for a change. If a change occurs, the program will print the channel and bit number that changed. EXAMPLE, "CHANNEL 46-14 INPUT MISSING".

This program will be useful in trouble shooting intermittant computer input signals, but will only check true inputs. For example, unauthorized entry. The program will not check this input unless you initiate the alarm to create a true input to the computer.

Following the initial print out of alarms gently tap and rake your finger across the input relay and logic cable connectors at location 1F2A and 1F1B. If an active input signal connector pin is loose or spread, the program will identify and print the channel and bit number of the signal. Remove card from cabinet and gently close the connector pin with a pair of long nose pliers. Be very careful with the fragile connector pins.

SAMPLE PRINT OUT OF PROGRAM

24 D OPEN	46-14
26 D OPEN	46-12
36 D OPEN	46-10
4-36 D OPEN	46-8
4-36 S OPEN	46-6
24 S OPEN	46-4
26 S OPEN	46-2
36 S OPEN	46-0
4-36 B OPEN	47-14
FUEL NO 2 ON	47-4
RECY VAL CLSE	47-3
DC PWR ON	47-1
SURGE V OPEN	47-0
MODE SELECT 2	50-15
V SHUT DN POS	50-12
INC STR SEQ 2	50-11
IN STRT SEQ 2	50-10
PERMIS STRT 2	50-9
MALF SHT DN 2	50-6
FUEL NO 1 OFF	50-5
MODE SELECT 1	51-15
BLK SIG RETRN	51-14
26 B CLOSED	51-3
36 BLOCK OPEN	51-0

-14 INPT MISSING

```
0001                    * * * * * * * * * * * * * * * * * * * * * * * * *
0002                    *     INPUT SIGNAL MONITOR DIAGNOSTIC             *
0003                    *                                                 *
0004                    *     PROGRAM IDENTIFIES AND PRINTS ALL           *
0005                    *     TRUE INPUT SIGNALS FOR CHANNEL 46-51'       *
0006                    *     THEN MONITORS EACH INPUT FOR A CHANGE.      *
0007                    *     IF A CHANGE OCCURS PROGRAM WILL IDEN-       *
0008                    *     TIFY AND PRINT CHANNEL WITH BIT NO OF       *
0009                    *     INPUT SIGNAL.                               *
0010                    *                                                 *
0011                    *     PREPARED BY CARL L THOMPSON 12-15-76        *
0012                    * * * * * * * * * * * * * * * * * * * * * * * * *
0013  00000 00000000          REL
0014  00000 01077760    BEGN  LAA   =-16
0015  00001 03100226          STA   CT16
0016  00002 00000003          CLA
0017  00003 03500715          STA   BB1,1
0018  00004 03500735          STA   CC1,1
0019  00005 03500755          STA   DD1,1
0020  00006 03501007          STA   EE1,1
0021  00007 00000026          IBS
0022  00010 00000033          NOP
0023  00011 14100226          IMS   CT16
0024  00012 11100003          BRU   *-7
0025  00013 11100162          BRU   C46
0026  00014 00000003    STRT  CLA
0027  00015 03100225          STA   CT15
0028  00016 01077760          LAA   =-16
0029  00017 03100226          STA   CT16          16 BIT CNTR
0030  00020 01000001          LAA   =1
0031  00021 03100224          STA   A2            BIT TST
0032  00022 00170246    AIP   AIP   '46
0033  00023 11100022          BRU   *-1
0034  00024 03100223          STA   A1
0035  00025 01100223    MORE  LAA   A1
0036  00026 02100224          LBA   A2
0037  00027 00000027          ABA
0038  00030 00000022          SAZ                 NO PRNT IF 0
0039  00031 11100046          BRU   B1A
0040  00032 02100225          LBA   CT15          INDEX CNTR
0041  00033 12100065          SPB   TEST          TST F/MISSING INPT
0042  00034 03500715          STA   BB1,1         PRNT NXT CHNG
0043  00035 01100224    HERE  LAA   A2
0044  00036 00000116          LSL   1             CK NXT BIT
0045  00037 03100224          STA   A2
0046  00040 14100225          IMS   CT15
0047  00041 14100226          IMS   CT16
```

```
0048  00042 11100025       BRU   MORE
0049  00043 14100234       IMS   CT4
0050  00044 11100076       BRU   CHNG
0051  00045 11100162       BRU   C46
0052  00046 02100225 B1A    LBA   CT15          INDEX CNTR
0053  00047 01500715       LAA   BB1,1         FLAG F/PRNT
0054  00050 00000022       SAZ                 PRNT IF 0
0055  00051 11100035       BRU   HERE          ARRANGE-TST NXT BIT
0056  00052 14500715       IMS   BB1,1
0057  00053 01500255 THE    LAA   B1,1          ALRM MSGE PRNT OUT
0058  00054 03100057 PRNT   STA   TABL
0059  00055 12100212       SPB   CRLF
0060  00056 02077766       LBA   =-10
0061  00057 01500715 TABL   LAA   TBLA+10,1
0062  00060 12100203       SPB   TTYO
0063  00061 00000026       IBS
0064  00062 11100057       BRU   *-3
0065  00063 12100212       SPB   CRLF
0066  00064 11100035       BRU   HERE          ARRANGE-TST NXT BIT
0067  00065 00000000 TEST   HLT                 TST F/ MISSING INPT
0068  00066 01500715       LAA   BB1,1
0069  00067 00000022       SAZ                 NO PRNT IF 0
0070  00070 11100072       BRU   *+2
0071  00071 11300065       BRU*  TEST
0072  00072 00000003       CLA
0073  00073 03500715 TESS   STA   BB1,1
0074  00074 01500355       LAA   B1B,1         INPT MISSING,PRNT MSGE
0075  00075 11100054       BRU   PRNT
0076  00076 01000001 CHNG   LAA   ='1
0077  00077 05100022       AMA   AIP
0078  00100 03100022       STA   AIP
0079  00101 15070247       CMA   ='170247
0080  00102 11100104       BRU   *+2
0081  00103 11100113       BRU   C47
0082  00104 15070250       CMA   ='170250
0083  00105 11100107       BRU   *+2
0084  00106 11100130       BRU   C50
0085  00107 15070251       CMA   ='170251
0086  00110 00000000       HLT
0087  00111 11100145       BRU   C51
0088  00112 00000000       HLT
0089  00113 01100252 C47    LAA   CCCC
0090  00114 03100074       STA   TESS+1
0091  00115 01100230       LAA   C1A           CH47 DATA
0092  00116 03100053       STA   THE           STA ALRM TO PRNT
0093  00117 01100240       LAA   CCC1          LAA CC1,1
0094  00120 03100047       STA   B1A+1
0095  00121 03100066       STA   TEST+1
```

```
0096  00122 01100241       LAA  CCC2          IMS CC1,1
0097  00123 03100052       STA  B1A+4
0098  00124 01100242       LAA  CCC3          STA CC1,1
0099  00125 03100034       STA  HERE-1
0100  00126 03100073       STA  TESS
0101  00127 11100014       BRU  STRT
0102  00130 01100253 C50   LAA  DDDD
0103  00131 03100074       STA  TESS+1
0104  00132 01100231       LAA  D1A           CH50 DATA
0105  00133 03100053       STA  THE           STA ALRM TO PRNT
0106  00134 01100243       LAA  DDD1          LAA DD1,1
0107  00135 03100047       STA  B1A+1
0108  00136 03100066       STA  TEST+1
0109  00137 01100244       LAA  DDD2          IMS DD1,1
0110  00140 03100052       STA  B1A+4
0111  00141 01100245       LAA  DDD3          STA DD1,1
0112  00142 03100034       STA  HERE-1
0113  00143 03100073       STA  TESS
0114  00144 11100014       BRU  STRT
0115  00145 01100254 C51   LAA  EEEE
0116  00146 03100074       STA  TESS+1
0117  00147 01100232       LAA  E1A           CH51 DATA
0118  00150 03100053       STA  THE           STA ALRM TO PRNT
0119  00151 01100246       LAA  EEE1          LAA EE1,1
0120  00152 03100047       STA  B1A+1
0121  00153 03100066       STA  TEST+1
0122  00154 01100247       LAA  EEE2          IMS EE1,1
0123  00155 03100052       STA  B1A+4
0124  00156 01100250       LAA  EEE3          STA EE1,1
0125  00157 03100034       STA  HERE-1
0126  00160 03100073       STA  TESS
0127  00161 11100014       BRU  STRT
0128  00162 01100251 C46   LAA  BBBB
0129  00163 03100074       STA  TESS+1
0130  00164 01100227       LAA  A1A
0131  00165 03100053       STA  THE           STA ALRM TO PRNT
0132  00166 01100233       LAA  AIP1          CH46
0133  00167 03100022       STA  AIP
0134  00170 01100235       LAA  BBB1          LAA BB1,1
0135  00171 03100047       STA  B1A+1
0136  00172 03100066       STA  TEST+1
0137  00173 01100236       LAA  BBB2          IMS BB1,1
0138  00174 03100052       STA  B1A+4
0139  00175 01100237       LAA  BBB3          STA BB1,1
0140  00176 03100034       STA  HERE-1
0141  00177 03100073       STA  TESS
0142  00200 01077774       LAA  =-4
0143  00201 03100234       STA  CT4
```

```
0144  00202 11100014       BRU   STRT
0145  00203 00000000 TTY0  HLT
0146  00204 00170001       AOP   1
0147  00205 11100204       BRU   *-1
0148  00206 00001016       LSL   8
0149  00207 00170001       AOP   1
0150  00210 11100207       BRU   *-1
0151  00211 11300203       BRU*  TTY0
0152  00212 00000000 CRLF  HLT
0153  00213 00170401       MOP   1
0154  00214 00106400       DATA  '106400
0155  00215 11100213       BRU   *-2
0156  00216 00170401       MOP   1
0157  00217 00105000       DATA  '105000
0158  00220 11100216       BRU   *-2
0159  00221 11300212       BRU*  CRLF
0160  00222 11100255 BRU   BRU   B1
0161  00223 00000000 A1    DATA  0
0162  00224 00000000 A2    DATA  0
0163  00225 00000000 CT15  DATA  0
0164  00226 00000000 CT16  DATA  0
0165  00227 01500255 A1A   LAA   B1,1
0166  00230 01500275 C1A   LAA   C1,1
0167  00231 01500315 D1A   LAA   D1,1
0168  00232 01500335 E1A   LAA   E1,1
0169  00233 00170246 AIP1  AIP   '46
0170  00234 00177774 CT4   DATA  -4
0171  00235 01500715 BBB1  LAA   BB1,1
0172  00236 14500715 BBB2  IMS   BB1,1
0173  00237 03500715 BBB3  STA   BB1,1
0174  00240 01500735 CCC1  LAA   CC1,1
0175  00241 14500735 CCC2  IMS   CC1,1
0176  00242 03500735 CCC3  STA   CC1,1
0177  00243 01500755 DDD1  LAA   DD1,1
0178  00244 14500755 DDD2  IMS   DD1,1
0179  00245 03500755 DDD3  STA   DD1,1
0180  00246 01501007 EEE1  LAA   EE1,1
0181  00247 14501007 EEE2  IMS   EE1,1
0182  00250 03501007 EEE3  STA   EE1,1
0183  00251 01500355 BBBB  LAA   B1B,1
0184  00252 01500375 CCCC  LAA   C1C,1
0185  00253 01500415 DDDD  LAA   D1D,1
0186  00254 01500435 EEEE  LAA   E1E,1
0187  00255 01500715 B1    LAA   TBLA+10,1
0188  00256 01500703 B2    LAA   TBLB+10,1
0189  00257 01500671 B3    LAA   TBLC+10,1
0190  00260 01500657 B4    LAA   TBLD+10,1
0191  00261 01500645 B5    LAA   TBLE+10,1
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0192  00262 01500633 B6    LAA   TBLF+10,1
0193  00263 01500621 B7    LAA   TBLG+10,1
0194  00264 01500607 B8    LAA   TBLH+10,1
0195  00265 01500575 B9    LAA   TBLI+10,1
0196  00266 01500563 B10   LAA   TBLJ+10,1
0197  00267 01500551 B11   LAA   TBLK+10,1
0198  00270 01500537 B12   LAA   TBLL+10,1
0199  00271 01500525 B13   LAA   TBLM+10,1
0200  00272 01500513 B14   LAA   TBLN+10,1
0201  00273 01500501 B15   LAA   TBLO+10,1
0202  00274 01500467       LAA   TBLP+10,1
0203  00275 01501267 C1    LAA   TBA+10,1
0204  00276 01501255 C2    LAA   TBB+10,1
0205  00277 01501243 C3    LAA   TBC+10,1
0206  00300 01501231 C4    LAA   TBD+10,1
0207  00301 01501217 C5    LAA   TBE+10,1
0208  00302 01501205 C6    LAA   TBF+10,1
0209  00303 01501173 C7    LAA   TBG+10,1
0210  00304 01501161 C8    LAA   TBH+10,1
0211  00305 01501147 C9    LAA   TBI+10,1
0212  00306 01501135 C10   LAA   TBJ+10,1
0213  00307 01501123 C11   LAA   TBK+10,1
0214  00310 01501111 C12   LAA   TBL+10,1
0215  00311 01501077 C13   LAA   TBM+10,1
0216  00312 01501065 C14   LAA   TBN+10,1
0217  00313 01501053 C15   LAA   TBO+10,1
0218  00314 01501041       LAA   TBP+10,1
0219  00315 01501527 D1    LAA   TAA+10,1
0220  00316 01501515 D2    LAA   TAB+10,1
0221  00317 01501503 D3    LAA   TAC+10,1
0222  00320 01501471 D4    LAA   TAD+10,1
0223  00321 01501457 D5    LAA   TAE+10,1
0224  00322 01501445 D6    LAA   TAF+10,1
0225  00323 01501433 D7    LAA   TAG+10,1
0226  00324 01501421 D8    LAA   TAH+10,1
0227  00325 01501407 D9    LAA   TAI+10,1
0228  00326 01501375 D10   LAA   TAJ+10,1
0229  00327 01501363 D11   LAA   TAK+10,1
0230  00330 01501351 D12   LAA   TAL+10,1
0231  00331 01501337 D13   LAA   TAM+10,1
0232  00332 01501325 D14   LAA   TAN+10,1
0233  00333 01501313 D15   LAA   TAO+10,1
0234  00334 01501301       LAA   TAP+10,1
0235  00335 01501766 E1    LAA   TA+10,1
0236  00336 01501754 E2    LAA   TB+10,1
0237  00337 01501742 E3    LAA   TC+10,1
0238  00340 01501730 E4    LAA   TD+10,1
0239  00341 01501716 E5    LAA   TE+10,1
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0240   00342 01501704 E6    LAA   TF+10,1
0241   00343 01501672 E7    LAA   TG+10,1
0242   00344 01501660 E8    LAA   TH+10,1
0243   00345 01501647 E9    LAA   TI+10,1
0244   00346 01501635 E10   LAA   TJ+10,1
0245   00347 01501623 E11   LAA   TK+10,1
0246   00350 01501611 E12   LAA   TL+10,1
0247   00351 01501577 E13   LAA   TM+10,1
0248   00352 01501565 E14   LAA   TN+10,1
0249   00353 01501553 E15   LAA   TO+10,1
0250   00354 01501541       LAA   TP+10,1
0251   00355 01502012 B1B   LAA   UBLA+10,1
0252   00356 01502024       LAA   UBLB+10,1
0253   00357 01502036       LAA   UBLC+10,1
0254   00360 01502050       LAA   UBLD+10,1
0255   00361 01502062       LAA   UBLE+10,1
0256   00362 01502074       LAA   UBLF+10,1
0257   00363 01502106       LAA   UBLG+10,1
0258   00364 01502120       LAA   UBLH+10,1
0259   00365 01502132       LAA   UBLI+10,1
0260   00366 01502144       LAA   UBLJ+10,1
0261   00367 01502156       LAA   UBLK+10,1
0262   00370 01502170       LAA   UBLL+10,1
0263   00371 01502202       LAA   UBLM+10,1
0264   00372 01502214       LAA   UBLN+10,1
0265   00373 01502226       LAA   UBLO+10,1
0266   00374 01502240       LAA   UBLP+10,1
0267   00375 01502252 C1C   LAA   UBA+10,1
0268   00376 01502264       LAA   UBB+10,1
0269   00377 01502276       LAA   UBC+10,1
0270   00400 01502310       LAA   UBD+10,1
0271   00401 01502322       LAA   UBE+10,1
0272   00402 01502334       LAA   UBF+10,1
0273   00403 01502346       LAA   UBG+10,1
0274   00404 01502360       LAA   UBH+10,1
0275   00405 01502372       LAA   UBI+10,1
0276   00406 01502404       LAA   UBJ+10,1
0277   00407 01502416       LAA   UBK+10,1
0278   00410 01502430       LAA   UBL+10,1
0279   00411 01502442       LAA   UBM+10,1
0280   00412 01502454       LAA   UBN+10,1
0281   00413 01502466       LAA   UBO+10,1
0282   00414 01502500       LAA   UBP+10,1
0283   00415 01502512 D1D   LAA   UAA+10,1
0284   00416 01502524       LAA   UAB+10,1
0285   00417 01502536       LAA   UAC+10,1
0286   00420 01502550       LAA   UAD+10,1
0287   00421 01502562       LAA   UAE+10,1
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0288  00422 01502574       LAA  UAF+10,1
0289  00423 01502606       LAA  UAG+10,1
0290  00424 01502620       LAA  UAH+10,1
0291  00425 01502632       LAA  UAI+10,1
0292  00426 01502644       LAA  UAJ+10,1
0293  00427 01502656       LAA  UAK+10,1
0294  00430 01502670       LAA  UAL+10,1
0295  00431 01502702       LAA  UAM+10,1
0296  00432 01502714       LAA  UAN+10,1
0297  00433 01502726       LAA  UAO+10,1
0298  00434 01502740       LAA  UAP+10,1
0299  00435 01503012 E1E   LAA  UA+10,1
0300  00436 01503024       LAA  UB+10,1
0301  00437 01503036       LAA  UC+10,1
0302  00440 01503050       LAA  UD+10,1
0303  00441 01503062       LAA  UE+10,1
0304  00442 01503074       LAA  UF+10,1
0305  00443 01503106       LAA  UG+10,1
0306  00444 01503120       LAA  UH+10,1
0307  00445 01503132       LAA  UI+10,1
0308  00446 01503144       LAA  UJ+10,1
0309  00447 01503156       LAA  UK+10,1
0310  00450 01503170       LAA  UL+10,1
0311  00451 01503202       LAA  UM+10,1
0312  00452 01503214       LAA  UN+10,1
0313  00453 01503226       LAA  UO+10,1
0314  00454 01503240       LAA  UP+10,1
0315  00455 00131666 TBLP  DATA ''36 S OPEN     46-0 ''
0315  00456 00120323
0315  00457 00120317
0315  00460 00150305
0315  00461 00147240
0315  00462 00120240
0315  00463 00120240
0315  00464 00132266
0315  00465 00126660
0315  00466 00120240
0316  00467 00131666 TBLO  DATA ''36 S CLOSED   46-1 ''
0316  00470 00120323
0316  00471 00120303
0316  00472 00146317
0316  00473 00151705
0316  00474 00142240
0316  00475 00120240
0316  00476 00132266
0316  00477 00126661
0316  00500 00120240
0317  00501 00131266 TBLN  DATA ''26 S OPEN     46-2 ''
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0317  00502 00120323
0317  00503 00120317
0317  00504 00150305
0317  00505 00147240
0317  00506 00120240
0317  00507 00120240
0317  00510 00132266
0317  00511 00126662
0317  00512 00120240
0318  00513 00131266 TBLM DATA ''26 S CLOSED   46-3 ''
0318  00514 00120323
0318  00515 00120303
0318  00516 00146317
0318  00517 00151705
0318  00520 00142240
0318  00521 00120240
0318  00522 00132266
0318  00523 00126663
0318  00524 00120240
0319  00525 00131264 TBLL DATA ''24 S OPEN     46-4 ''
0319  00526 00120323
0319  00527 00120317
0319  00530 00150305
0319  00531 00147240
0319  00532 00120240
0319  00533 00120240
0319  00534 00132266
0319  00535 00126664
0319  00536 00120240
0320  00537 00131264 TBLK DATA ''24 S CLOSED   46-5 ''
0320  00540 00120323
0320  00541 00120303
0320  00542 00146317
0320  00543 00151705
0320  00544 00142240
0320  00545 00120240
0320  00546 00132266
0320  00547 00126665
0320  00550 00120240
0321  00551 00132255 TBLJ DATA ''4-36 S OPEN   46-6 ''
0321  00552 00131666
0321  00553 00120323
0321  00554 00120317
0321  00555 00150305
0321  00556 00147240
0321  00557 00120240
0321  00560 00132266
0321  00561 00126666
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0321  00562 00120240
0322  00563 00132255 TBLI  DATA ''4-36 S CLOSED 46-7 ''
0322  00564 00131666
0322  00565 00120323
0322  00566 00120303
0322  00567 00146317
0322  00570 00151705
0322  00571 00142240
0322  00572 00132266
0322  00573 00126667
0322  00574 00120240
0323  00575 00132255 TBLH  DATA ''4-36 D OPEN   46-8 ''
0323  00576 00131666
0323  00577 00120304
0323  00600 00120317
0323  00601 00150305
0323  00602 00147240
0323  00603 00120240
0323  00604 00132266
0323  00605 00126670
0323  00606 00120240
0324  00607 00132255 TBLG  DATA ''4-36 D CLOSED 46-9 ''
0324  00610 00131666
0324  00611 00120304
0324  00612 00120303
0324  00613 00146317
0324  00614 00151705
0324  00615 00142240
0324  00616 00132266
0324  00617 00126671
0324  00620 00120240
0325  00621 00131666 TBLF  DATA ''36 D OPEN     46-10''
0325  00622 00120304
0325  00623 00120317
0325  00624 00150305
0325  00625 00147240
0325  00626 00120240
0325  00627 00120240
0325  00630 00132266
0325  00631 00126661
0325  00632 00130240
0326  00633 00131666 TBLE  DATA ''36 D CLOSED   46-11''
0326  00634 00120304
0326  00635 00120303
0326  00636 00146317
0326  00637 00151705
0326  00640 00142240
0326  00641 00120240
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0326  00642 00132266
0326  00643 00126661
0326  00644 00130640
0327  00645 00131266 TBLD DATA ''26 D OPEN     46-12''
0327  00646 00120304
0327  00647 00120317
0327  00650 00150305
0327  00651 00147240
0327  00652 00120240
0327  00653 00120240
0327  00654 00132266
0327  00655 00126661
0327  00656 00131240
0328  00657 00131266 TBLC DATA ''26 D CLOSED   46-13''
0328  00660 00120304
0328  00661 00120303
0328  00662 00146317
0328  00663 00151705
0328  00664 00142240
0328  00665 00120240
0328  00666 00132266
0328  00667 00126661
0328  00670 00131640
0329  00671 00131264 TBLB DATA ''24 D OPEN     46-14''
0329  00672 00120304
0329  00673 00120317
0329  00674 00150305
0329  00675 00147240
0329  00676 00120240
0329  00677 00120240
0329  00700 00132266
0329  00701 00126661
0329  00702 00132240
0330  00703 00131264 TBLA DATA ''24 D CLOSED   46-15''
0330  00704 00120304
0330  00705 00120303
0330  00706 00146317
0330  00707 00151705
0330  00710 00142240
0330  00711 00120240
0330  00712 00132266
0330  00713 00126661
0330  00714 00132640
0331  00715 00000020 BB1   BSS  16
0332  00735 00000020 CC1   BSS  16
0333  00755 00000020 DD1   BSS  16
0334  00775 00000012 DATA  BSS  10
0335  01007 00000020 EE1   BSS  16
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0336  01027 00151725 TBP   DATA ''SURGE V OPEN  47-0 ''
0336  01030 00151307
0336  01031 00142640
0336  01032 00153240
0336  01033 00147720
0336  01034 00142716
0336  01035 00120240
0336  01036 00132267
0336  01037 00126660
0336  01040 00120240
0337  01041 00142303 TBO   DATA ''DC PWR ON     47-1 ''
0337  01042 00120320
0337  01043 00153722
0337  01044 00120317
0337  01045 00147240
0337  01046 00120240
0337  01047 00120240
0337  01050 00132267
0337  01051 00126661
0337  01052 00120240
0338  01053 00151305 TBN   DATA ''RECY VAL OPEN 47-2 ''
0338  01054 00141731
0338  01055 00120326
0338  01056 00140714
0338  01057 00120317
0338  01060 00150305
0338  01061 00147240
0338  01062 00132267
0338  01063 00126662
0338  01064 00120240
0339  01065 00151305 TBM   DATA ''RECY VAL CLSE 47-3 ''
0339  01066 00141731
0339  01067 00120326
0339  01070 00140714
0339  01071 00120303
0339  01072 00146323
0339  01073 00142640
0339  01074 00132267
0339  01075 00126663
0339  01076 00120240
0340  01077 00143325 TBL   DATA ''FUEL NO 2 ON  47-4 ''
0340  01100 00142714
0340  01101 00120316
0340  01102 00147640
0340  01103 00131240
0340  01104 00147716
0340  01105 00120240
0340  01106 00132267
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0340  01107 00126664
0340  01110 00120240
0341  01111 00143325 TBK   DATA ''FUEL NO 2 OFF 47-5 ''
0341  01112 00142714
0341  01113 00120316
0341  01114 00147640
0341  01115 00131240
0341  01116 00147706
0341  01117 00143240
0341  01120 00132267
0341  01121 00126665
0341  01122 00120240
0342  01123 00141317 TBJ   DATA ''BOILER ALARM  47-6 ''
0342  01124 00144714
0342  01125 00142722
0342  01126 00120301
0342  01127 00146301
0342  01130 00151315
0342  01131 00120240
0342  01132 00132267
0342  01133 00126666
0342  01134 00120240
0343  01135 00144311 TBI   DATA ''HI D GAS PRES 47-7 ''
0343  01136 00120304
0343  01137 00120307
0343  01140 00140723
0343  01141 00120320
0343  01142 00151305
0343  01143 00151640
0343  01144 00132267
0343  01145 00126667
0343  01146 00120240
0344  01147 00144716 TBH   DATA ''INVALID       47-8 ''
0344  01150 00153301
0344  01151 00146311
0344  01152 00142240
0344  01153 00120240
0344  01154 00120240
0344  01155 00120240
0344  01156 00132267
0344  01157 00126670
0344  01160 00120240
0345  01161 00144716 TBG   DATA ''INVALID       47-9 ''
0345  01162 00153301
0345  01163 00146311
0345  01164 00142240
0345  01165 00120240
0345  01166 00120240
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0345  01167 00120240
0345  01170 00132267
0345  01171 00126671
0345  01172 00120240
0346  01173 00144716 TBF   DATA ''INVALID       47-10''
0346  01174 00153301
0346  01175 00146311
0346  01176 00142240
0346  01177 00120240
0346  01200 00120240
0346  01201 00120240
0346  01202 00132267
0346  01203 00126661
0346  01204 00130240
0347  01205 00144716 TBE   DATA ''INVALID       47-11''
0347  01206 00153301
0347  01207 00146311
0347  01210 00142240
0347  01211 00120240
0347  01212 00120240
0347  01213 00120240
0347  01214 00132267
0347  01215 00126661
0347  01216 00130640
0348  01217 00146317 TBD   DATA ''LO STROKE GAS 47-12''
0348  01220 00120323
0348  01221 00152322
0348  01222 00147713
0348  01223 00142640
0348  01224 00143701
0348  01225 00151640
0348  01226 00132267
0348  01227 00126661
0348  01230 00131240
0349  01231 00146317 TBC   DATA ''LO CONTR GAS  47-13''
0349  01232 00120303
0349  01233 00147716
0349  01234 00152322
0349  01235 00120307
0349  01236 00140723
0349  01237 00120240
0349  01240 00132267
0349  01241 00126661
0349  01242 00131640
0350  01243 00132255 TBB   DATA ''4-36 B OPEN   47-14''
0350  01244 00131666
0350  01245 00120302
0350  01246 00120317
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0350  01247 00150305
0350  01250 00147240
0350  01251 00120240
0350  01252 00132267
0350  01253 00126661
0350  01254 00132240
0351  01255 00132255 TBA   DATA ''4-36 B CLOSED 47-15''
0351  01256 00131666
0351  01257 00120302
0351  01260 00120303
0351  01261 00146317
0351  01262 00151705
0351  01263 00142240
0351  01264 00132267
0351  01265 00126661
0351  01266 00132640
0352  01267 00141325 TAP   DATA ''BURGLAR ALARM 50-0 ''
0352  01270 00151307
0352  01271 00146301
0352  01272 00151240
0352  01273 00140714
0352  01274 00140722
0352  01275 00146640
0352  01276 00132660
0352  01277 00126660
0352  01300 00120240
0353  01301 00143311 TAO   DATA ''FIRE MAIN BLD 50-1 ''
0353  01302 00151305
0353  01303 00120315
0353  01304 00140711
0353  01305 00147240
0353  01306 00141314
0353  01307 00142240
0353  01310 00132660
0353  01311 00126661
0353  01312 00120240
0354  01313 00143701 TAN   DATA ''GAS DETECTION 50-2 ''
0354  01314 00151640
0354  01315 00142305
0354  01316 00152305
0354  01317 00141724
0354  01320 00144717
0354  01321 00147240
0354  01322 00132660
0354  01323 00126662
0354  01324 00120240
0355  01325 00144716 TAM   DATA ''INVALID       50-3 ''
0355  01326 00153301
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0355  01327 00146311
0355  01330 00142240
0355  01331 00120240
0355  01332 00120240
0355  01333 00120240
0355  01334 00132660
0355  01335 00126663
0355  01336 00120240
0356  01337 00143325 TAL   DATA ''FUEL NO 1 ON  50-4 ''
0356  01340 00142714
0356  01341 00120316
0356  01342 00147640
0356  01343 00130640
0356  01344 00147716
0356  01345 00120240
0356  01346 00132660
0356  01347 00126664
0356  01350 00120240
0357  01351 00143325 TAK   DATA ''FUEL NO 1 OFF 50-5 ''
0357  01352 00142714
0357  01353 00120316
0357  01354 00147640
0357  01355 00130640
0357  01356 00147706
0357  01357 00143240
0357  01360 00132660
0357  01361 00126665
0357  01362 00120240
0358  01363 00146701 TAJ   DATA ''MALF SHT DN 2 50-6 ''
0358  01364 00146306
0358  01365 00120323
0358  01366 00144324
0358  01367 00120304
0358  01370 00147240
0358  01371 00131240
0358  01372 00132660
0358  01373 00126666
0358  01374 00120240
0359  01375 00146701 TAI   DATA ''MALF WARN   2 50-7 ''
0359  01376 00146306
0359  01377 00120327
0359  01400 00140722
0359  01401 00147240
0359  01402 00120240
0359  01403 00131240
0359  01404 00132660
0359  01405 00126667
0359  01406 00120240
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0360  01407 00147317 TAH  DATA ''NO 2 LOADED   50-8 ''
0360  01410 00120262
0360  01411 00120314
0360  01412 00147701
0360  01413 00142305
0360  01414 00142240
0360  01415 00120240
0360  01416 00132660
0360  01417 00126670
0360  01420 00120240
0361  01421 00150305 TAG  DATA ''PERMIS STRT 2 50-9 ''
0361  01422 00151315
0361  01423 00144723
0361  01424 00120323
0361  01425 00152322
0361  01426 00152240
0361  01427 00131240
0361  01430 00132660
0361  01431 00126671
0361  01432 00120240
0362  01433 00144716 TAF  DATA ''IN STRT SEQ 2 50-10''
0362  01434 00120323
0362  01435 00152322
0362  01436 00152240
0362  01437 00151705
0362  01440 00150640
0362  01441 00131240
0362  01442 00132660
0362  01443 00126661
0362  01444 00130240
0363  01445 00144716 TAE  DATA ''INC STR SEQ 2 50-11''
0363  01446 00141640
0363  01447 00151724
0363  01450 00151240
0363  01451 00151705
0363  01452 00150640
0363  01453 00131240
0363  01454 00132660
0363  01455 00126661
0363  01456 00130640
0364  01457 00153240 TAD  DATA ''V SHUT DN POS 50-12''
0364  01460 00151710
0364  01461 00152724
0364  01462 00120304
0364  01463 00147240
0364  01464 00150317
0364  01465 00151640
0364  01466 00132660
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0364  01467 00126661
0364  01470 00131240
0365  01471 00143311 TAC   DATA ''FIRE AUX BLDG 50-13''
0365  01472 00151305
0365  01473 00120301
0365  01474 00152730
0365  01475 00120302
0365  01476 00146304
0365  01477 00143640
0365  01500 00132660
0365  01501 00126661
0365  01502 00131640
0366  01503 00151724 TAB   DATA ''ST PAN C MODE 50-14''
0366  01504 00120320
0366  01505 00140716
0366  01506 00120303
0366  01507 00120315
0366  01510 00147704
0366  01511 00142640
0366  01512 00132660
0366  01513 00126661
0366  01514 00132240
0367  01515 00146717 TAA   DATA ''MODE SELECT 2 50-15''
0367  01516 00142305
0367  01517 00120323
0367  01520 00142714
0367  01521 00142703
0367  01522 00152240
0367  01523 00131240
0367  01524 00132660
0367  01525 00126661
0367  01526 00132640
0368  01527 00131666 TP    DATA ''36 BLOCK OPEN 51-0 ''
0368  01530 00120302
0368  01531 00146317
0368  01532 00141713
0368  01533 00120317
0368  01534 00150305
0368  01535 00147240
0368  01536 00132661
0368  01537 00126660
0368  01540 00120240
0369  01541 00131666 TO    DATA ''36 B CLOSED   51-1 ''
0369  01542 00120302
0369  01543 00120303
0369  01544 00146317
0369  01545 00151705
0369  01546 00142240
```

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0369  01547 00120240
0369  01550 00132661
0369  01551 00126661
0369  01552 00120240
0370  01553 00131266 TN    DATA ''26 BLOCK OPEN 51-2 ''
0370  01554 00120302
0370  01555 00146317
0370  01556 00141713
0370  01557 00120317
0370  01560 00150305
0370  01561 00147240
0370  01562 00132661
0370  01563 00126662
0370  01564 00120240
0371  01565 00131266 TM    DATA ''26 B CLOSED   51-3 ''
0371  01566 00120302
0371  01567 00120303
0371  01570 00146317
0371  01571 00151705
0371  01572 00142240
0371  01573 00120240
0371  01574 00132661
0371  01575 00126663
0371  01576 00120240
0372  01577 00131264 TL    DATA ''24 BLOCK OPEN 51-4 ''
0372  01600 00120302
0372  01601 00146317
0372  01602 00141713
0372  01603 00120317
0372  01604 00150305
0372  01605 00147240
0372  01606 00132661
0372  01607 00126664
0372  01610 00120240
0373  01611 00131264 TK    DATA ''24 B CLOSED   51-5 ''
0373  01612 00120302
0373  01613 00120303
0373  01614 00146317
0373  01615 00151705
0373  01616 00142240
0373  01617 00120240
0373  01620 00132661
0373  01621 00126665
0373  01622 00120240
0374  01623 00146701 TJ    DATA ''MALF SHT DN 1 51-6 ''
0374  01624 00146306
0374  01625 00120323
0374  01626 00144324
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0374  01627 00120304
0374  01630 00147240
0374  01631 00130640
0374  01632 00132661
0374  01633 00126666
0374  01634 00120240
0375  01635 00146701 TI    DATA ''MALF WARN  1 51-7 ''
0375  01636 00146306
0375  01637 00120327
0375  01640 00140722
0375  01641 00147240
0375  01642 00120261
0375  01643 00120265
0375  01644 00130655
0375  01645 00133640
0376  01646 00147317 TH    DATA ''NO 1 LOADED   51-8 ''
0376  01647 00120261
0376  01650 00120314
0376  01651 00147701
0376  01652 00142305
0376  01653 00142240
0376  01654 00120240
0376  01655 00132661
0376  01656 00126670
0376  01657 00120240
0377  01660 00150305 TG    DATA ''PERMIS STRT 1 51-9 ''
0377  01661 00151315
0377  01662 00144723
0377  01663 00120323
0377  01664 00152322
0377  01665 00152240
0377  01666 00130640
0377  01667 00132661
0377  01670 00126671
0377  01671 00120240
0378  01672 00144716 TF    DATA ''IN STRT SEQ 1 51-10''
0378  01673 00120323
0378  01674 00152322
0378  01675 00152240
0378  01676 00151705
0378  01677 00150640
0378  01700 00130640
0378  01701 00132661
0378  01702 00126661
0378  01703 00130240
0379  01704 00144716 TE    DATA ''INC STR SEQ 1 51-11''
0379  01705 00141640
0379  01706 00151724
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0379  01707 00151240
0379  01710 00151705
0379  01711 00150640
0379  01712 00130640
0379  01713 00132661
0379  01714 00126661
0379  01715 00130640
0380  01716 00153240 TD    DATA ''V SHUT DN POS 51-12''
0380  01717 00151710
0380  01720 00152724
0380  01721 00120304
0380  01722 00147240
0380  01723 00150317
0380  01724 00151640
0380  01725 00132661
0380  01726 00126661
0380  01727 00131240
0381  01730 00151724 TC    DATA ''STA BLOW DN   51-13''
0381  01731 00140640
0381  01732 00141314
0381  01733 00147727
0381  01734 00120304
0381  01735 00147240
0381  01736 00120240
0381  01737 00132661
0381  01740 00126661
0381  01741 00131640
0382  01742 00141314 TB    DATA ''BLK SIG RETRN 51-14''
0382  01743 00145640
0382  01744 00151711
0382  01745 00143640
0382  01746 00151305
0382  01747 00152322
0382  01750 00147240
0382  01751 00132661
0382  01752 00126661
0382  01753 00132240
0383  01754 00146717 TA    DATA ''MODE SELECT 1 51-15''
0383  01755 00142305
0383  01756 00120323
0383  01757 00142714
0383  01760 00142703
0383  01761 00152240
0383  01762 00130640
0383  01763 00132661
0383  01764 00126661
0383  01765 00132640
0384  01766 00000012 DOTA BSS  10
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0385  02000 00141710 UBLA DATA ''CH46-15 INPT MISSING''
0385  02001 00132266
0385  02002 00126661
0385  02003 00132640
0385  02004 00144716
0385  02005 00150324
0385  02006 00120315
0385  02007 00144723
0385  02010 00151711
0385  02011 00147307
0386  02012 00141710 UBLB DATA ''CH46-14 INPT MISSING''
0386  02013 00132266
0386  02014 00126661
0386  02015 00132240
0386  02016 00144716
0386  02017 00150324
0386  02020 00120315
0386  02021 00144723
0386  02022 00151711
0386  02023 00147307
0387  02024 00141710 UBLC DATA ''CH46-13 INPT MISSING''
0387  02025 00132266
0387  02026 00126661
0387  02027 00131640
0387  02030 00144716
0387  02031 00150324
0387  02032 00120315
0387  02033 00144723
0387  02034 00151711
0387  02035 00147307
0388  02036 00141710 UBLD DATA ''CH46-12 INPT MISSING''
0388  02037 00132266
0388  02040 00126661
0388  02041 00131240
0388  02042 00144716
0388  02043 00150324
0388  02044 00120315
0388  02045 00144723
0388  02046 00151711
0388  02047 00147307
0389  02050 00141710 UBLE DATA ''CH46-11 INPT MISSING''
0389  02051 00132266
0389  02052 00126661
0389  02053 00130640
0389  02054 00144716
0389  02055 00150324
0389  02056 00120315
0389  02057 00144723
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0389  02060 00151711
0389  02061 00147307
0390  02062 00141710 UBLF DATA ''CH46-10 INPT MISSING''
0390  02063 00132266
0390  02064 00126661
0390  02065 00130240
0390  02066 00144716
0390  02067 00150324
0390  02070 00120315
0390  02071 00144723
0390  02072 00151711
0390  02073 00147307
0391  02074 00141710 UBLG DATA ''CH46-9  INPT MISSING''
0391  02075 00132266
0391  02076 00126671
0391  02077 00120240
0391  02100 00144716
0391  02101 00150324
0391  02102 00120315
0391  02103 00144723
0391  02104 00151711
0391  02105 00147307
0392  02106 00141710 UBLH DATA ''CH46-8  INPT MISSING''
0392  02107 00132266
0392  02110 00126670
0392  02111 00120240
0392  02112 00144716
0392  02113 00150324
0392  02114 00120315
0392  02115 00144723
0392  02116 00151711
0392  02117 00147307
0393  02120 00141710 UBLI DATA ''CH46-7  INPT MISSING''
0393  02121 00132266
0393  02122 00126667
0393  02123 00120240
0393  02124 00144716
0393  02125 00150324
0393  02126 00120315
0393  02127 00144723
0393  02130 00151711
0393  02131 00147307
0394  02132 00141710 UBLJ DATA ''CH46-6  INPT MISSING''
0394  02133 00132266
0394  02134 00126666
0394  02135 00120240
0394  02136 00144716
0394  02137 00150324
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0394  02140 00120315
0394  02141 00144723
0394  02142 00151711
0394  02143 00147307
0395  02144 00141710 UBLK DATA ''CH46-5  INPT MISSING''
0395  02145 00132266
0395  02146 00126665
0395  02147 00120240
0395  02150 00144716
0395  02151 00150324
0395  02152 00120315
0395  02153 00144723
0395  02154 00151711
0395  02155 00147307
0396  02156 00141710 UBLL DATA ''CH46-4  INPT MISSING''
0396  02157 00132266
0396  02160 00126664
0396  02161 00120240
0396  02162 00144716
0396  02163 00150324
0396  02164 00120315
0396  02165 00144723
0396  02166 00151711
0396  02167 00147307
0397  02170 00141710 UBLM DATA ''CH46-3  INPT MISSING''
0397  02171 00132266
0397  02172 00126663
0397  02173 00120240
0397  02174 00144716
0397  02175 00150324
0397  02176 00120315
0397  02177 00144723
0397  02200 00151711
0397  02201 00147307
0398  02202 00141710 UBLN DATA ''CH46-2  INPT MISSING''
0398  02203 00132266
0398  02204 00126662
0398  02205 00120240
0398  02206 00144716
0398  02207 00150324
0398  02210 00120315
0398  02211 00144723
0398  02212 00151711
0398  02213 00147307
0399  02214 00141710 UBL0 DATA ''CH46-1  INPT MISSING''
0399  02215 00132266
0399  02216 00126661
0399  02217 00120240
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0399  02220 00144716
0399  02221 00150324
0399  02222 00120315
0399  02223 00144723
0399  02224 00151711
0399  02225 00147307
0400  02226 00141710 UBLP DATA ''CH46-0  INPT MISSING''
0400  02227 00132266
0400  02230 00126660
0400  02231 00120240
0400  02232 00144716
0400  02233 00150324
0400  02234 00120315
0400  02235 00144723
0400  02236 00151711
0400  02237 00147307
0401  02240 00141710 UBA  DATA ''CH47-15 INPT MISSING''
0401  02241 00132267
0401  02242 00126661
0401  02243 00132640
0401  02244 00144716
0401  02245 00150324
0401  02246 00120315
0401  02247 00144723
0401  02250 00151711
0401  02251 00147307
0402  02252 00141710 UBB  DATA ''CH47-14 INPT MISSING''
0402  02253 00132267
0402  02254 00126661
0402  02255 00132240
0402  02256 00144716
0402  02257 00150324
0402  02260 00120315
0402  02261 00144723
0402  02262 00151711
0402  02263 00147307
0403  02264 00141710 UBC  DATA ''CH47-13 INPT MISSING''
0403  02265 00132267
0403  02266 00126661
0403  02267 00131640
0403  02270 00144716
0403  02271 00150324
0403  02272 00120315
0403  02273 00144723
0403  02274 00151711
0403  02275 00147307
0404  02276 00141710 UBD  DATA ''CH47-12 INPT MISSING''
0404  02277 00132267
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0404  02300 00126661
0404  02301 00131240
0404  02302 00144716
0404  02303 00150324
0404  02304 00120315
0404  02305 00144723
0404  02306 00151711
0404  02307 00147307
0405  02310 00141710 UBE  DATA ''CH47-11 INPT MISSING''
0405  02311 00132267
0405  02312 00126661
0405  02313 00130640
0405  02314 00144716
0405  02315 00150324
0405  02316 00120315
0405  02317 00144723
0405  02320 00151711
0405  02321 00147307
0406  02322 00141710 UBF  DATA ''CH47-10 INPT MISSING''
0406  02323 00132267
0406  02324 00126661
0406  02325 00130240
0406  02326 00144716
0406  02327 00150324
0406  02330 00120315
0406  02331 00144723
0406  02332 00151711
0406  02333 00147307
0407  02334 00141710 UBG  DATA ''CH47-9  INPT MISSING''
0407  02335 00132267
0407  02336 00126671
0407  02337 00120240
0407  02340 00144716
0407  02341 00150324
0407  02342 00120315
0407  02343 00144723
0407  02344 00151711
0407  02345 00147307
0408  02346 00141710 UBH  DATA ''CH47-8  INPT MISSING''
0408  02347 00132267
0408  02350 00126670
0408  02351 00120240
0408  02352 00144716
0408  02353 00150324
0408  02354 00120315
0408  02355 00144723
0408  02356 00151711
0408  02357 00147307
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0409  02360 00141710 UBI   DATA ''CH47-7  INPT MISSING''
0409  02361 00132267
0409  02362 00126667
0409  02363 00120240
0409  02364 00144716
0409  02365 00150324
0409  02366 00120315
0409  02367 00144723
0409  02370 00151711
0409  02371 00147307
0410  02372 00141710 UBJ   DATA ''CH47-6  INPT MISSING''
0410  02373 00132267
0410  02374 00126666
0410  02375 00120240
0410  02376 00144716
0410  02377 00150324
0410  02400 00120315
0410  02401 00144723
0410  02402 00151711
0410  02403 00147307
0411  02404 00141710 UBK   DATA ''CH47-5  INPT MISSING''
0411  02405 00132267
0411  02406 00126665
0411  02407 00120240
0411  02410 00144716
0411  02411 00150324
0411  02412 00120315
0411  02413 00144723
0411  02414 00151711
0411  02415 00147307
0412  02416 00141710 UBL   DATA ''CH47-4  INPT MISSING''
0412  02417 00132267
0412  02420 00126664
0412  02421 00120240
0412  02422 00144716
0412  02423 00150324
0412  02424 00120315
0412  02425 00144723
0412  02426 00151711
0412  02427 00147307
0413  02430 00141710 UBM   DATA ''CH47-3  INPT MISSING''
0413  02431 00132267
0413  02432 00126663
0413  02433 00120240
0413  02434 00144716
0413  02435 00150324
0413  02436 00120315
0413  02437 00144723
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0413  02440 00151711
0413  02441 00147307
0414  02442 00141710 UBN   DATA ''CH47-2  INPT MISSING''
0414  02443 00132267
0414  02444 00126662
0414  02445 00120240
0414  02446 00144716
0414  02447 00150324
0414  02450 00120315
0414  02451 00144723
0414  02452 00151711
0414  02453 00147307
0415  02454 00141710 UBO   DATA ''CH47-1  INPT MISSING''
0415  02455 00132267
0415  02456 00126661
0415  02457 00120240
0415  02460 00144716
0415  02461 00150324
0415  02462 00120315
0415  02463 00144723
0415  02464 00151711
0415  02465 00147307
0416  02466 00141710 UBP   DATA ''CH47-0  INPT MISSING''
0416  02467 00132267
0416  02470 00126660
0416  02471 00120240
0416  02472 00144716
0416  02473 00150324
0416  02474 00120315
0416  02475 00144723
0416  02476 00151711
0416  02477 00147307
0417  02500 00141710 UAA   DATA ''CH50-15 INPT MISSING''
0417  02501 00132660
0417  02502 00126661
0417  02503 00132640
0417  02504 00144716
0417  02505 00150324
0417  02506 00120315
0417  02507 00144723
0417  02510 00151711
0417  02511 00147307
0418  02512 00141710 UAB   DATA ''CH50-14 INPT MISSING''
0418  02513 00132660
0418  02514 00126661
0418  02515 00132240
0418  02516 00144716
0418  02517 00150324
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0418  02520 00120315
0418  02521 00144723
0418  02522 00151711
0418  02523 00147307
0419  02524 00141710 UAC   DATA ''CH50-13 INPT MISSING''
0419  02525 00132660
0419  02526 00126661
0419  02527 00131640
0419  02530 00144716
0419  02531 00150324
0419  02532 00120315
0419  02533 00144723
0419  02534 00151711
0419  02535 00147307
0420  02536 00141710 UAD   DATA ''CH50-12 INPT MISSING''
0420  02537 00132660
0420  02540 00126661
0420  02541 00131240
0420  02542 00144716
0420  02543 00150324
0420  02544 00120315
0420  02545 00144723
0420  02546 00151711
0420  02547 00147307
0421  02550 00141710 UAE   DATA ''CH50-11 INPT MISSING''
0421  02551 00132660
0421  02552 00126661
0421  02553 00130640
0421  02554 00144716
0421  02555 00150324
0421  02556 00120315
0421  02557 00144723
0421  02560 00151711
0421  02561 00147307
0422  02562 00141710 UAF   DATA ''CH50-10 INPT MISSING''
0422  02563 00132660
0422  02564 00126661
0422  02565 00130240
0422  02566 00144716
0422  02567 00150324
0422  02570 00120315
0422  02571 00144723
0422  02572 00151711
0422  02573 00147307
0423  02574 00141710 UAG   DATA ''CH50-9  INPT MISSING''
0423  02575 00132660
0423  02576 00126671
0423  02577 00120240
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0423  02600 00144716
0423  02601 00150324
0423  02602 00120315
0423  02603 00144723
0423  02604 00151711
0423  02605 00147307
0424  02606 00141710 UAH   DATA ''CH50-8  INPT MISSING''
0424  02607 00132660
0424  02610 00126670
0424  02611 00120240
0424  02612 00144716
0424  02613 00150324
0424  02614 00120315
0424  02615 00144723
0424  02616 00151711
0424  02617 00147307
0425  02620 00141710 UAI   DATA ''CH50-7  INPT MISSING''
0425  02621 00132660
0425  02622 00126667
0425  02623 00120240
0425  02624 00144716
0425  02625 00150324
0425  02626 00120315
0425  02627 00144723
0425  02630 00151711
0425  02631 00147307
0426  02632 00141710 UAJ   DATA ''CH50-6  INPT MISSING''
0426  02633 00132660
0426  02634 00126666
0426  02635 00120240
0426  02636 00144716
0426  02637 00150324
0426  02640 00120315
0426  02641 00144723
0426  02642 00151711
0426  02643 00147307
0427  02644 00141710 UAK   DATA ''CH50-5  INPT MISSING''
0427  02645 00132660
0427  02646 00126665
0427  02647 00120240
0427  02650 00144716
0427  02651 00150324
0427  02652 00120315
0427  02653 00144723
0427  02654 00151711
0427  02655 00147307
0428  02656 00141710 UAL   DATA ''CH50-4  INPT MISSING''
0428  02657 00132660
```

```
0428  02660 00126664
0428  02661 00120240
0428  02662 00144716
0428  02663 00150324
0428  02664 00120315
0428  02665 00144723
0428  02666 00151711
0428  02667 00147307
0429  02670 00141710 UAM   DATA ''CH50-3  INPT MISSING''
0429  02671 00132660
0429  02672 00126663
0429  02673 00120240
0429  02674 00144716
0429  02675 00150324
0429  02676 00120315
0429  02677 00144723
0429  02700 00151711
0429  02701 00147307
0430  02702 00141710 UAN   DATA ''CH50-2  INPT MISSING''
0430  02703 00132660
0430  02704 00126662
0430  02705 00120240
0430  02706 00144716
0430  02707 00150324
0430  02710 00120315
0430  02711 00144723
0430  02712 00151711
0430  02713 00147307
0431  02714 00141710 UA0   DATA ''CH50-1  INPT MISSING''
0431  02715 00132660
0431  02716 00126661
0431  02717 00120240
0431  02720 00144716
0431  02721 00150324
0431  02722 00120315
0431  02723 00144723
0431  02724 00151711
0431  02725 00147307
0432  02726 00141710 UAP   DATA ''CH50-0  INPT MISSING''
0432  02727 00132660
0432  02730 00126660
0432  02731 00120240
0432  02732 00144716
0432  02733 00150324
0432  02734 00120315
0432  02735 00144723
0432  02736 00151711
0432  02737 00147307
```

```
0433  02740 00000040 DETA BSS  32
0434  03000 00141710 UA   DATA ''CH51-15 INPT MISSING''
0434  03001 00132661
0434  03002 00126661
0434  03003 00132640
0434  03004 00144716
0434  03005 00150324
0434  03006 00120315
0434  03007 00144723
0434  03010 00151711
0434  03011 00147307
0435  03012 00141710 UB   DATA ''CH51-14 INPT MISSING''
0435  03013 00132661
0435  03014 00126661
0435  03015 00132240
0435  03016 00144716
0435  03017 00150324
0435  03020 00120315
0435  03021 00144723
0435  03022 00151711
0435  03023 00147307
0436  03024 00141710 UC   DATA ''CH51-13 INPT MISSING''
0436  03025 00132661
0436  03026 00126661
0436  03027 00131640
0436  03030 00144716
0436  03031 00150324
0436  03032 00120315
0436  03033 00144723
0436  03034 00151711
0436  03035 00147307
0437  03036 00141710 UD   DATA ''CH51-12 INPT MISSING''
0437  03037 00132661
0437  03040 00126661
0437  03041 00131240
0437  03042 00144716
0437  03043 00150324
0437  03044 00120315
0437  03045 00144723
0437  03046 00151711
0437  03047 00147307
0438  03050 00141710 UE   DATA ''CH51-11 INPT MISSING''
0438  03051 00132661
0438  03052 00126661
0438  03053 00130640
0438  03054 00144716
0438  03055 00150324
0438  03056 00120315
```

```
0438  03057 00144723
0438  03060 00151711
0438  03061 00147307
0439  03062 00141710 UF    DATA ''CH51-10 INPT MISSING''
0439  03063 00132661
0439  03064 00126661
0439  03065 00130240
0439  03066 00144716
0439  03067 00150324
0439  03070 00120315
0439  03071 00144723
0439  03072 00151711
0439  03073 00147307
0440  03074 00141710 UG    DATA ''CH51-9  INPT MISSING''
0440  03075 00132661
0440  03076 00126671
0440  03077 00120240
0440  03100 00144716
0440  03101 00150324
0440  03102 00120315
0440  03103 00144723
0440  03104 00151711
0440  03105 00147307
0441  03106 00141710 UH    DATA ''CH51-8  INPT MISSING''
0441  03107 00132661
0441  03110 00126670
0441  03111 00120240
0441  03112 00144716
0441  03113 00150324
0441  03114 00120315
0441  03115 00144723
0441  03116 00151711
0441  03117 00147307
0442  03120 00141710 UI    DATA ''CH51-7  INPT MISSING''
0442  03121 00132661
0442  03122 00126667
0442  03123 00120240
0442  03124 00144716
0442  03125 00150324
0442  03126 00120315
0442  03127 00144723
0442  03130 00151711
0442  03131 00147307
0443  03132 00141710 UJ    DATA ''CH51-6  INPT MISSING''
0443  03133 00132661
0443  03134 00126666
0443  03135 00120240
0443  03136 00144716
```

```
0443  03137 00150324
0443  03140 00120315
0443  03141 00144723
0443  03142 00151711
0443  03143 00147307
0444  03144 00141710 UK    DATA ''CH51-5  INPT MISSING''
0444  03145 00132661
0444  03146 00126665
0444  03147 00120240
0444  03150 00144716
0444  03151 00150324
0444  03152 00120315
0444  03153 00144723
0444  03154 00151711
0444  03155 00147307
0445  03156 00141710 UL    DATA ''CH51-4  INPT MISSING''
0445  03157 00132661
0445  03160 00126664
0445  03161 00120240
0445  03162 00144716
0445  03163 00150324
0445  03164 00120315
0445  03165 00144723
0445  03166 00151711
0445  03167 00147307
0446  03170 00141710 UM    DATA ''CH51-3  INPT MISSING''
0446  03171 00132661
0446  03172 00126663
0446  03173 00120240
0446  03174 00144716
0446  03175 00150324
0446  03176 00120315
0446  03177 00144723
0446  03200 00151711
0446  03201 00147307
0447  03202 00141710 UN    DATA ''CH51-2  INPT MISSING''
0447  03203 00132661
0447  03204 00126662
0447  03205 00120240
0447  03206 00144716
0447  03207 00150324
0447  03210 00120315
0447  03211 00144723
0447  03212 00151711
0447  03213 00147307
0448  03214 00141710 UO    DATA ''CH51-1  INPT MISSING''
0448  03215 00132661
0448  03216 00126661
```

```
0448  03217 00120240
0448  03220 00144716
0448  03221 00150324
0448  03222 00120315
0448  03223 00144723
0448  03224 00151711
0448  03225 00147307
0449  03226 00141710 UP    DATA ''CH51-0  INPT MISSING''
0449  03227 00132661
0449  03230 00126660
0449  03231 00120240
0449  03232 00144716
0449  03233 00150324
0449  03234 00120315
0449  03235 00144723
0449  03236 00151711
0449  03237 00147307
0450  03240 70400000        END
       BEGN     00000
       STRT     00014
       AIP      00022
       MORE     00025
       HERE     00035
       B1A      00046
       THE      00053
       PRNT     00054
       TABL     00057
       TEST     00065
       TESS     00073
       CHNG     00076
       C47      00113
       C50      00130
       C51      00145
       C46      00162
       TTYO     00203
       CRLF     00212
       BRU      00222
       A1       00223
       A2       00224
       CT15     00225
       CT16     00226
       A1A      00227
       C1A      00230
       D1A      00231
       E1A      00232
       AIP1     00233
       CT4      00234
       BBB1     00235
```

BBB2	00236
BBB3	00237
CCC1	00240
CCC2	00241
CCC3	00242
DDD1	00243
DDD2	00244
DDD3	00245
EEE1	00246
EEE2	00247
EEE3	00250
BBBB	00251
CCCC	00252
DDDD	00253
EEEE	00254
B1	00255
B2	00256
B3	00257
B4	00260
B5	00261
B6	00262
B7	00263
B8	00264
B9	00265
B10	00266
B11	00267
B12	00270
B13	00271
B14	00272
B15	00273
C1	00275
C2	00276
C3	00277
C4	00300
C5	00301
C6	00302
C7	00303
C8	00304
C9	00305
C10	00306
C11	00307
C12	00310
C13	00311
C14	00312
C15	00313
D1	00315
D2	00316
D3	00317

D4	00320
D5	00321
D6	00322
D7	00323
D8	00324
D9	00325
D10	00326
D11	00327
D12	00330
D13	00331
D14	00332
D15	00333
E1	00335
E2	00336
E3	00337
E4	00340
E5	00341
E6	00342
E7	00343
E8	00344
E9	00345
E10	00346
E11	00347
E12	00350
E13	00351
E14	00352
E15	00353
B1B	00355
C1C	00375
D1D	00415
E1E	00435
TBLP	00455
TBLO	00467
TBLN	00501
TBLM	00513
TBLL	00525
TBLK	00537
TBLJ	00551
TBLI	00563
TBLH	00575
TBLG	00607
TBLF	00621
TBLE	00633
TBLD	00645
TBLC	00657
TBLB	00671
TBLA	00703
BB1	00715

CC1	00735
DD1	00755
DATA	00775
EE1	01007
TBP	01027
TBO	01041
TBN	01053
TBM	01065
TBL	01077
TBK	01111
TBJ	01123
TBI	01135
TBH	01147
TBG	01161
TBF	01173
TBE	01205
TBD	01217
TBC	01231
TBB	01243
TBA	01255
TAP	01267
TAO	01301
TAN	01313
TAM	01325
TAL	01337
TAK	01351
TAJ	01363
TAI	01375
TAH	01407
TAG	01421
TAF	01433
TAE	01445
TAD	01457
TAC	01471
TAB	01503
TAA	01515
TP	01527
TO	01541
TN	01553
TM	01565
TL	01577
TK	01611
TJ	01623
TI	01635
TH	01646
TG	01660
TF	01672
TE	01704

TD	01716
TC	01730
TB	01742
TA	01754
DOTA	01766
UBLA	02000
UBLB	02012
UBLC	02024
UBLD	02036
UBLE	02050
UBLF	02062
UBLG	02074
UBLH	02106
UBLI	02120
UBLJ	02132
UBLK	02144
UBLL	02156
UBLM	02170
UBLN	02202
UBLO	02214
UBLP	02226
UBA	02240
UBB	02252
UBC	02264
UBD	02276
UBE	02310
UBF	02322
UBG	02334
UBH	02346
UBI	02360
UBJ	02372
UBK	02404
UBL	02416
UBM	02430
UBN	02442
UBO	02454
UBP	02466
UAA	02500
UAB	02512
UAC	02524
UAD	02536
UAE	02550
UAF	02562
UAG	02574
UAH	02606
UAI	02620
UAJ	02632
UAK	02644

```
        UAL     02656
        UAM     02670
        UAN     02702
        UAO     02714
        UAP     02726
        DETA    02740
        UA      03000
        UB      03012
        UC      03024
        UD      03036
        UE      03050
        UF      03062
        UG      03074
        UH      03106
        UI      03120
        UJ      03132
        UK      03144
        UL      03156
        UM      03170
        UN      03202
        UO      03214
        UP      03226
ERRORS  0000    00000
```

PROGRAM DESCRIPTION

CATALOG NO. 300001E Modified

DATE 1 September 1970

REVISED 17 May 1972

PROGRAM TITLE: SYSTEMS 810A/B STANDARD LOAD/DUMP PACKAGE MODIFIED 8K OR 16K MEMORY

PURPOSE: To provide capability for:
(1) loading relocatable object programs generated by the SYSTEMS 810A/B Macro-Assembler or SYSTEMS 810A/B FORTRAN IV Compiler;
(2) dumping selected areas of memory in absolute binary format;
(3) loading object modules generated by the absolute dump function.

CONFIGURATION: SYSTEMS 810A/B with ASR-33 and High Speed Paper Tape Reader.

PROGRAM LANGUAGE: SYSTEMS 810A/B Assembly Language

SIZE: 2000_8

LOADING PROCEDURE:

The 300001E Modified Standard Load/Dump program is loaded directly into upper 8K or upper 16K of memory via the modified bootstrap program. The modified 300001E Load/Dump program made for upper 8K will not function or load in upper 16K and the 300001E Load/Dump program modified for upper 16K will not function or load in upper 8K memory.

The procedure required to load this package includes:

(1) MASTER CLEAR the computer;

(2) Manually enter the modified Binary Bootstrap Loader (below) at locations $0\text{-}17_8$:

OCTAL LOCATION	8K OCTAL CODING	16K OCTAL CODING
0	130101	130101
1	004000	004000
2	170301	170301
3	000022	000022
4	111006	111006
5	111002	111002
6	170301	170301
7	001016	001016
10	174301	174301
11	033016	033016
12	000022	000022
13	000026	000026
14	113017	113017
15	111006	111006
16	117671	137671
17	017673	037673

(3) Position the appropriate 8K or 16K Modified Standard Load/Dump program (300001E Modified) on the high speed tape reader

(4) Master Clear and depress "START" twice

The 300001E Standard Load/Dump Package (program) is in the upper portion of the 8K or 16K memory at the following addresses:

	8K	16K
Relocatable Loader	016060_8	036060_8
Absolute Dump	017561_8	037561_8
Absolute Loader	017673_8	037673_8

USE:

The SYSTEMS 810A/B STANDARD LOAD/DUMP PACKAGE may be used to load object programs in relocatable binary format; to dump selected areas of memory in absolute binary format; and to load object modules in absolute binary format.

I - RELOCATABLE LOADER

The procedure required to use the relocatable loader portion of the STANDARD LOAD/DUMP PACKAGE includes:

(1) Position the relocatable binary object program to be loaded in the desired input device (High Speed Tape Reader):

(2) Make the following manual entries:

- A - Accumulator = Relocation Base for program (Starting location of program)
- B - Accumulator = Map Zero Starting Location
- P - Counter = Relocatable Loader Starting Location

  8K 016060

  16K 036060

(3) Depress START twice - the program will be loaded;

(4) If "EJ" only is printed on the ASR-33 teletypewriter, the relocatable loader is awaiting further input to satisfy external subroutines referenced by the loaded program. In this instance, position the unloaded external program (s) in the proper input device and repeat step (3) above;

NOTE

Do not MASTER CLEAR the computer prior to loading external subroutines.

(5) When loading is complete, the following will be printed on the ASR-33 teletypewriter:

LC = LOAD COMPLETE

EJ = END OF JOB

XXXXX YYYYY, where

XXXXX - indicates the highest memory location used by the program;

YYYYY - indicates the next available map zero location

(6) To execute the loaded program:

(a) MASTER CLEAR the computer;

(b) Enter the starting location of the program into the P-Counter;

(c) Depress START twice to begin program execution.

II - ABSOLUTE DUMP

The procedure required to use the Absolute Dump portion of the STANDARD LOAD/DUMP PACKAGE includes:

(1) Set the appropriate control switches as follows:

- Control Switches Reset (Normal)
- Control Switch 1 Set = Dump Intermap References after dumping program

(2) Make the following manual entries:

8K Location	16K Location	Entry
017776_8	037776_8	End of Dump Address
017777_8	037777_8	Start of Dump Address

(3) Enter 017561_8 for 8K or 037561_8 for 16K into the P-Counter. This is the start address for the Absolute Dump portion of the STANDARD LOAD/DUMP PACKAGE:

(4) Depress START once - a dump of the specified memory locations will be generated in absolute binary format acceptable to the Absolute Loader portion of this package (below)

III - ABSOLUTE LOADER

The procedure required to use the Absolute Loader portion of the STANDARD LOAD/DUMP PACKAGE includes:

(1) Position the absolute binary object module to be loaded in the desired input device (High Speed Tape Reader).

(2) Set the appropriate control switches as follows:

- Control Switch 1 Set = Load intermap references after loading program

(3) Enter 017673_8 for 8K or 037673_8 for 16K into the P-Counter. This is the start address for the Absolute Loader portion of the STANDARD LOAD/DUMP PACKAGE;

(4) Depress START twice - the core-image contents of the absolute binary input module will be loaded into the same portion of memory from which originally dumped.

METHOD:

(1) RELOCATABLE LOADER

(a) Tape format consists of blocks of 111 frames. Each block contains a start code, thirty-six 24-bit words, and a 16-bit check sum. A complete block is read by the loader before the first word in the block is processed;

If a parity error occurs during input, five attempts are made to read the record before the loader message "R" is printed on the ASR-33 teletypewriter, and the computer HALTS. Clearing the HALT will cause the record to be accepted.

(b) The following messages are output by the relocatable loader:

- CK - Check Sum Error
- MO - Memory Overflow into Area of Core Used by Loader
- CM - Common Request prior to Common Definition
- LC - Loading Process Complete
- EJ - End of Job

(2) ABSOLUTE DUMP

Tape format consists of a start code, a 16-bit starting address, and a 16-bit negative word count followed by blocks of 66 frames each. The last block may have less than 66 frames. Each block is terminated with a 16-bit check sum.

(3) ABSOLUTE LOADER

(a) Tape format consists of a start code, a 16-bit starting address, and a 16-bit negative word count followed by blocks of 66 frames each. The last block may have less than 66 frames. Each block is terminated with a 16-bit check sum. Words are stored into core as they are read.

(b) If a check sum error is encountered during the loading process, the loader message "K" will be printed on the ASR-33 teletypewriter, and the computer will HALT. Clearing the HALT will cause the record to be accepted.

#303001B
MAINFRAME EXERCISER

#303001C 1-23-78

PROGRAM DESCRIPTION

IDENTIFICATION: 810A/B Mainframe Exerciser Number 303001C

ISSUED: Modified January 23, 1978 to eliminate the Keytran option and to include indexing and testing of IMS, SAP and DIV instructions. Changed starting address to keep program resident in computer.
Carl L. Thompson

PURPOSE: A fast no-loop program designed to use each of the mainframe instructions in such a way that if a halt occurs, the Technician can determine from the program listing the instruction that is failing.

STORAGE: 462 Octal Locations

LOADING PROCEDURE:

Relocatable Loader
Program Counter, Enter '36060
"A" Accumulator, Enter 0
"B" Accumulator, Enter 0

Insert tape in reader and press start switch twice.

To start program, enter '34000 in program counter and press start switch twice.

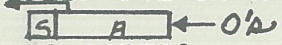
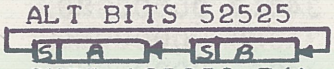
The program will continue to run until manually halted or until an instruction fails. If the program halts due to an instruction failure, the program counter will point to the second instruction following the last halt. Place a programmers halt at approximately 10 instructions preceeding the halt location. Restart program and following the programmers halt, single cycle the computer, carefully noting the execution of each instruction in the control panel until you find the instruction that failed to execute properly.

Continue the program to determine if other instructions fail. The relationship of several instruction failures may provide a clue to the area of failure.

To trouble shoot a failure, thumb in the shortest program loop possible with the failing instruction to permit tracing the failure with the oscilloscope.

To test the divide instruction place a NOP ('000033) instruction at location '34374.

```
0001                    * * * * * * * * * * * * * * * * * * * * * * * *
0002                    *    810A/B MAINFRAME EXERCISER NO 303001C     *
0003                    *    PROGRAM MODIFIED TO TEST INDEXING, IMS,   *
0004                    *    SAP, DIV. REMOVED KEYTRAN OPTION, MOVED   *
0005                    *    STARTING ADDRESS TO '34000 TO MAINTAIN    *
0006                    *    PERMANENT RESIDENCE IN COMPUTER.          *
0007                    *    CARL L THOMPSON JANUARY 23, 1978          *
0008                    * * * * * * * * * * * * * * * * * * * * * * * *
0009  00000 00000000        REL
0010  34000 70034000        ORG   '34000          START LOCATION OF PROG
0011  34000 01134422 STAR    LAA   TES6           LOAD A W/077777
0012  34001 05134424        AMA   TE10           ADD 1 TO A
0013  34002 00000025        SOF                  OVERFLOW
0014  34003 11134005        BRU   *+2            YES, GO ON
0015  34004 00000000        HLT                  NO, HALT
0016  34005 00000020        ASC                  CHANGE SIGN OF A
0017  34006 00000022        SAZ                  IS A ZERO
0018  34007 00000000        HLT                  NO, HALT
0019  34010 01134416        LAA   TES2           LOAD ALL ONES IN A
0020  34011 02134422        LBA   TES6           LOAD SEVENS IN B = 077777
0021  34012 16134424        AMB   TE10           ADD 1 TO B
0022  34013 00000004        TBA                  TRANSFER B TO A
0023  34014 00000025        SOF                  OVERFLOW
0024  34015 11134017        BRU   *+2            YES, GO ON
0025  34016 00000000        HLT                  NO HALT
0026  34017 00000020        ASC                  CHANGE SIGN OF A
0027  34020 00000022        SAZ                  IS A ZERO
0028  34021 00000000        HLT                  NO
0029  34022 01134424        LAA   TE10           ONE IN A
0030  34023 00001716        LSL   15             <-[S A]<-0's
0031  34024 00000023        SAN                  SHIFT OK
0032  34025 00000000        HLT                  NO, HALT
0033  34026 00001710        FSA   15             [S->A]->
0034  34027 06134416        SMA   TES2           SUBTRACT ALL ONES
0035  34030 00000022        SAZ                  IS A ZERO
0036  34031 00000000        HLT                  NO, HALT
0037  34032 01134424        LAA   TE10           YES, ONE IN A
0038  34033 02134424        LBA   TE10           ONE IN B
0039  34034 00001713        FLL   15             <-[S A]<-[S B]<-0's
0040  34035 00000023        SAN                  SHIFT OK
0041  34036 00000000        HLT                  NO, HALT
0042  34037 00000006        IAB                  YES, CHECK B
0043  34040 00000023        SAN                  IS A NEGATIVE
0044  34041 00000000        HLT                  NO
0045  34042 00001712        FRA   15             [S->A]  [S->B]->
0046  34043 00000007        CSB                  COPY (REMOVE) SIGN OF B
0047  34044 05134415        AMA   TES1           ADD ZERO TO A
```

```
0048  34045 00000022      SAZ             IS A ZERO
0049  34046 00000000      HLT             NO, HALT
0050  34047 00000006      IAB             YES
0051  34050 00000022      SAZ             IS B ZERO
0052  34051 00000000      HLT             NO, HALT
0053  34052 01134424      LAA   TE10       YES, ONE IN A
0054  34053 00000111      LSA   1          
0055  34054 00000022      SAZ             IS A ZERO
0056  34055 11134057      BRU   *+2        NO
0057  34056 00000000      HLT             YES HLT
0058  34057 00001611      LSA   14         
0059  34060 00000022      SAZ             IS A ZERO
0060  34061 00000000      HLT             NO
0061  34062 01134422      LAA   TES6       SEVENS IN A
0062  34063 00000111      LSA   1          
0063  34064 00000022      SAZ             IS A ZERO
0064  34065 11134067      BRU   *+2        NO
0065  34066 00000000      HLT             YES HLT
0066  34067 00001611      LSA   14         
0067  34070 00000022      SAZ             IS A ZERO
0068  34071 00000000      HLT             NO
0069  34072 01134416      LAA   TES2       ALL ONES IN A
0070  34073 00000003      CLA             DOES CLEAR A WORK
0071  34074 00000022      SAZ             IS A ZERO
0072  34075 00000000      HLT             NO
0073  34076 00000033      NOP
0074  34077 00000033      NOP
0075  34100 01134416      LAA   TES2       ALL ONES 177777
0076  34101 02134420      LBA   TES4       ALT BITS 52525
0077  34102 00001714      FRL   15         
0078  34103 06134417      SMA   TES3       SUBT 125252 F/A
0079  34104 00000022      SAZ             IS A ZERO
0080  34105 00000000      HLT             NO HLT
0081  34106 00000004      TBA             TRANSFER B TO A
0082  34107 06134416      SMA   TES2       SUBT ALL ONES FROM A
0083  34110 00000022      SAZ             IS A ZERO
0084  34111 00000000      HLT             NO
0085  34112 01134415      LAA   TES1       ZERO IN A
0086  34113 15134424      CMA   TE10       COMPARE ZERO TO ONE
0087  34114 11134117      BRU   *+3        A LESS THAN M, OK.
0088  34115 00000000      HLT             NO
0089  34116 00000000      HLT             NO
0090  34117 01134424      LAA   TE10       ONE IN A
0091  34120 15134424      CMA   TE10       COMPARE ONE TO ONE
0092  34121 00000000      HLT             NO
0093  34122 11134124      BRU   *+2        A = M, OK.
0094  34123 00000000      HLT             NO
0095  34124 05134424      AMA   TE10       2 IN A
```

```
0096  34125 15134424      CMA  TE10        COMPARE 2 TO 1
0097  34126 00000000      HLT
0098  34127 00000000      HLT
0099  34130 02134416      LBA  TES2        A IS MORE THAN M
0100  34131 04134432      STB  LOC1
0101  34132 00000006      IAB
0102  34133 15134432      CMA  LOC1        WAS B STORED PROPERLY
0103  34134 00000000      HLT              NO
0104  34135 11134137      BRU  *+2         YES
0105  34136 00000000      HLT              NO
0106  34137 01134417      LAA  TES3        ALT. BITS IN A
0107  34140 02134420      LBA  TES4        ALT. BITS IN B
0108  34141 00000027      ABA              AND A AND B
0109  34142 00000022      SAZ              ANDED CORRECTLY
0110  34143 00000000      HLT              NO
0111  34144 01134417      LAA  TES3        YES
0112  34145 00000030      OBA              OR A + B
0113  34146 06134416      SMA  TES2        SUBTRACT ALL ONES
0114  34147 00000022      SAZ              A ZERO
0115  34150 00000000      HLT              NO
0116  34151 01134422      LAA  TES6        ALL SEVENS 077777
0117  34152 03134432      STA  LOC1        CK STORE A
0118  34153 01134432      LAA  LOC1
0119  34154 06134422      SMA  TES6        SUBT 077777 F/A
0120  34155 00000022      SAZ              IS A ZERO
0121  34156 00000000      HLT              NO HLT
0122  34157 01134415      LAA  TES1        ZERO IN A
0123  34160 03134433      STA  LOC2        STORE A
0124  34161 14134433      IMS  LOC2        MAKE ZERO A ONE
0125  34162 01134433      LAA  LOC2        A=1
0126  34163 00000022      SAZ              IS A ZERO
0127  34164 11134166      BRU  *+2         NO
0128  34165 00000000      HLT              YES HLT
0129  34166 00000002      NEG              CHNG A TO 177777
0130  34167 06134416      SMA  TES2        SUBT 177777 F/A
0131  34170 00000022      SAZ              IS A ZERO
0132  34171 00000000      HLT              NO HLT
0133  34172 01134416      LAA  TES2        ALL ONES 177777
0134  34173 00000034      CNS              CHNG A TO 100000
0135  34174 06134424      SMA  TE10        SUBTRACT ONE
0136  34175 00000023      SAN              NEGATIVE SIGN LEFT
0137  34176 00000000      HLT              NO
0138  34177 01134416      LAA  TES2        ONES IN A
0139  34200 00000021      SAS              IS A -, 0, +
0140  34201 11134204      BRU  *+3         A IS -
0141  34202 00000000      HLT              0, HALT
0142  34203 00000000      HLT              +, HALT
0143  34204 05134424      AMA  TE10        ZERO IN A
```

```
0144  34205 00000021     SAS                  IS A -, 0, +
0145  34206 00000000     HLT
0146  34207 11134211     BRU   *+2            A IS ZERO
0147  34210 00000000     HLT
0148  34211 05134422     AMA   TES6           SEVENS IN A
0149  34212 00000021     SAS                  IS A -, 0, +
0150  34213 00000000     HLT
0151  34214 00000000     HLT
0152  34215 00000033     NOP                  A IS +
0153  34216 02134422     LBA   TES6           SEVENS IN B
0154  34217 00000003     CLA                  CLEAR A
0155  34220 00001717     FLA   15             S A S B  <- 0's
0156  34221 06134422     SMA   TES6           SUBTRACT SEVENS
0157  34222 00000022     SAZ                  IS A ZERO
0158  34223 00000000     HLT                  NO
0159  34224 01134421     LAA   TES5           MINUS ZERO IN A
0160  34225 00001715     RSL   15             0's -> S A
0161  34226 00000022     SAZ                  IS A ZERO
0162  34227 11134231     BRU   *+2            NO
0163  34230 00000000     HLT                  YES HLT
0164  34231 00000112     FRA   1              S -> A  S B ->
0165  34232 00000022     SAZ                  IS A ZERO
0166  34233 00000000     HLT                  NO HLT
0167  34234 00000001     RNA                  INCR A BY 1 IF B1 IS 1
0168  34235 00000022     SAZ                  IS A ZERO
0169  34236 11134240     BRU   *+2            NO
0170  34237 00000000     HLT                  YES HLT
0171  34240 00000005     TAB                  TRANSFER A TO B
0172  34241 00000003     CLA                  CLEAR A
0173  34242 00000006     IAB                  INTERCHANGE A AND B
0174  34243 00000022     SAZ                  IS A ZERO
0175  34244 11134246     BRU   *+2            NO
0176  34245 00000000     HLT                  YES HLT
0177  34246 00000033     NOP
0178  34247 00000020     ASC                  COMPLEMENT SIGN BIT OF A
0179  34250 00000001     RNA                  INCREASE A BY 1 IF B1 IS 1
0180  34251 06134424     SMA   TE10           SUBTRACT 1 FROM A
0181  34252 00000021     SAS                  IS A -,0,+
0182  34253 11134256     BRU   *+3            (-)
0183  34254 00000000     HLT
0184  34255 00000000     HLT
0185  34256 00000020     ASC                  COMPLEMENT SIGN BIT OF A
0186  34257 00000022     SAZ                  IS A ZERO
0187  34260 00000000     HLT                  NO
0188  34261 01134423     LAA   TES7           '146314 IN A
0189  34262 00000032     SNO                  DOES BIT A1 EQUAL A0
0190  34263 11134265     BRU   *+2            YES
0191  34264 00000000     HLT                  NO
```

```
0192  34265 00000116       LSL  1              SHIFT LEFT
0193  34266 00000032       SNO                 DOES BIT A1 EQUAL A0
0194  34267 00000000       HLT                 YES
0195  34270 01134416       LAA  TES2           ALL ONES 177777
0196  34271 02134416       LBA  TES2           LOAD B WITH ALL ONES
0197  34272 00000036       LOB                 BRU TO LOC 35000
0198  34273 35435000       DAC  CAT0           SECOND WORD OF LOB
0199  34274 00000000       HLT
0200  34275 12334436 RTN   SPB* CHAR           GO TO CHAR FOR ADDRESS
0201  34276 06134424       SMA  TE10           SUBTRACT 1 FROM A
0202  34277 00000022       SAZ                 IS A ZERO
0203  34300 00000000       HLT                 NO
0204  34301 00000005       TAB                 TRANS A TO B
0205  34302 00000026       IBS                 INCR B, SKIP IF 0 OR +
0206  34303 00000000       HLT
0207  34304 00000004       TBA                 TRANSFER B TO A
0208  34305 06134426       SMA  TE12           SUBTRACT '400 FROM A
0209  34306 00000022       SAZ                 IS A ZERO
0210  34307 02134425       LBA  TE11           200 IN B
0211  34310 07134426       MPY  TE12           MULTIPLY BY 400
0212  34311 06134424       SMA  TE10           SUBTRACT ONE
0213  34312 00000022       SAZ                 IS A ZERO
0214  34313 00000000       HLT                 NO
0215  34314 00000004       TBA                 TRANSFER B TO A
0216  34315 00000022       SAZ                 IS A ZERO
0217  34316 00000000       HLT                 NO
0218  34317 02134424       LBA  TE10           ONE IN B
0219  34320 00000117       FLA  1              TWO IN A
0220  34321 07134422       MPY  TES6           MULTIPLY BY SEVENS
0221  34322 06134424       SMA  TE10           SUBTRACT ONE
0222  34323 00000022       SAZ                 IS A ZERO
0223  34324 00000000       HLT
0224  34325 00000004       TBA                 TRANSFER B TO A
0225  34326 05134424       AMA  TE10           ADD 1 TO A
0226  34327 06134422       SMA  TES6           SUBT 077777 FROM A
0227  34330 00000022       SAZ                 IS A ZERO
0228  34331 00000000       HLT                 NO
0229                  * * * * * * * * * * * * * * * * * * * * * * * * * *
0230                  *    MODIFICATIONS MADE BY CLT TO INCLUDE
0231                  *    TEST FOR INDEXING, IMS, SAP AND DOUBLE
0232                  *    DIVIDEND DIVIDE INSTRUCTIONS.
0233                  * * * * * * * * * * * * * * * * * * * * * * * * * *
0234  34332 02134427       LBA  TE13           '177775 IN B
0235  34333 01534433       LAA  TE14+3,1       ADD ONE TO A
0236  34334 00000022       SAZ                 IS A ZERO
0237  34335 11134337       BRU  *+2            NO
0238  34336 00000000       HLT                 A IS ZERO
0239  34337 00000026       IBS                 INCREMENT B
```

```
0240  34340 11134342        BRU  *+2            B STILL NEGATIVE
0241  34341 00000000        HLT                 B IS / OR +
0242  34342 01534433        LAA  TE14+3,1       A = 0
0243  34343 00000022        SAZ                 IS A ZERO
0244  34344 00000000        HLT                 A IS NOT ZERO
0245  34345 01334434        LAA* LOC3           ADD ONE TO A
0246  34346 00000022        SAZ                 IS A ZERO
0247  34347 11134351        BRU  *+2            NO
0248  34350 00000000        HLT                 A IS ZERO
0249  34351 00000026        IBS                 INCREMENT B SKIP IF 0/+
0250  34352 00000026        IBS
0251  34353 00000000        HLT                 B NOT 0 OR +
0252  34354 01134416        LAA  TES2           ALL ONES 177777
0253  34355 00000024        SAP                 IS A POS
0254  34356 11134360        BRU  *+2            NO
0255  34357 00000000        HLT                 YES HLT
0256  34360 00000003        CLA                 CLEAR A
0257  34361 00000024        SAP                 IS A POS
0258  34362 00000000        HLT                 NO HLT
0259  34363 01134427        LAA  TE13           A = 177775
0260  34364 03134435        STA  LOC5           STORE A
0261  34365 14134435        IMS  LOC5           INCREMENT-ADD 1 TO LOC5
0262  34366 01134435        LAA  LOC5           A=177776
0263  34367 14134435        IMS  LOC5           INCREMENT-ADD 1 TO LOC5
0264  34370 11134372        BRU  *+2            LOC5 STILL NO ZERO
0265  34371 00000000        HLT
0266  34372 14134435        IMS  LOC5           INCREMENT-ADD 1 TO LOC5
0267  34373 00000000        HLT                 HLT IF LOC5 NOT ZERO
0268                  * *  * * * * * * * * * * * * * * * * * * * * * *
0269                  * TO TEST DIVIDE CHANGE NEXT LOCATION TO NOP '33
0270                  * *  * * * * * * * * * * * * * * * * * * * * * *
0271  34374 11134000        BRU  STAR           RETEST INSTRUCTIONS
0272  34375 01134410        LAA  DIV            DIVIDEND '72345
0273  34376 02134411        LBA  DIVB           DIVIDEND '54321
0274  34377 10134412        DIV  DIVC           DIVISOR '74074
0275  34400 06134413        SMA  DIVD           SUBT QUO F/'76162
0276  34401 00000022        SAZ                 IS A ZERO
0277  34402 00000000        HLT                 NO HLT
0278  34403 00000004        TBA                 XFER REMAINDER TO A
0279  34404 06134414        SMA  DIVE           SUBT REM F/'37031
0280  34405 00000022        SAZ                 IS A ZERO
0281  34406 00000000        HLT                 NO HLT
0282  34407 11134000        BRU  STAR           REPEAT COMPLETE PROGRAM
0283  34410 00072345  DIV   DATA '72345
0284  34411 00054321  DIVB  DATA '54321
0285  34412 00074074  DIVC  DATA '74074
0286  34413 00076162  DIVD  DATA '76162
0287  34414 00037031  DIVE  DATA '37031
```

```
0288   34415 00000000 TES1  DATA 0
0289   34416 00177777 TES2  DATA -1
0290   34417 00125252 TES3  DATA '125252
0291   34420 00052525 TES4  DATA '52525
0292   34421 00100000 TES5  DATA '100000
0293   34422 00077777 TES6  DATA '77777
0294   34423 00146314 TES7  DATA '146314
0295   34424 00000001 TE10  DATA 1
0296   34425 00000200 TE11  DATA '200
0297   34426 00000400 TE12  DATA '400
0298   34427 00177775 TE13  DATA -3
0299   34430 00000001 TE14  DATA 1,0
0299   34431 00000000
0300   34432 00000000 LOC1  ZZZ   **
0301   34433 00000000 LOC2  ZZZ   **
0302   34434 35635023 LOC3  DAC   LOC4,1        ADDR OF LOC4 + B INDX
0303   34435 00000000 LOC5  ZZZ   **
0304   34436 35435003 CHAR  DAC   RED           SUBROUTINE 'RED'
0305   35000 70035000       ORG   '35000        STORE BAL IN MAP '35000
0306   35000 11335001 CAT0  BRU*  *+1           BRU INDIR + 1 TO RTN
0307   35001 35434275       DAC   RTN           ADDR OF BRU
0308   35002 00000000       HLT
0309   35003 00000000 RED   ZZZ   **            STORE ADDR OF RTN+1
0310   35004 00000025       SOF                 IF OVERFLOW GO TO NOP
0311   35005 00000033       NOP
0312   35006 00000003       CLA                 CLEAR A
0313   35007 00000005       TAB                 TRANSFER A TO B
0314   35010 05135020       AMA   PSEV          ADD '77777 TO A
0315   35011 00000025       SOF                 IF OVERFLOW GO TO HLT
0316   35012 00000000       HLT
0317   35013 16135020       AMB   PSEV          ADD '77777 TO B
0318   35014 00000025       SOF                 IF OVERFLOW GO TO HLT
0319   35015 00000000       HLT
0320   35016 01135021       LAA   ONE           LOAD A WITH 1
0321   35017 11335003       BRU*  RED           BRU INDIRECT TO RED
0322   35020 00077777 PSEV  DATA '77777
0323   35021 00000001 ONE   DATA 1
0324   35022 00000001       DATA 1              ADD TO A F/LAA* LOC3
0325   35023 00000000 LOC4  DATA 0
0326   35024 70400000       END
        STAR     34000
        RTN      34275
        DIV      34410
        DIVB     34411
        DIVC     34412
        DIVD     34413
        DIVE     34414
        TES1     34415
```

```
        TES2    34416
        TES3    34417
        TES4    34420
        TES5    34421
        TES6    34422
        TES7    34423
        TE10    34424
        TE11    34425
        TE12    34426
        TE13    34427
        TE14    34430
        LOC1    34432
        LOC2    34433
        LOC3    34434
        LOC5    34435
        CHAR    34436
        CAT0    35000
        RED     35003
        PSEV    35020
        ONE     35021
        LOC4    35023
ERRORS  0000    00000
```

SYSTEMS ENGINEERING LATORATORIES PROGRAM LIBRARY

SOFTWARE DESCRIPTION

CATALOG NO. 303002B

DOCUMENTATION REV*_____

DATE June 15, 1970

PROGRAM TITLE	810A/B Instruction Simulation and Comparison (IS&C)
PURPOSE:	Executes mainframe instructions and simulates them if possible by software. The results are compared and an error condition occurs on an error. Some instructions cannot be simulated easily so they are executed and the results compared to a constant.
CONFIGURATION:	Basic SYSTEMS 810A/B Computer
SOFTWARE ENVIRONMENT:	Stand-Alone
PROGRAM LANGUAGE:	SYSTEMS 810A/B Assembly Language

SIZE: 2000_8 - 4163_8

TIMING: Approx 20 Seconds/Cycle

Note:
When using the upper 16K load/dump program the relocatable loader, program counter 360 60 should be utilized to load the program rather than the 160 60

Relocatable Loader
Prog. Counter 16060
A-Accum 0 B-Accum 0
After Load Start At '2000

REASON FOR CHANGE:

Changes were made to allow this program to run with the Keytran System and output all messages to the selectric typewriter by setting Sense Switch 13.

USE:

Start at location 2000_8, the program will run until manually halted.

When running under the Keytran System, the Diagnostic Number for this program is four (4). The program will automatically be started at location 2000_8 and will run continuously until the Index Key is depressed on the selectric typewriter at which time control will be returned to the Keytran Diagnostic Loader.

If an error occurs, consult the routine description to find what instruction failed.

Sense Switch Settings:

SSW 0 up - A successful cycle type-out will occur approximately every 25 seconds only if there have been no errors during that cycle.

SSW 1 up - Errors will be ignored.

SSW 2 up - No error type-out will occur, the machine will halt and the A-Accumulator may be displayed for the error location.

SSW 3 up - A halt will occur after the error type-out.

SSW 13 up - Indicates program is being run with the Keytran System and that all output will be via the selectric typewriter.

Type-Out Formats

Successful Cycles - NNNN
NNNN = Decimal number of cycles in which no errors occurred.

Machine error preceeding location XXXXX
XXXXX = Octal location from which a SPB occurred after an error condition found by the program.

METHOD:

Clear A-Accumulator (CLAT)

The A-Accumulator is loaded with the counter and cleared. A is then checked for zero. The counter is then incremented.

The test is repreated for every case. An error at location 2053_8 indicates a CLA error.

Skip if A-Accumulator is Zero (SAZT)

The B-Accumulator is incremented and transferred to A. A is checked for zero by the SAZ and then A is checked for zero by the CMA. An error will occur at location 2071_8 if a skip occurs when A is not zero and at location 2074_8 if there is not a skip when A is zero. An error can also occur at 2100_8 if a skip does not occur when A is zero, and if a skip occurs but A is not zero there will be an error indication at 2102_8 or 2104_8.

Skip if A-Accumulator is Positive (SAPT)

B is incremented in the same manner as the zero test. An error at location 2114_8 means a skip should have occurred. An error at location 2125_8 indicates a skip occurred when A was not positive. A counter is used to test every case.

Skip A-Accumulator is Negative (SANT)

Operates in the same manner as the A positive Test. An error at location 2140_8 indicates an illegal skip and an error at 2150_8 indicates no skip occurred.

Skip on A-Accumulator Sign (SAST)

Runs similar to the previous tests except that there are three possibilities instead of two. An error at 2164_8 or 2166_8 indicates A was zero and the SAS did not detect this condition. An error at 2173_8 will occur when the SAS did not detect a positive sign. If a negative sign if not sensed, an error will occur at 2200_8.

Compare Memory to A-Accumulator (CMAT)

The A-Accumulator is loaded with the counter, a CMA to zero is executed and according to the skip after the CMA, the A-Accumulator is tested for more, less, or equal to zero.

An illegal skip to n+1 will cause an error at location 2214_8. An illegal skip to n+2 will cause an error at location 2217_8. An illegal skip to n+3 will cause an error at location 2226_8.

Load and Store Instructions (LASA, LBSB)

The Accumulator is loaded with the counter and then stored in the location tagged STOP. A comparison between the stored data and the accumulator is then executed. The data is then compared with the counter. Errors at 2237_8 or 2241_8 indicate a bad STA, errors at 2243_8 or 2245_8 indicate a bad LAA. If an error occurs at location 2257_8 or 2261_8 the STB instruction failed, errors at 2264_8 or 2266_8 indicate LBA failed.

Transfer and Interchange A & B (TATB)

A is loaded with the counter and transferred to B, B is then stored and compared to A. An error at 2301_8 or 2303_8 indicates this phase failed.

B is loaded with the counter and is then transferred to A. A is compared to the counter and an error will occur at location 2310_8 or 2312_8 if TBA fails.

IAB is tested by loaded A with the counter and B with minus one. After an IAB, A is compared to minus one, B is stored and A is loaded with STOR. A comparison then takes place. Errors at location 2317_8 or 2321_8 indicate a bad LAA. If an error occurs at location 2257_8 the STB instruction failed, errors at 2264_8 or 2266_8 indicate LBA failed.

Transfer and Interchange A & B (TATB)

A is loaded with the counter and transferred to B, B is then stored and compared to A. An error at 2301_8 or 2303_8 indicates this phase failed.

B is loaded with the counter and is then transferred to A. A is compared to the counter and an error will occur at location 2310_8 or 2312_8 if TBA fails.

IAB is tested by loading A with the counter and B with minus one. After an IAB, A is compared to minus one, B is stored and A is loaded with STOR. A comparison then takes place. Errors at location 2317_8 or 2321_8 indicate A did not contain a minus one. If B did not contain the proper information errors will occur at 2325_8 or 2327_8.

Negate A-Accumulator (NEGT)

The counter is subtracted from zero in A and stored. A is then loaded with the counter and negated. The results are compared and an error will occur at location 2343_8 or 2345_8 if they are not equal.

Shift Instructions (BEG1)

The RSA is tested extensively by loading A with a constant and shifting zero positions the first time. A comparison through an indirect address (DAT1, location 2412_8), checks the proper constant. The shift is incremented along with the indirect address. After all tests are completed, the shift and indirect address are returned to their original quantities. An error at 2355_8 or 2357_8 indicate an RSA error.

The rest of the shift instructions (SHTE) are tested two to six times, each shifting one position at a time. The results are compared to the proper constants.

Errors will occur at the following locations:

2421_8	LSA	2520_8	RSL	2472_8	RSA
2423_8		2522_8		2474_8	
2426_8		2525_8		2477_8	
2430_8		2527_8		2501_8	
2434_8				2505_8	
2436_8		2455_8	LSL	2507_8	
2441_8		2460_8		2512_8	
2443_8		2463_8		2514_8	
2447_8		2466_8			
2451_8					

2534_8	2720_8	2642_8
2536_8	2722_8	2644_8
2541_8	2725_8	2647_8
2543_8	2727_8	2651_8
2547_8	2733_8	2655_8
2551_8	2735_8	2657_8
2554_8	2740_8	2662_8
2556_8	2742_8	2664_8
2563_8		2671_8
2565_8	2607_8	2673_8
2570_8	2611_8	2676_8
2572_8	2614_8	2700_8
2600_8	2616_8	2704_8
2602_8	2623_8	2706_8
	2630_8	2711_8
	2635_8	2713_8
FLA	FRL / FLL	FRA

Add (ADD1, ADD3)

ADD1 - A is cleared, one is added to A and the counter is incremented, the results are compared and an error will occur at location 3006_8 or 3011_8 if there is a failure. This test is repeated in the B-Accumulator. A failure in B is indicated by an error at location 3023_8 or 3025_8.

ADD3 - The next test adds the counter to itself in A and B, the registers are then loaded with the counter and shifted left one position. The sums are compared and errors will occur at location 3040_8 or 3042_8 for an error in A and 3057_8 or 3061_8 for an error in B.

Subtract (SUB1, SUB2, SUB3)

SUB1 - A is loaded with the counter, it is then subtracted, the A-Accumulator is then checked for zero, a typeout at location 3072_8 indicates an error.

SUB2 - Zero is subtracted from the counter, A is then compared to the counter, if there is an error, a typeout will occur at location 3102_8 or 3104_8.

SUB3 - The counter is multiplied by two, it is then subtracted. A should then be equal to the counter, a halt at location 3115_8 or 3117_8 indicates A is not equal to the counter.

And A & B Or A & B (ANOR)

Constants are and'ed and or'ed, the results are compared to constants. Error indications at locations 3144_8, 3146_8, 3162_8, 3164_8, and 3200_8 or 3202_8 are errors in the ABA instruction. Error indications at locations 3134_8, 3136_8, 3152_8, 3154_8, 3170_8, 3172_8, and 3206_8 or 3208_8 are errors in the OBA instruction. All worst cases are tested.

Increment B and Skip (IBST)

B is loaded with minus one and incremented, the counter is operated in the same fashion. The B-Accumulator and the counter are compared. If no skip occurs while B is positive, an error will occur at location 3244_8. If B skips when it is negative, an error will occur at location 3257_8. An unequal comparison between B and the counter will cause an error at location 3247_8 or 3251_8 when B is positive and at location 3262_8 or 3264_8 when B is negative.

Copy Sign of B - (CSBN, CSBP)

The CSB instruction is tested with the B sign bit on and off. With the bit on a CSB, NEG gets the bit into A, the counter is then negated and one is subtracted from it. The two answers are then compared. Error indications on this test are at locations 3303_8 and 3305_8.

With the B sign bit off a CSB, NEG is used again but the counter is only negated. After the comparison the error indications are at locations 3320_8 and 3322_8.

Complement Sign of A (ASCT)

The counter is loaded in A, the sign is changed by adding a minus sign. The counter's sign is then complemented. The two results are compared and if they are not equal, an error will occur at location 3336_8 or 3340_8.

Change Number Systems (CNST)

If the counter is negative, the data is checked, if the data is zero, nothing is done. All other cases the counter is changed by a CNS and a ASC, the counter is then negated. The results are compared and if they are not equal, an error will occur at location 3362_8 or 3364_8.

The remaining part of memory contains the cycle counter, error routine, and typeout routines.

#3B3003B
COMPARE MEM. TO "A"

SYSTEMS ENGINEERING LABORATORIES PROGRAM LIBRARY

SOFTWARE DESCRIPTION

CATALOG NO. 303003B

DOCUMENTATION REV*_____

DATE June 15, 1970

PROGRAM TITLE: 810A/B Compare Memory to A, A Sign Test (CMASAS)

PURPOSE: CMASAS tests every memory location with a CMA and SAS for every type of condition, except the first 1014_8 locations.

CONFIGURATION: Basic SYSTEMS 810A/B Computer

SOFTWARE ENVIRONMENT: Stand-Alone

PROGRAM LANGUAGE: SYSTEMS 810A/B Assembly Language

SIZE: 0 - 1014_8 plus every other memory location

Not Relocatable

TIMING: Dependent on Memory Size

Note:
When using the upper 16K load/dump program the relocatable loader program counter 36060 should be utilized to load the program rather than the 16060.

Relocatable Loader
Prog. Counter 16060
A-Accum 0 B-Accum 0
After Load Enter Bit 3
In Memory Location '753
Start At '0 Prog. Cntr.

When using the Upper 16K loader program. after load enter bits 2 + 3 in memory location '753

SYSTEMS 303003B

REASON FOR CHANGE:

Changes were made to allow this program to run on the KEYTRAN System and output all messages to the selectric typewriter by setting Sense Switch 13.

USE:

After loading, set location 753_8 (TOP) with bits 2-3 dependent on memory size.*

Start at location zero, the program will run until manually halted.

When running under the KEYTRAN System the Diagnostic Number for this program is five (5). The program will automatically be started at location zero and will continuously run until the Index Key is depressed on the selectric typewriter at which time a halt will occur. At this time the operator must mount the KEYTRAN disc pack and depress start. The program will then seek home and halt. The operator must depress start to load the KEYTRAN System back into memory. The program will then halt at location 407_8. At this time the operator must enter 2000_8 in the program counter and depress Start.

Sense Switch Setting:

SSW 13 up - Indicates Program being run with the KEYTRAN System and that all output will be via the selectric typewriter.

*Note

For a 4K memory -- set no bits in location 753_8.
8K - bit 3
12K - bit 2
16K - bits 2 & 3

Type-Out Formats

L xxxxxx n

where:

L = Letter C for CMA error
Letter S for SAS error

xxxxxx = The location of the erroneous instruction

n = A number, if a CMA error the number indicates the operand in memory, A is always zero. If an SAS error the number is what was contained in A. There are three possible numbers: 1, 0, -1.

Note

This program will clear every memory location above $(1014)_8$.

SEL PROGRAM LIBRARY

PROGRAM DESCRIPTION

 Catalog No. 303004A

IDENTIFICATION: MEMDEX

AUTHOR: Systems Engineering Laboratories, Incorporated

ACCEPTED: 13 January 1967

PURPOSE: Under sense switch control, the program will load into all memory locations; all zeros and ones, indirect and indirect indexed; alternate bits, indirect and indirect indexed; walking one, indirect; walking zero, indirect indexed. Each location is checked for the proper information stored.

Absolute Loader
Prog. Counter '17673
A-Accum 0 B-Accum 0
After Load Enter Bit 3
In Memory Location '227
Start At 0 Prog. Cntr.

SOURCE PROGRAM LANGUAGE: MNEMBLER 810A

COMPUTER CONFIGURATION: Standard SEL 810A

STORAGE: 0000 to 0502_8, plus every other memory location. Not relocatable.

SUBROUTINES REQUIRED: 810A Mainframe Diagnostic Loading Procedure

TIMING: Dependent on memory size.

USE: After loading, set the location tagged FIN (227_8) with the most significant four bits of the highest memory address (see note). Start at location zero. The program will run continuously until halted manually.

NOTE: For a 4K memory, no bits should be set in FIN.
8K - set bit 3
12K - set bit 2
16K - set bits 2 and 3

Absolute Loader
Prog. Counter '17673
A-Accum 0 B-Accum 0
After Load Enter Bit 3
In Memory Location '227
Start At '0 Prog. Cntr.

Snese Switches:

SSW 0 up - the all ones, all zeros test will run.
SSW 1 up - the alternate bit pattern test will be run.

Prog. Cntr. 37673 when using the upper 16K loader program

Note: When using the upper 16K loader program:
- After load enter bits 2+3 in memory location '227

SSW 2 up - the walking one and walking zero test will run.
SSW 3 up - a halt will occur after an error type-out.

Any combination of sense switches may be used.

Type-Out Format:

12345 WORD aaaaaa
Memory Error
12345 - location at which the error occurred.

WORD - what the location should contain.
ZERO - if the location should contain a zero.
ONES - if the location should contain a zero.

1010 or 0101 - the sequence of binary bits for the alternate bit patterns.

1 or Z and XX - a walking one or zero error where XX = the left shift count from the farthest right position.

aaaaaa - the octal contents of the memory location in error.

NOTE: This program will destroy the contents of every memory location.

To restart this program, start at location 15_8.

METHOD:

Setup Routine

Sets the various addresses used to correspond with the highest memory address which is loaded into the location tagged FIN (227_8). FIN does not have to be changed if the machine in which the program is to be run has a 4096 location memory.

Sense Switch Routine (EXEC):

Checks the sense switches that are up and branches to the routine indicated by the sense switch settings.

All Ones, All Zeros Test (ALL1)

The zeros are obtained by clearing the A-Register. The

zeros are then stored and checked indirectly through the location tagged STAR (225_8). Ones are stored and checked indirectly through the location tagged FIN (227_8) which has its index bit set.

Alternate Bits Test (WORS)

The constant tagged ONEO (234_8) is stored and checked indirectly through STAR. The constant OH1 (235_8) is stored and checked indirectly through FIN.

Walking One and Zero Test (WALK)

The Walk One routine is executed first. A one is loaded in A and shifted zero times. The A-Register is then stored and checked indirectly through STAR. After all of memory is tested, the shift instruction is incremented and the test is repeated. When all bit positions are tested, the Walk Zero routine will be executed.

The Walk Zero routine is executed in the same manner as the Walk One routine except that FIN is used as an indirect address.

Ping Pong Routine (PIPO)

The starting addresses are changed to include the map not exercised previously. The routine then moves the entire program to either the top or bottom map and modifies itself to return the program to the map from which it was moved.

Address Reset Routine (REST)

This routine is executed after every test to reset STAR and the index count contained in the B-Register.

```
0001  00000 00000000 *                                                    00100
0002  00000 00000000 *          MEMDEX          REV-1                    00000100
0003  00000 00000000 *          MEMØRY TEST - USES INDEXED AND INDIRECT  00000200
0004  00000 00000000 *          ALL LØADERS MUST BE RELØADED AFTER       00000300
0005  00000 00000000 *          RUNNING THIS PRØGRAM                     00000400
0006  00000 00000000 *                                                   00000500
0007  00000 00000000 *                                                   00000800
0008  00000 00000000      REL
0009  01000 70001000      ØRG   '1000
0010  01000 01101247      LAA   TØP         SET UP RØUTINE             00000900
0011  01001 05101227      AMA   FIN         FIN CØNTAINS HIGH BIT FØR MØRE THAN 4K  00001000
0012  01002 03101247      STA   TØP         TØP IS THE HIGH LØCATIØN FØR PING-PØNG  00001100
0013  01003 01101227      LAA   FIN         FIN BECØMES AN INDIRECT ADDRESS         00001200
0014  01004 05101224      AMA   END         FØR USE IN THE INDIRECT-INDEXED         00001300
0015  01005 03101224      STA   END         ØPERATIØNS,MINZ SETS THE INDEX BIT      00001400
0016  01006 05101244      AMA   MINZ        ØN IN FIN                  00001500
0017  01007 03101227      STA   FIN                                    00001600
0018  01010 01101224      LAA   END         END BECØMES THE INDEX CØUNT 00001700
0019  01011 06101225      SMA   STAR                                   00001800
0020  01012 00000002      NEG               FØR ALL ØPERATIØNS         00001900
0021  01013 03101224      STA   END                                    00002000
0022  01014 00000005      TAB                                          00002100
0023  01015 00000000 *                                                00002200
0024  01015 00000000 *          EXECUTIVE RØUTINE                      00002300
0025  01015 00000000 *                                                00002400
0026  01015 00130400 EXEC  SNS   0           SENSE SWITCH ZERØ          00002500
0027  01016 12101026      SPB   ALL1        ALL ØNES, ALL ZERØS        00002600
0028  01017 00130401      SNS   1           SENSE SWITCH ØNE           00002700
0029  01020 12101050      SPB   WØRS        WØRST BIT PATTERN          00002800
0030  01021 00130402      SNS   2           SENSE SWITCH TWØ           00002900
0031  01022 12101072      SPB   WALK        WALKING ØNE AND ZERØ       00003000
0032  01023 12101151      SPB   PIPØ-1      PING-PØNG                  00003200
0033  01024 12101144      SPB   REST                                   00003250
0034  01025 11101015      BRU   EXEC                                   00003300
0035  01026 00000000 *                                                00003400
0036  01026 00000000 ALL1  ZZZ   **          ALL ØNES, ALL ZERØS TEST   00003500
0037  01027 00000003      CLA                                          00003600
0038  01030 03301225      STA*  STAR        STØRE ZERØS INDIRECT       00003700
```

```
0039  01031 15301225       CMA* STAR          ZERØS STØRED                    00003800
0040  01032 12101254       SPB  ERRZ                                          00003900
0041  01033 11101035       BRU  *+2           YES                             00004000
0042  01034 12101254       SPB  ERRZ                                          00004100
0043  01035 01101243       LAA  ØNES                                          00004200
0044  01036 03301227       STA* FIN                                           00004300
0045  01037 15301227       CMA* FIN                                           00004400
0046  01040 12101265       SPB  ERR1                                          00004500
0047  01041 11101043       BRU  *+2           YES                             00004600
0048  01042 12101265       SPB  ERR1                                          00004700
0049  01043 14101225       IMS  STAR          INCREMENT INDIRECT ADDRES       00004800
0050  01044 00000026       IBS                                                00004900
0051  01045 11101027       BRU  ALL1+1        NØ, REPEAT TEST                 00005000
0052  01046 12101144       SPB  REST                                          00005100
0053  01047 11301026       BRU* ALL1                                          00005400
0054  01050 00000000 *                                                        00005450
0055  01050 00000000 WØRS  ZZZ  **            ALTERNATE BITS TEST             00005500
0056  01051 01101234       LAA  ØNEØ                                          00005600
0057  01052 03301225       STA* STAR          STØRE INDIRECT                  00005700
0058  01053 15301225       CMA* STAR          STØRED PRØPERLY                 00005800
0059  01054 12101276       SPB  ER1ø                                          00005900
0060  01055 11101057       BRU  *+2           YES                             00006000
0061  01056 12101276       SPB  ER1ø                                          00006100
0062  01057 01101235       LAA  ØH1                                           00006200
0063  01060 03301227       STA* FIN                                           00006300
0064  01061 15301227       CMA* FIN                                           00006400
0065  01062 12101307       SPB  ER01                                          00006500
0066  01063 11101065       BRU  *+2           YES                             00006600
0067  01064 12101307       SPB  ER01                                          00006700
0068  01065 14101225       IMS  STAR          INCREMENT INDIRECT ADDRES       00006800
0069  01066 00000026       IBS                INDEX = ZERØ                    00006900
0070  01067 11101051       BRU  WØRS+1        NØ, RETURN TØ REPEAT            00007000
0071  01070 12101144       SPB  REST                                          00007100
0072  01071 11301020       BRU* WØRS          EXIT                            00007400
0073  01072 00000000 *                                                        00007450
0074  01072 00000000 WALK  ZZZ  **                                           00007500
0075  01073 01101230       LAA  ØNE           WALK ØNE RØUTINE                00007600
0076  01074 00000016       LSL  0             SHIFT ØNE                       00007700
0077  01075 03301225       STA* STAR          STØRE INDIRECT                  00007800
```

```
0078  01076 15301225       CMA*  STAR      STØRED PRØPERLY               00007900
0079  01077 12101320       SPB   ERWA                                    00008000
0080  01100 11101102       BRU   *+2       YES                           00008100
0081  01101 12101320       SPB   ERWA                                    00008200
0082  01102 14101225       IMS   STAR      INCREMENT INDIRECT ADDRES     00008300
0083  01103 00000026       IBS                                           00008400
0084  01104 11101073       BRU   WALK+1    AND RETURN                    00008500
0085  01105 00000000 *                                                   00008600
0086  01105 01101074       LAA   WALK+2    CHANGE SHIFT INSTRUCTIØN      00009000
0087  01106 05101231       AMA   ØNEH                                    00009100
0088  01107 03101074       STA   WALK+2                                  00009200
0089  01110 12101144       SPB   REST                                    00009200
0090  01111 14101236       IMS   SHCN                                    00009300
0091  01112 11101073       BRU   WALK+1                                  00009600
0092  01113 00000000 *                                                   00009700
0093  01113 01101233 WA1   LAA   Ø01       WALK ZERØ RØUTINE             00009800
0094  01114 03301227       STA*  FIN                                     00009900
0095  01115 15301227       CMA*  FIN                                     00010000
0096  01116 12101330       SPB   EWA1                                    00010100
0097  01117 11101121       BRU   *+2                                     00010200
0098  01120 12101330       SPB   EWA1                                    00010300
0099  01121 14101225       IMS   STAR                                    00010350
0100  01122 00000026       IBS                                           00010400
0101  01123 11101113       BRU   WA1                                     00010500
0102  01124 01101233       LAA   Ø01                                     00010600
0103  01125 02101243       LBA   ØNES                                    00010700
0104  01126 00000113       FLL   1                                       00010800
0105  01127 03101233       STA   Ø01                                     00010900
0106  01130 12101144       SPB   REST                                    00011000
0107  01131 14101240       IMS   RSCN                                    00011100
0108  01132 11101113       BRU   WA1                                     00011200
0109  01133 01101253       LAA   LSL                                     00011500
0110  01134 03101074       STA   WALK+2                                  00011600
0111  01135 01101237       LAA   NEW                                     00011700
0112  01136 03101236       STA   SHCN                                    00011800
0113  01137 01101241       LAA   NECN                                    00011900
0114  01140 03101240       STA   RSCN                                    00012000
0115  01141 01101242       LAA   NEWK                                    00012100
0116  01142 03101233       STA   Ø01                                     00012200
```

```
0117  01143 11301072       BRU* WALK                                          00012400
0118  01144 00000000 *                                                        00012446
0119  01144 00000000 REST ***  **          RESET INDIRECT AND INDEX           00012447
0120  01145 01101226       LAA  BEG                                           00012450
0121  01146 03101225       STA  STAR                                          00012451
0122  01147 02101224       LBA  END                                           00012452
0123  01150 11301144       BRU* REST                                          00012453
0124  01151 00000000 *                                                        00012500
0125  01151 00000000 *          PING PØNG RØUTINE                            00012600
0126  01151 00000000 *                                                        00012700
0127  01151 00000000       ZZZ  **          EXIT ADDRESS                     00012800
0128  01152 01101225 PIPØ  LAA  STAR        RESET ALL ADDRESSES SØ PRØGRAM CAN 00012900
0129  01153 03101245       STA  SAVE        BE MØVED TØ TØP MAP TØ EXERCISE  00013000
0130  01154 01101227       LAA  FIN         LØWER PØRTIØN ØF MEMØRY          00013100
0131  01155 03101246       STA  STØR                                          00013200
0132  01156 06101245       SMA  SAVE                                          00013300
0133  01157 03101227       STA  FIN                                           00013400
0134  01160 00000003       CLA                                                00013500
0135  01161 03101226       STA  BEG                                           00013600
0136  01162 03101225       STA  STAR                                          00013700
0137  01163 01101251       LAA  BRU                                           00013800
0138  01164 03101152       STA  PIPØ                                          00013900
0139  01165 01101224       LAA  END                                           00014000
0140  01166 00000002       NEG              SET EXIT ADDRESS TØ GØ TØ TØP MAP 00014100
0141  01167 05101230       AMA  ØNE                                           00014200
0142  01170 05101151       AMA  PIPØ-1      AFTER MØVE IS CØMPLETE            00014300
0143  01171 03101151       STA  PIPØ-1                                        00014400
0144  01172 02101232       LBA  IDX                                           00014500
0145  01173 01301250       LAA* BØT         MØVE PRØGRAM TØ TØP MAP           00014600
0146  01174 03301247       STA* TØP         TØ  EXERCISE LØWER PART ØF        00014700
0147  01175 00000026       IBS              MEMØRY                            00014800
0148  01176 11101173       BRU  *-3                                           00014900
0149  01177 11301151       BRU* PIPØ-1      EXIT TØ TØP MAP                   00015000
0150  01200 01101245 PØNG  LAA  SAVE        RESET ALL ADDRESSES SØ PRØGRAM CAN 00015100
0151  01201 03101225       STA  STAR        BE MØVED BACK TØ THE BØTTØM MAP   00015200
0152  01202 03101226       STA  BEG                                           00015300
0153  01203 01101246       LAA  STØR                                          00015400
0154  01204 03101227       STA  FIN                                           00015500
0155  01205 01101252       LAA  LAA                                           00015600
```

```
0156  01206 03101152        STA  PIPØ                                        00015700
0157  01207 01101224        LAA  END                                         00015800
0158  01210 00000002        NEG                                              00015900
0159  01211 05101230        AMA  ØNE                                         00016000
0160  01212 03101246        STA  STØR                                        00016100
0161  01213 01101151        LAA  PIPØ-1                                      00016200
0162  01214 06101246        SMA  STØR                                        00016300
0163  01215 03101151        STA  PIPØ-1                                      00016400
0164  01216 02101232        LBA  IDX                                         00016500
0165  01217 01301247        LAA* TØP      MØVE PRØGRAM BACK TØ BØTTØM MAP    00016600
0166  01220 03301250        STA* BØT      AND CØNTINUE                       00016700
0167  01221 00000026        IBS                                              00016800
0168  01222 11101217        BRU  *-3                                         00016900
0169  01223 11301151        BRU* PIPØ-1   EXIT TØ BØTTØM MAP                 00017000
0170  01224 00000000 *                                                       00017100
0171  01224 25407777 END    DAC  '7777                                       00017200
0172  01225 25401000 STAR   DAC  '1000                                       00017300
0173  01226 25401000 BEG    DAC  '1000                                       00017400
0174  01227 00000000 FIN    ZZZ  **                                          00017500
0175  01230 00000001 ØNE    DATA 1                                           00017600
0176  01231 00000100 ØNEH   DATA '100                                        00017700
0177  01232 00177275 IDX    DATA -323                                        00017800
0178  01233 00177776 Ø01    DATA -2                                          00017900
0179  01234 00125252 ØNEØ   DATA '125252                                     00018000
0180  01235 00052525 ØH1    DATA '52525                                      00018100
0181  01236 00177760 SHCN   DATA -16                                         00018200
0182  01237 00177760 NEW    DATA -16                                         00018300
0183  01240 00177760 RSCN   DATA -16                                         00018400
0184  01241 00177760 NECN   DATA -16                                         00018500
0185  01242 00177776 NEWK   DATA -2                                          00018600
0186  01243 00177777 ØNES   DATA -1                                          00018700
0187  01244 00100000 MINZ   DATA '100000                                     00018800
0188  01245 00000000 SAVE   ZZZ  **                                          00018900
0189  01246 00000000 STØR   ZZZ  **                                          00019000
0190  01247 25607503 TØP    DAC  3907,1                                      00019100
0191  01250 25600503 BØT    DAC  323,1                                       00019200
0192  01251 11101200 BRU    BRU  PØNG                                        00019300
0193  01252 01101225 LAA    LAA  STAR                                        00019400
0194  01253 00003016 LSL    LSL  0                                           00019500
```

```
0195  01254 00000000 *
0196  01254 00000000 ERRZ ***  **          ZERØS STØRED ERRØR                    00019600
0197  01255 12101355       SPB  SAB                                              0019700
0198  01256 01101456       LAA  LETØ       SET UP TYPE ØUT MESSAGE               0019800
0199  01257 03101470       STA  MESS                                             0019900
0200  01260 01101457       LAA  LETØ+1                                           0020000
0201  01261 03101471       STA  MESS+1                                           0020100
0202  01262 12101365       SPB  TPØ                                              0020200
0203  01263 12101361       SPB  LAB                                              0020300
0204  01264 11301254       BRU* ERRZ                                             0020400
0205  01265 00000000 *                                                           0020500
0206  01265 00000000 ERR1 ***  **          ØNES STØRED ERRØR                     0020600
0207  01266 12101355       SPB  SAB                                              0020700
0208  01267 01101460       LAA  LET1       SET UP TYPE ØUT MESSAGE               0020800
0209  01270 03101470       STA  MESS                                             0020900
0210  01271 01101461       LAA  LET1+1                                           0021000
0211  01272 03101471       STA  MESS+1                                           0021100
0212  01273 12101365       SPB  TPØ                                              0021200
0213  01274 12101361       SPB  LAB                                              0021300
0214  01275 11301265       BRU* ERR1                                             0021400
0215  01276 00000000 *                                                           0021500
0216  01276 00000000 ER1Ø ***  **          ØNE-ZERØ STØRED ERRØR                  0021600
0217  01277 12101355       SPB  SAB                                              0021700
0218  01300 01101462       LAA  LE10       SET UP TYPE ØUT MESSAGE               0021800
0219  01301 03101470       STA  MESS                                             0021900
0220  01302 01101463       LAA  LE10+1                                           0022000
0221  01303 03101471       STA  MESS+1                                           0022100
0222  01304 12101365       SPB  TPØ                                              0022200
0223  01305 12101361       SPB  LAB                                              0022300
0224  01306 11301276       BRU* ER1Ø                                             0022400
0225  01307 00000000 *                                                           0022500
0226  01307 00000000 ER01 ***  **          ZERØ-ØNE STØRED ERRØR                  0022600
0227  01310 12101355       SPB  SAB                                              0022700
0228  01311 01101464       LAA  LE01       SET UP TYPE ØUT MESSAGE               0022800
0229  01312 03101470       STA  MESS                                             0022900
0230  01313 01101465       LAA  LE01+1                                           0023000
0231  01314 03101471       STA  MESS+1                                           0023100
0232  01315 12101365       SPB  TPØ                                              0023200
0233  01316 12101361       SPB  LAB                                              0023300
                                                                                 0023400
```

```
0234  01317 11301307       BRU*  ER01                                    0023500
0235  01320 00000000 *                                                   0023550
0236  01320 00000000 ERWA ***   **      WALKING ØNE STØRED ERRØR         0023600
0237  01321 12101355       SPB   SAB                                     0023700
0238  01322 01101466       LAA   W1      SET UP TYPE ØUT MESSAGE          0023800
0239  01323 03101470       STA   MESS                                    0023900
0240  01324 01101237       LAA   NEW                                     0024000
0241  01325 06101236       SMA   SHCN                                    0024100
0242  01326 12101340       SPB   GSCN                                    0024200
0243  01327 11301320       BRU*  ERWA                                    0024300
0244  01330 00000000 *                                                   0024400
0245  01330 00000000 EWA1 ***   **      WALKING ZERØ STØRED ERRØR         0024500
0246  01331 12101355       SPB   SAB                                     0024600
0247  01332 01101467       LAA   WZ      SET UP TYPE ØUT MESSAGE          0024700
0248  01333 03101470       STA   MESS                                    0024800
0249  01334 01101241       LAA   NECN                                    0024900
0250  01335 06101240       SMA   RSCN                                    0025000
0251  01336 12101340       SPB   GSCN                                    0025100
0252  01337 11301330       BRU*  EWA1                                    0025200
0253  01340 00000000 *                                                   0025300
0254  01340 00000000 GSCN ***   **      GET SHIFT CØUNT FØR WALK-        0025400
0255  01341 00000002       NEG           ING ØNE AND ZERØ ERRØRS          0025500
0256  01342 00000312       FRA   3                                       0025600
0257  01343 03101472       AMA   TWØo                                    0025700
0258  01344 00000113       FLL   1                                       0025800
0259  01345 00000115       RSL   1                                       0025900
0260  01346 00000516       LSL   5                                       0026000
0261  01347 00000313       FLL   3                                       0026100
0262  01350 03101472       AMA   TWØ6                                    0026200
0263  01351 03101471       STA   MESS+1    FINISH TYPE ØUT MESSAGE       0026300
0264  01352 12101365       SPB   TPØ                                     0026400
0265  01353 12101361       SPB   LAB                                     0026500
0266  01354 11301340       BRU*  GSCN                                    0026600
0267  01355 00000000 *                                                   0026700
0268  01355 00000000 SAB  ***   **      SAVE A AND B REG.                0026800
0269  01356 03101473       STA   SAVA                                    0026900
0270  01357 04101474       STB   SAVB                                    0027000
0271  01360 11301355       BRU*  SAB                                     0027100
0272  01361 00000000 *                                                   0027200
```

```
0273  01361 00000000 LAB  ***  **          LØAD A AND B REG.                0027300
0274  01362 01101473       LAA  SAVA                                         0027400
0275  01363 02101474       LBA  SAVB                                         0027500
0276  01364 11301361       BRU* LAB                                          0027600
0277  01365 00000000 *                                                       0027700
0278  01365 00000000 TPØ   ***  **          TYPE ØUT MESSAGE                 0027800
0279  01366 02101225       LBA  STAR                                         0027900
0280  01367 12101422       SPB  SHFT        LØCATIØN                         0028000
0281  01370 12101452       SPB  SPAC                                         0028100
0282  01371 12101452       SPB  SPAC                                         0028200
0283  01372 02101470       LBA  MESS        ERRØR MESSAGE                    0028300
0284  01373 12101414       SPB  BØUT                                         0028400
0285  01374 02101471       LBA  MESS+1                                       0028500
0286  01375 12101414       SPB  BØUT                                         0028600
0287  01376 12101452       SPB  SPAC                                         0028700
0288  01377 02301225       LBA* STAR        ØUTPUT CØNTENT ØF LØC.           0028800
0289  01400 00000003       CLA                                               0028900
0290  01401 00000113       FLL  1                                            0029000
0291  01402 12101437       SPB  TYPE                                         0029100
0292  01403 00000007       CSB                                               0029200
0293  01404 00000002       NEG                                               0029300
0294  01405 00000002       NEG                                               0029400
0295  01406 00000112       FRA  1                                            0029500
0296  01407 12101422       SPB  SHFT                                         0029600
0297  01410 12101446       SPB  CRLF                                         0029700
0298  01411 00130403       SNS  3           SWITCH 3 UP, HALT                0029800
0299  01412 00000000       HLT                                               0029900
0300  01413 11301365       BRU* TPØ                                          0030000
0301  01414 00000000 *                                                       0030100
0302  01414 00000000 BØUT  ***  **          B REG. ØUTPUT                    0030200
0303  01415 00001013       FLL  8                                            0030300
0304  01416 12101437       SPB  TYPE                                         00030400
0305  01417 00001013       FLL  8                                            0030500
0306  01420 12101437       SPB  TYPE                                         00030600
0307  01421 11301414       BRU* BØJT                                         0030700
0308  01422 00000000 *                                                       0030800
0309  01422 00000000 SHFT  ***  **          ØUTPUT 5 ØCTAL DIGITS            0030900
0310  01423 00000003       CLA                                               0031000
0311  01424 12101452       SPB  SHFS                                         0031100
```

```
0312  01425 12101432       SPB  SHF3                                        0031200
0313  01426 12101432       SPB  SHF3                                        0031300
0314  01427 12101432       SPB  SHF3                                        0031400
0315  01430 12101432       SPB  SHF3                                        0031500
0316  01431 11301422       BRU* SHFT                                        0031600
0317  01432 00000000 *                                                      0031700
0318  01432 00000000 SHF3 ***  **          ØUTPUT ØNE ØCTAL DIGIT          0031800
0319  01433 00000317       FLA  3                                           0031900
0320  01434 05101472       AMA  TWØ6                                        0032000
0321  01435 12101437       SPB  TYPE                                        0032100
0322  01436 11301432       BRU* SHF3                                        0032200
0323  01437 00000000 *                                                      0032300
0324  01437 00000000 TYPE ***  **          ØUTPUT A REG.                   0032400
0325  01440 00130101       DATA '130101    CEU   1,W
0326  01441 00001000       DATA '1000
0327  01442 00001016       LSL  8
0328  01443 00170101       DATA '170101    AØP   1,W
0329  01444 00000003       CLA                                              0033000
0330  01445 11301437       BRU* TYPE                                        0033400
0331  01446 00000000 *                                                      0033500
0332  01446 00000000 CRLF ***  **          ØUTPUT CAR. RTN.,LN. FD.        0033600
0333  01447 02101475       LBA  LFCR                                        0033700
0334  01450 12101414       SPB  BØUT                                        0033800
0335  01451 11301446       BRU* CRLF                                        0033900
0336  01452 00000000 *                                                      0034000
0337  01452 00000000 SPAC ***  **          ØUTPUT A SPACE                  0034100
0338  01453 01101476       LAA  SPCE                                        0034200
0339  01454 12101437       SPB  TYPE                                        0034300
0340  01455 11301452       BRU* SPAC                                        0034400
0341  01456 00000000 *                                                      0034500
0342  01456 00000000 *                                                      0034600
0343  01456 00155305 LETØ DATA ''ZERØ''                                     0034700
0343  01457 00151317
0344  01460 00147716 LET1 DATA ''ØNES''                                     0034800
0344  01461 00142723
0345  01462 00130660 LE10 DATA ''1010''                                     0034900
0345  01463 00130660
0346  01464 00130261 LE01 DATA ''0101''                                     0035000
0346  01465 00130261
```

```
0347  01466 00130640 W1    DATA ''1 ''                              0035100
0348  01467 00155240 WZ    DATA ''7 ''                              0035200
0349  01470 00000000 MESS  DATA 0,0                                 0035300
0349  01471 00000000
0350  01472 00000260 TW06  DATA 176                                 0035400
0351  01473 00000000 SAVA  DATA 0                                   0035500
0352  01474 00000000 SAVB  DATA 0                                   0035600
0353  01475 00106612 LFCR  DATA -29302                              0035700
0354  01476 00000240 SPCE  DATA 160                                 0035800
0355  01477 00000000 *                                              0035900
0356  01477 70400000       END
        EXEC    01015
        ALL1    01026
        W0RS    01050
        WALK    01072
        WA1     01113
        REST    01144
        PIP0    01152
        P0NG    01200
        END     01224
        STAR    01225
        BEG     01226
        FIN     01227
        0NE     01230
        0NEH    01231
        IDX     01232
        001     01233
        0NE0    01234
        0H1     01235
        SHCN    01236
        NEW     01237
        RSCN    01240
        NECN    01241
        NEWK    01242
        0NES    01243
        MINZ    01244
        SAVE    01245
        ST0R    01246
        T0P     01247
```

BØT	01250
BRU	01251
LAA	01252
LSL	01253
ERRZ	01254
ERR1	01265
ER1Ø	01276
ER01	01307
ERWA	01320
EWA1	01330
GSCN	01340
SAB	01355
LAB	01361
TPØ	01365
BØUT	01414
SHFT	01422
SHF3	01432
TYPE	01437
CRLF	01446
SPAC	01452
LETØ	01456
LET1	01460
LE1Ø	01462
LEØ1	01464
W1	01466
WZ	01467
MESS	01470
TWØ6	01472
SAVA	01473
SAVB	01474
LFCR	01475
SPCE	01476

SYSTEMS ENGINEERING LABORATORIES PROGRAM LIBRARY

SOFTWARE DESCRIPTION

CATALOG NO. 303005B

DOCUMENTATION REV*_____

DATE June 15, 1970

PROGRAM TITLE: 810A/B Load/Store/Register Change Test (LSRCT)

PURPOSE: LSRCT uses each of the load, store and register change instructions except the LCS and CSB instruction. The data used is a counter, so all bit combinations are used. Errors are indicated by a type-out, as are successful cycles.

CONFIGURATION: Basic SYSTEMS 810A/B Computer

SOFTWARE ENVIRONMENT: Stand-Alone

PROGRAM LANGUAGE: SYSTEMS 810A/B Assembly Language

SIZE: 2000_8 - 2710_8

TIMING: Approx. 2.5MS/Cycle

Note!

When using the upper 16K load/dump program the relocatable loader program counter 36060 should be utilized to load the program rather than the 16060.

Relocatable Loader
Prog. Counter 16060
A-Accum 0 B-Accum 0
After Load Start At '2000

REASON FOR CHANGE:

Changes were made to allow this program to run with the KeyTran System and output all messages to the selectric typewriter by setting sense switch 13.

USE:

Start at location 2000_8, the program will run until manually halted.

When running under the KeyTran System the diagnostic number for this program is six (6). The program will automatically be started at location 2000_8 and will continuously run until the Index key is depressed on the selectric typewriter at which time control will be returned to the KeyTran Diagnostic Loader.

If a halt occurs, consult the listing or halt log using the P-Counter location to find the instruction that failed.

Sense Switchs Settings:

SSW 0 up - The cycle count will not be typed.

SSW 1 up - Errors are ignored.

SSW 2 up - No error type-out will occur, the machine will halt. The A-Accumulator will contain the error location and locations 2603_8, 2604_8 and 2576_8 will contain the A&B Accumulators and the counter respectively.

SSW 13 up - Indicates program being run with the KeyTran System and that all output will be via the selectric typewriter.

Type-Out Formats:

Successful Cycles - NNNN
NNNN = The number of cycles completed without error.

Machine Error Preceeding Loc XXXXX
AAAAAA BBBBBB CCCCCC

XXXXX = The location plus one form which an SPB occurred following an error condition.
AAAAAA = The contents of the A-Accumulator.
BBBBBB = The contents of the B-Accumulator.
CCCCCC = The contents of the counter.

HALT LOG:

P-Counter	Instruction In Error
2041	CLA
2045, 2047	LBA, TBA
2052, 2054	IAB
2057, 2061	LAA
2065, 2067	TAB, STB
2072, 2074	STA

SYSTEMS ENGINEERING LABORATORIES PROGRAM LIBRARY

SOFTWARE DESCRIPTION

CATALOG NO. 303006B

DOCUMENTATION REV_____

DATE June 15, 1970

PROGRAM TITLE:	810A/B Arithmetic Test (ADDO)
PURPOSE:	This program exercises the adder using the AMA, AMB and SMA instructions, RNA is also tested. A random bit pattern generator is used to generate operands. Memory is added to A and B, the results are compared. Memory is subtracted from A using the same operands, one in A, one in memory, then vice-versa. The differences are compared ignoring the signs. RNA is tested by a software round A simulation. Overflow is checked and an error condition will be generated if the overflow latch is not set at the proper time.
CONFIGURATION:	Basic SYSTEMS 810A/B Computer
SOFTWARE: ENVIRONMENT:	N/A
PROGRAM LANGUAGE:	SYSTEMS 810A/B Assembly Language

SIZE: 2000_8 - 2751_8

TIMING: Approx. 400 microseconds/cycle

Note:
When using the upper 16K load/dump program the relocatable loader program counter 36060 should be utilized to load the program rather than the 16060.

Relocatable Loader
Prog. Counter 16060
A-Accum 0 B-Accum 0
After Load Start At '2000

REASON FOR CHANGE:

Changes were made to allow this program to run with the KEYTRAN System and output all messages to the selectric typewriter by setting Sense Switch 13.

USE:

Start at location 2000_8, the program will run until manually halted.

When running under the KEYTRAN System the Diagnostic Number for this program is seven (7). The program will automatically be started at location 2000_8 and will continuously run until the Index Key is depressed on the selectric typewriter at which time control will be returned to the KEYTRAN Diagnostic Loader.

Sense Switch Settings:

SSW 0 up - Errors are ignored.

SSW 1 up - A halt will occur after an error type-out.

SSW 2 up - No error type-out, a halt will occur.

SSW 13 up - Indicates program being run with the KEYTRAN System and that all output will be via the selectric typewriter.

Note

With SSW 2 up a halt at location 2167_8 indicates an RNA error. An add error will cause a halt at 2251_8 and a subtract error halts at 2321_8.

Type-Out Formats:

```
aaaaaa     bbbbbb
A  nnnnnn  OVFL
B  mmmmmm  OVFL
```

Indicates add error:

aaaaaa = operand in A for AMA, in memory for AMB
bbbbbb = operand in memory for AMA, in B for AMB
nnnnnn = the AMA sum
mmmmmm = the AMB sum

Note

If both sums are the same and the letters OVFL (indicating overflow) are not typed next to both sums this indicates an overflow error. The letters will not always be typed, only if an overflow occurred.

```
aaaaaa  bbbbbb
S  A  nnnnnn  OVFL
   B  mmmmmm  OVFL
```

Indicates an SMA error:

nnnnnn = difference of a-b
mmmmmm = difference of b-a

Note

Only the signs should be unlike. As in the add test overflow should occur on both subtracts.

```
aaaaaa  bbbbbb
  R  nnnnnn  mmmmmm
```

Indicates an RNA error:

a's = A-Accumulator
b's = B-Accumulator
nnnnnn = software RNA
mmmmmm = hardware RNA

SYSTEMS ENGINEERING LABORATORIES PROGRAM LIBRARY

SOFTWARE DESCRIPTION

CATALOG NO. 303007C

DOCUMENTATION REV

DATE June 15, 1970

PROGRAM TITLE: 810A/B Multiply Test (MTPY)

PURPOSE: MTPY uses a random operand generator to generate two operands. The two operands are multiplied by the hardware, the product is then compared to the product of a software multiply. An inequality causes a typeout. The software multiply arrives at a product by adding and shifting.

CONFIGURATION: Basic SYSTEMS 810A/B Computer

SOFTWARE ENVIRONMENT: Stand-Alone

PROGRAM LANGUAGE: SYSTEMS 810A/B Assembly Language

SIZE: 2000_8 - 3351_8

TIMING: Approx. 0.75 microseconds/product

Note!
When using the upper 16K load/dump program the relocatable loader, program counter 36060 should be utilized to load the program rather than the 16060.

Relocatable Loader
Prog. Counter 16060
A-Accum 0 B-Accum 0
After Load Start At '2000

SYSTEMS 303007C

REASON FOR CHANGE:

Changes were made to allow this program to run with the Keytran System and output all messages to the selectric typewriter by setting Sense Switch 13.

USE:

Start at location 2000_8, the program will run until manually halted.

When running under the Keytran System the Diagnostic Number for this program is eight (8). The program will automatically be started at location 2000_8 and will continuously run until the Index Key is depressed on the selectric typewriter at which time control will be returned to the Keytran Diagnostic Loader.

Sense Switch Settings:

SSW 0 up - Errors are ignored.

SSW 1 up - No error typeout, a halt will occur.

SSW 2 up - The same operands will be used continuously.

SSW 3 up - A halt will occur after an error typeout.

SSW 4 up - A bit pattern will be typed out.

SSW 13 up - Indicates program being run with the Keytran System and that all output will be via the selectric typewriter.

Typeout Format:

Multiply Error

aaaaaa bbbbbb

nnnnnn mmmmmm

xxxxxx yyyyyy

aaaaaa = Multiplier (In Memory)

bbbbbb = Multiplicand (In B-Accumulator)

nnnnnn = Software Product in A

mmmmmm = Software Product in B

xxxxxx = Product in A

yyyyyy = Product in B

Example of a Bit Typeout

TTTTTT BBBBBB

T x xxx xxx xxx xxx xxx - T y yyy yyy yyy yyy yyy

S z zzz zzz zzz zzz zzz - S w www www www www www atc 123 t

a a aaa aaa aaa aaa aaa b b bbb bbb bbb bbb bbb atc def g

where:

TTTTTT	= T-Register
BBBBBB	= B-Register
x xxx xxx ...	= Bit Pattern of T-Register
y yyy yyy ...	= Bit Pattern of -T
z zzz zzz ...	= Bit Pattern of T Shifted
w www www..	= Bit Pattern of -T Shifted
a aaa aaa ...	= Bit Pattern of A-Register
b bbb bbb ...	= Bit Pattern of B-Register
a	= Sign of A
t	= Sign of T
c	= Carry
d	= 1X
e	= 2X
f	= -1X
g	= Toggle

Note

If it is desired to find two operands that fail continuously set sense switch three up, after the typeout and halt set sense switches zero up and two up and three down. The program will run continuously using the operands that failed and the error condition will be ignored allowing easier troubleshooting. To get a bit pattern, after the halt, set sense switches two up and four up. When it starts typing out, lower four to discontinue typeout.

SEL #303007C
810A MULTIPLY TEST
SPECIAL OPERATION DESCRIPTION
TESTING SPECIFIC NUMBERS

1. After loading the program enter the desired multiplicand in memory location '2126 and the desired multiplyer in memory location '2127.

2. Set Sense Switch (SSW) #2 and start the program (Program Counter '2000).

3. The program will continue to test multiply the specific numbers entered in the two memory locations until manually halted, Sense Switch (SSW) #2 is reset, or a program halt occures (Sense Switch #1 or #3 program options).

NOTE: The multiplyer corresponds to the number located in the "B" accumulator and the multiplicand to the number in memory ("T" register during the multiply).

SYSTEMS ENGINEERING LABORATORIES PROGRAM LIBRARY

SOFTWARE DESCRIPTION

CATALOG NO. 303008C

DOCUMENTATION REV*_____

DATE June 15, 1970

PROGRAM TITLE: 810A/B Divide Test

PURPOSE: Divide uses a software divide which simulates the hardware exactly. Both hardware and software divide operands in single and double precision forms, the quotients and remainder are compared for accuracy

CONFIGURATION: Basic SYSTEMS 810A/B Computer

SOFTWARE ENVIRONMENT: Stand-Alone

PROGRAM LANGUAGE: SYSTEMS 810A/B Assembly Language

SIZE: 2000_8 - 3327_8

TIMING: Approx. 1050 microseconds/cycle

Note!
When using the upper 16K load/dump program the relocatable loader program counter 36060 should be utilized to load the program rather than the 16060

Relocatable Loader
Prog. Counter 16060
A-Accum 0 B-Accum 0
After Load Start At '2000

SYSTEMS 303008C

REASON FOR CHANGE:

Changes were made to allow this program to run with the KEYTRAN System and output all messages to the selectric typewriter by setting Sense Switch 13.

USE:

Start at location 2000_8, the program will run until manually halted.

When running under the KEYTRAN System the Diagnostic Number for this program is nine (9). The program will automatically be started at location 2000_8 and will continuously run until the Index Key is depressed on the selectric typewriter at which time control will be returned to the KEYTRAN Diagnostic Loader.

Sense Switch Settings:

SSW 0 up - Errors are ignored.

SSW 1 up - No error typeout, a halt will occur.

SSW 2 up - The same operands will be used continuously.

SSW 3 up - A halt will occur after an error typeout.

SSW 4 up - A bit pattern will be typed out.

SSW 13 up - Indicates program being run with the KEYTRAN System and that all output will be via the selectric typewriter.

Typeout Format:

Divide Error

xxxxxx	yyyyyy
aaaaaa	bbbbbb
cccccc	dddddd

Line 18 is the answer.

Single Precision Divide Error

xxxxxx = B-Accumulator Operand
yyyyyy = Memory Operand
aaaaaa = Quotient, Software
bbbbbb - Remainder, Software
cccccc = Quotient, Hardware
dddddd = Remainder, Hardware

```
mmmmmm nnnnnn xxxxxx
 aaaaaa bbbbbb
 cccccc dddddd
```

Double Precision Divide Error

mmmmmm = A-Accumulator Operand
nnnnnn = B-Accumulator Operand
xxxxxx = Memory Operand
a's, b's, c's, d's = Same as Single Precision

Note

If the letters "OVFL" are typed out on a double precision divide error in place of a quotient and remainder, this indicates that operation causes a divide overflow. The hardware should get overflow when the software does and the hardware should not get overflow when the software does not.

Example of Bit Pattern Type Out

```
AAAAAA BBBBBB MMMMMM
01 X XXX XXX XXX XXX XXX  Y YYY YYY YYY YYY YYY (C)
```

where AAAAAA = A-Register
BBBBBB = B-Register
MMMMMM = Memory
X XXX XXX= Bit-Pattern of A
Y YYY YYY= Bit-Pattern of B
C= Optional Typeout if Correction Has Been Made

Note

To find operands that fail, set sense switch three. After the halt, set sense switches zero and two. This will repeat the operands and errors will be ignored which will aid troubleshooting. To get a bit pattern, after the halt, set sense switches two and four. When typeout begins, lower four to discontinue typeout.

SEL #303008C
810A DIVIDE TEST
SPECIAL OPERATION DESCRIPTION
TESTING SPECIFIC NUMBERS

1. After loading the program enter the desired dividend (double length-A & B accumutators) in memory locations '3312 ("A" accum.) and '3313 ("B" accum.) and the desired divisor in memory location '3314.

2. Set Sense Switch (SSW) #2 and start the program (Program Counter '2000).

3. The program will continue to test divide the specific numbers entered in Step #1 until manually halted, Sense Switch (SSW) #2 is reset, or a program halt occures (Sense Switch #1 or 3 program options).

NOTE: The dividend corresponds to the number located in the A & B accumulator and the divisor to the number in memory ("T" register during the divide.)

SEL PROGRAM LIBRARY

PROGRAM DESCRIPTION

 Catalog No. 303010A

IDENTIFICATION: Memory Worst Case Test (MEMTES)

AUTHOR: SEL

ACCEPTED: 13 January 1967

PURPOSE: MEMTES analyzes the program counter bits in conjunction with a Boolean expression to find which locations should be loaded with ones or zeros. After all memory is loaded, each location is unloaded sequentially. While unloading memory, the worst case pattern will cause additive noise in the sense windings possibly causing bits to be dropped or picked up.

Absolute Loader
Prog. Counter '17673
A-Accum 0 B-Accum 0
After Load Enter Bit 3
In Memory Location '420
Start At '0 Prog. Cntr.

All of memory is tested through the use of a ping-pong routine. After the upper portion of memory has been exercised (location 1000_8 and up), the program is modified to exercise the lower portion of memory (location 0 up to, but not including the highest map) and transferred to the highest map in memory. Once the lower portion is exercised, the program is reset to exercise upper memory and moved back to the lowest map.

Note:
Sense switch No. 2 must be set before the program is started.

SOURCE PROGRAM LANGUAGE: MNEMBLER 810A

COMPUTER CONFIGURATIONS: Standard SEL 810A

STORAGE: 0000 to 0467_8, plus every other location - Not relocatable

SUBROUTINES REQUIRED: 810A Mainframe Diagnostic Loading Procedure

TIMING: Dependent on memory size.

Absolute Loader
Prog. Counter '17673
A-Accum 0 B-Accum 0
After Load Enter Bit 3
In Memory Location '420
Start At 0 Prog. Cntr.

Prog. Cntr. 37673 when using the upper 16K loader program

Note: When using the upper 16K loader program; - after load enter bits 2 + 3 in memory location '420.

USE:

After loading, set the location tagged FIN (420_8) with the four (4) most significant bits of the highest memory address (see note).

Set the sense switches to the desired combination before starting.

Start at location zero. The program will run continuously until halted manually.

NOTE: For a 4K memory, no bits should be set in FIN
8K - set bit 3
12K - set bit 2
16K - set bit 2 and 3

Sense Switches:

~~Set~~ - No switches for: Ferroxcube, ~~4K Memory~~
SSW 0 ~~up for:~~ Ferroxcube, 8K Memory
SSW 0 ~~and 1 up for:~~ ~~Ampex~~ Mod 1, 8K Memory
~~SSW~~ 1 up for: Ampex Mod 1, ~~4K Memory~~
SSW 2 up for: Ampex Mod 2, All Memories — Use this one.

don't use these.

NOTE: Be sure the proper sense switches are set before the program is started, otherwise the wrong worst case will be used.

Type-Out Format:

aaaaa b ccccccccccccccc

Memory Unload Error

a's = octal memory location in error.
b = a one or a zero, what every bit position of the error location should contain.
c's = sixteen binary bits which were unloaded from the error location.

NOTE: A parity error may also be caused when unloading a location. If a parity error occurs, there may not be an error type-out. The A-Register may be displayed and if it does not contain either all ones or all zeros, the parity error may be cleared and the program started where it has stopped, the error type-out will follow. If, however, the A register does contain all ones or all zeros, the B Register may be displayed to find the location that caused the parity error.

Pin 24 on 13F to gen. will give you a type out.

```
0001  00000 00000000 *          MEMTES          REV-0                                    00000200
0002  00000 00000000 *          WØRST CASE MEMØRY TEST                                   00000300
0003  00000 00000000 *          ALL LØADERS AND ØTHER PRØGRAMS MUST BE                   00000500
0004  00000 00000000 *           RELØADED AFTER RUNNING THIS PRØGRAM                     00000600
0005  00000 00000000 *                                                                   00000700
0006  00000 00000000 *          SENSE SWITCH SETTINGS                                    00000800
0007  00000 00000000 *               NØ SWITCHES UP - FERRØXCUBE 4K CØRE STACK           00000900
0008  00000 00000000 *                                 WØRST CASE IS USED                00001000
0009  00000 00000000 *               SWITCH ZERØ UP - FERRØXCUBE 8K CØRE STACK           00001100
0010  00000 00000000 *                                 WØRST CASE IS USED                00001200
0011  00000 00000000 *               SWITCHES ZERØ                                       00001300
0012  00000 00000000 *                   AND ØNE UP - AMPEX MØD-1,8K CØRE STACK          00001400
0013  00000 00000000 *                                 WØRST CASE IS USED                00001500
0014  00000 00000000 *               SWITCH ØNE  UP - AMPEX MØD-1,4K CØRE STACK          00001600
0015  00000 00000000 *                                 WØRST CASE IS USED                00001700
0016  00000 00000000 *               SWITCH TWØ  UP - AMPEX MØD-2, ALL STACKS            00001800
0017  00000 00000000 *                                 WØRST CASE IS USED                00001900
0018  00000 00000000 *                                                                   00002000
0019  00000 00000000 *                                                                   00002100
0020  00000 00000000 *          ADDRESS SET UP RØUTINE FØR ALL CØRE STACKS               00002200
0021  00000 00000000 *                                                                   00002300
0022  00000 00000000      REL                                                          
0023  01000 70001000      ØRG   '1000                                                  
0024  01000 01101455      LAA   TØP                                                    
0025  01001 05101420      AMA   FIN          FIN HAS HIGH BIT FØR MØRE THAN 4K         00002400
0026  01002 03101455      STA   TØP          TØP IS THE HIGH LØC. FØR PING-PØNG        00002500
0027  01003 01101420      LAA   FIN          FIN AND INDX ARE CØMBINED WITH            00002600
0028  01004 05101421      AMA   INDX         STAR TØ ØBTAIN A NEGATIVE                 00002700
0029  01005 06101422      SMA   STAR         CØUNT FØR MEMØRY ADDRESSING               00002800
0030  01006 00000002      NEG                                                          00002900
0031  01007 03101420      STA   FIN          THE ABØVE IS EXECUTED ØNCE                00003000
0032  01010 03101421      STA   INDX                                                   00003100
0033  01011 00000000 *                                                                 00003200
0034  01011 00000000 *          SENSE SWITCH TEST FØR CØRE STACK TYPE                  00003300
0035  01011 00000000 *                                                                 00003400
0036  01011 00130402      SNS   2            TWØ                                       00003500
0037  01012 11101243      BRU   MØD2         AMPEX MØD-2          UP                   00003600
0038  01013 00130401      SNS   1            ØNE                  DØWN                 00003700
                                                                                       00003800
```

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01014 11101020       BRU  *+4                                      UP     00003900
01015 00130400       SNS  0       ZERØ W/ ØNE DØWN                         00004000
01016 11101236       BRU  FR88    FERRØXCUBE 8K                    UP     00004100
01017 11101231       BRU  FR84    FERRØXCUBE 4K                    DØWN   00004200
01020 00130400       SNS  0       ZERØ W/ ØNE UP                           00004300
01021 11101252       BRU  MD18    AMPEX MØD 1-8K                   UP     00004400
01022 11101261       BRU  MD14    AMPEX MØD 1-4K                   DØWN   00004500
01023 00000000 *                                                           00004600
01023 00000000 *          FERRØXCUBE TEST, EARLY MØDEL 810                 00004700
01023 00000000 *                  MØDIFIED FØR ØTHER CØRE STACKS           00004800
01023 00000000 *                                                           00004900
01023 12101173 FRCB SPB  REST    RESET CNTRS. AND INDIRECT ADDR.          00005000
01024 12101061       SPB  FML1    LØGICAL FØRMULA FØR WØRST CASE           00005100
01025 00000000 *                                                           00005200
01025 12101205       SPB  LØD1    STØRE ØNES AS WØRST CASE                 00005300
01026 11101030       BRU  *+2                                              00005400
01027 00000000 *                                                           00005500
01027 12101201       SPB  LØD0    STØRE ZERØS AS WØRST CASE                00005600
01030 00000000 *                                                           00005700
01030 14101422       IMS  STAR    NEXT CØRE LØCATIØN                       00005800
01031 14101421       IMS  INDX                                             00005900
01032 11101024       BRU  FRCB+1  NEGATIVE CØUNT NØT ZERØ                  00006000
01033 12101173       SPB  REST    RESET                                    00006100
01034 00000000 *                                                           00006200
01034 12101061 ULØD SPB  FML1    FØRMULA                                  00006300
01035 00000000 *                                                           00006400
01035 12101221       SPB  UL1     UNLØAD ØNES                              00006500
01036 11101040       BRU  *+2                                              00006600
01037 00000000 *                                                           00006700
01037 12101211       SPB  UL0     UNLØAD ZERØS                             00006800
01040 00000000 *                                                           00006900
01040 14101422       IMS  STAR    NEXT LØC.                                00007000
01041 14101421       IMS  INDX                                             00007100
01042 11101034       BRU  ULØD    NEG. CNT. NØT ZERØ                       00007200
01043 00000000 *                                                           00007300
01043 01101025       LAA  FRCB+2  INTERCHANGE LØAD AND                     00007400
01044 02101027       LBA  FRCB+4   UNLØAD INSTRUCTIØNS                     00007500
01045 03101027       STA  FRCB+4                                           00007600
01046 04101025       STB  FRCB+2                                           00007700
```

```
0078  01047  01101065        LAA   UL0D+1                                    00007800
0079  01050  02101067        LBA   UL0D+3                                    00007900
0080  01051  03101067        STA   UL0D+3                                    00008000
0081  01052  04101065        STB   UL0D+1                                    00008100
0082  01053  14101423        IMS   TW0                                       00008200
0083  01054  11101023        BRU   FRCB          MEMORY NOT EXERCISED TWICE  00008300
0084  01055  01101424        LAA   NTW0                                      00008400
0085  01056  03101423        STA   TW0                                       00008500
0086  01057  12101273        SPB   PIP0          MOVE PROGRAM TO TOP MAP     00008600
0087  01060  11101023        BRU   FRCB          REPEAT TEST                 00008700
0088  01061  00000000  *                                                     00008800
0089  01061  00000000  *           LOGICAL FORMULA FOR WORST CASE FERROXCUBE CORE STACKS 00008900
0090  01061  00000000  *                 WC = (A+B) AND NOT (A AND B)        00009000
0091  01061  00000000  *                                                     00009300
0092  01061  00000000  FML1 ***    **                                        00009400
0093  01062  02101422        LBA   STAR                                      00009500
0094  01063  01101461        LAA   A                                         00009600
0095  01064  00000027        ABA                                           00009700
0096  01065  00000022        SAZ                                           00009800
0097  01066  11101074        BRU   AASS                                    00009900
0098  01067  01101462        LAA   B             NOT A                     00010000
0099  01070  00000027        ABA                                           00010200
0100  01071  00000022        SAZ                                           00010300
0101  01072  11101103        BRU   ANBA          AND B, STORE ONES         00010400
0102  01073  11101101        BRU   AABA                                    00010500
0103  01074  00000000  *                                                   00010600
0104  01074  01101462  AASS  LAA   B             A                         00010700
0105  01075  00000027        ABA                                           00010900
0106  01076  00000002        NEG                                           00011000
0107  01077  00000023        SAN                                           00011100
0108  01100  11101103        BRU   ANBA          AND NOT B, STORE ONES     00011200
0109  01101  00000000  *                                                   00011300
0110  01101  14101061  AABA  IMS   FML1          AND B, STORE ZEROS        00011400
0111  01102  14101061        IMS   FML1                                    00011500
0112  01103  11301061  ANBA  BRU*  FML1                                    00011600
0113  01104  00000000  *                                                   00011700
0114  01104  00000000  *                                                   00011800
0115  01104  00000000  *                                                   00011900
0116  01104  00000000  *           LOGICAL FORMULA FOR WORST CASE AMPEX CORE STACKS 00012000
```

```
0117  01104 00000000 *                          NC = A AND NØT B AND NØT C                00012100
0118  01104 00000000 *                            ØR NØT A AND B AND NØT C                00012200
0119  01104 00000000 *                            ØR NØT A AND NØT B AND C                00012300
0120  01104 00000000 *                            ØR A AND B AND C                        00012400
0121  01104 00000000 *                                                                    00012500
0122  01104 00000000 FØRM *** **                                                          00012600
0123  01105 02101422       LBA  STAR                                                     00012700
0124  01106 01101463       LAA  C                                                        00012800
0125  01107 00000027       ABA                                                           00012900
0126  01110 00000022       SAZ                                                           00013000
0127  01111 11101122       BRU  PRT2                                                     00013100
0128  01112 01101462       LAA  B                    NØT C                               00013200
0129  01113 00000027       ABA                                                           00013400
0130  01114 00000022       SAZ                                                           00013500
0131  01115 11101122       BRU  PRT2                                                     00013600
0132  01116 01101461       LAA  A                    AND NØT B                           00013700
0133  01117 00000027       ABA                                                           00013900
0134  01120 00000022       SAZ                                                           00014000
0135  01121 11301104       BRU* FØRM                 AND A, STØRE ØNES                   00014100
0136  01122 00000000 *                                                                   00014200
0137  01122 01101461 PRT2  LAA  A                    ØR                                  00014300
0138  01123 00000027       ABA                                                           00014500
0139  01124 00000022       SAZ                                                           00014600
0140  01125 11101136       BRU  PRT3                                                     00014700
0141  01126 01101463       LAA  C                    NØT A                               00014800
0142  01127 00000027       ABA                                                           00015000
0143  01130 00000022       SAZ                                                           00015100
0144  01131 11101136       BRU  PRT3                                                     00015200
0145  01132 01101462       LAA  B                    AND NØT C                           00015300
0146  01133 00000027       ABA                                                           00015500
0147  01134 00000022       SAZ                                                           00015600
0148  01135 11301104       BRU* FØRM                 AND B, STØRE ØNES                   00015700
0149  01136 00000000 *                                                                   00015800
0150  01136 01101461 PRT3  LAA  A                    ØR                                  00015900
0151  01137 00000027       ABA                                                           00016100
0152  01140 00000022       SAZ                                                           00016200
0153  01141 11101152       BRU  PRT4                                                     00016300
0154  01142 01101462       LAA  B                    NØT A                               00016400
0155  01143 00000027       ABA                                                           00016600
```

```
0156  01144  00000022        SAZ
0157  01145  11101152        BRU   PRT4
0158  01146  01101463        LAA   C                 AND NØT B
0159  01147  00000027        ABA
0160  01150  00000022        SAZ
0161  01151  11301104        BRU*  FØRM              AND C, STØRE ØNES
0162  01152  00000000  *
0163  01152  01101461  PRT4  LAA   A                 ØR
0164  01153  00000027        ABA
0165  01154  00000002        NEG
0166  01155  00000023        SAN
0167  01156  11101170        BRU   EXIT
0168  01157  01101462        LAA   B                 A
0169  01160  00000027        ABA
0170  01161  00000002        NEG
0171  01162  00000023        SAN
0172  01163  11101170        BRU   EXIT
0173  01164  01101463        LAA   C                 AND B
0174  01165  00000027        ABA
0175  01166  00000022        SAZ
0176  01167  11301104        BRU*  FØRM              AND C, STØRE ØNES
0177  01170  00000000  *
0178  01170  14101104  EXIT  IMS   FØRM              ØTHERWISE STØRE ZERØS
0179  01171  14101104        IMS   FØRM
0180  01172  11301104        BRU*  FØRM
0181  01173  00000000  *
0182  01173  00000000  *
0183  01173  00000000  *
0184  01173  00000000  *           RESET INDIRECT ADDRESS AND NEGATIVE CØUNT
0185  01173  00000000  *
0186  01173  00000000  REST  ***   **
0187  01174  01101427        LAA   BEG
0188  01175  03101422        STA   STAR
0189  01176  01101420        LAA   FIN
0190  01177  03101421        STA   INDX
0191  01200  11301173        BRU*  REST
0192  01201  00000000  *
0193  01201  00000000  *           LØAD ZERØS INDIRECTLY THRU STAR
0194  01201  00000000  *
```

```
00016700
00016800
00016900
00017100
00017200
00017300
00017400
00017500
00017700
00017800
00017900
00018000
00018100
00018300
00018400
00018500
00018600
00018700
00018900
00019000
00019100
00019200
00019300
00019400
00019500
00019600
00019700
00019800
00019900
00020000
00020100
00020200
00020300
00020400
00020500
00020600
00020700
00020800
00020900
```

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0195  01201 00000000 LØD0 ***  **                                        00021000
0196  01202 03000003       CLA                                          00021100
0197  01203 03301422       STA* STAR                                    00021200
0198  01204 11301201       BRU* LØD0                                    00021300
0199  01205 00000000 *                                                  00021400
0200  01205 00000000 *          LØAD ØNES INDIRECTLY THRU STAR          00021500
0201  01205 00000000 *                                                  00021600
0202  01205 00000000 LØD1 ***  **                                        00021700
0203  01206 01101425       LAA  ØNES                                    00021800
0204  01207 03301422       STA* STAR                                    00021900
0205  01210 11301205       BRU* LØD1                                    00022000
0206  01211 00000000 *                                                  00022100
0207  01211 00000000 *          UNLØAD ZERØS INDIRECTLY THRU STAR        00022200
0208  01211 00000000 *                                                  00022300
0209  01211 00000000 ULO  ***  **                                        00022400
0210  01212 00000003       CLA                                          00022500
0211  01213 01301422       LAA* STAR                                    00022600
0212  01214 15101426       CMA  ZERØ                                    00022700
0213  01215 12101334       SPB  ERØ0                                    00022800
0214  01216 11301211       BRU* ULO                                     00022900
0215  01217 12101334       SPB  ERØ0                                    00023000
0216  01220 11301211       BRU* ULO                                     00023100
0217  01221 00000000 *                                                  00023200
0218  01221 00000000 *          ULØAD ØNES INDIRECTLY THRU STAR          00023300
0219  01221 00000000 *                                                  00023400
0220  01221 00000000 UL1  ***  **                                        00023500
0221  01222 00000003       CLA                                          00023600
0222  01223 01301422       LAA* STAR                                    00023700
0223  01224 15101425       CMA  ØNES                                    00023800
0224  01225 12101342       SPB  ERØ1                                    00023900
0225  01226 11301221       BRU* UL1                                     00024000
0226  01227 12101342       SPB  ERØ1                                    00024100
0227  01230 11301221       BRU* UL1                                     00024200
0228  01231 00000000 *                                                  00024300
0229  01231 00000000 *                                                  00024400
0230  01231 00000000 *                                                  00024400
0231  01231 00000000 *          FERRØXCUBE 4K CØRE STACK TEST            00024450
0232  01231 00000000 *                                                  00024500
0233  01231 01101433 FRB4 LAA  B11          SET CØNSTANT FØR WØRST      00024550
```

```
0234  01232 03101461       STA  A              CASE EQUATION                00024600
0235  01233 01101436       LAA  B5                                          00024650
0236  01234 03101462       STA  B                                           00024700
0237  01235 11101023       BRU  FRCB                                        00024750
0238  01236 00000000 *                                                      00024800
0239  01236 00000000 *          FERROXCUBE 8K CORE STACK TEST               00024850
0240  01236 00000000 *                                                      00024900
0241  01236 01101434 FRB8 LAA  B10            SET CONSTANTS FOR W.C.       00025000
0242  01237 03101461       STA  A                                           00025100
0243  01240 01101437       LAA  B4                                          00025200
0244  01241 03101462       STA  B                                           00025300
0245  01242 11101023       BRU  FRCB                                        00025400
0246  01243 00000000 *                                                      00025500
0247  01243 00000000 *          AMPEX MOD-2, ALL CORE STACKS TEST           00025600
0248  01243 00000000 *                                                      00025700
0249  01243 01101430 MOD2 LAA  B15            SET CONSTANTS FOR W.C.       00025800
0250  01244 03101461       STA  A                                           00025900
0251  01245 01101431       LAA  B14                                         00026000
0252  01246 03101462       STA  B                                           00026100
0253  01247 01101435       LAA  B8                                          00026200
0254  01250 03101463       STA  C                                           00026300
0255  01251 11101267       BRU  STA                                         00026400
0256  01252 00000000 *                                                      00026500
0257  01252 00000000 *          AMPEX MOD 1 - 8K CORE STACK TEST            00026600
0258  01252 00000000 *                                                      00026700
0259  01252 01101436 MD18 LAA  B5             SET CONSTANTS FOR W.C.       00026800
0260  01253 03101461       STA  A                                           00026900
0261  01254 01101437       LAA  B4                                          00027000
0262  01255 03101462       STA  B                                           00027100
0263  01256 01101434       LAA  B10                                         00027200
0264  01257 03101463       STA  C                                           00027300
0265  01260 11101267       BRU  STA                                         00027400
0266  01261 00000000 *                                                      00027500
0267  01261 00000000 *          AMPEX MOD 1 - 4K CORE STACK TEST            00027600
0268  01261 00000000 *                                                      00027700
0269  01261 01101432 MD14 LAA  B12            SET CONSTANTS FOR W.C.       00027800
0270  01262 03101461       STA  A                                           00027900
0271  01263 01101433       LAA  B11                                         00028000
0272  01264 03101462       STA  B                                           00028100
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01265 01101436      LAA   B5                                                  00028200
01266 03101463      STA   C                                                   00028300
01267 00000000 *                                                              00028400
01267 01101456 STA  LAA   BFØR          MØDIFY FRCB TØ USE AMPEX              00028500
01270 03101024      STA   FRCB+1         WØRST CASE FØRMULA                   00028600
01271 03101034      STA   ULØD                                                00028700
01272 11101023      BRU   FRCB                                                00028800
01273 00000000 *                                                              00028900
01273 00000000 *                                                              00029000
01273 00000000 *                                                              00029100
01273 00000000 *          PING-PØNG RØUTINE                                   00029200
01273 00000000 *                                                              00029300
01273 00000000 PIPØ ***   **                                                  00029400
01274 01101427      LAA   BEG           SAVE ADDRESSES                        00029500
01275 03101440      STA   SAVE                                                00029600
01276 01101420      LAA   FIN                                                 00029700
01277 00000002      NEG                                                       00029800
01300 05101273      AMA   PIPØ                                                00030000
01301 03101273      STA   PIPØ                                                00030100
01302 00000003      CLA                                                       00030200
01303 03101427      STA   BEG                                                 00030300
01304 01101457      LAA   BRU           SET ENTRANCE TØ RESET ABØVE ØN RETURN 00030800
01305 03101274      STA   PIPØ+1                                              00030900
01306 00000000 *                                                              00031000
01306 02101417      LBA   IDX                                                 00031100
01307 01301454      LAA*  BØT           MØVE PRØGRAM TØ TØP MAP               00031200
01310 03301455      STA*  TØP                                                 00031300
01311 00000026      IBS                                                       00031400
01312 11101307      BRU   *-3                                                 00031500
01313 11301273      BRU*  PIPØ          EXIT TØ UPPER MEMØRY                  00031600
01314 00000000 *                                                              00031700
01314 00000000 *                                                              00031800
01314 01101440 PØNG LAA   SAVE          RE-SET ADDRESSES                      00031900
01315 03101427      STA   BEG                                                 00032000
01316 01101420      LAA   FIN                                                 00032100
01317 00000002      NEG                                                       00032200
01320 03101441      STA   STØR                                                00032400
01321 01101273      LAA   PIPØ                                                00032500
01322 06101441      SMA   STØR                                                00032600
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0312  01625 03101273       STA  PIPØ                                  00032700
0313  01624 01101460       LAA  LAA            RESET ENTRANCE        00033000
0314  01625 03101274       STA  PIPØ+1                               00033100
0315  01626 00000000 *                                               00033200
0316  01626 02101417       LBA  IDX                                  00033300
0317  01627 01501405       LAA* TØP            MØVE PRØGRAM TØ LØWEST MAP 00033400
0318  01630 03501454       STA* BØT                                  00033500
0319  01631 00000026       IBS                                       00033600
0320  01632 11101627       BRU  *-3                                  00033700
0321  01633 11501273       BRU* PIPØ           EXIT TØ LØWER MEMØRY  00033800
0322  01634 00000000 *                                               00033900
0323  01634 00000000 *                                               00034000
0324  01634 00000000 *                                               00034100
0325  01634 00000000 *          ZERØS UNLØADED ERRØR                 00034200
0326  01634 00000000 *                                               00034300
0327  01634 00000000 ERØ0 ***   **                                   00034400
0328  01635 03101447       STA  NUM2           STØRE MEMØRY CØNTENTS 00034500
0329  01636 01101442       LAA  TWØ6           SET-UP TYPE ØUT       00034600
0330  01637 03101443       STA  NUM1                                 00034700
0331  01640 12101650       SPB  TPØ                                  00034800
0332  01641 11501654       BRU* ERØ0           RETURN                00034900
0333  01642 00000000 *                                               00035000
0334  01642 00000000 *          ØNES UNLØADED ERRØR                  00035100
0335  01642 00000000 *                                               00035200
0336  01642 00000000 ERØ1 ***   **                                   00035300
0337  01643 03101447       STA  NUM2           STØRE MEMØRY CØNTENTS 00035400
0338  01644 01101444       LAA  TB1            SET-UP TYPE ØUT       00035500
0339  01645 03101443       STA  NUM1                                 00035600
0340  01646 12101650       SPB  TPØ                                  00035700
0341  01647 11501642       BRU* ERØ1           RETURN                00035800
0342  01650 00000000 *                                               00035900
0343  01650 00000000 *                                               00036000
0344  01650 00000000 *                                               00036100
0345  01650 00000000 *          TYPE-ØUT SUBR                        00036200
0346  01650 00000000 *                                               00036300
0347  01650 00000000 TPØ  ***   **                                   00036400
0348  01651 00000003       CLA                                       00036500
0349  01652 00000017       FLA  3                                    00036700
0350  01653 03101442       AMA  TWØ6                                 00036750
```

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0351  01354 12101410       SPB   TYPE                                          00036800
0352  01355 14101450       IMS   M5                                            00036900
0353  01356 11101352       BRU   *-4                                           00037000
0354  01357 01101451       LAA   NM5                                           00037100
0355  01360 03101450       STA   M5                                            00037200
0356  01361 01101452       LAA   SPAC                                          00037300
0357  01362 12101410       SPB   TYPE                                          00037400
0358  01363 12101410       SPB   TYPE                                          00037500
0359  01364 12101410       SPB   TYPE                                          00037600
0360  01365 01101443       LAA   NUM1        ØUTPUT WHAT LØCATIØN SHØULD CØNTAIN 00037700
0361  01366 12101410       SPB   TYPE                                          00037800
0362  01367 01101452       LAA   SPAC                                          00037900
0363  01370 12101410       SPB   TYPE                                          00038000
0364  01371 12101410       SPB   TYPE                                          00038100
0365  01372 02101447       LBA   NUM2        ØUTPUT CØNTENTS IN BINARY           00038200
0366  01373 00000113       FLL   1                                             00038300
0367  01374 05101442       AMA   TW06                                          00038350
0368  01375 12101410       SPB   TYPE                                          00038400
0369  01376 14101445       IMS   WCNT                                          00038500
0370  01377 11101373       BRU   *-4                                           00038600
0371  01400 01101446       LAA   NCNT                                          00038700
0372  01401 03101445       STA   WCNT                                          00038800
0373  01402 02101453       LBA   CRLF        CAR. RTN., LN. FD.                00038900
0374  01403 00001013       FLL   8                                             00038950
0375  01404 12101410       SPB   TYPE                                          00039000
0376  01405 00001013       FLL   8                                             00039100
0377  01406 12101410       SPB   TYPE                                          00039200
0378  01407 11301350       BRU*  TP0         EXIT                              00039300
0379  01410 00000000 *                                                        00039400
0380  01410 00000000 *           TYPE A REG. SUBR.                            00039500
0381  01410 00000000 *                                                        00039600
0382  01410 00000000 TYPE ***    **                                           00039700
0383  01411 00130101       DATA  '130101     CEU   1,W
0384  01412 00001000       DATA  '1000
0385  01413 00001016       LSL   8
0386  01414 00170101       DATA  '170101     A0P   1,W
0387  01415 00000003       CLA                                               00040300
0388  01416 11301410       BRU*  TYPE                                        00040700
0389  01417 00000000 *                                                        00040800
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0390  01417 00000000 *                                          00040900
0391  01417 00000000 *                                          00041000
0392  01417 00000000 *                                          00041100
0393  01417 00177001 IDX   DATA -511                            00041200
0394  01420 00000000 FIN   DATA 0                               00041300
0395  01421 00010000 INDX  DATA 4096                            00041400
0396  01422 00001000 STAR  DATA 512                             00041500
0397  01423 00177776 TWØ   DATA -2                              00041600
0398  01424 00177776 NTWØ  DATA -2                              00041700
0399  01425 00177777 ØNES  DATA -1                              00041800
0400  01426 00000000 ZERØ  DATA 0                               00041900
0401  01427 00001000 BEG   DATA 512                             00042000
0402  01430 00000001 B15   DATA 1                               00042100
0403  01431 00000002 B14   DATA 2                               00042200
0404  01432 00000010 B12   DATA 8                               00042300
0405  01433 00000020 B11   DATA 16                              00042400
0406  01434 00000040 B10   DATA 32                              00042500
0407  01435 00000200 B8    DATA 128                             00042600
0408  01436 00002000 B5    DATA 1024                            00042800
0409  01437 00004000 B4    DATA 2048                            00042900
0410  01440 00000000 SAVE  DATA 0                               00043000
0411  01441 00000000 STØR  DATA 0                               00043100
0412  01442 00000260 TWØ6  DATA 176                             00043200
0413  01443 00000000 NUM1  DATA 0                               00043300
0414  01444 00000261 T61   DATA 177                             00043400
0415  01445 00177760 WCNT  DATA -16                             00043500
0416  01446 00177760 NCNT  DATA -16                             00043600
0417  01447 00000000 NUM2  DATA 0                               00043700
0418  01450 00177773 M5    DATA -5                              00043800
0419  01451 00177773 NM5   DATA -5                              00043900
0420  01452 00000240 SPAC  DATA 160                             00044000
0421  01453 00106612 CRLF  DATA '106612                         00044100
0422  01454 25600777 BØT   DAC  511,1                           00044200
0423  01455 25607777 TØP   DAC  4095,1                          00044300
0424  01456 12101104 BFØR  SPB  FØRM                            00044400
0425  01457 11101314 BRU   BRU  PØNG                            00044500
0426  01460 01101427 LAA   LAA  BEG                             00044600
0427  01461 00000000 A     DATA 0                               00044649
0428  01462 00000000 B     DATA 0                               00044650
```

```
0429  01463 00000000 C     DATA 0                                  00044651
0430  01464 00000000 *                                             00044700
0431  01464 00000000 *                                             00044800
0432  01464 /0400000       END
```

	FRCB	01023
	UL0D	01034
	FML1	01061
	AASS	01074
	AABA	01101
	ANBA	01103
	F0RM	01104
	PRT2	01122
	PRT3	01136
	PRT4	01152
	EXIT	01170
	REST	01173
	L0D0	01201
	L0D1	01205
	UL0	01211
	UL1	01221
	FRB4	01231
	FRB8	01236
	M0D2	01243
	MD16	01252
	MD14	01261
	STA	01267
	PIP0	01273
	P0NG	01314
	ER00	01334
	ER01	01342
	TP0	01350
	TYPE	01410
	IDX	01417
	FIN	01420
	INDX	01421
	STAR	01422
	TW0	01423
	NTW0	01424
	0NES	01425

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ZERØ     01426
BEG      01427
B15      01430
B14      01431
B12      01432
B11      01433
B10      01434
B8       01435
B5       01436
B4       01437
SAVE     01440
STØR     01441
TWØ6     01442
NUM1     01443
T61      01444
WCNT     01445
NCNT     01446
NUM2     01447
M5       01450
NM5      01451
SPAC     01452
CRLF     01453
BØT      01454
TØP      01455
BFØR     01456
BRU      01457
LAA      01460
A        01461
B        01462
C        01463
0001  00000 00000000 *
0002  00000 00000000 *          SELF-LØADER
0003  14000 60014000       ØRG   '14000
0004  14000 00130401 LØAD SNS   1
0005  14001 11014006       BRU   *+5
0006  14002 00130101       CEU   1,W                    CKA
0007  14003 00004000       DATA  '004000
0008  14004 00170301       AIP   1,W                    CKA
0009  14005 11014011       BRU   *+4
```

SYSTEMS ENGINEERING LABORATORIES PROGRAM LIBRARY

PROGRAM DESCRIPTION

IDENTIFICATION:	SEL 810A Teletypewriter Test
AUTHOR:	Systems Engineering Laboratories
ACCEPTED:	July 19, 1968
PURPOSE:	To provide a diagnostic program for the ASR-33 and ASR-35 Teletypewriters
COMPUTER CONFIGURATION:	Basic SEL 810A Computer
SUBROUTINES REQUIRED:	None
STORAGE:	Relocatable with a bias of 2000_8; 454_8 memory locations
TIMING:	N/A
LOADING PROCEDURE:	Load the relocatable object tape by means of the SEL 810A Relocatable Loader (Catalog No. 300001B)

Relocatable Loader
Prog. Counter 16060
A-Accum 0 B-Accum 0
After Load Start At '2000
Prog. Cntr.

USE:

1. Set program counter to 2000.
2. Turn on punch.
3. Set sense switch 0 (Test 1).
4. Depress start twice (Test 1a).
5. A halt will occur at location 2056 to load punched tape into reader.
6. Depress start (Test 1b).
7. A halt will occur at location 2145 to load duplicated tape into reader.

Relocatable Loader
Prog. Counter 16060
A-Accum 0 B-Accum 0
After Load Start At '2000
Prog. Cntr.

Note:
When using the upper 16K load/dump program the relocatable loader program counter 36060 should be utilized to load the program rather than the 16060.

USE: (Cont'd)

8. Turn off punch.

9. Depress start (Test 1c).

10. A halt will occur at location 2223 to indicate end of Test 1.

NOTE

Test 1b can be restarted at 2057. Test 1c can be restarted at 2146.

11. Reset sense switch 0 and set sense switch 1 (Test 2).

12. Depress start.

13. Reset sense switch 1 and enter one more character to end turn-around test.

14. Load tape punched in Test 1 into reader and turn on punch.

15. Set sense switch 2 (Test 3).

16. A halt will occur at location 2315 to indicate end of Test 3.

ERROR INDICATIONS

A program halt at location 2354 indicates a data comparison error has occurred. The A-Register contains the input character, and the B-Register contains the expected character.

NOTE

Sense switch 3 up - all errors will be ignored, and a continuous loop will be executed during test 1b and test 1c.

METHOD:

Test 1 (Sense switch 0 Up)

Test 1a - A binary progression will be punched and printed.

Test 1b - The tape just punched will be read, compared, and duplicated.

Test 1c - The tape just punched will be read and compared.

Test 2 (Sense switch 1 Up)

Keyboard turn-around test. Input from keyboard is typed out on the console printer.

Test 3 (Sense switch 2 Up)

The tape punched in Test 1 will be read and duplicated on an interrupt basis.

```
1      PAGE  0001          TELETYPEWRITER TEST (303012B) 19JUL68
 0002  00000 00000000 *          START AT '2000
 0003  00000 00000000 *          SNS 0 UP   TEST 1 WILL BE EXCUTED
 0004  00000 00000000 *          SNS 1 UP   TEST 2 WILL BE EXCUTED
 0005  00000 00000000 *          SNS 2 UP   TEST 3 WILL BE EXCUTED
 0006  00000 00000000 *          SNS 3 UP   CONTINUOUS LOOP WITH ERRORS IGNORED
 0007  00000 00000000 *          TEST 1     '2000-PUNCH BINARY PROGRESSION
 0008  00000 00000000 *                     '2057-READ(SLAVED TO OUTPUT), COMPARE AND PUNCH    *B
 0009  00000 00000000 *                     '2146-READ(HIGH SPEED)COPIED TAPE AND COMPARE      *B
 0010  00000 00000000 *          TEST 2     '2000-KEYBOARD TURNAROUND
 0011  00000 00000000 *          TEST 3     '2000-INPUT AND OUTPUT WITH INTERRUPT
 0012  00000 00000000       REL
 0013  00000 00000001 UNIT EQU  1
 0014  02000 70002000       ORG  '2000
 0015  02000 01102441       LAA  ADD3                                                        JPB
 0016  02001 03302437       STA* ADD1          STORE INTERRUPT ADDRESS IN  '10,6             JPB
 0017  02002 01102442       LAA  ADD4                                                        JPB
 0018  02003 03302440       STA* ADD2          STORE INTERRUPT ADDRESS IN  '10,7             JPB
 0019  02004 00130400       SNS  0
 0020  02005 12102013       SPB  TES1
 0021  02006 00130401       SNS  1
 0022  02007 12102227       SPB  TES2
 0023  02010 00130402       SNS  2
 0024  02011 12102240       SPB  TES3
 0025  02012 11102004       BRU  *-6
 0026  02013 00000000 TES1  ZZZ  **
 0027  02014 12102430       SPB  LEDR
 0028  02015 01102443       LAA  K1                                                          JPB
 0029  02016 03102225       STA  NUM0          STORE FIRST NO. IN CELL
 0030  02017 02102444       LBA  N64           LOAD INDEX WITH CHAR. COUNT                   JPB
 0031  02020 01102225 ADD    LAA  NUM0          LOAD NEW NO. IN A
 0032  02021 00001016       LSL  8
 0033  02022 00170101       AOP  UNIT,W
 0034  02023 00000026       IBS                64 CHARACTERS TYPED
 0035  02024 11102027       BRU  *+3           NO, CONTINUE
 0036  02025 12102414       SPB  CR0           YES, CARRIAGE RETURN
 0037  02026 02102444       LBA  N64           RELOAD INDEX                                  JPB
 0038  02027 14102225       IMS  NUM0
 0039  02030 01102445       LAA  K377          LOAD A WITH BINARY 255                        JPB
```

```
0040  02031 15102225        CMA  NUM0          COMPARE COUNT
0041  02032 11102035        BRU  *+3           A < MEMORY, BRU TO DOWNCOUNT
0042  02033 00000033        NOP               A = MEMORY, ONE MORE CYCLE
0043  02034 11102020        BRU  ADD           A > MEMORY, MORE CYCLES
0044  02035 12102414        SPB  CR0
0045  02036 02102444        LBA  N64                                          JPB
0046  02037 01102446 SUBT   LAA  N1            SUBTRACT 1 FROM MEMORY      JPB
0047  02040 05102225        AMA  NUM0
0048  02041 03102225        STA  NUM0
0049  02042 00001016        LSL  8
0050  02043 00170101        AOP  UNIT,W
0051  02044 00000026        IBS               64 CHARACTERS TYPED
0052  02045 11102050        BRU  *+3           NO, CONTINUE
0053  02046 12102414        SPB  CR0           YES, CARRIAGE RETURN
0054  02047 02102444        LBA  N64           RELOAD INDEX                   JPB
0055  02050 00000003        CLA               LOAD ZEROS FOR COMPARE
0056  02051 15102225        CMA  NUM0
0057  02052 11102037        BRU  SUBT          A<MEMORY CONTINUE
0058  02053 00000033        NOP               A=M HALT
0059  02054 00000033        NOP               A>M HALT
0060  02055 12102430        SPB  LEDR
0061  02056 00000000        HLT               HALT TO LOAD PUNCHED TAPE
0062  02057 12102430        SPB  LEDR
0063  02060 00130101        CEU  UNIT,W
0064  02061 25404000        DAC  '4000        READER MODE
0065  02062 01102443 INLS   LAA  K1                                           JPB
0066  02063 03102225        STA  NUM0          STORE FIRST NO. IN CELL
0067  02064 02102444        LBA  N64                                          JPB
0068  02065 00170301 INPA   AIP  UNIT,W
0069  02066 00000022        SAZ
0070  02067 11102071        BRU  *+2
0071  02070 11102065        BRU  *-3
0072  02071 00130403        SNS  3             IGNORE ANY ERRORS
0073  02072 11102077        BRU  *+5
0074  02073 15102225        CMA  NUM0          CHECK INPUT
0075  02074 12102351        SPB  CLER
0076  02075 11102077        BRU  *+2           NO ERRORS, CONTINUE
0077  02076 12102351        SPB  CLER
0078  02077 00001016        LSL  8
```

```
0079  02100 00170101       AØP  UNIT,W
0080  02101 00000026       IBS
0081  02102 11102105       BRU  *+3
0082  02103 12102363       SPB  CRLF
0083  02104 12102414       SPB  CRØ
0084  02105 14102225       IMS  NUMØ          ADVANCE MEMØRY
0085  02106 01102445       LAA  K377                                    JPB
0086  02107 15102225       CMA  NUMØ          CØMPARE CØUNT
0087  02110 11102113       BRU  *+3           A < MEMØRY, BRU TØ DØWNCØUNT
0088  02111 00000033       NØP                A = MEMØRY, ØNE MØRE CYCLE
0089  02112 11102065       BRU  INPA          A > MEMØRY, MØRE CYCLES
0090  02113 12102363       SPB  CRLF
0091  02114 12102414       SPB  CRØ
0092  02115 01102446 INPS  LAA  N1                                      JPB
0093  02116 05102225       AMA  NUMØ          SUBTRACT 1 FRØM MEMØRY
0094  02117 03102225       STA  NUMØ
0095  02120 00170301       AIP  UNIT,W
0096  02121 00130403       SNS  3             IGNØRE ANY ERRØRS
0097  02122 11102127       BRU  *+5
0098  02123 15102225       CMA  NUMØ          CHECK INPUT
0099  02124 12102351       SPB  CLER
0100  02125 11102127       BRU  *+2           NØ ERRØR, CØNTINUE
0101  02126 12102351       SPB  CLER
0102  02127 00001016       LSL  8
0103  02130 00170101       AØP  UNIT,W
0104  02131 00000026       IBS
0105  02132 11102135       BRU  *+3
0106  02133 12102363       SPB  CRLF
0107  02134 12102414       SPB  CRØ
0108  02135 00000003       CLA
0109  02136 15102225       CMA  NUMØ          CHECK CØUNT
0110  02137 11102115       BRU  INPS          A L.T. MEM, CØNTINUE
0111  02140 00000033       NØP                A = MEMØRY HALT
0112  02141 00000033       NØP                A > MEMØRY HALT
0113  02142 00130403       SNS  3             GØ INTØ LØØP
0114  02143 11102062       BRU  INLS
0115  02144 12102430       SPB  LEDR
0116  02145 00000000       HLT
0117  02146 01102443 INHS  LAA  K1                                      JPB
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0118  02147 03102225       STA  NUM0
0119  02150 02102444       LBA  N64                                    JPB
0120  02151 00130101       CEU  UNIT,W
0121  02152 25404000       DAC  '4000          READER MODE
0122  02153 00170301 IN31  AIP  UNIT,W
0123  02154 00000022       SAZ                 LEADER LOOP
0124  02155 11102157       BRU  *+2
0125  02156 11102153       BRU  *-3
0126  02157 00130403       SNS  3
0127  02160 11102165       BRU  *+5
0128  02161 15102225       CMA  NUM0
0129  02162 12102351       SPB  CLER           ERROR
0130  02163 11102165       BRU  *+2
0131  02164 12102351       SPB  CLER           ERROR
0132  02165 00000026       IBS
0133  02166 11102170       BRU  *+2
0134  02167 12102363       SPB  CRLF
0135  02170 14102225       IMS  NUM0
0136  02171 01102445       LAA  K377                                   JPB
0137  02172 15102225       CMA  NUM0
0138  02173 11102176       BRU  *+3            A<NUM0
0139  02174 00000033       NOP                 A=NUM0
0140  02175 11102153       BRU  IN31           A>NUM0
0141  02176 12102363       SPB  CRLF
0142  02177 01102446 IN32  LAA  N1                                     JPB
0143  02200 05102225       AMA  NUM0
0144  02201 03102225       STA  NUM0
0145  02202 00170301       AIP  UNIT,W
0146  02203 00130403       SNS  3
0147  02204 11102211       BRU  *+5
0148  02205 15102225       CMA  NUM0
0149  02206 12102351       SPB  CLER           ERROR
0150  02207 11102211       BRU  *+2
0151  02210 12102351       SPB  CLER           ERROR
0152  02211 00000026       IBS
0153  02212 11102214       BRU  *+2
0154  02213 12102363       SPB  CRLF
0155  02214 00000003       CLA                 LOAD ZEROS FOR COMPARE
0156  02215 15102225       CMA  NUM0
```

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0157  02216 11102177        BRU  IN32          A<NUM0
0158  02217 00000033        N0P                A=NUM0
0159  02220 00000033        N0P
0160  02221 00130403        SNS  3             G0 INT0 L00P
0161  02222 11102146        BRU  INHS
0162  02223 00000000        HLT                A>NUM0
0163  02224 11302013        BRU* TES1
0164  02225 00000000 NUM0   ZZZ  **
0165  02226 00000000 CHAR   ZZZ  **
0166  02227 00000000 TES2   ZZZ  **
0167  02230 00130101        CEU  UNIT,W
0168  02231 25402000        DAC  '2000         KEYB0ARD M0DE
0169  02232 00170301        AIP  UNIT,W
0170  02233 00001016        LSL  8
0171  02234 00170101        A0P  UNIT,W
0172  02235 00130401        SNS  1
0173  02236 11102232        BRU  *-4
0174  02237 11302227        BRU* TES2
0175  02240 00000000 TES3   ZZZ  **
0176  02241 12102430        SPB  LEDR
0177  02242 01102447        LAA  N24                                    JPB
0178  02243 03102226        STA  CHAR
0179  02244 00000003        CLA
0180  02245 00130101        CEU  UNIT,W
0181  02246 25404000        DAC  '4000         READER M0DE
0182  02247 00170301        AIP  UNIT,W
0183  02250 00000022        SAZ                LEADER L00P
0184  02251 11102253        BRU  *+2
0185  02252 11102247        BRU  *-3
0186  02253 02102450        LBA  N10                                    JPB
0187  02254 03502351        STA  BL0K,1
0188  02255 00000026        IBS
0189  02256 00000033        N0P
0190  02257 11102261        BRU  *+2
0191  02260 02102450 INPU   LBA  N10                                    JPB
0192  02261 00130101        CEU  UNIT,W
0193  02262 00031000        DATA '31000        CLEAR INTERRUPTS AND READER
0194  02263 00130101        CEU  UNIT,W
0195  02264 00064000        DATA '64000        ENABLE INPUT INTERRUPT AND READER  *B
```

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1      PAGE  0006          TELETYPEWRITER TEST (303012B) 19JUL68
 0196  02265 00130601        PID                    DISABLE GRØUP 1, LEVEL 2          *B
 0197  02266 00010002        DATA '10002
 0198  02267 00130600        PIE                    ENABLE GRØUP 1, LEVEL 1           *B
 0199  02270 00010001        DATA '10001
 0200  02271 11102271        BRU  *
 0201  02272 11102271        BRU  *-1
 0202  02273 00130101 ØUT    CEU  UNIT,W
 0203  02274 00031000        DATA '31000            CLEAR ALL INTERRUPTS
 0204  02275 00130101        CEU  UNIT,W
 0205  02276 00050000        DATA '50000
 0206  02277 00130601        PID                    DISABLE GRØUP 1, LEVEL 1          *B
 0207  02300 00010001        DATA '10001
 0208  02301 00130600        PIE                    ENABLE GRØUP 1, LEVEL 2           *B
 0209  02302 00010002        DATA '10002
 0210  02303 02102450        LBA  NIO                                                 JPB
 0211  02304 00000000 * REMØVED LAA  BLØK,1                                          *B
 0212  02304 00000000 * REMØVED LSL  8                                               *B
 0213  02304 00000000 * REMØVED AØP  UNIT,W                                         *B
 0214  02304 00000000 * REMØVED IBS                                                 *B
 0215  02304 00000000 * REMØVED NØP                                                 *B
 0216  02304 11102304        BRU  *
 0217  02305 11102304        BRU  *-1
 0218  02306 14102226 CNT    IMS  CHAR
 0219  02307 11102260        BRU  INPU
 0220  02310 00000000        HLT
 0221  02311 11302240        BRU* TES3
 0222  02312 00000000 INT1   ZZZ  **
 0223  02313 00170301        AIP  UNIT,W
 0224  02314 03502351        STA  BLØK,1            STØRE A INDEXED
 0225  02315 00000026        IBS
 0226  02316 11102321        BRU  *+3
 0227  02317 00000035        TØI
 0228  02320 11302335        BRU* CØN1              BRANCH TØ ØUTpUT ENABLE
 0229  02321 00000035        TØI
 0230  02322 11302312        BRU* INT1              RETURN TØ INPUT LØØP
 0231  02323 00000000 INT2   ZZZ  **
 0232  02324 01502351        LAA  BLØK,1            LØAD A
 0233  02325 00001016        LSL  8
 0234  02326 00170101        AØP  UNIT,W
```

```
0235  02327 00000026        IBS
0236  02330 11102333        BRU   *+3
0237  02331 00000035        TØI
0238  02332 11302336        BRU*  CØN2
0239  02333 00000035        TØI
0240  02334 11302323        BRU*  INT2
0241  02335 35402273 CØN1   DAC   ØUT
0242  02336 35402306 CØN2   DAC   CNT
0243  02351 70002351 BLØK   BES   10
0244  02351 00000000 CLER   ZZZ   **
0245  02352 00130101        CEU   UNIT,W
0246  02353 25401000        DAC   '1000          CLEAR MØDE
0247  02354 04102427        STB   SVB                                  *B
0248  02355 02102225        LBA   NUMØ                                 *B
0249  02356 00000000        HLT
0250  02357 02102427        LBA   SVB                                  *B
0251  02360 00130101        CEU   UNIT,W
0252  02361 25404000        DAC   '4000          READER MØDE
0253  02362 11302351        BRU*  CLER
0254  02363 00000000 CRLF   ZZZ   **
0255  02364 01102225        LAA   NUMØ           SAVE LAST FRAME
0256  02365 03102426        STA   SVA
0257  02366 01102451        LAA   K215                                 JPB
0258  02367 03102225        STA   NUMØ
0259  02370 00170301        AIP   UNIT,W
0260  02371 00130403        SNS   3
0261  02372 11102377        BRU   *+5
0262  02373 15102225        CMA   NUMØ
0263  02374 12102351        SPB   CLER
0264  02375 11102377        BRU   *+2
0265  02376 12102351        SPB   CLER
0266  02377 01102452        LAA   K212                                 JPB
0267  02400 03102225        STA   NUMØ
0268  02401 00170301        AIP   UNIT,W
0269  02402 00130403        SNS   3
0270  02403 11102410        BRU   *+5
0271  02404 15102225        CMA   NUMØ
0272  02405 12102351        SPB   CLER
0273  02406 11102410        BRU   *+2
```

```
0274  02407 12102351        SPB  CLER
0275  02410 01102426        LAA  SVA
0276  02411 03102225        STA  NUM0
0277  02412 02102444        LBA  N64                                        JPB
0278  02413 11302363        BRU* CRLF
0279  02414 00000000 CR0    ZZZ  **      ***** CARRIAGE RETURN/LINE FEED SUBROUTINE *****
0280  02415 03102426        STA  SVA
0281  02416 01102451        LAA  K215                                       JPB
0282  02417 00001016        LSL  8
0283  02420 00170101        A0P  UNIT,W
0284  02421 01102452        LAA  K212                                       JPB
0285  02422 00001016        LSL  8
0286  02423 00170101        A0P  UNIT,W
0287  02424 01102426        LAA  SVA
0288  02425 11302414        BRU* CR0
0289  02426 00000000 SVA    ZZZ  **
0290  02427 00000000 SVB    ZZZ  **                                         *B
0291  02430 00000000 LEDR   ZZZ  **      LEADER  ROUTINE
0292  02431 02102453        LBA  N50                                        JPB
0293  02432 00000003        CLA
0294  02433 00170101        A0P  UNIT,W
0295  02434 00000026        IBS
0296  02435 11102432        BRU  *-3
0297  02436 11302430        BRU* LEDR
0298  02437 25401016 ADD1   DAC  '1016                                      JPB
0299  02440 25401017 ADD2   DAC  '1017                                      JPB
0300  02441 35402312 ADD3   DAC  INT1                                       JPB
0301  02442 35402323 ADD4   DAC  INT2                                       JPB
0302  02443 00000001 K1     DATA 1                                          JPB
0303  02444 00177700 N64    DATA -64                                        JPB
0304  02445 00000377 K377   DATA '377                                       JPB
0305  02446 00177777 N1     DATA -1                                         JPB
0306  02447 00177712 N54    DATA -54                                        JPB
0307  02450 00177766 N10    DATA -10                                        JPB
0308  02451 00000215 K215   DATA '215                                       JPB
0309  02452 00000212 K212   DATA '212                                       *B
0310  02453 00177716 N50    DATA -50                                        JPB
0311  02454 /0400000        END
ERRORS 0000    00000
```

SEL PROGRAM LIBRARY

PROGRAM DESCRIPTION

 Catalog No. 303013A

IDENTIFICATION: 810A Priority Interrupt Checkout Program

AUTHOR: J. B. Boyer, SEL

ACCEPTED: 29 June 1967

PURPOSE: To verify the proper execution of the PIE PID and TOI hardware instructions. This program is designed to operate with either a "black box" to generate the interrupt or by manually applying the proper voltage to generate the interrupt.

COMPUTER CONFIGURATION: 810A Computer with teletype.

Relocatable Loader
Prog. Counter 16060
A-Accum 0 B-Accum '743
After Load Start At '2
Prog. Cntrl.

SUBROUTINES REQUIRED: None

STORAGE: Locations octal 00000 through 01375

TIMING: N/A

USE:

1. Loading Procedures
Load the program into memory by using the standard relocatable loader. The intermap references must be relocated by octal '0743. This value must be placed in the B accumulator prior to starting the load procedure.

2. Program Starting Location
The starting address of the program is location octal 00002. However, the teletype messages may be checked by starting at location octal 00036. When all messages have been output to the teletype the program will halt. (location octal 63) The program may then be initialized by entering the starting location of the program into the program counter and pressing start.

Relocatable Loader
Prog. Counter 16060
A-Accum 0 B-Accum '743
After Load Start At '2
Prog. Cntrl.

Note:
When using the upper 16K load/dump program the relocatable loader program counter 36060 should be utilized to load the program rather than the 16060.

3. Console Switches

Control Switch 14
SET - The program will disable the interrupt once it has been serviced. If the interrupt occurs again without program reinitialization the conditions indicate a faulty PID instruction.

RESET - The interrupt will not be disabled after the output of the message to the teletype.

Control Switch 15
SET - The program will suppress the print out of any messages. This control switch may be set to avoid teletype output when trouble shooting a faulty interrupt.

METHOD:

This program is designed to verify that the PIE, PID and TOI instructions are functioning properly. The program is designed to test the interrupt instructions and cannot be operated with any input/output devices, nor is it intended to act as a subroutine for any other program. The power-down interrupt may be verified by turning off the power while the program is active. The program may be restarted by turning the power switch to on and pressing start on the console. The program automatically stores in location zero a branch instruction to the power up subroutine.

Teletype Output
The program will output the group and level of the interrupt which has occurred.

Interrupt Generation
Priority Interrupt Card Type 8634-2 810A
Plus voltage applied to the proper pin connector will cause a disable or no request condition. Zero voltage applied to the proper pin will cause the request latch to be set.

Priority Interrupt Card Type 8634-3 810A, 8242-1 810a
The opposite voltages indicated in the above paragraph must be applied to set the proper condition.

```
1
0001  00000 00000000 *          810A PRIORITY INTERRUPT CHECKOUT PROGRAM   CAT. NO. 303013A
0002  00000 00000000 *          J B BOYER   JUNE 29, 1967
0003  00000 00000000       REL
0004  00000 00000000 ****
0005  00000 00000000 ****PRIORITY INTERRUPT TEST
0006  00000 00000000 ****
0007  00000 00000000 ****ENTER PROGRAM AT LOCATION '2
0008  00000 00000000 ****
0009  00000 00000000 **** ENTER TEST OF PROGRAM AT LOCATION '36
0010  00000 00000000 ****
0011  00000 00000000 **** SET CS 15 TO SUPPRESS PRINT OUT
0012  00000 00000000 ****
0013  00000 00000000 **** SET CS 14 TO DISABLE INTERRUPT AFTER
0014  00000 00000000 ****     INTERRUPT SIGNAL IS GENERATED
0015  00000 00000000 ****
0016  00002 70000002       ORG  '2
0017  00002 12100014       SPB  PI       ENABLE ALL GROUPS AND LEVELS
0018  00003 00000000 *                  WHEN THE PROGRAM IS INITIALIZED THIS SUBROUTINE
0019  00003 00000000 *                  IS USED AS A LOOP UNTIL AN INTERRUPT IS GENERATED
0020  00003 02100065 BGN   LBA  DT1            '100000
0021  00004 01100066       LAA  DT2            -10000
0022  00005 03101363       STA  CHCK
0023  00006 00000003       CLA
0024  00007 14101363       IMS  CHCK
0025  00010 11100006       BRU  *-2
0026  00011 00000026       IBS
0027  00012 11100004       BRU  BGN+1
0028  00013 11100003       BRU  BGN
0029  00014 00000000 *          THIS SUBROUTINE ENABLES ALL GROUPS AND LEVELS OF PRIORITY SYSTEM
0030  00014 00000000 PI    ZZZ  **
0031  00015 00130600       PIE
0032  00016 00007777       DATA '7777          ENABLE
0033  00017 00130600       PIE
0034  00020 00017777       DATA '17777         ALL
0035  00021 00130600       PIE
0036  00022 00027777       DATA '27777         AVAILABLE
0037  00023 00130600       PIE
0038  00024 00037777       DATA '37777         INTERRUPTS
0039  00025 00130600       PIE
```

```
0040  00026 00047777        DATA '47777          TØ
0041  00027 00130600        PIE
0042  00030 00057777        DATA '57777          TEST
0043  00031 00130600        PIE
0044  00032 00067777        DATA '67777          CØMPUTER
0045  00033 00130600        PIE
0046  00034 00077777        DATA '77777
0047  00035 11300014        BRU* PI
0048  00036 00000000 *              THIS SUBRØUTINE IS USED TØ ØUTPUT THE MESSAGES THAT WILL
0049  00036 00000000 *              BE ØUTPUT TØ THE TELETYPE WHEN A PRIØRITY INTERRUPT IS
0050  00036 00000000 *              GENERATED.  THIS IS NØT PART ØF THE MAIN PRØGRAM.
0051  00036 01100067 TEST LAA  DT3        TEST ØF PRØGRAM    '41000
0052  00037 03100046      STA  LØC        DATA
0053  00040 01100070      LAA  DT4        '41100
0054  00041 03100056      STA  LCØ
0055  00042 01100071      LAA  DT5        -60
0056  00043 03100064      STA  TEMP
0057  00044 12300046 TES1 SPØ* *+2
0058  00045 11100047      BRU  *+2
0059  00046 00000000 LØC  ZZZ  **
0060  00047 14100046      IMS  LØC
0061  00050 14100064      IMS  TEMP
0062  00051 11100044      BRU  TES1
0063  00052 01100071      LAA  DT5        -60
0064  00053 03100064      STA  TEMP
0065  00054 12300056 TES2 SPB* *+2
0066  00055 11100057      BRU  *+2
0067  00056 00000000 LCØ  ZZZ  **
0068  00057 14100056      IMS  LCØ
0069  00060 14100064      IMS  TEMP
0070  00061 11100054      BRU  TES2
0071  00062 00000000      HLT
0072  00063 11100036      BRU  TEST
0073  00064 00000001 TEMP BSS  1
0074  00065 00100000 DT1  DATA '100000
0075  00066 00154360 DT2  DATA -10000
0076  00067 00041000 DT3  DATA '41000
0077  00070 00041100 DT4  DATA '41100
0078  00071 00177720 DT5  DATA -'60
0079  00072 00000000 *            PØWER DØWN RØUTINE
```

```
0080  00072 00000000 PDR1 ZZZ  **
0081  00073 01100134      LAA  FLAG
0082  00074 00000022      SAZ
0083  00075 11100102      BRU  *+5
0084  00076 01100072      LAA  PDR1
0085  00077 03100135      STA  RTN
0086  00100 01101371      LAA  BNE
0087  00101 03100134      STA  FLAG
0088  00102 04100104      STB  PDR2
0089  00103 11100105      BRU  *+2
0090  00104 00000000 PDR2 ZZZ  **      B ACC.
0091  00105 00000033      NBP          TVB CHANGE '43
0092  00106 04100110      STB  PDR3
0093  00107 11100111      BRU  *+2
0094  00110 00000000 PDR3 ZZZ  **      VBR
0095  00111 03100113      STA  PDR4
0096  00112 11100114      BRU  *+2
0097  00113 00000000 PDR4 ZZZ  **      A ACC.
0098  00114 01100121      LAA  LBB
0099  00115 03000000      STA  0
0100  00116 01100122      LAA  DAC
0101  00117 03000001      STA  1
0102  00120 00000000 HLT  HLT
0103  00121 00000036 LBB  LBB
0104  00122 35400123 DAC  DAC  PDR5
0105  00123 01100113 PDR5 LAA  PDR4
0106  00124 02100110      LBA  PDR3
0107  00125 00000033      NBP          TBV CHANGE '42
0108  00126 02100104      LBA  PDR2
0109  00127 12100014      SPB  PI
0110  00130 00000003      CLA
0111  00131 03100134      STA  FLAG
0112  00132 00000035      TBI
0113  00133 11300135      BRU* RTN
0114  00134 00000000 FLAG DATA 0
0115  00135 00000001 RTN  BSS  1
0116  00136 00000000 STAL ***  **
0117  00137 04101367      STB  TMPB
0118  00140 00000031      LCS          IF CS 15 IS
0119  00141 00001713      FLL  15      SET
```

```
0120  00142 00000024       SAP          SUPPRESS
0121  00143 11100152       BRU  ST2     ØUTPUT
0122  00144 02077772       LBA  =-6
0123  00145 01501236 ST1    LAA  M5+6,1
0124  00146 12101324       SPB  TYPE
0125  00147 00000026       IBS
0126  00150 11100145       BRU  ST1
0127  00151 12101330       SPB  CRLF
0128  00152 02101367 ST2    LBA  TMP8
0129  00153 00000035       TBI
0130  00154 11300136       BRU* STAL
0131  00155 00000000 ZE1    ***  **      0,1
0132  00156 12101236       SPB  MESS
0133  00157 00000001       DATA '1
0134  00160 11300155       BRU* ZE1
0135  00161 00000000 ZE2    ***  **      0,2
0136  00162 12101236       SPB  MESS
0137  00163 00000002       DATA '2
0138  00164 11300161       BRU* ZE2
0139  00165 00000000 ZE3    ***  **      0,3
0140  00166 12101236       SPB  MESS
0141  00167 00000003       DATA '3
0142  00170 11300165       BRU* ZE3
0143  00171 00000000 ZE4    ***  **      0,4
0144  00172 12101236       SPB  MESS
0145  00173 00000004       DATA '4
0146  00174 11300171       BRU* ZE4
0147  00175 00000000 ZE5    ***  **      0,5
0148  00176 12101236       SPB  MESS
0149  00177 00000005       DATA '5
0150  00200 11300175       BRU* ZE5
0151  00201 00000000 ZE6    ***  **      0,6
0152  00202 12101236       SPB  MESS
0153  00203 0000000(       DATA '6
0154  00204 11300201       BRU* ZE6
0155  00205 00000000 ZE7    ***  **      0,7
0156  00206 12101236       SPB  MESS
0157  00207 00000007       DATA '7
0158  00210 11300205       BRU* ZE7
0159  00211 00000000 ZE8    ***  **      0,8
```

```
0160  00212 12101236       SPB  MESS
0161  00213 00000010       DATA '10
0162  00214 11300211       BRU* ZE8
0163  00215 00000000 ZE9   ***  **          0,9
0164  00216 12101236       SPB  MESS
0165  00217 00000011       DATA '11
0166  00220 11300215       BRU* ZE9
0167  00221 00000000 ZE10  ***  **          0,10
0168  00222 12101236       SPB  MESS
0169  00223 00000012       DATA '12
0170  00224 11300221       BRU* ZE10
0171  00225 00000000 ZE11  ***  **          0,11
0172  00226 12101236       SPB  MESS
0173  00227 00000013       DATA '13
0174  00230 11300225       BRU* ZE11
0175  00231 00000000 ZE12  ***  **          0,12
0176  00232 12101236       SPB  MESS
0177  00233 00000014       DATA '14
0178  00234 11300231       BRU* ZE12
0179  00235 00000000 ØN1   ***  **          1,1
0180  00236 12101236       SPB  MESS
0181  00237 00010001       DATA '10001
0182  00240 11300235       BRU* ØN1
0183  00241 00000000 ØN2   ***  **          1,2
0184  00242 12101236       SPB  MESS
0185  00243 00010002       DATA '10002
0186  00244 11300241       BRU* ØN2
0187  00245 00000000 ØN3   ***  **          1,3
0188  00246 12101236       SPB  MESS
0189  00247 00010003       DATA '10003
0190  00250 11300245       BRU* ØN3
0191  00251 00000000 ØN4   ***  **          1,4
0192  00252 12101236       SPB  MESS
0193  00253 00010004       DATA '10004
0194  00254 11300251       BRU* ØN4
0195  00255 00000000 ØN5   ***  **          1,5
0196  00256 12101236       SPB  MESS
0197  00257 00010005       DATA '10005
0198  00260 11300255       BRU* ØN5
0199  00261 00000000 ØN6   ***  **          1,6
```

```
0200  00262 12101236       SPB   MESS
0201  00263 00010006       DATA  '10006
0202  00264 11300261       BRU*  ØN6
0203  00265 00000000 ØN7   ***   **          1,7
0204  00266 12101236       SPB   MESS
0205  00267 00010007       DATA  '10007
0206  00270 11300265       BRU*  ØN7
0207  00271 00000000 ØN8   ***   **          1,8
0208  00272 12101236       SPB   MESS
0209  00273 00010010       DATA  '10010
0210  00274 11300271       BRU*  ØN8
0211  00275 00000000 ØN9   ***   **          1,9
0212  00276 12101236       SPB   MESS
0213  00277 00010011       DATA  '10011
0214  00300 11300275       BRU*  ØN9
0215  00301 00000000 ØN10  ***   **          1,10
0216  00302 12101236       SPB   MESS
0217  00303 00010012       DATA  '10012
0218  00304 11300301       BRU*  ØN10
0219  00305 00000000 ØN11  ***   **          1,11
0220  00306 12101236       SPB   MESS
0221  00307 00010013       DATA  '10013
0222  00310 11300305       BRU*  ØN11
0223  00311 00000000 ØN12  ***   **          1,12
0224  00312 12101236       SPB   MESS
0225  00313 00010014       DATA  '10014
0226  00314 11300311       BRU*  ØN12
0227  00315 00000000 TW1   ***   **          2,1
0228  00316 12101236       SPB   MESS
0229  00317 00020001       DATA  '20001
0230  00320 11300315       BRU*  TW1
0231  00321 00000000 TW2   ***   **          2,2
0232  00322 12101236       SPB   MESS
0233  00323 00020002       DATA  '20002
0234  00324 11300321       BRU*  TW2
0235  00325 00000000 TW3   ***   **          2,3
0236  00326 12101236       SPB   MESS
0237  00327 00020003       DATA  '20003
0238  00330 11300325       BRU*  TW3
0239  00331 00000000 TW4   ***   **          2,4
```

```
0240  00332 12101236       SPB  MESS
0241  00333 00020004       DATA '20004
0242  00334 11300331       BRU* TW4
0243  00335 00000000 TW5   ***  **          2,5
0244  00336 12101236       SPB  MESS
0245  00337 00020005       DATA '20005
0246  00340 11300335       BRU* TW5
0247  00341 00000000 TW6   ***  **          2,6
0248  00342 12101236       SPB  MESS
0249  00343 00020006       DATA '20006
0250  00344 11300341       BRU* TW6
0251  00345 00000000 TW7   ***  **          2,7
0252  00346 12101236       SPB  MESS
0253  00347 00020007       DATA '20007
0254  00350 11300345       BRU* TW7
0255  00351 00000000 TW8   ***  **          2,8
0256  00352 12101236       SPB  MESS
0257  00353 00020010       DATA '20010
0258  00354 11300351       BRU* TW8
0259  00355 00000000 TW9   ***  **          2,9
0260  00356 12101236       SPB  MESS
0261  00357 00020011       DATA '20011
0262  00360 11300355       BRU* TW9
0263  00361 00000000 TW10  ***  **          2,10
0264  00362 12101236       SPB  MESS
0265  00363 00020012       DATA '20012
0266  00364 11300361       BRU* TW10
0267  00365 00000000 TW11  ***  **          2,11
0268  00366 12101236       SPB  MESS
0269  00367 00020013       DATA '20013
0270  00370 11300365       BRU* TW11
0271  00371 00000000 TW12  ***  **          2,12
0272  00372 12101236       SPB  MESS
0273  00373 00020014       DATA '20014
0274  00374 11300371       BRU* TW12
0275  00375 00000000 TH1   ***  **          3,1
0276  00376 12101236       SPB  MESS
0277  00377 00030001       DATA '30001
0278  00400 11300375       BRU* TH1
0279  00401 00000000 TH2   ***  **          3,2
```

```
0280  00402 12101236       SPB   MESS
0281  00403 00030002       DATA  '30002
0282  00404 11300401       BRU*  TH2
0283  00405 00000000 TH3   ***   **          3,3
0284  00406 12101236       SPB   MESS
0285  00407 00030003       DATA  '30003
0286  00410 11300405       BRU*  TH3
0287  00411 00000000 TH4   ***   **          3,4
0288  00412 12101236       SPB   MESS
0289  00413 00030004       DATA  '30004
0290  00414 11300411       BRU*  TH4
0291  00415 00000000 TH5   ***   **          3,5
0292  00416 12101236       SPB   MESS
0293  00417 00030005       DATA  '30005
0294  00420 11300415       BRU*  TH5
0295  00421 00000000 TH6   ***   **          3,6
0296  00422 12101236       SPB   MESS
0297  00423 00030006       DATA  '30006
0298  00424 11300421       BRU*  TH6
0299  00425 00000000 TH7   ***   **          3,7
0300  00426 12101236       SPB   MESS
0301  00427 00030007       DATA  '30007
0302  00430 11300425       BRU*  TH7
0303  00431 00000000 TH8   ***   **          3,8
0304  00432 12101236       SPB   MESS
0305  00433 00030010       DATA  '30010
0306  00434 11300431       BRU*  TH8
0307  00435 00000000 TH9   ***   **          3,9
0308  00436 12101236       SPB   MESS
0309  00437 00030011       DATA  '30011
0310  00440 11300435       BRU*  TH9
0311  00441 00000000 TH10  ***   **          3,10
0312  00442 12101236       SPB   MESS
0313  00443 00030012       DATA  '30012
0314  00444 11300441       BRU*  TH10
0315  00445 00000000 TH11  ***   **          3,11
0316  00446 12101236       SPB   MESS
0317  00447 00030013       DATA  '30013
0318  00450 11300445       BRU*  TH11
0319  00451 00000000 TH12  ***   **          3,12
```

```
0320  00452 12101236       SPB  MESS
0321  00453 00030014       DATA '30014
0322  00454 11300451       BRU* TH12
0323  00455 00000000 F01   ***  **          4.1
0324  00456 12101236       SPB  MESS
0325  00457 00040001       DATA '40001
0326  00460 11300455       BRU* F01
0327  00461 00000000 F02   ***  **          4.2
0328  00462 12101236       SPB  MESS
0329  00463 00040002       DATA '40002
0330  00464 11300461       BRU* F02
0331  00465 00000000 F03   ***  **          4.3
0332  00466 12101236       SPB  MESS
0333  00467 00040003       DATA '40003
0334  00470 11300465       BRU* F03
0335  00471 00000000 F04   ***  **          4.4
0336  00472 12101236       SPB  MESS
0337  00473 00040004       DATA '40004
0338  00474 11300471       BRU* F04
0339  00475 00000000 F05   ***  **          4.5
0340  00476 12101236       SPB  MESS
0341  00477 00040005       DATA '40005
0342  00500 11300475       BRU* F05
0343  00501 00000000 F06   ***  **          4.6
0344  00502 12101236       SPB  MESS
0345  00503 00040006       DATA '40006
0346  00504 11300501       BRU* F06
0347  00505 00000000 F07   ***  **          4.7
0348  00506 12101236       SPB  MESS
0349  00507 00040007       DATA '40007
0350  00510 11300505       BRU* F07
0351  00511 00000000 F08   ***  **          4.8
0352  00512 12101236       SPB  MESS
0353  00513 00040010       DATA '40010
0354  00514 11300511       BRU* F08
0355  00515 00000000 F09   ***  **          4.9
0356  00516 12101236       SPB  MESS
0357  00517 00040011       DATA '40011
0358  00520 11300515       BRU* F09
0359  00521 00000000 F010  ***  **          4.10
```

```
0360  00522 12101236       SPB  MESS
0361  00523 00040012       DATA '40012
0362  00524 11300521       BRU* F010
0363  00525 00000000 F011  ***  **          4.11
0364  00526 12101236       SPB  MESS
0365  00527 00040013       DATA '40013
0366  00530 11300525       BRU* F011
0367  00531 00000000 F012  ***  **          4.12
0368  00532 12101236       SPB  MESS
0369  00533 00040014       DATA '40014
0370  00534 11300531       BRU* F012
0371  00535 00000000 FI1   ***  **          5.1
0372  00536 12101236       SPB  MESS
0373  00537 00050001       DATA '50001
0374  00540 11300535       BRU* FI1
0375  00541 00000000 FI2   ***  **          5.2
0376  00542 12101236       SPB  MESS
0377  00543 00050002       DATA '50002
0378  00544 11300541       BRU* FI2
0379  00545 00000000 FI3   ***  **          5.3
0380  00546 12101236       SPB  MESS
0381  00547 00050003       DATA '50003
0382  00550 11300545       BRU* FI3
0383  00551 00000000 FI4   ***  **          5.4
0384  00552 12101236       SPB  MESS
0385  00553 00050004       DATA '50004
0386  00554 11300551       BRU* FI4
0387  00555 00000000 FI5   ***  **          5.5
0388  00556 12101236       SPB  MESS
0389  00557 00050005       DATA '50005
0390  00560 11300555       BRU* FI5
0391  00561 00000000 FI6   ***  **          5.6
0392  00562 12101236       SPB  MESS
0393  00563 00050006       DATA '50006
0394  00564 11300561       BRU* FI6
0395  00565 00000000 FI7   ***  **          5.7
0396  00566 12101236       SPB  MESS
0397  00567 00050007       DATA '50007
0398  00570 11300565       BRU* FI7
0399  00571 00000000 FI8   ***  **          5.8
```

```
0400  00572 12101236       SPB  MESS
0401  00573 00050010       DATA '50010
0402  00574 11300571       BRU* FI8
0403  00575 00000000 FI9   ***  **          5,9
0404  00576 12101236       SPB  MESS
0405  00577 00050011       DATA '50011
0406  00600 11300575       BRU* FI9
0407  00601 00000000 FI10  ***  **          5,10
0408  00602 12101236       SPB  MESS
0409  00603 00050012       DATA '50012
0410  00604 11300601       BRU* FI10
0411  00605 00000000 FI11  ***  **          5,11
0412  00606 12101236       SPB  MESS
0413  00607 00050013       DATA '50013
0414  00610 11300605       BRU* FI11
0415  00611 00000000 FI12  ***  **          5,12
0416  00612 12101236       SPB  MESS
0417  00613 00050014       DATA '50014
0418  00614 11300611       BRU* FI12
0419  00615 00000000 SI1   ***  **          6,1
0420  00616 12101236       SPB  MESS
0421  00617 00060001       DATA '60001
0422  00620 11300615       BRU* SI1
0423  00621 00000000 SI2   ***  **          6,2
0424  00622 12101236       SPB  MESS
0425  00623 00060002       DATA '60002
0426  00624 11300621       BRU* SI2
0427  00625 00000000 SI3   ***  **          6,3
0428  00626 12101236       SPB  MESS
0429  00627 00060003       DATA '60003
0430  00630 11300625       BRU* SI3
0431  00631 00000000 SI4   ***  **          6,4
0432  00632 12101236       SPB  MESS
0433  00633 00060004       DATA '60004
0434  00634 11300631       BRU* SI4
0435  00635 00000000 SI5   ***  **          6,5
0436  00636 12101236       SPB  MESS
0437  00637 00060005       DATA '60005
0438  00640 11300635       BRU* SI5
0439  00641 00000000 SI6   ***  **          6,6
```

```
0440  00642 12101236       SPB  MESS
0441  00643 00060006       DATA '60006
0442  00644 11300641       BRU* SI6
0443  00645 00000000 SI7   ***  **          6,7
0444  00646 12101236       SPB  MESS
0445  00647 00060007       DATA '60007
0446  00650 11300645       BRU* SI7
0447  00651 00000000 SI8   ***  **          6,8
0448  00652 12101236       SPB  MESS
0449  00653 00060010       DATA '60010
0450  00654 11300651       BRU* SI8
0451  00655 00000000 SI9   ***  **          6,9
0452  00656 12101236       SPB  MESS
0453  00657 00060011       DATA '60011
0454  00660 11300655       BRU* SI9
0455  00661 00000000 SI10  ***  **          6,10
0456  00662 12101236       SPB  MESS
0457  00663 00060012       DATA '60012
0458  00664 11300661       BRU* SI10
0459  00665 00000000 SI11  ***  **          6,11
0460  00666 12101236       SPB  MESS
0461  00667 00060013       DATA '60013
0462  00670 11300665       BRU* SI11
0463  00671 00000000 SI12  ***  **          6,12
0464  00672 12101236       SPB  MESS
0465  00673 00060014       DATA '60014
0466  00674 11300671       BRU* SI12
0467  00675 00000000 SE1   ***  **          7,1
0468  00676 12101236       SPB  MESS
0469  00677 00070001       DATA '70001
0470  00700 11300675       BRU* SE1
0471  00701 00000000 SE2   ***  **          7,2
0472  00702 12101236       SPB  MESS
0473  00703 00070002       DATA '70002
0474  00704 11300701       BRU* SE2
0475  00705 00000000 SE3   ***  **          7,3
0476  00706 12101236       SPB  MESS
0477  00707 00070003       DATA '70003
0478  00710 11300705       BRU* SE3
0479  00711 00000000 SE4   ***  **          7,4
```

```
0480  00712 12101236       SPB   MESS
0481  00713 00070004       DATA  '70004
0482  00714 11300711       BRU*  SE4
0483  00715 00000000 SE5   ***   **          7,5
0484  00716 12101236       SPB   MESS
0485  00717 00070005       DATA  '70005
0486  00720 11300715       BRU*  SE5
0487  00721 00000000 SE6   ***   **          7,6
0488  00722 12101236       SPB   MESS
0489  00723 00070006       DATA  '70006
0490  00724 11300721       BRU*  SE6
0491  00725 00000000 SE7   ***   **          7,7
0492  00726 12101236       SPB   MESS
0493  00727 00070007       DATA  '70007
0494  00730 11300725       BRU*  SE7
0495  00731 00000000 SE8   ***   **          7,8
0496  00732 12101236       SPB   MESS
0497  00733 00070010       DATA  '70010
0498  00734 11300731       BRU*  SE8
0499  00735 00000000 SE9   ***   **          7,9
0500  00736 12101236       SPB   MESS
0501  00737 00070011       DATA  '70011
0502  00740 11300735       BRU*  SE9
0503  00741 00000000 SE10  ***   **          7,10
0504  00742 12101236       SPB   MESS
0505  00743 00070012       DATA  '70012
0506  00744 11300741       BRU*  SE10
0507  00745 00000000 *     THE FOLLOWING DAC LOCATIONS SHOW THE SYMBOLIC TAG ASSOCIATED
0508  00745 00000000 *          WITH EACH INTERRUPT LOCATION.
0509  00745 00000000 *          WHENEVER AN INTERRUPT IS RECEIVED THE PROGRAM BRANCHES TO THE
0510  00745 00000000 *          LOCATION SPECIFIED.
0511  01000 70001000       ORG   '1000
0512  01000 35400072       DAC   PDR1          POWER DOWN
0513  01001 35400136       DAC   STAL          STALL ALARM
0514  01002 35400155       DAC   ZE1           0,1
0515  01003 35400161       DAC   ZE2           0,2
0516  01004 35400165       DAC   ZE3           0,3
0517  01005 35400171       DAC   ZE4           0,4
0518  01006 35400175       DAC   ZE5           0,5
0519  01007 35400201       DAC   ZE6           0,6
```

```
0520  01010  35400205    DAC   ZE7     0,7
0521  01011  35400211    DAC   ZE8     0,8
0522  01012  35400215    DAC   ZE9     0,9
0523  01013  35400221    DAC   ZE10    0,10
0524  01014  35400225    DAC   ZE11    0,11
0525  01015  35400231    DAC   ZE12    0,12
0526  01016  35400235    DAC   BN1     1,1
0527  01017  35400241    DAC   BN2     1,2
0528  01020  35400245    DAC   BN3     1,3
0529  01021  35400251    DAC   BN4     1,4
0530  01022  35400255    DAC   BN5     1,5
0531  01023  35400261    DAC   BN6     1,6
0532  01024  35400265    DAC   BN7     1,7
0533  01025  35400271    DAC   BN8     1,8
0534  01026  35400275    DAC   BN9     1,9
0535  01027  35400301    DAC   BN10    1,10
0536  01030  35400305    DAC   BN11    1,11
0537  01031  35400311    DAC   BN12    1,12
0538  01032  35400315    DAC   TW1     2,1
0539  01033  35400321    DAC   TW2     2,2
0540  01034  35400325    DAC   TW3     2,3
0541  01035  35400331    DAC   TW4     2,4
0542  01036  35400335    DAC   TW5     2,5
0543  01037  35400341    DAC   TW6     2,6
0544  01040  35400345    DAC   TW7     2,7
0545  01041  35400351    DAC   TW8     2,8
0546  01042  35400355    DAC   TW9     2,9
0547  01043  35400361    DAC   TW10    2,10
0548  01044  35400365    DAC   TW11    2,11
0549  01045  35400371    DAC   TW12    2,12
0550  01046  35400375    DAC   TH1     3,1
0551  01047  35400401    DAC   TH2     3,2
0552  01050  35400405    DAC   TH3     3,3
0553  01051  35400411    DAC   TH4     3,4
0554  01052  35400415    DAC   TH5     3,5
0555  01053  35400421    DAC   TH6     3,6
0556  01054  35400425    DAC   TH7     3,7
0557  01055  35400431    DAC   TH8     3,8
0558  01056  35400435    DAC   TH9     3,9
0559  01057  35400441    DAC   TH10    3,10
```

```
0560  01100 70001100      ØRG   '1100
0561  01100 35400445      DAC   TH11        3,11
0562  01101 35400451      DAC   TH12        3,12
0563  01102 35400455      DAC   FØ1         4,1
0564  01103 35400461      DAC   FØ2         4,2
0565  01104 35400465      DAC   FØ3         4,3
0566  01105 35400471      DAC   FØ4         4,4
0567  01106 35400475      DAC   FØ5         4,5
0568  01107 35400501      DAC   FØ6         4,6
0569  01110 35400505      DAC   FØ7         4,7
0570  01111 35400511      DAC   FØ8         4,8
0571  01112 35400515      DAC   FØ9         4,9
0572  01113 35400521      DAC   FØ10        4,10
0573  01114 35400525      DAC   FØ11        4,11
0574  01115 35400531      DAC   FØ12        4,12
0575  01116 35400535      DAC   F11         5,1
0576  01117 35400541      DAC   F12         5,2
0577  01120 35400545      DAC   F13         5,3
0578  01121 35400551      DAC   F14         5,4
0579  01122 35400555      DAC   F15         5,5
0580  01123 35400561      DAC   F16         5,6
0581  01124 35400565      DAC   F17         5,7
0582  01125 35400571      DAC   F18         5,8
0583  01126 35400575      DAC   F19         5,9
0584  01127 35400601      DAC   F110        5,10
0585  01130 35400605      DAC   F111        5,11
0586  01131 35400611      DAC   F112        5,12
0587  01132 35400615      DAC   S11         6,1
0588  01133 35400621      DAC   S12         6,2
0589  01134 35400625      DAC   S13         6,3
0590  01135 35400631      DAC   S14         6,4
0591  01136 35400635      DAC   S15         6,5
0592  01137 35400641      DAC   S16         6,6
0593  01140 35400645      DAC   S17         6,7
0594  01141 35400651      DAC   S18         6,8
0595  01142 35400655      DAC   S19         6,9
0596  01143 35400661      DAC   S110        6,10
0597  01144 35400665      DAC   S111        6,11
0598  01145 35400671      DAC   S112        6,12
0599  01146 35400675      DAC   SE1         7,1
```

```
0600  01147 35400701       DAC  SE2          7,2
0601  01150 35400705       DAC  SE3          7,3
0602  01151 35400711       DAC  SE4          7,4
0603  01152 35400715       DAC  SE5          7,5
0604  01153 35400721       DAC  SE6          7,6
0605  01154 35400725       DAC  SE7          7,7
0606  01155 35400731       DAC  SE8          7,8
0607  01156 35400735       DAC  SE9          7,9
0608  01157 35400741       DAC  SE10         7,10
0609  01200 70001200       ORG  '1200
0610  01200 00000000 ****
0611  01200 00000000 ****         B    R    B    U    P
0612  01200 00000307 M1    DATA '307,'322,'317,'325,'320,'240
0612  01201 00000322
0612  01202 00000317
0612  01203 00000325
0612  01204 00000320
0612  01205 00000240
0613  01206 00000000 ****         L    E    V    E    L
0614  01206 00000314 M2    DATA '314,'305,'326,'305,'314,'240
0614  01207 00000305
0614  01210 00000326
0614  01211 00000305
0614  01212 00000314
0614  01213 00000240
0615  01214 00000000 ****       NUMBERS
0616  01214 00000000 ****         0    1    2    3    4    5    6    7    8    9
0617  01214 00000260 M3    DATA '260,'261,'262,'263,'264,'265,'266,'267,'270,'271
0617  01215 00000261
0617  01216 00000262
0617  01217 00000263
0617  01220 00000264
0617  01221 00000265
0617  01222 00000266
0617  01223 00000267
0617  01224 00000270
0617  01225 00000271
0618  01226 00000215 M4    DATA '215,'212
0618  01227 00000212
0619  01230 00000000 ****         S    T    A    L    L
```

```
0620  01230 00000323 M5    DATA '323,'324,'301,'314,'314,'240
0620  01231 00000324
0620  01232 00000301
0620  01233 00000314
0620  01234 00000314
0620  01235 00000240
0621  01236 00000000 *           TELETYPE MESSAGE OUTPUT SUBROUTINE
0622  01236 00000000 MESS ***     **
0623  01237 03101366        STA   TMPA
0624  01240 04101367        STB   TMPB
0625  01241 00000031        LCS
0626  01242 00001613        FLL   14
0627  01243 00000024        SAP
0628  01244 11101336        BRU   DABL
0629  01245 00000031        LCS                 IF CS 15 IS
0630  01246 00001713        FLL   15
0631  01247 00000024        SAP
0632  01250 11101320        BRU   MESS          OUTPUT
0633  01251 01301236 LA     LAA*  MESS
0634  01252 02101370        LBA   ZERO
0635  01253 00000414        FRL   4
0636  01254 04101364        STB   S1
0637  01255 01301236        LAA*  MESS
0638  01256 02101372        LBA   MSK1
0639  01257 00000027        ABA
0640  01260 03101365        STA   S2
0641  01261 14101236        IMS   MESS
0642  01262 02077772        LBA   =-6
0643  01263 01501206 MES1   LAA   M1+6,1         PRINT ''GROUP''
0644  01264 12101324        SPB   TYPE
0645  01265 00000026        IBS
0646  01266 11101263        BRU   MES1
0647  01267 02101364        LBA   S1
0648  01270 01501214 MES2   LAA   M3,1           PRINT NUMBER
0649  01271 12101324        SPB   TYPE
0650  01272 01000240        LAA   ='240
0651  01273 12101324        SPB   TYPE          TYPE TWO
0652  01274 01000240        LAA   ='240         SPACES
0653  01275 12101324        SPB   TYPE
0654  01276 02077772        LBA   =-6
```

```
0655  01277 01501214 MES3 LAA   M2+6,1      PRINT ''LEVEL''
0656  01300 12101324      SPB   TYPE
0657  01301 00000026      IBS
0658  01302 11101277      BRU   MES3
0659  01303 01101365      LAA   S2
0660  01304 15000012      CMA   =10
0661  01305 11101314      BRU   MES4
0662  01306 00000033      NOP
0663  01307 06000012      SMA   =10
0664  01310 03101365      STA   S2
0665  01311 01101215      LAA   M3+1          PRINT ''1''
0666  01312 12101324      SPB   TYPE
0667  01313 01101365      LAA   S2
0668  01314 00000005 MES4 TAB
0669  01315 01501214      LAA   M3,1          PRINT SECOND DIGIT
0670  01316 12101324      SPB   TYPE
0671  01317 12101330      SPB   CRLF
0672  01320 02101367 MES5 LBA   TMPB
0673  01321 01101366      LAA   TMPA
0674  01322 00000035      TOI
0675  01323 11301236      BRU*  MESS
0676  01324 00000000 TYPE ***   **
0677  01325 00001016      LSL   8
0678  01326 00170101      AOP   1,W
0679  01327 11301324      BRU*  TYPE
0680  01330 00000000 CRLF ***   **            CARRIAGE RETURN
0681  01331 01101226      LAA   M4                 AND
0682  01332 12101324      SPB   TYPE          LINE FEED
0683  01333 01101227      LAA   M4+1
0684  01334 12101324      SPB   TYPE
0685  01335 11301330      BRU*  CRLF
0686  01336 01301236 DABL LAA*  MESS
0687  01337 02101373      LBA   MSK2          '70000
0688  01340 00000027      ABA
0689  01341 03101374      STA   AAA
0690  01342 01301236      LAA*  MESS
0691  01343 02101372      LBA   MSK1          '17
0692  01344 00000027      ABA
0693  01345 00000002      NEG
0694  01346 00000005      TAB
```

```
0695  01347 01101371       LAA   ØNE
0696  01350 00000026 IBS   IBS
0697  01351 11101353       BRU   *+2
0698  01352 11101355       BRU   *+3
0699  01353 00000116       LSL   1
0700  01354 11101350       BRU   IBS
0701  01355 02101374       LBA   AAA
0702  01356 00000030       ØBA
0703  01357 03101361       STA   *+2
0704  01360 00130601       PID   0
0705  01361 00000000       DATA  0
0706  01362 11101251       BRU   LA
0707  01363 00000001 CHCK  BSS   1
0708  01364 00000001 S1    BSS   1
0709  01365 00000001 S2    BSS   1
0710  01366 00000001 TMPA  BSS   1
0711  01367 00000001 TMPB  BSS   1
0712  01370 00000000 ZERØ  DATA  0
0713  01371 00000001 ØNE   DATA  1
0714  01372 00000017 MSK1  DATA  '17
0715  01373 00070000 MSK2  DATA  '70000
0716  01374 00000001 AAA   BSS   1
0717  01375 70400000       END
```

SYSTEMS ENGINEERING LABORATORIES PROGRAM LIBRARY

PROGRAM DESCRIPTION

 Catalog No. 303014A

IDENTIFICATION: Inter-Map Verification Check Program

AUTHOR: Systems Engineering Laboratories

ACCEPTED: August 30, 1967

PURPOSE: This program is designed to verify the proper execution of specific memory reference instructions which are located on the memory boundary between Map 2 and Map 3.

COMPUTER CONFIGURATION: SEL 810A Computer

Relocatable Loader
Prog. Counter 16060
A-Accum 0 B-Accum 0
After Load Start At '5000
Prog. Cntr.

SUBROUTINES REQUIRED: Not applicable.

STORAGE: '02470-'2515, '2773-'3005, '3470-'3505, '4000-'4504, '5000-'5372 locations.

TIMING: Not applicable.

LOADING PROCEDURE:

1. Load the program into memory by using the Standard Relocatable Loader. When loading is complete the computer will halt. The program should not be relocated.

2. Enter the starting address of the program ('05000) into the program counter.

3. Press the START switch on the console twice.

4. The program will remain in a test loop until a program halt is detected or the CPU is manually halted. The program performs all 18 tests listed in the Method section of this document.

USE: The program is designed to check the proper execution of specific memory reference instructions located on the map boundary between Map 2 and Map 3. The program also checks several skip instructions to determine if the CPU has functioned correctly.

Relocatable Loader
Prog. Counter 16060
A-Accum 0 B-Accum 0
After Load Start At '5000
Prog. Cntr.

Note:
When using the upper 16K load/dump2 program the relocatable loader program counter 36060, should be utilized to load the programs rather than the 16060

METHOD:

1. INSTRUCTIONS

The following list shows the instructions used by the program to verify the proper execution of the CPU on the map boundary and the halt locations associated with each test.

Test No.	Halt (PC location)	Instruction
Test 1	'5022	Store B accumulator
" 2	'5040	Store A accumulator
" 3	'5051	Load A accumulator
" 4	'5063	Load B accumulator
" 5	'5076	Add memory to A
" 6	'5111	Add memory to B
" 7	'5122	Subtract memory from A accumulator
" 8	'3002	Skip A zero (A NQ zero) B accumulator equal 1
" 9	'3002	Skip A negative (A not negative) B accumulator equal 2
" 10	'3002	Skip A positive (A not positive) B accumulator equal 3
" 11	'3006	Skip A negative (A not negative) B accumulator equal 4
" 12	'3006	Skip A positive (A not positive) B accumulator equal 5
" 13	'3006	Skip A zero (A NQ zero) B accumulator equal 6
" 14	'5225	Add memory to A accumulator (Indirect) B accumulator equal 7
" 15	'5241	Subtract memory from A accumulator (Indirect) B accumulator equal 10
" 16	'3003 '5265	Increment memory and skip B accumulator equal 11
" 17	'3474	Store place and branch B accumulator equal 12
" 18	'3003 '5311	Skip no overflow B accumulator equal 13

2. TEST DESCRIPTION

The program is designed to use locations '2774 thru '3004 as test locations. The program will insert the operands that are to be checked into the test locations from the main program starting at location '5000.

The primary purpose of the program is to ensure that memory reference instructions on a map boundary use the memory location within the same map as the

METHOD (CONT'D):

2. TEST DESCRIPTION (CONT'D)

instruction itself. A malfunction will be detected if the memory address accessed is in the next map instead of the map containing the instruction.

Test 1. Store B Accumulator.

The program will execute a Store B Accumulator instruction with the memory reference address in the same map as the instruction. The program location of the Store B Accumulator command is location '02777 and the memory address is '02504. The test locations are as follows:

Location	OP Code	Address	Comment
'02776	NOP		Augmented instruction.
'02777	STB	T5	T5 location is '02504
'03000	BRU*	Test	Return to main program

Halt Location..

If the CPU has functioned properly the program will proceed to Test 2, otherwise a halt will occur at location '05022. This indicates that the memory address of the Store B instruction was in location '03505 of the next map rather than in location '02504 of the map that contained the instruction.

The A accumulator contains the data from location '02504, the B accumulator contains the data from location '03504.

Test 2. Store A Accumulator.

The program will execute a Store A Accumulator instruction with the memory reference address in the same map as the instruction. The program will Store the contents of the A accumulator from location '02777. The memory address is '02504. The test locations are as follows:

Location	OP Code	Address	Comment
'02776	NOP		Augmented instruction
'02777	STA	T5	T5 location is '2504
'03000	BRU*	Test	Return to main program

Halt Condition.

If the CPU has functioned properly the program will proceed to Test 3, otherwise a halt will occur at location '05040. This indicates that the memory address of

METHOD (CONT'D):

Test 2. Store A Accumulator (Cont'd)

the Store A instruction was in location '3504 of the next map rather than in location '2504 of the map that contained the instruction.

The A accumulator contains the contents of location '2504 which should be '177777. The B accumulator contains the contents of location '3504 which should be '000000. If the data in A is '000000 and the B accumulator contains '177777 the CPU has a malfunction.

Test 3. Load A Accumulator.

The program will execute a Load A Accumulator instruction with the memory reference address in the same map as the instruction. The A accumulator should contain 177777. If the memory address was in the next map the A accumulator will contain zero's which indicate a CPU malfunction. The test locations are as follows:

Location	OP Code	Address	Comment
'02776	NOP		Augmented instruction
'02777	LAA	T1	T1 location is '2500
'03000	BRU*	Test	Return to main program

Halt Location.

If the CPU has functioned properly the program will proceed to Test 4, otherwise the program will halt at location '05051.

This indicates that the memory address of the Load A instruction was in location '3500 of the next map rather than in location '02500 of the map that contained the instruction. The A accumulator has the incorrect data.

Test 4. Load B Accumulator.

The program will execute a Load B Accumulator instruction with the memory reference address in the same map as the instruction. The B accumulator should contain '177777. If the memory address was in the next map the B accumulator will contain zeros which indicate a CPU malfunction. The test locations are as follows:

Location	OP Code	Address	Comment
'02776	NOP		Augmented instruction
'02777	LBA	T1	T1 location is '3500
'03000	BRU*	Test	Return to main program

METHOD (CONT'D):

Test 4. Load B Accumulator (Cont'd)

Halt Location.

If the CPU has functioned properly the program will proceed to Test 5, otherwise the program will halt at location '05063.

This indicates that the memory address of the Load B Accumulator instruction was in location '3500 of the next map rather than in location '2500 of the map that contained the instruction. The A accumulator has the incorrect data.

Test 5. Add Memory to A Accumulator.

The program will execute an Add Memory to A Accumulator instruction with the memory reference address in the same map as the instruction.. The A accumulator should contain '177777. If the memory address was from the next map the A accumulator will contain '077777.

Halt Location.

If the CPU has functioned properly the program will proceed to Test 6, otherwise the program will halt at location '05076. This indicates that the memory address of the Add Memory to A accumulator was in location '03502 of the next map rather than in location '02502 of the map that contained the instruction. The test locations are as follows:

Location	OP Code	Address	Comment
'02776	NOP		Augmented instruction
'02777	AMA	T3	T3 EQ T1 000001
'03000	BRU*	Test	

Test 6. Add Memory to B Accumulator.

The program will execute an Add Memory to B Accumulator instruction with the memory address in the same map as the instruction. The B accumulator after execution of the instruction should contain '177777. If the memory address was in the next map, the B accumulator will contain '077777 indicating a malfunction in the CPU. The test locations are as follows:

Location	OP Code	Address	Comment
02776	NOP		Augmented instruction
02777	AMB	T3	T3 EQ 000001
03000	BRU*	Test	Return

METHOD (CONT'D):

Test 6. Add Memory to B Accumulator (cont'd).

Halt Location.

If the CPU has functioned properly, the program will proceed to Test 7, otherwise a halt will occur at location '05111. The A accumulator will contain the incorrect data.

Test 7. Subtract Memory from A Accumulator.

The program will execute Subtract Memory from A Accumulator instruction with the memory address in the same map as the instruction. The test locations are as follows:

Location	OP Code	Address	Comment
'02776	NOP		A contains 177777
'02777	SMA	T4	T4 EQ to '100000
'03000	BRU*	Test	Return

Halt Location..

If the CPU has functioned properly the program will proceed to Test 8, otherwise a halt will occur at location '05122. The A accumulator will display the incorrect data value of '177777. The correct data value is '077777.

Test 8. Skip A Zero.

The augmented instruction SAZ will be executed from location '02776. The data in the A accumulator is not equal to zero, therefore the program should not cross the map boundary.

Halt Locations.

If the CPU has functioned peoperly the program will proceed to Test 9, otherwise a halt will occur at location '03002. This indicates that the CPU has crossed the map boundary which is an error. The B accumulator will contain '000001 indicating the error number.

Test 9. Skip A Negative.

The augmented instruction SAN will be executed from location '02776. The data in the A accumulator is not negative, therefore the program should not cross the map boundary.

METHOD (CONT'D):

Test 9. Skip A Negative (cont'd).

Halt Locations.

If the CPU has functioned properly the program will proceed to Test 10, otherwise a halt will occur at location '03002. This indicates that the CPU has crossed the map boundary which is an error. The B accumulator will contain '000002 indicating the error number.

Test 10. Skip A Positive.

The augmented instruction SAP will be executed from location '02776. The data in the A accumulator is not positive, therefore the program should not cross the map boundary.

Halt Location.

If the CPU has functioned properly the program will proceed to Test 11, otherwise a halt will occur at location '03002. This indicates that the CPU has crossed the map boundary which is an error. The B accumulator will contain '000003 indicating the error number.

Test 11. Skip A Negative.

The augmented instruction SAN will be executed from location '02777. The data in the A accumulator will be a positive number, therefore the program will cross the map boundary to the first location of the next map.

Halt Location.

If the CPU has functioned properly the program will proceed to Test 12, otherwise a halt will occur at location '03006. This indicates that the CPU has crossed the map boundary but skipped incorrectly. The B accumulator will contain '000004 indicating the error number.

Test 12. Skip A Positive.

The augmented instruction SAP will be executed from location '02777. The data in the A accumulator will be negative, therefore the program will cross the map boundary and execute the first instruction of the next map.

Halt Location.

If the CPU has functioned properly the program will proceed to Test 13, otherwise a halt will occur at location '03006. This indicates that the CPU has skipped on A positive when the data in A was negative. The B accumulator will contain '000005 indicating the error number.

METHOD (CONT'D):

Test 13. Skip A Zero.

The augmented instruction SAZ will be executed from location '027777. The data in the A accumulator will not be zero, therefore the program will cross the map boundary and execute the first instruction of the next map.

Halt Location.

If the CPU has functioned properly the program will proceed to Test 14, otherwise a halt will occur at location '03006. This indicates that the CPU has skipped on A zero when the data in A was positive. The B accumulator will contain 000006 indicating the error number.

Test 14. Add Memory to A (Indirect)

The program will execute an Add Memory to A Accumulator instruction with the indirect-bit set. The memory address will be indirect thru the map which contains the instruction. When the command has been executed the value in A should be '177777. If the memory address was in the next map the value in A will be '100000. The test locations are as follows:

Location	OP Code	Address	Comment
'02776	NOP		Augmented instruction
'02777	AMA*	T2	A EQ 177777
'03000	BRU*	Test	Return

Halt Location.

If the CPU has functioned properly the program will proceed to Test 15, otherwise a halt will occur at location '05225. The operator may visually observe the contents of A accumulator. The data value should be '177777. Any other value indicates an error. The B accumulator will contain 000007 indicating the error number.

Test 15. Subtract Memory from A (Indirect).

The program will execute a Subtract Memory from A Indirect instruction with the indirect address in the same map as the instruction. When the command has been executed, the data in the A accumulator should be '077777. If the memory address was in the next map the value will be '177777. The test locations are as follows:

Location	OP Code	Address	Comment
'02776	FRA		A EQ 177777
'02777	SMA*	T4	T4 EQ 100000
'03000	BRU*	Test	Return

METHOD (CONT'D):

Test 15. Subtract Memory from A (Indirect) (cont'd)

Halt Location.

If the CPU has functioned properly the program will proceed to Test 16, otherwise a halt will occur at location '05241. The operator may visually observe the contents of the A accumulator. The data should be '077777. Any other data indicates an error. The B accumulator will contain 000010 indicating the error number.

Test 16. Increment Memory and Skip.

The program will execute an Increment Memory and Skip instruction with the memory address in the same map as the instruction. The A accumulator after execution of the instruction should contain 000000. If the memory address was in the next map, the data in A will be 000001. The test locations are as follows:

Location	OP Code	Address	Comment
'02776 '03000 '03001 '03002	NOP IMS HLT BRU*	T6	Augmented Code T6 EQ 177777

Halt Location.

If the CPU has functioned properly the program will proceed to test 17, otherwise a halt will occur at location '03003 or '05265. The B accumulator contains the error number count which is equal to 000011. The halt at '03003 indicates that the IMS instruction didnot skip properly. The halt at '05265 indicates that the incremented memory address was in the next map rather than in the same map as the instruction.

Test 17. Store Place and Branch.

The program will execute a Store Place and Branch instruction with the branch location in the same map as the SPB instruction. The subroutine in the same map will clear the A accumulator indicating that the subroutine was entered. The test locations are as follows:

Location	OP Code	Address	Comment
'02776 '02777 '03000	NOP SPB BRU*	THMP Test	Augmented instruction location is 2470 Return

METHOD (CONT'D):

Test 17. Store Place and Branch (cont'd).

Halt Location.

If the CPU has functioned properly the program will proceed to Test 18, otherwise a halt will occur at location '03474. The operator may visually observe the contents of the A accumulator. The data value should be 177777, which indicates an error. The B accumulator should have a value of 000012. This verifies that the SPB test is the one which caused the failure.

Test 18. Skip No Overflow Test.

The program will execute a Skip No Overflow instruction. The skip instruction crosses an intermap boundary. The overflow latch is not set. The test locations are as follows:

Location	OP Code	Address	Comment
02776	SOF		Overflow not set
02777	HLT		Incorrect skip
03000	BRU*	Test	Return

Halt Location..

If the CPU has functioned properly, the progra will reset all counters and begin with Test 1, otherwise the program will halt at location '3003 or '05311. The B accumulator should contain a value of 000013. The halt at location '03003 indicates that the SOF didnot skip properly to the next map.

Catalog No. 303014A

```
1
 0001  00000 00000000 ***          INTER-MAP VERIFICATION CHECK PROGRAM 810A      303014A
 0002  00000 00000000 ***          J.B. BOYER    AUG 30, 1967
 0003  02470 60002470        ORG   '2470
 0004  02470A00000000 THMP   ZZZ                      THIS MAP
 0005  02471 00000033        NOP
 0006  02472 00000003        CLA
 0007  02473 11202470        BRU*  THMP
 0008  02500 60002500        ORG   '2500
 0009  02500 00177777 T1     DATA  '177777
 0010  02501 00077777 T2     DATA  '077777
 0011  02502 00000001 T3     DATA  '000001
 0012  02503 00100000 T4     DATA  '100000
 0013  02504 00000000 T5     DATA  0
 0014  02505 00000000 T6     DATA  0                SAME MAP
 0015  02506 14002505 IMS    IMS   T6
 0016  02507 05202510 AMAA   AMA*  T6D
 0017  02510 25402502 T6D    DAC   T3
 0018  02511 06202512 SMAA   SMA*  T7D
 0019  02512 25402503 T7D    DAC   T4
 0020  02513 12002470 SPB    SPB   THMP
 0021  02514 11002515 BRUB   BRU   T7
 0022  02515 11202773 T7     BRU*  TEST
 0023  02773 60002773        ORG   '2773
 0024  02773 00000000 TEST   ZZZ   **
 0025  02774 00000033        NOP                    LOCATION 2774
 0026  02775 00000033        NOP                    LOCATION 2775
 0027  02776 00000033        NOP                    LOCATION 2776
 0028  02777 00000033        NOP                    LOCATION 2777
 0029  03000 00000033        NOP                    LOCATION 3000
 0030  03001 00000033        NOP                    LOCATION 3001
 0031  03002 00000033        NOP                    LOCATION 3002
 0032  03003 00000033        NOP                    LOCATION 3003
 0033  03004 00000033        NOP                    LOCATION 3004
 0034  03005 00000000 *
 0035  03005 11202773        BRU*  TEST
 0036  03006 11202773 BRUA   BRU*  TEST
 0037  03007 00002777 TES1   EQU   TEST+4
 0038  03470 60003470        ORG   '3470
 0039  03470A00000000 NTMP   ZZZ                    NEXT MAP IF PROGRAM COUNTER ADVANCED
```

```
0040  03471 00000033        NØP
0041  03472 00000000        HLT          INDICATES INCØRRECT BRANCH
0042  03473 11203470        BRU* NTMP
0043  03500 60003500        ØRG  '3500
0044  03500 00000000 TA     DATA 0
0045  03501 00000000 TB     DATA 0
0046  03502 00000000 TC     DATA 0
0047  03503 00000000 TD     DATA 0
0048  03504 00000000 TE     DATA 0
0049  03505E00000000 TF     DATA         NEXT MAP
0050  04000 60004000        ØRG  '4000
0051  04000 01004500 LAA    LAA  T1D     T1D EQ 177777
0052  04001 02004500 LBA    LBA  T1D
0053  04002 05004502 AMA    AMA  T3D     T3D EQ 000001
0054  04003 16004502 AMB    AMB  T3D     T3D EQ 000001
0055  04004 06004503 SMA    SMA  T4D     T4D EQ 100000
0056  04005 04004504 STB    STB  T5D
0057  04006 03004504 STA    STA  T5D     T5D EQ 0
0058  04007 00000002 SAZA   SAZ
0059  04010 00000024 SAP    SAP
0060  04011 00000023 SAN    SAN
0061  04012 00001712 FRA    FRA  15
0062  04013 00001716 LSL    LSL  15
0063  04014 00000025 SØF    SØF
0064  04015 25405372 LC04   DAC  L304+1
0065  04016 25405365 LC00   DAC  L300
0066  04500 60004500        ØRG  '4500
0067  04500 00177777 T1D    DATA '177777
0068  04501 00077777 T2D    DATA '077777
0069  04502 00000001 T3D    DATA '000001
0070  04503 00100000 T4D    DATA '100000
0071  04504 00000000 T5D    DATA '0
0072  05000 60005000        ØRG  '5000
0073  05000 12005335 TAR    SPB  STBS
0074  05001 00000000 ****$         STØRE B INSTRUCTIØN
0075  05001 00000003        CLA
0076  05002 03005332        STA  CNT       CØUNTER
0077  05003 01004005        LAA  STB     STB INSTRUCTIØN
0078  05004 03002777        STA  TES1    STØRED INTØ TEST LØCATIØN
0079  05005 00000003        CLA
```

```
0080  05006 03002504        STA   T5        LØCATIØN IN SAME MAP AS STB
0081  05007 03003504        STA   TE        LØCATIØN IN NEXT MAP
0082  05010 14005332        IMS   CNT       CØUNTER
0083  05011 02002500        LBA   T1        T1 EQ TØ 177777
0084  05012 12002773        SPB   TEST      TEST SUBRØUTINE
0085  05013 01002504        LAA   T5        T5 IS IN SAME MAP AS STB
0086  05014 15002500        CMA   T1        T1 EQ 177777
0087  05015 11005017        BRU   *+2       NØ
0088  05016 11005021        BRU   ØT        YES GØ TØ NEXT TEST
0089  05017 02003504        LBA   TE        GET VALUE INTØ B
0090  05020 00000000        HLT             A CØNTAINS DATA ØF SAME MAP LØCATIØN
0091  05021 00000000  *                     B CØNTAINS DATA ØF NEXT MAP LØCATIØN
0092  05021 00000000  *                     CØRRECT DATA VALUE SHØULD BE 177777
0093  05021 01004006  ØT    LAA   STA       STØRE A INSTRUCTIØN
0094  05022 03002777        STA   TES1
0095  05023 00000000  *****                 CHECK STØRE A INSTRUCTIØN
0096  05023 00000003        CLA
0097  05024 03002504        STA   T5        SAME MAP AS STA
0098  05025 03003504        STA   TE        NEXT MAP
0099  05026 14005332        IMS   CNT       CØUNTER INCREMENTED
0100  05027 01002500        LAA   T1        T1 EQ TØ 177777
0101  05030 12002773        SPB   TEST
0102  05031 01002504        LAA   T5        CHECK SAME MAP FØR DATA
0103  05032 15002500        CMA   T1        T1 EQ 177777
0104  05033 11005035        BRU   *+2
0105  05034 11005037        BRU   ØA
0106  05035 02003504        LBA   TE
0107  05036 00000000        HLT             A CØNTAINS VALUE FRØM SAME MAP AS STA
0108  05037 00000000  ****                  B CØNTAINS DATA FRØM NEXT MAP
0109  05037 00000033  ØA    NØP
0110  05040 01004000        LAA   LAA
0111  05041 03002777        STA   TES1      LAA SET TØ LØAD FRØM SAME MAP
0112  05042 14005332        IMS   CNT       CØUNTER
0113  05043 00000003        CLA
0114  05044 03003504        STA   TE
0115  05045 12002773        SPB   TEST      TEST SUBRØUTINE
0116  05046 00000023        SAN
0117  05047 00000000        HLT
0118  05050 14005332        IMS   CNT       CØUNTER INCREMENTED
0119  05051 01004001        LAA   LBA       LBA CHECK
```

```
0120  05052 03002777        STA   TES1      SET TEST LOCATION TO LDA INSTRUCTION
0121  05053 00000003        CLA             SET A+B TO ZEROS
0122  05054 03003504        STA   TE
0123  05055 00000005        TAB
0124  05056 12002773        SPB   TEST      TEST SUBROUTINE
0125  05057 00000004        TBA
0126  05060 00000023        SAN             CHECK A FOR NEGATIVE VALUE
0127  05061 00000000        HLT
0128  05062 00000000 ****$                  CHECK ADD MEMORY TO A
0129  05062 01004002        LAA   AMA
0130  05063 03002777        STA   TES1      STORE AMA INSTRUCTION INTOTEST LOCATION
0131  05064 14005332        IMS   CNT       COUNTER FOR INSTRUCTION
0132  05065 01002501        LAA   T2        T2 EQUAL TO 077777
0133  05066 12002773        SPB   TEST      TEST
0134  05067 00000025        SBF
0135  05070 11005071        BRU   *+1       TURN OFF OVERFLOW
0136  05071 15002503        CMA   T4        T4 EQ 100000
0137  05072 11005074        BRU   *+2
0138  05073 11005075        BRU   *+2
0139  05074 00000000        HLT             VALUE OF INCORRECT DATA IS IN A ACCUMULATOR
0140  05075 00000000 *****                  CHECK ADD MEMORY TO B
0141  05075 14005332        IMS   CNT       COUNTER
0142  05076 01004003        LAA   AMB       AMB INSTRUCTION USES T3 EQ T0
0143  05077 03002777        STA   TES1      STORE AMB INSTRUCTION INTO TEST LOCATION
0144  05100 00000003        CLA
0145  05101 02002501        LBA   T2        T2 VALUE IS 077777
0146  05102 12002773        SPB   TEST      TEST ROUTINE
0147  05103 00000004        TBA
0148  05104 15002503        CMA   T4        T4 EQ TO 100000
0149  05105 11005107        BRU   *+2
0150  05106 11005110        BRU   *+2
0151  05107 00000000        HLT
0152  05110 00000000 *****                  CHECK SMA INSTRUCTION
0153  05110 01004004        LAA   SMA       SMA USES T4 EQ TO 100000
0154  05111 03002777        STA   TES1      STORE SMA INTO TEST LOCATION
0155  05112 14005332        IMS   CNT
0156  05113 01002500        LAA   T1        T1 VALUE IS 177777
0157  05114 12002773        SPB   TEST      TEST SUBROUTINE
0158  05115 15002501        CMA   T2        T2 VALUE IS 077777
0159  05116 11005120        BRU   *+2
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```
0160  05117 11005121        BRU   *+2
0161  05120 00000000        HLT                    A CONTAINS INCORRECT VALUE SHOULD BE 077777
0162  05121 00000000 ****                          SAZ TEST A ACCUMULATOR NOT EQ ZERO
0163  05121 00000000 *                             SHOULD NOT CROSS MAP BOUNDARY LAST LOCATION OF
0164  05121 00000000 *                             TEST MAP HAS A BRU* TEST WHICH SHOULD RETURN TO
0165  05121 00000000 *                             MAIN PROGRAM
0166  05121 00000000 *                             B ACC CONTAINS ERROR NUMBER
0167  05121 01005334        LAA   HLT
0168  05122 03205365        STA*  L300             TEST LOCATION
0169  05123 14005332        IMS   CNT              INCREMENT COUNTER
0170  05124 00000003        CLA
0171  05125 00000005        TAB
0172  05126 03005333        STA   STBT             STBT WILL BE TEMPORARY STORAGE FOR COUNTER
0173  05127 03005372        STA   L304+1            TEST LOCATION
0174  05130 01004007        LAA   SAZA
0175  05131 03205363        STA*  L276             TEST LOCATION
0176  05132 01003006        LAA   BRUA
0177  05133 03205364        STA*  L277             TEST LOCATION
0178  05134 00000026        IBS                    INCREMENT COUNTER
0179  05135 00000033        NOP
0180  05136 04005333        STB   STBT             SAVE ERROR COUNTER
0181  05137 12002773        SPB   TEST
0182  05140 14005332        IMS   CNT
0183  05141 00000000 ****          SAN TEST A ACCUMULATOR EQ POSITIVE NUMBER
0184  05141 00000000 *                            WHICH IS THE AUGMENTED INSTRUCTION
0185  05141 12005353        SPB   BUPD             INCREMENT B SUBROUTINE
0186  05142 01004011        LAA   SAN
0187  05143 03205363        STA*  L276             TEST LOCATION
0188  05144 12002773        SPB   TEST             TEST SUBROUTINE
0189  05145 00000000 ****                          SAP TEST A ACCUMULATOR EQ NEGATIVE NUMBER
0190  05145 14005332        IMS   CNT              INCREMENT COUNTER
0191  05146 12005353        SPB   BUPD             INCREMENT B SUBROUTINE
0192  05147 01004010        LAA   SAP              SAP SET TO TEST LOCATION
0193  05150 03205363        STA*  L276             TEST LOCATION
0194  05151 01004503        LAA   T4D              T4D EQ 100000
0195  05152 12002773        SPB   TEST             TEST SUBROUTINE
0196  05153 01005331        LAA   SAZ
0197  05154 03205365        STA*  L300
0198  05155 01003006        LAA   BRUA             TEST LOCATION
0199  05156 03205372        STA*  L304+1
```

```
0200  05157 12005335       SPB   STBS     RESET COUNTERS
0201  05160 01004011       LAA   SAN
0202  05161 03205364       STA*  L277     TEST LOCATION
0203  05162 01003006       LAA   BRUA
0204  05163 03205365       STA*  L300     NEXT MAP
0205  05164 01005334       LAA   HLT      HALT
0206  05165 03205371       STA*  L304     HALT SHOULD OCCUR
0207  05166 12005353       SPB   BUPD     INCREMENT COUNTER SUBROUTINE
0208  05167 01004011       LAA   SAN      POSITIVE NUMBER IN A
0209  05170 12002773       SPB   TEST
0210  05171 00000000 *                    SAP TEST OVER MAP
0211  05171 14005332       IMS   CNT      COUNTER
0212  05172 12005353       SPB   BUPD     INCREMENT B COUNTER
0213  05173 01004010       LAA   SAP
0214  05174 03205364       STA*  L277     TEST LOCATION
0215  05175 01004503       LAA   T4D      T4D EQ 100000
0216  05176 12002773       SPB   TEST     TEST SUBROUTINE
0217  05177 00000000 *
0218  05177 14005332       IMS   CNT      COUNTER
0219  05200 12005353       SPB   BUPD     INCREMENT B COUNTER
0220  05201 01004007       LAA   SAZA
0221  05202 03205364       STA*  L277     TEST LOCATION
0222  05203 01004503       LAA   T4D      T4D EQ 100000
0223  05204 12002773       SPB   TEST     TEST SUBROUTINE
0224  05205 00000000 *
0225  05205 12005335       SPB   STBS     RESET ALL TEST LOCATIONS TO NOP
0226  05206 00000000 ****
0227  05206 00000000 *                    MAP
0228  05206 00000000 *****                AMA* TEST INSTRUCTION IS LOCATED IN LAST
0229  05206 00000000 *                    MEMORY CELL OF THE MAP
0230  05206 14005332       IMS   CNT      INCREMENT COUNTER
0231  05207 12005353       SPB   BUPD
0232  05210 01005331       LAA   SAZ
0233  05211 03205363       STA*  L276     RESET TEST LOCATION TO NOP
0234  05212 01002507       LAA   AMAA
0235  05213 03002777       STA   TES1     TES1 IS THE TEST LOCATION
0236  05214 01002501       LAA   T2       T2 EQ 077777
0237  05215 12002773       SPB   TEST     GO TO TEST
0238  05216 00000025       SOF
0239  05217 00000033       NOP
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```
0240  05220 15002503      CMA   T4          T4 EQ 100000
0241  05221 11005223      BRU   *+2
0242  05222 11005224      BRU   *+2
0243  05223 00000000      HLT               A HAS INCORRECT DATA SHOULD BE 100000
0244  05224 00000000 *****                  SMA* TEST
0245  05224 00000000 *                      INSTRUCTION LOCATED IN LAST CELL OF THE MAP
0246  05224 12005353      SPB   BUPD
0247  05225 01004012      LAA   FRA
0248  05226 03002776      STA   TES1-1      SHIFT THRU ALL BITS
0249  05227 01002511      LAA   SNAA
0250  05230 03002777      STA   TES1        TEST LOCATION
0251  05231 14005332      IMS   CNT         COUNTER INCREMENT
0252  05232 01004503      LAA   T4D         T4D EQ 100000
0253  05233 00000000 *                      FRA WILL SET ALL BITS TO N
0254  05233 00000000 *                      FRA WILL SET ALL BITS TO ONES PRIOR TO
0255  05233 00000000 *                      SUBTRACT INDIRECT
0256  05233 12002773      SPB   TEST        TEST SUBROUTINE
0257  05234 02005333      LBA   STBT
0258  05235 15002501      CMA   T2
0259  05236 11005240      BRU   *+2
0260  05237 11005241      BRU   *+2         DATA EQ
0261  05240 00000000      HLT               A EQ TO INCORRECT DATA
0262  05241 01005331      LAA   SAZ
0263  05242 03002776      STA   TES1-1
0264  05243 00000000 ****                   IMS TEST
0265  05243 12005353      SPB   BUPD
0266  05244 01004500      LAA   T1D
0267  05245 03002505      STA   T6          T6 EQ 177777
0268  05246 00000003      CLA
0269  05247 03003505      STA   TF          ZERO IN TF
0270  05250 00000000 *                      INCREMENT B COUNTER
0271  05250 03205365      STA*  L300        HLT WILL OCCUR IF MEMORY NOT ZERO
0272  05251 01002506      LAA   IMS
0273  05252 03205364      STA*  L277
0274  05253 14005332      IMS   CNT         COUNTER
0275  05254 01005006      LAA   BRUA        BRU* SET TO 2ND LOCATION OF MAP
0276  05255 03205366      STA*  L301
0277  05256 12002773      SPB   TEST        TEST SUBROUTINE
0278  05257 01002505      LAA   T6
0279  05260 00000023      SAN
```

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0280  05261 11005270        BRU  ØPR
0281  05262 01002505        LAA  T6
0282  05263 00000000        HLT
0283  05264 01002505        LAA  T6
0284  05265 02003505        LBA  TF
0285  05266 00000033        NØP
0286  05267 02005333        LBA  STBT
0287  05270 00000003 ØPR    CLA
0288  05271 03002505        STA  T6          RESET TEST LØCATIØN TØ ZERØ
0289  05272 03003505        STA  TF          RESET
0290  05273 00000000 *                       A CØNTAINS SAME MAP LØCATIØN WHICH SHØULD BE
0291  05273 00000000 *                       ZERØ ØRIGINAL DATA WAS 177777
0292  05273 00000000 *                       CHECK FØR VALUE
0293  05273 00000000 *
0294  05273 00000000 ********                SPB TEST RØUTINE
0295  05273 01004013        LAA  LSL         LSL 15 TØ LØCATIØN X776
0296  05274 03205363        STA* L276        NEXT TØ LAST LØCATIØN ØF THE MAP
0297  05275 01002513        LAA  SPB
0298  05276 03205364        STA* L277        SET SPB INSTRUCTIØN TØ TEST LØCATIØN
0299  05277 01005334        LAA  HLT
0300  05300 03205366        STA* L301        SET HALT TØ
0301  05301 12005353        SPB  BUPD        INCREMENT CØUNTER FØR ERRØR DISPLAY
0302  05302 01005006        LAA  BRUA
0303  05303 03205365        STA* L300        RETURN BRU* ØUT ØF TEST PRØGRAM
0304  05304 01002500        LAA  T1          T1 EQ TØ 000001
0305  05305 12002773        SPB  TEST
0306  05306 00000022        SAZ
0307  05307 00000000        HLT              CHECK B ACCUMULATØR FØR ERRØR NUMBER
0308  05310 00000000 *                       IF SPB FUNCTIØNED PRØPERLY A SHØULD BE CLEAR
0309  05310 00000000 *
0310  05310 00000003        CLA
0311  05311 03002470        STA  THMP        CLEAR SUBRØUTINE ENTRANCE LØCATIØN
0312  05312 03003470        STA  NTMP        CLEAR SUBRØUTINE ENTRANCE LØCATIØN
0313  05313 12005335 ØK1A   SPB  STBS
0314  05314 00000000 ********                SØF TEST
0315  05314 12005353        SPB  BUPD        INCREMENT B CØUNT
0316  05315 12005335        SPB  STBS
0317  05316 01004014        LAA  SØF         ØVERFLØW CHECK ØVERFLØW WILL BE SET
0318  05317 03205363        STA* L276        2776 CØNTAINS SØF INSTRUCTIØN
0319  05320 00000003        CLA
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```
0320  05321 03205364        STA* L277          SET TEST LOCATION 2777 TO HALT
0321  05322 01003006        LAA  BRUA
0322  05323 03205365        STA* L300
0323  05324 14005332        IMS  CNT           INCREMENT COUNTER
0324  05325 01002502        LAA  T3            T3 EQ 000001
0325  05326 05002502        AMA  T3            NO OVERFLOW
0326  05327 12002773        SPB  TEST
0327  05330 11005000        BRU  TAR
0328  05331 00000033 SAZ    NOP
0329  05332 00000000 CNT    DATA 0
0330  05333 00000000 STBT   DATA 0             TEMP STORAGE FOR ERROR COUNTER
0331  05334 00000000 HLT    HLT
0332  05335 00000000 STBS   ZZZ  **
0333  05336 04005333        STB  STBT
0334  05337 02077773 STRT   LBA  *-5
0335  05340 01005331        LAA  SAZ
0336  05341 03605372        STA* L304+1,1      SET TEST LOCATIONS TO NOP
0337  05342 00000026        IBS
0338  05343 11005340        BRU  *-3
0339  05344 02077774        LBA  *-4
0340  05345 01005331        LAA  SAZ
0341  05346 03605365        STA* L300,1        SET TEST LOCATIONS TO NOP
0342  05347 00000026        IBS
0343  05350 11005345        BRU  *-3
0344  05351 02005333        LBA  STBT
0345  05352 11205335        BRU* STBS
0346  05353 00000000 BUPD   ZZZ  **            COUNTER UPDATE SUBROUTINE
0347  05354 00000000 *
0348  05354 02005333        LBA  STBT
0349  05355 00000026        IBS                INCREMENT ERROR COUNTER
0350  05356 00000033        NOP
0351  05357 04005333        STB  STBT          SAVE NEW ERROR NUMBER
0352  05360 11205353        BRU* BUPD
0353  05361 00000000 *
0354  05361 25402774 L274   DAC  '2774         LOCATIONS TO BE USED
0355  05362 25402775 L275   DAC  '2775         TO CHECK INTER MAP
0356  05363 25402776 L276   DAC  '2776
0357  05364 25402777 L277   DAC  '2777
0358  05365 25403000 L300   DAC  '3000
0359  05366 25403001 L301   DAC  '3001
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0360  05367 25403002 L302 DAC  '3002
0361  05370 25403003 L303 DAC  '3003
0362  05371 25403004 L304 DAC  '3004
0363  05372 25403005 L305 DAC  '3005
0364  05373 60400000      END
```

SEL PROGRAM LIBRARY

PROGRAM DESCRIPTION

 Catalog No. 310002B

IDENTIFICATION: Paper Tape Reproducer/Verifier

AUTHOR: S. R. Brandt, SEL

ACCEPTED: 3 March 1967

PURPOSE: To reliably reproduce paper tape of any size, within a minimum amount of core storage.

COMPUTER CONFIGURATION: Any 810A computer; High Speed Paper Tape optional.

SUBROUTINES REQUIRED: None

STORAGE: 1465_{10}

TIMING: N/A

USE:

1. Load with Relocatable Loader

2. Options

SNS 0 - Input Option
a. OFF - read from ASR-33
b. ON - [redacted]

SNS 1 - Output Option
a. OFF - punch on ASR-33
b. ON - [redacted]
Above two switches may be used in any combination.

SNS 2 - ON to read source tape through continuously (no stopping) to obtain accurate verification counts.

A REGISTER - clear it and press start to re-verify a tape that did not verify correctly the first time.

Note!
When using the upper 16K load/dump program the relocatable loader, program counter 360060 should be utilized to load the program rather than the 160060

Relocatable Loader
Prog. Counter 160060
A-Accum '2000 B-Accum 0
After Load Start At '2000
Prog. Cntr.

Relocatable Loader
Prog. Counter 160060
A-Accum '2000 B-Accum 0
After Load Start At '2000
Prog. Cntr.

3. It is a requirement of this program that the input or source tape contain a stop code at the very end. This stop code consists of three (3) consecutive "colon" characters (full ASCII code 272). This stop code is reproduced into the new tape.

4. Operating Procedure:

a. Load the Tape Copy/Verify Program with relocatable loader.
b. Set Sense Switches 0 and 1 as desired.
c. Set Sense Switch 2 ON to read the original tape through to obtain verification counts.
d. Ready the original tape on the appropriate device.
e. Press START; tape will read through continuously until the Stop Code is encountered.
f. Reset Sense Switch 2 to OFF.
g. Ready the original tape again.
h. Press START and new tape will be punched out; when punching is completed, the program compares verification counts taken when reading the original tape in continuously against the same counts taken when alternately reading and punching 1000 frame segments. This verifies, effectively, the original tape. If the counts agree, the message "READY TO VERIFY" will type out. If the counts disagree the message "INPUT TAPE DOES NOT VERIFY" types out. If this occurs, throw away the newly punched tape and return to step c. Otherwise, continue.
i. Ready the newly punched tape on the reader and press START. The tape will read through continuously until the Stop Code is encountered and counts will be taken. If these counts agree with the counts taken from the original tape, the message "NO ERR" types out.
j. If tape does not verify, a message as to the kind of error will type out, i.e., FR ERR for frame error or T1 ERR, T2 ERR etc. up to T8 ERR for from one to eight longitudinal track errors, or A1 ERR, A2 ERR etc. up to A8 ERR, or B1 ERR, B2 ERR, etc. up to B8 ERR for from one to sixteen possible diagonal or bias count errors.

A frame error occurs when the frame count has been reached and the character just read in was

not the Stop Code. The other errors occur when any one of twenty-four different counts taken on the source tape disagrees with its corresponding count taken on the new tape during verification.

k. If the tape did not verify correctly and it is desired to re-verify the tape, clear the A-register to all zeros and return to step f.

l. To make another copy of the same original, return to step g.

m. To copy a different tape return to step c.

METHOD:

The source tape is first read in continuously with no stopping, until the stop code is reached. High Speed Tape Reader errors most commonly occur when the read operation is completed and the tape motion must come to an abrupt halt. If the tape does not stop quickly enough a frame can slip by the read station. Therefore, the tape is read through continuously to avoid this type of error and obtain accurate verification counts. These counts are taken as follows: as each character is read, one is added to an input frame count. Then, the eight character bits are added into eight longitudinal track counts, bit one in track count one, bit two in track count two, etc. The eight character bits are also added into eight arbitrarily defined "A-Bias" counts and eight "B-Bias" counts, so that altogether the eight character bits are added into twenty-four separate counts, any given track bit adding into three different counts. (The A and B Bias counts are explained subsequently.) When the stop code has been read in and counted, this phase is completed.

The source tape is then read back in, a thousand characters at a time; as each character is read, it is shifted to the left and stored in a thousand word buffer. When the buffer is filled, it is then punched out. As each character is punched, one is added to a frame count and eight character bits are counted the same as above. When the Stop Code has been punched out, the two frame counts and the two sets of twenty-four counts are compared and appropriate messages issued.

Once the output tape has been completed, it is verified by reading it back in and keeping a frame count plus another twenty-four counts, the same as above. Then,

when the Stop Code has been reached, the frame counts are compared and, if not equal, a frame error message is issued. This will catch the adding or dropping of all-zero frames. If this check is passed, each of the original twenty-four counts is compared against its corresponding verify count. Each unequal comparison is noted via the typewriter.

The A and B Bias counts are kept as follows: each A-Bias count has all eight track bits added to it every eight frames, one different track bit per frame and the pattern repeating again on every ninth frame. For example, A-Bias counter A1 has successively added to it track bits 8, 7, 6, 5, 4, 3, 2, 1, 8, 7, 6, ... etc. on down the tape. Counter A2 begins with track bit 7, counter A3 with track bit 6, etc. to counter A8 beginning with track bit 1. The B-Bias counters are kept the same, except that the progression of track bit order is reversed, i.e., counter B1 has successively added to it track bits 1, 2, 3, 4, 5, 6, 7, 8, 1, 2, 3, ... etc. By this method, any given bit on the tape is added into three different counts; which three particular counts out of the twenty-four depends upon the frame count. The purpose of these bias counts is to catch the dropping and adding of punches within the same track, which just the track counts alone would not detect.

```
0001  00000 00000000       REL
0002  00000 00000000 *
0003  00000 00000000 *      810-A  TAPE COPY/VERIFY  PROGRAM
0004  00000 00000000 *        * * * AUTHOR- S.R. BRANDT   * * *
0005  00000 00000000 *
0006  00000 01100713 STRT   LAA  AIP1          * PICK UP INSTRUC-  AIP 1,W
0007  00001 00130400        SNS  0             * INPUT OPTION SWITCH
0008  00002 11100006        BRU  *+4
0009  00003 00130101        CEU  1,W           * SELECT ASR-33 READER MODE
0010  00004 00004000        DATA '4000
0011  00005 11100011        BRU  *+4
0012  00006 00130102        CEU  2,W           * ENABLE HSPT READER
0013  00007 00001000        DATA '1000
0014  00010 00000001        AMA  =1            * CHANGE TO   AIP 2,W
0015  00011 00100702        STA  AIP           * STORE IN READ SUBRTNE.
0016  00012 01100714        LAA  AOP1          * PICK UP INSTRUC-   AOP 1,W
0017  00013 00130401        SNS  1             * OUTPUT OPTION SWITCH
0018  00014 11100016        BRU  *+2
0019  00015 11100021        BRU  *+4
0020  00016 00130102        CEU  2,W           * TURN ON HSPT PUNCH
0021  00017 00004000        DATA '4000
0022  00020 00000001        AMA  =1            * CHANGE TO   AOP 2,W
0023  00021 00100705        STA  AOP           * STORE IN PUNCH SUBRTNE.
0024  00022 00130402        SNS  2
0025  00023 11100025        BRU  *+2
0026  00024 11100133        BRU  STR2
0027  00025 02077746        LBA  =-26
0028  00026 00000003        CLA
0029  00027 00000063        STA  RF+26,1       * RESET MASTER VERIFIC. COUNTS
0030  00030 00000026        IBS
0031  00031 11100027        BRU  *-2
0032  00032 01077770        LAA  =-8
0033  00033 00100710        STA  HLD1
0034  00034 00100711        STA  HLD2
0035  00035 12100001        SPB  READ
0036  00036 00000022        SAZ
0037  00037 11100042        BRU  *+3
0038  00040 11100035        BRU  *-3
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```
0039  00041 12100501 STR1 SPB  READ
0040  00042 00001016       LSL  8
0041  00043 14100531       IMS  RF              * INCRMNT INPUT FRAME CNT
0042  00044 11100046       BRU  *+2
0043  00045 14100532       IMS  RF+1
0044  00046 03100712       STA  TEMP
0045  00047 02077770       LBA  =-8
0046  00050 00000024 ØUT6 SAP
0047  00051 14500543       IMS  RT1+8,1         * ADD INTØ 8 LØNGITUDINAL TRACK CØUNTS
0048  00052 00000033       NØP                  * FØR ØVFLØ
0049  00053 00000116       LSL  1
0050  00054 00000026       IBS
0051  00055 11100050       BRU  ØUT6
0052  00056 01077770       LAA  =-8
0053  00057 03100664       STA  LØØP
0054  00060 01100712       LAA  TEMP
0055  00061 02100710       LBA  HLD1
0056  00062 00000024 ØT1A SAP
0057  00063 14500553       IMS  RA1+8,1         * ADD TØ A-BIAS CNTS
0058  00064 00000033       NØP                  * FØR ØVFLØ
0059  00065 00000116       LSL  1
0060  00066 14100664       IMS  LØØP
0061  00067 11100071       BRU  *+2
0062  00070 11100075       BRU  ØT2A
0063  00071 00000026       IBS
0064  00072 11100062       BRU  ØT1A
0065  00073 02077770       LBA  =-8
0066  00074 11100062       BRU  ØT1A
0067  00075 04100710 ØT2A STB  HLD1
0068  00076 01077770       LAA  =-8
0069  00077 03100664       STA  LØØP
0070  00100 02100711       LBA  HLD2
0071  00101 00000026       IBS
0072  00102 11100104       BRU  *+2
0073  00103 02077770       LBA  =-8
0074  00104 04100711       STB  HLD2
0075  00105 01100712       LAA  TEMP
0076  00106 00000024 ØT1B SAP
0077  00107 14500563       IMS  RB8+8,1         * ADD TØ B-BIAS CNTS
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```
0078  00110  00000033        NOP                  * FOR OVFLO
0079  00111  00000116        LSL   1
0080  00112  14100664        IMS   LOOP
0081  00113  11100115        BRU   *+2
0082  00114  11100121        BRU   *+5
0083  00115  00000026        IBS
0084  00116  11100106        BRU   OT1B
0085  00117  02077770        LBA   =-8
0086  00120  11100106        BRU   OT1B
0087  00121  01100712        LAA   TEMP
0088  00122  15100663        CMA   STOP           * CHK FOR COLON CHARAC.
0089  00123  11100125        BRU   *+2
0090  00124  11100130        BRU   *+4
0091  00125  01077775        LAA   =-3
0092  00126  03100616        STA   SCNT
0093  00127  11100041        BRU   STR1
0094  00130  14100616        IMS   SCNT
0095  00131  11100041        BRU   STR1
0096  00132  00000000        HLT
0097  00133  02077745  STR2  LBA   =-27
0098  00134  00000003        CLA
0099  00135  03500616        STA   VF+27,1
0100  00136  00000026        IBS
0101  00137  11100135        BRU   *-2
0102  00140  01100707        LAA   BR1
0103  00141  03100212        STA   OUT3
0104  00142  01077770        LAA   =-8
0105  00143  03100710        STA   HLD1
0106  00144  03100711        STA   HLD2
0107  00145  00000003        CLA
0108  00146  02077760        LBA   =-400
0109  00147  12100504        SPB   PNCH           * RUN OUT LEADER
0110  00150  00000026        IBS
0111  00151  11100147        BRU   *-2
0112  00152  12100501        SPB   READ           * READ LEADER
0113  00153  00000022        SAZ
0114  00154  11100156        BRU   *+2
0115  00155  11100152        BRU   *-3
0116  00156  02076030        LBA   =-1000
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0117  00157 11100164       BRU  INP2
0118  00160 00000026 INP4  IBS
0119  00161 11100163       BRU  INP1
0120  00162 11100201       BRU  OUT1
0121  00163 12100501 INP1  SPB  READ          * READ A FRAME
0122  00164 00001016 INP2  LSL  8
0123  00165 03502665       STA  BUF+1000,1
0124  00166 15100663       CMA  STOP          * CHK FOR COLON CHARAC.
0125  00167 11100171       BRU  *+2
0126  00170 11100174       BRU  *+4
0127  00171 01077775       LAA  =-3
0128  00172 03100616       STA  SCNT
0129  00173 11100160       BRU  INP4
0130  00174 14100616       IMS  SCNT          * CHK FOR 3 CONSECUTIVE COLON CHARACS.
0131  00175 11100160       BRU  INP4
0132  00176 01102670       LAA  NOP           * SNS 3 ON-  FIX TO END COPYING
0133  00177 03100212       STA  OUT3
0134  00200 04100705       STB  TMP1          * CONTROLS INCOMPLETE BUFFER WHEN PUNCHING
0135  00201 01076030 OUT1  LAA  =-1000
0136  00202 03102667       STA  IR1
0137  00203 02102667 OUT2  LBA  IR1
0138  00204 01502665       LAA  BUF+1000,1    * FETCH NEXT CHARACTER
0139  00205 12100504       SPB  PNCH          * PUNCH A FRAME
0140  00206 14100563       IMS  VF
0141  00207 11100211       BRU  *+2
0142  00210 14100564       IMS  VF+1
0143  00211 12100422       SPB  VFCT
0144  00212 11100220 OUT3  BRU  OUT4
0145  00213 01102667       LAA  IR1           * SEE IF DONE PROCESSING INCOMPLETE BUFFER
0146  00214 05100705       SMA  TMP1
0147  00215 00000022       SAZ
0148  00216 11100220       BRU  *+2
0149  00217 11100224       BRU  OUT5
0150  00220 14102667 OUT4  IMS  IR1
0151  00221 11100203       BRU  OUT2
0152  00222 02076030       LBA  =-1000        * BUFFER EXHAUSTED
0153  00223 11100163       BRU  INP1
0154  00224 02077470 OUT5  LBA  =-200
0155  00225 00000003       CLA
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0156  00226 12100504       SPB  PNCH          * TRAILER
0157  00227 00000026       IBS
0158  00230 11100226       BRU  *-2
0159  00231 01100563       LAA  VF
0160  00232 15100531       CMA  RF            * VERIFY INPUT TAPE
0161  00233 11100242       BRU  ERR1
0162  00234 11100236       BRU  *+2
0163  00235 11100242       BRU  ERR1
0164  00236 01100564       LAA  VF+1
0165  00237 15100532       CMA  RF+1
0166  00240 11100242       BRU  *+2
0167  00241 11100254       BRU  CHK1
0168  00242 12100523 ERR1  SPB  CRLF
0169  00243 02077763       LBA  =-13
0170  00244 01500661       LAA  MSG2+13,1
0171  00245 00170101       AØP  1,W
0172  00246 00001016       LSL  8
0173  00247 00170101       AØP  1,W
0174  00250 00000026       IBS
0175  00251 11100244       BRU  *-5
0176  00252 12100523       SPB  CRLF
0177  00253 11100351       BRU  HALT-1
0178  00254 12100365 CHK1  SPB  CHK
0179  00255 01100615       LAA  ECNT
0180  00256 00000022       SAZ
0181  00257 11100242       BRU  ERR1
0182  00260 00130401       SNS  1
0183  00261 11100263       BRU  *+2
0184  00262 11100275       BRU  PAWS
0185  00263 12100523       SPB  CRLF
0186  00264 02077770       LBA  =-8
0187  00265 01500644       LAA  HMSG+8,1
0188  00266 00170101       AØP  1,W           * MESSAGE- "READY TØ VERIFY"
0189  00267 00001016       LSL   8
0190  00270 00170101       AØP   1,W
0191  00271 00000026       IBS
0192  00272 11100265       BRU  *-5
0193  00273 00130102       CEJ  2,W
0194  00274 00002000       DATA  '2000
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0195  00275 00000000 PAWS HLT
0196  00276 00000000 *
0197  00276 00000000 * VERIFICATIØN SEGMENT
0198  00276 00000000 *
0199  00276 00000003       CLA
0200  00277 02077745 AGAN  LBA   =-27          * RESET ØNLY VERIFY CØUNTS
0201  00300 03500616       STA   VF+27,1
0202  00301 00000026       IBS
0203  00302 11100300       BRU   *-2
0204  00303 01077770 VRFY  LAA   =-8
0205  00304 03100710       STA    HLD1
0206  00305 03100711       STA   HLD2
0207  00306 12100501       SPB   READ           * READ LEADER
0208  00307 00000022       SAZ
0209  00310 11100313       BRU   *+3
0210  00311 11100306       BRU   *-3
0211  00312 12100501 NXT   SPB   READ
0212  00313 00001016 VR1   LSL   8
0213  00314 14100563       IMS   VF
0214  00315 11100317       BRU   *+2
0215  00316 14100564       IMS   VF+1
0216  00317 12100422       SPB   VFCT
0217  00320 01100712       LAA   TEMP
0218  00321 15100663       CMA   STØP
0219  00322 11100324       BRU   *+2
0220  00323 11100327       BRU   *+4
0221  00324 01077775       LAA   =-3
0222  00325 03100616       STA   SCNT
0223  00326 11100312       BRU   NXT
0224  00327 14100616       IMS   SCNT
0225  00330 11100312       BRU   NXT
0226  00331 01100632       LAA   ERRK
0227  00332 03100630       STA   MHLD+1         * STØRE CNSTANT- ERR - IV MSSGE HØLD
0228  00333 01100633       LAA   ERRK+1
0229  00334 03100631       STA   MHLD+2
0230  00335 01100563       LAA   VF
0231  00336 15100531       CMA   RF
0232  00337 11100346       BRU   ERR2
0233  00340 11100342       BRU   *+2
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0234  00341 11100346       BRU  ERR2
0235  00342 01100364       LAA  VF+1
0236  00343 15100332       CMA  RF+1
0237  00344 11100346       BRU  *+2
0238  00345 11100356       BRU  FCØK
0239  00346 01100661 ERR2  LAA  FR
0240  00347 03100627       STA  MHLD
0241  00350 12100307       SPB  MSG
0242  00351 01100277       LAA  AGAN          * MAKE A-REG NØN-ZERØ
0243  00352 00000000 HALT  HLT
0244  00353 00000022       SAZ                * RE-VERIFY ØPTIØN
0245  00354 11100000       BRU  STRT
0246  00355 11100277       BRU  AGAN
0247  00356 12100365 FCØK  SPB  CHK
0248  00357 01100615       LAA  ECNT
0249  00360 00000022       SAZ                * TEST ERRØR FLAG
0250  00361 11100352       BRU  HALT
0251  00362 01100662       LAA  NØ
0252  00363 03100627       STA  MHLD
0253  00364 11100350       BRU  HALT-2
0254  00365 25400000 CHK   DAC  **
0255  00366 02077770 ØK1   LBA  =-8           * CHK LØNGITUDINAL TRACK CNTS
0256  00367 01500543       LAA  RT1+8,1
0257  00370 15500575       CMA  VT1+8,1
0258  00371 11100373       BRU  *+2
0259  00372 11100377       BRU  CHKA
0260  00373 01500627       LAA  MT1+8,1
0261  00374 03100627       STA  MHLD
0262  00375 12100307       SPB  MSG
0263  00376 14100615       IMS  ECNT
0264  00377 01500553 CHKA  LAA  RA1+8,1       * CHK A-BIAS CNTS
0265  00400 15500605       CMA  VA1+8,1
0266  00401 11100403       BRU  *+2
0267  00402 11100407       BRU  CHKB
0268  00403 01500675       LAA  MA1+8,1
0269  00404 03100627       STA  MHLD
0270  00405 12100307       SPB  MSG
0271  00406 14100615       IMS  ECNT
0272  00407 01500563 CHKB  LAA  RB8+8,1       * CHECK B-BIAS CNTS
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0273  00410 15500615       CMA   VBB+8,1
0274  00411 11100413       BRU   *+2
0275  00412 11100417       BRU   ØK2
0276  00413 01500705       LAA   MB1+8,1
0277  00414 03100627       STA   MHLD
0278  00415 12100507       SPB   MSG
0279  00416 14100615       IMS   ECNT
0280  00417 00000026 ØK2   IBS
0281  00420 11100367       BRU   ØK1+1
0282  00421 11300365       BRU*  CHK
0283  00422 25400000 VFCT  DAC   **
0284  00423 03100712       STA   TEMP
0285  00424 04102666       STB   SAVB
0286  00425 02077770 CØNT  LBA   =-8          * ADD TØ LØNGITUDINAL TRACK CNTS
0287  00426 01100712       LAA   TEMP
0288  00427 00000024 VR2   SAP
0289  00430 14500575       IMS   VT1+8,1
0290  00431 00000033       NØP
0291  00432 00000116       LSL   1
0292  00433 00000026       IBS
0293  00434 11100427       BRU   VR2
0294  00435 01077770       LAA   =-8          * ADD TØ A-BIAS CNTS
0295  00436 03100664       STA   LØØP
0296  00437 01100712       LAA   TEMP
0297  00440 02100710       LBA   HLD1
0298  00441 00000024 VR3   SAP
0299  00442 14500605       IMS   VA1+8,1
0300  00443 00000033       NØP                * FØR ØVFLØ
0301  00444 00000116       LSL   1
0302  00445 14100664       IMS   LØØP
0303  00446 11100450       BRU   *+2
0304  00447 11100454       BRU   VAD2
0305  00450 00000026       IBS
0306  00451 11100441       BRU   VR3
0307  00452 02077770       LBA   =-8
0308  00453 11100441       BRU   VR3
0309  00454 04100710 VAD2  STB   HLD1
0310  00455 01077770       LAA   =-8          * ADD TØ B-BIAS CNTS
0311  00456 03100664       STA   LØØP
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0312  00457 02100711        LBA  HLD2
0313  00460 00000026        IBS
0314  00461 11100463        BRU  *+2
0315  00462 02077770        LBA  =-8
0316  00463 04100711        STB  HLD2
0317  00464 01100712        LAA  TEMP
0318  00465 00000024 VR4     SAP
0319  00466 14500615        IMS  VB8+8,1
0320  00467 00000033        NØP                  * FØR ØVFLØ
0321  00470 00000116        LSL  1
0322  00471 14100664        IMS  LØØP
0323  00472 11100475        BRU  *+3
0324  00473 02102666        LBA  SAVB
0325  00474 11300422        BRU* VFCT
0326  00475 00000026        IBS
0327  00476 11100465        BRU  VR4
0328  00477 02077770        LBA  =-8
0329  00500 11100465        BRU  VR4
0330  00501 25400000 READ    DAC  **
0331  00502 00170302 AIP     AIP  2,N             * INPUT A CHAR
0332  00503 11300501         BRU* READ            * EXIT
0333  00504 25400000 PNCH    DAC  **
0334  00505 00170102 AØP     AØP  2,N             * ØUTPUT A CHAR
0335  00506 11300504         BRU* PNCH            * EXIT
0336  00507 25400000 MSG     DAC  **
0337  00510 04102666         STB  SAVB
0338  00511 12100523         SPB  CRLF
0339  00512 02077775         LBA  =-3
0340  00513 01500632 MSG1    LAA  MHLD+3,1
0341  00514 00170101         AØP  1,N
0342  00515 00001016         LSL  8
0343  00516 00170101         AØP  1,N
0344  00517 00000026         IBS
0345  00520 11100513         BRU  MSG1
0346  00521 02102666         LBA  SAVB
0347  00522 11300507         BRU* MSG             * EXIT
0348  00523 25400000 CRLF    DAC  **
0349  00524 00170501         MØP  1,N
0350  00525 00106400         DATA '106400
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0351  00526 00170501        MØP  1,W
0352  00527 00105000        DATA '105000
0353  00530 11300523        BRU* CRLF
0354  00531 00000002 RF     BSS  2
0355  00533 00000010 RT1    BSS  8              * 8 INPUT LØNGITUDINAL TRACK CNTS
0356  00543 00000010 RA1    BSS  8              * INPUT A-BIAS CNTS
0357  00553 00000001 RB8    BSS  1              * INPUT B-BIAS CNTS
0358  00554 00000001 RB7    BSS  1              *
0359  00555 00000001 RB6    BSS  1
0360  00556 00000001 RB5    BSS  1
0361  00557 00000001 RB4    BSS  1
0362  00560 00000001 RB3    BSS  1
0363  00561 00000001 RB2    BSS  1
0364  00562 00000001 RB1    BSS  1
0365  00563 00000002 VF     BSS  2
0366  00565 00000010 VT1    BSS  8              * 8 VERIFY LØNGITUDINAL TRACK CNTS
0367  00575 00000010 VA1    BSS  8              * VERIFY A-BIAS CNTS
0368  00605 00000001 VB8    BSS  1              * VERIFY B-BIAS CNTS
0369  00606 00000001 VB7    BSS  1
0370  00607 00000001 VB6    BSS  1
0371  00610 00000001 VB5    BSS  1
0372  00611 00000001 VB4    BSS  1
0373  00612 00000001 VB3    BSS  1
0374  00613 00000001 VB2    BSS  1
0375  00614 00000001 VB1    BSS  1
0376  00615 00000000 ECNT   DATA 0
0377  00616 00000001 SCNT   BSS  1
0378  00617 00152270 MT1    DATA ''T8T7T6T5T4T3T2T1''
0378  00620 00152267
0378  00621 00152266
0378  00622 00152265
0378  00623 00152264
0378  00624 00152263
0378  00625 00152262
0378  00626 00152261
0379  00627 00000003 MHLD   BSS  3
0380  00632 00120305 ERRK   DATA ''ERR''
0380  00633 00151322
0381  00634 00151305 HMSG   DATA ''READY TØ VERIFY''
```

```
0381  00635 00140704
0381  00636 00154640
0381  00637 00152317
0381  00640 00120326
0381  00641 00142722
0381  00642 00144706
0381  00643 00154640
0382  00644 00144716 MSG2 DATA ''INPUT TAPE DØES NØT VERIFY''
0382  00645 00150325
0382  00646 00152240
0382  00647 00152301
0382  00650 00150305
0382  00651 00120304
0382  00652 00147705
0382  00653 00151640
0382  00654 00147317
0382  00655 00152240
0382  00656 00153305
0382  00657 00151311
0382  00660 00143331
0383  00661 00143322 FR   DATA ''FR''
0384  00662 00147317 NØ   DATA ''NØ''
0385  00663 00135000 STØP DATA '135000
0386  00664 00000000 LØØP DATA 0
0387  00665 00140661 MA1  DATA ''A1A2A3A4A5A6A7A8''
0387  00666 00140662
0387  00667 00140663
0387  00670 00140664
0387  00671 00140665
0387  00672 00140666
0387  00673 00140667
0387  00674 00140670
0388  00675 00141270 MB1  DATA ''B8B7B6B5B4B3B2B1''
0388  00676 00141267
0388  00677 00141266
0388  00700 00141265
0388  00701 00141264
0388  00702 00141263
0388  00703 00141262
```

```
0388  00704 00141261
0389  00705 00000000 TMP1 DATA 0
0390  00706 00000000 TMP2 DATA 0
0391  00707 11100220 BR1  BRU  ØUT4
0392  00710 00177770 HLD1 DATA -8
0393  00711 00177770 HLD2 DATA -8
0394  00712 00000000 TEMP DATA 0
0395  00713 00170301 AIP1 AIP  1,W
0396  00714 00170101 AØP1 AØP  1,W
0397  00715 00001751 BUF  BSS  1001
0398  02666 00000001 SAVB BSS  1
0399  02667 00000000 IR1  DATA 0
0400  02670 00000033 NØP  NØP
0401  02671 /0400000       END  STRT
```

VB4	0372										
VB5	0371										
VB6	0370										
VB7	0369										
VB8	0368	0273	0319								
VFCT	0283	0143	0216	0325							
VF	0365	0099	0140	0142	0159	0164	0201	0213	0215	0230	0235
VRFY	0204										
VR1	0212										
VR2	0286	0293									
VR3	0298	0306	0308								
VR4	0318	0327	0329								
VT1	0366	0257	0289								

SYSTEMS ENGINEERING LABORATORIES PROGRAM LIBRARY
SOFTWARE DESCRIPTION

CATALOG NO. 393007B

DATE: 30 March 1972

PROGRAM TITLE: 810A/B Variable Base Register Checkout Program

PURPOSE: To provide a test of the operation of the variable base register with the following instructions: LAA, STA, LBA, STB, AMA, AMB, SMA, CMA, IMS, and Store VBR.

CONFIGURATION: SYSTEMS 810A/B With Variable Base Register

SOFTWARE ENVIRONMENT: Stand-Alone

PROGRAM LANGUAGE: 810A/B Assembly Language

SIZE: 630_8

REASON FOR CHANGE:

(1) To provide a correctly printed error message;

(2) To remove an extraneous branch that occasionally caused program failure.

USE:

(1) Load the program into memory using the Standard Load/Dump Package (Catalog Number 300001)

(2) Enter the starting location of the program ('02005) into the program counter.

(3) Depress START on the console.

(4) The program will output "VBR TEST" to the teletype-writer.

(5) Set the console switches which will determine whether a typeout or tight loop is needed when an error is detected.

(6) Depress Start on the console.

METHOD:

CONSOLE SWITCH SETTINGS

Switch Zero

SET - The program will not output any messages when an error is detected.

RESET - When an error is detected, the program will output the instruction in error and the current bit status of the Variable Base Register.

Switch Two

SET - The program will continue to cycle in the test which generated the error. To eliminate the typeout of errors, sense switch zero should be set. Otherwise, the program will output the error message for the unsuccessful test.

RESET - If an error is detected, the program will not remain in a tight loop executing the instructions which generated the error.

Switch Three

SET - The program will print the number of successful cycles which were completed by the program.

RESET - Upon the completion of a successful cycle, the program will output to the teletype the following message:

SUCCESSFUL CYCLES XXX

where XXX equals the octal number of complete error free cycles.

USAGE:

The program is designed to perform all tests listed below into each map up to the maximum memory map.

Test One

Indirect Test

The program will verify that the indirect instruction will not be modified by the contents of the VBR. The starting and ending test locations are '2073-'2117.

Test Two

Load A-Accumulator

Zero will be stored into location zero modified by the value in the index register. The data in the index register should be equal to the value of the VBR. The program will store '10101 into location zero modified by the index register. The program will then perform a load A-Accumulator from the location specified by the bits in the variable base register appended to the least significant 9 bits of the program counter. The data value of the A-Accumulator should be '010101. The starting and ending locations of the test are '2120-'2136.

Test Three

Store A-Accumulator

The program will store '010101 into the location specified by the contents of the VBR plus the least significant 9 bits of the program counter. The program will then add the contents of the previously stored memory location to the A-Accumulator using the same VBR data in the index register. The contents of the A-Accumulator should equal '020202. The starting and ending locations of the program are '2137-'2155.

Test Four

Load B-Accumulator

The program will perform a Load B-Accumulator from the location specified by the bits in the variable base register appended to the least significant 9 bits of the program counter. The program will then add '010101 to the A-Accumulator. The value in the A-Accumulator should equal '020202. The starting and ending locations of the test are '2156-'2172.

Test Five

Store B-Accumulator

The program will perform a Store B-Accumulator into the location specified by the bits in the variable base register. The constant will then be loaded into the A-Accumulator and the data from the stored location will be added to the accumulator. The value of the A-Accumulator should equal '020202. The starting location of the test is '2173-'2210.

Test Six

Add Memory to A-Accumulator

The data value of '010101 will be stored in location zero modified by the contents of the index register. The index register data and the VBR data should be equal. The program will then add memory to the A-Accumulator using location zero modified by the contents of the VBR. The data value of A should be '020202. The starting and ending locations of the test are '2211-'2227.

Test Seven

Add Memory to B-Accumulator

The data value of '010101 will be stored in location zero modified by the contents of the index register. The data in the index register and the VBR should be equal. The B-Accumulator will then be set to '010101. The program will then add memory to the B-Accumulator using location zero modified by the contents of the VBR. The data in the B-Accumulator should equal '020202. The starting and ending locations of the test are '2230-'2250.

Test Eight

Subtract Memory From A-Accumulator

The data value of '010101 will be stored in location zero modified by the contents of the index register. The data in the index register and the VBR should be equal. The A-Accumulator will then be set to '020202.

The program will Subtract Memory from the A-Accumulator using location zero modified by the contents of the VBR. The data in the A-Accumulator should equal '010101. The starting and ending locations of the test are '2251-'2270.

Test Nine

Compare Memory To A-Accumulator

The data value of '010101 will be stored in location zero modified by the contents of the index register. The data in the index register and the VBR should be equal. The program will then compare memory to the A-Accumulator. The memory location specified in the CMA will be zero modified by the contents of the VBR. The data in the A-Accumulator should equal '010101. The starting and ending locations of the program are '2271-'2306.

Test Ten

Increment Memory and Skip Test

The data value of '010101 will be stored in location zero modified by the contents of the index register. The data in the index register and the VBR should be equal. The data previously stored will be incremented by one using the VBR as a modifier. The contents of the A-Accumulator will be added by one and a comparison made to the data using location zero modified by the contents of the B register. The starting and ending location of the test are '2307-'2326.

Test Eleven

Transfer Variable Base Register To B-Accumulator

The variable base register will be transferred to the B-Accumulator and a comparison will be made to the temporary core storage location or the VBR. The starting and ending locations of the test are '2327-'2341.

VBR Console Display

The VBR register may be displayed during the execution of any test to visually verify that the VBR contents are equal to the B register, as follows:

- HALT the computer.
- Place the PROGRAM HALT switch in the raised position.
- Set a program stop via control switches to '2124.
- Raise the program counter ENTER switch.
- Depress START on the console.

For each program cycle, the contents of the VBR and the index register will be incremented by one. To continuously cycle the program, place the program HALT switch in the center position.

Error Detection

The following messages will be output to the teletypewriter when an error condition is detected. Error output is applicable to all tests:

```
IND ERROR VBR BIT XXXXXX
LAA ERROR VBR BIT XXXXXX
STA ERROR VBR BIT XXXXXX
LBA ERROR VBR BIT XXXXXX
STB ERROR VBR BIT XXXXXX
AMA ERROR VBR BIT XXXXXX
AMB ERROR VBR BIT XXXXXX
SMA ERROR VBR BIT XXXXXX
CMA ERROR VBR BIT XXXXXX
IMS ERROR VBR BIT XXXXXX
TXB ERROR VER BIT XXXXXX
```

XXXXXX will represent the expected contents of the variable base register. The program may be placed into a tight loop by setting console switch 2. The contents of the VBR may be visually observed by raising the program counter ENTER switch.

```
00001                *    VARIABLE BASE REGISTER CHECKØUT PRØGRAM     CATALØG = 393007B
```

```
                                        VARIABLE BASE REGISTER CHECKØUT PRØGRAM    03/30/72  CATALØG = 393007B
00003                          *      SEL
00004  00000 00000000 VAR1 ŻŻŻ  **
00005  00001 00000000 VAR2 ŻŻŻ  **
00006  00002 35500003 INDT DAC* INDC
00007  00003 35400001 INDC DAC  VAR2
00008  02005 70002005       ØRG  '2005          BEGIN VBR TEST
00009  02005 12102613       SPB  CRØ
00010  02006 12102535       SPB  DPHD           ØUT  PUT  TEST  NAME
00011  02007 35402444       DAC  LØ1
00012  02010 00000004       DATA 4
00013  02011 02102425       LBA  BIT2
00014  02012 01102426 SRCH  LAA  NEG1
00015  02013 03400000       STA  0,1
00016  02014 01400000       LAA  0,1
00017  02015 00000022       SAŻ
00018  02016 11102020       BRU  *+2
00019  02017 11102024       BRU  *+5
00020  02020 16102425       AMB  BIT2
00021  02021 00000004       TBA
00022  02022 00000023       SAN
00023  02023 11102012       BRU  SRCH
00024  02024 16102427       AMB  NMAP
00025  02025 04102342       STB  MAX
00026  02026 01102421       LAA  CØN3
00027  02027 03102473       STA  CYCT
00028  02030 01102423 XYQ   LAA  N1K
00029  02031 03102461       STA  LØ3
00030  02032 00000003       CLA                 CLEAR ERRØR FLAG
00031  02033 03102434       STA  ERFL
00032  02034 02102424 ØUT   LBA  STRT           LØAD B WITH STARTING MØDIFIER
00033  02035 00000042 TRAN  TBV                 TBV, TRANSFER MØDIFIER TØ VBR
00034  02036 04102440       STB  SAVB           SAVE MØDIFIER
00035  02037 12102072       SPB  TEST           GØ TØ TEST RØUTINE
00036  02040 02102440       LBA  SAVB
00037  02041 16102343       AMB  ØNTA
00038  02042 04102440       STB  SAVB           INCREMENT TEMP STØRAGE ØF VBR
00039  02043 01102342       LAA  MAX           MAX CØUNT FØR VBR
00040  02044 15102440       CMA  SAVB          CØMPARE TØ PRESENT VBR CØNTENTS
00041  02045 11102051       BRU  ØKK
00042  02046 00000033       NØP
00043  02047 02102440       LBA  SAVB
00044  02050 11102035       BRU  TRAN
00045  02051 01102434 ØKK   LAA  ERFL           ERRØR FLAG CHECK
00046  02052 00000022       SAŻ
00047  02053 11102032       BRU  ØUT-2
00048  02054 14102461       IMS  LØ3
00049  02055 11102032       BRU  XYQ+2
00050  02056 00130403       SNS  3
00051  02057 11102061       BRU  *+2
00052  02060 11102067       BRU  *+7
00053  02061 12102613       SPB  CRØ
00054  02062 12102535       SPB  DPHD           ØUTPUT  SUCCESSFUL  CYCLES
00055  02063 35402450       DAC  LØ2
00056  02064 00000011       DATA 9
```

```
                                    VARIABLE BASE REGISTER CHECKØUT PRØGRAM    03/30/72  CATALØG = 3930078
00057  02065 12102563        SPB   CYØT          ØUTPUT  CYCLE  CØUNT
00058  02066 35402473        DAC   CYCT          IN  ØCTAL
00059  02067 14102473        IMS   CYCT
00060  02070 00000033        NØP                                                          *B
00061  02071 11102030        BRU   XYQ
00062  02072 00000000  TEST  ZZZ   **
00063                        ********** IND
00064  02073 02102440  INDV  LBA   SAVB
00065  02074 01102430        LAA   INDX-2
00066  02075 05102440        AMA   SAVB
00067  02076 03400002        STA   2,1
00068  02077 01102431        LAA   INDX-1
00069  02100 05102440        AMA   SAVB
00070  02101 03400003        STA   3,1
00071  02102 01102417        LAA   CØN1
00072  02103 03400001        STA   1,1
00073  02104 00000003        CLA
00074  02105 00000005        TAB
00075  02106 01600002        LAA*  2,1
00076  02107 15102417        CMA   CØN1
00077  02110 11102113        BRU   *+3
00078  02111 11102120        BRU   LAAV          GØ TØ LØAD A TEST
00079  02112 11102113        BRU   *+1
00080  02113 01102474        LAA   IND
00081  02114 03102462        STA   LØ4
00082  02115 12102344        SPB   ERR
00083  02116 00130402        SNS   2             IS SENSE 2 SET IF TIGHT LØØP IS NEEDED RESET SS1
00084  02117 11102073        BRU   INDV          YES REPEAT TEST
00085                        ********** LAA
00086  02120 00000003  LAAV  CLA                 LØAD A TEST
00087  02121 03400000        STA   0,1
00088  02122 02102440        LBA   SAVB
00089  02123 01102417        LAA   CØN1
00090  02124 03400000        STA   0,1
00091  02125 01100000        LAA   VAR1          LØAD A FRØM VARIABLE
00092  02126 15102417        CMA   CØN1
00093  02127 11102132        BRU   *+3           ERRØR
00094  02130 11102137        BRU   STAV          STØRE A TEST
00095  02131 11102132        BRU   *+1           ERRØR
00096  02132 01102477        LAA   LAA
00097  02133 03102462        STA   LØ4
00098  02134 12102344        SPB   ERR
00099  02135 00130402        SNS   2             SENSE TWØ SET
00100  02136 11102120        BRU   LAAV          REPEAT LØAD A TEST RESET ØNE FØR TIGHT LØØP
00101                        ********** STA
00102  02137 02102440  STAV  LBA   SAVB
00103  02140 00000003        CLA
00104  02141 03400000        STA   0,1
00105  02142 01102417        LAA   CØN1          LØAD A FRØM FIRST CØNSTANT LØCATIØN
00106  02143 03100000        STA   VAR1          STØRE A IN VARIABLE LØCATIØN
00107  02144 05400000        AMA   0,1
00108  02145 15102420        CMA   CØN2          CØMPARE TØ SECØND CØNSTANT LØCATIØN
00109  02146 11102151        BRU   *+3           ERRØR
00110  02147 11102156        BRU   LBAV          CHECK LBA INSTRUCTIØN
00111  02150 11102151        BRU   *+1           ERRØR
```

```
00112  02151 01102502       LAA  STA
00113  02152 03102462       STA  L04
00114  02153 12102344       SPB  ERR
00115  02154 00130402       SNS  2              SENSE TWØ SET
00116  02155 11102137       BRU  STAV           YES REPEAT STØRE A TEST RESET ØNE FØR TIGHT LØØP
00117                     ********** LBA
00118  02156 02100000 LBAV  LBA  VAR1           VARIABLE LØCATIØN
00119  02157 00000004       TBA
00120  02160 02102440       LBA  SAVB
00121  02161 05400000       AMA  0,1
00122  02162 15102420       CMA  CØN2
00123  02163 11102166       BRU  *+3            ERRØR
00124  02164 11102173       BRU  STBV           GØ TØ STØRE B TEST
00125  02165 11102166       BRU  *+1            ERRØR
00126  02166 01102505       LAA  LBA
00127  02167 03102462       STA  L04
00128  02170 12102344       SPB  ERR
00129  02171 00130402       SNS  2
00130  02172 11102156       BRU  LBAV           REPEAT TEST RESET SENSE ØNE FØR TIGHT LØØP
00131                     ********** STB
00132  02173 02102417 STBV  LBA  CØN1           STØRE B TEST
00133  02174 04100000       STB  VAR1
00134  02175 02102440       LBA  SAVB
00135  02176 01102417       LAA  CØN1
00136  02177 05400000       AMA  0,1
00137  02200 15102420       CMA  CØN2           CØMPARE VARIABLE TØ CØNSTANT
00138  02201 11102204       BRU  *+3            ERRØR
00139  02202 11102211       BRU  AMAV           ADD MEMØRY TØ A TEST
00140  02203 11102204       BRU  *+1            ERRØR
00141  02204 01102510       LAA  STB
00142  02205 03102462       STA  L04
00143  02206 12102344       SPB  ERR
00144  02207 00130402       SNS  2              SENSE TWØ SET
00145  02210 11102173       BRU  STBV           REPEAT STØRE B TEST  RESET ØNE FØR TIGHT LØØP
00146                     ********** AMA
00147  02211 00000003 AMAV  CLA                 ADD MEMØRY TØ A TEST
00148  02212 03100000       STA  VAR1
00149  02213 02102440       LBA  SAVB
00150  02214 01102417       LAA  CØN1
00151  02215 03400000       STA  0,1
00152  02216 05100000       AMA  VAR1           DØ A VARIABLE ADD TØ A
00153  02217 15102420       CMA  CØN2
00154  02220 11102223       BRU  *+3            ERRØR
00155  02221 11102230       BRU  AMBV           GØ TØ NEXT TEST ADD MEMØRY TØ B
00156  02222 11102223       BRU  *+1            ERRØR
00157  02223 01102513       LAA  AMA
00158  02224 03102462       STA  L04
00159  02225 12102344       SPB  ERR
00160  02226 00130402       SNS  2              IS SENSE TWØ SET
00161  02227 11102211       BRU  AMAV           REPEAT TEST
00162                     ********** AMB
00163  02230 00000003 AMBV  CLA                 ADD MEMØRY TØ B TEST
00164  02231 03100000       STA  VAR1
00165  02232 02102440       LBA  SAVB
00166  02233 01102417       LAA  CØN1
```

```
00167  02234 03400000       STA  0,1
00168  02235 02102417       LBA  CØN1
00169  02236 16100000       AMB  VAR1          DØ A VARIABLE ADD TØ B
00170  02237 00000004       TBA
00171  02240 15102420       CMA  CØN2
00172  02241 11102244       BRU  *+3           ERRØR
00173  02242 11102251       BRU  SMAV          GØ TØ SUBTRACT MEMØRY FRØM A TEST
00174  02243 11102244       BRU  *+1           ERRØR
00175  02244 01102516       LAA  AMB
00176  02245 03102462       STA  LØ4
00177  02246 12102344       SPB  ERR
00178  02247 00130402       SNS  2             SENSE TWØ SET
00179  02250 11102230       BRU  AMBV          REPEAT ADD MEMØRY TØ A RESET ØNE FØR TIGHT LØØP
00180                  ********** SMA
00181  02251 00000003 SMAV  CLA                SUBTRACT MEMØRY FRØM A
00182  02252 03100000       STA  VAR1
00183  02253 02102440       LBA  SAVB
00184  02254 01102417       LAA  CØN1
00185  02255 03400000       STA  0,1
00186  02256 01102420       LAA  CØN2
00187  02257 06100000       SMA  VAR1          SUBTRACT MEMØRY
00188  02260 15102417       CMA  CØN1          CØMPARE TØ CØNSTANT
00189  02261 11102264       BRU  *+3           ERRØR
00190  02262 11102271       BRU  CMAV          GØ TØ CØMPARE MEMØRY TØ A TEST
00191  02263 11102264       BRU  *+1           ERRØR
00192  02264 01102521       LAA  SMA
00193  02265 03102462       STA  LØ4
00194  02266 12102344       SPB  ERR
00195  02267 00130402       SNS  2
00196  02270 11102251       BRU  SMAV
00197                  ********** CMA
00198  02271 00000003 CMAV  CLA                CØMPARE MEMØRY TØ A TEST
00199  02272 03100000       STA  VAR1
00200  02273 02102440       LBA  SAVB
00201  02274 01102417       LAA  CØN1
00202  02275 03400000       STA  0,1
00203  02276 15100000       CMA  VAR1
00204  02277 11102302       BRU  *+3           ERRØR
00205  02300 11102307       BRU  IMSV
00206  02301 11102302       BRU  *+1           ERRØR
00207  02302 01102524       LAA  CMA
00208  02303 03102462       STA  LØ4
00209  02304 12102344       SPB  ERR
00210  02305 00130402       SNS  2             SENSE TWØ SET
00211  02306 11102271       BRU  CMAV          REPEAT CØMPARE MEMØRY TØ A TEST  RESET FØR LØØP
00212                  ********** IMS
00213  02307 01102417 IMSV  LAA  CØN1
00214  02310 02102440       LBA  SAVB
00215  02311 03400000       STA  0,1
00216  02312 14100000       IMS  VAR1
00217  02313 00000033       NØP
00218  02314 01102417       LAA  CØN1
00219  02315 05102421       AMA  CØN3          ADD ØNE TØ A
00220  02316 15400000       CMA  0,1           CØMPARE VARIABLE TØ A
00221  02317 11102322       BRU  *+3           ERRØR
```

```
00222  02320 11102327       BRU  TVBV
00223  02321 11102322       BRU  *+1          ERRØR
00224  02322 01102527       LAA  IMS
00225  02323 03102462       STA  LØ4
00226  02324 12102344       SPB  ERR
00227  02325 00130402       SNS  2
00228  02326 11102307       BRU  IMSV         IF SET  USE TIGHT LØØP RESET SENSE ØNE
00229                  ********** TVB
00230  02327 00000043 TVBV  TVB                TRANSFER V TØ B
00231  02330 00000004       TBA
00232  02331 15102440       CMA  SAVB
00233  02332 11102334       BRU  *+2
00234  02333 11102341       BRU  BRUØ
00235  02334 01102532       LAA  TVB
00236  02335 03102462       STA  LØ4
00237  02336 12102344       SPB  ERR
00238  02337 00130402       SNS  2
00239  02340 11102327       BRU  TVBV
00240  02341 11302072 BRUØ  BRU* TEST
00241  02342 00000000 MAX   DATA 0
00242  02343 00001000 ØNTA  DATA '001000
00243  02344 00000000 ERR   ZZZ  **           ERRØR SUBRØUTINE
00244  02345 14102434       IMS  ERFL         SET ERRØR FLAG
00245  02346 00000033       NØP
00246  02347 00130400       SNS  0            SENSE SWITCH ZERØ SET NØ ERRØR TYPEØUT
00247  02350 11302344       BRU* ERR
00248  02351 12102613       SPB  CRØ
00249  02352 12102374       SPB  INME
00250  02353 35502462       DAC* LØ4
00251  02354 00000002       DATA 2
00252  02355 12102535       SPB  DPHD         ØUTPUT ERRØR VBR BIT
00253  02356 35402463       DAC  LØ5
00254  02357 00000007       DATA 7
00255  02360 02102440       LBA  SAVB         LØAD VBR STATUS
00256  02361 01102433       LAA  NBCT         NEGATIVE BIT CØUNT
00257  02362 03102443       STA  NBC
00258  02363 00000113       FLL  1
00259  02364 00000003 BITØ  CLA
00260  02365 00000113       FLL  1
00261  02366 05102422       AMA  ASC          CØNVERT TØ ASCII
00262  02367 00001016       LSL  8            SHIFT FØR ØUTPUT
00263  02370 00170101       AØP  1,W          ØUTPUT TØ TTY
00264  02371 14102443       IMS  NBC
00265  02372 11102364       BRU  BITØ
00266  02373 11302344       BRU* ERR
00267  02374 00000000 INME  ZZZ  **           RØUTINE TØ DUMP INSTRUCTIØN MESSAGE
00268  02375 03102436       STA  INSA
00269  02376 04102437       STB  INSB
00270  02377 01302374       LAA* INME
00271  02400 03102435       STA  STMS
00272  02401 14102374       IMS  INME
00273  02402 01302374       LAA* INME                                        *B
00274  02403 00000002       NEG
00275  02404 00000005       TAB
00276  02405 14102374       IMS  INME
```

```
00277  02406 01302435       LAA*  STMS
00278  02407 12102623       SPB   TCØ
00279  02410 00000026       IBS
00280  02411 11102415       BRU   *+4
00281  02412 01102436       LAA   INSA
00282  02413 02102437       LBA   INSB
00283  02414 11302374       BRU*  INME
00284  02415 14102462       IMS   LØ4
00285  02416 11102406       BRU   *-8
00286  02417 00010101 CØN1  DATA  '10101
00287  02420 00020202 CØN2  DATA  '20202
00288  02421 00000001 CØN3  DATA  '1
00289  02422 00000260 ASC   DATA  '260
00290  02423 00176030 N1K   DATA  '176030
00291  02424 00000000 STRT  DATA  '0
00292  02425 00020000 BIT2  DATA  '020000
00293  02426 00177777 NEG1  DATA  '177777
00294  02427 00177000 NMAP  DATA  '177000
00295  02430 00040003       DATA  '040003
00296  02431 00000001 CNT   DATA  '1
00297  02432 00177774 INDX  DATA  '177774        -4
00298  02433 00177772 NBCT  DATA  '177772        -6
00299  02434 00000000 ERFL  ZZZ   **
00300  02435 00000000 STMS  ZZZ   **
00301  02436 00000000 INSA  ZZZ   **
00302  02437 00000000 INSB  ZZZ   **
00303  02440 00000000 SAVB  ZZZ   **
00304  02441 00000000 SVB   ZZZ   **
00305  02442 00000000 INSV  ZZZ   **
00306  02443 00000000 NBC   ZZZ   **
00307  02444 00153302 LØ1   DATA  ''VBR TEST''
00307  02445 00151240
00307  02446 00152305
00307  02447 00151724
00308  02450 00151725 LØ2   DATA  ''SUCCESSFUL CYCLES''
00308  02451 00141703
00308  02452 00142723
00308  02453 00151706
00308  02454 00152714
00308  02455 00120303
00308  02456 00154703
00308  02457 00146305
00308  02460 00151640
00309  02461 00000000 LØ3   ZZZ   **
00310  02462 00000000 LØ4   ZZZ   **
00311  02463 00142722 LØ5   DATA  ''ERRØR VBR BIT  ''
00311  02464 00151317
00311  02465 00151240
00311  02466 00153302
00311  02467 00151240
00311  02470 00141311
00311  02471 00152240
00311  02472 00120240
00312  02473 00000000 CYCT  DATA  '0
00313  02474 35402475 IND   DAC   INDD
```

```
00314  02475 00144716 INDD DATA ''IND ''
00314  02476 00142240
00315  02477 35402500 LAA  DAC  LAAD
00316  02500 00146301 LAAD DATA ''LAA ''
00316  02501 00140640
00317  02502 35402503 STA  DAC  STAD
00318  02503 00151724 STAD DATA ''STA ''
00318  02504 00140640
00319  02505 35402506 LBA  DAC  LBAD
00320  02506 00146302 LBAD DATA ''LBA ''
00320  02507 00140640
00321  02510 35402511 STB  DAC  STBD
00322  02511 00151724 STBD DATA ''STB ''
00322  02512 00141240
00323  02513 35402514 AMA  DAC  AMAD
00324  02514 00140715 AMAD DATA ''AMA ''
00324  02515 00140640
00325  02516 35402517 AMB  DAC  AMBD
00326  02517 00140715 AMBD DATA ''AMB ''
00326  02520 00141240
00327  02521 35402522 SMA  DAC  SMAD
00328  02522 00151715 SMAD DATA ''SMA ''
00328  02523 00140640
00329  02524 35402525 CMA  DAC  CMAD
00330  02525 00141715 CMAD DATA ''CMA ''
00330  02526 00140640
00331  02527 35402530 IMS  DAC  IMSD
00332  02530 00144715 IMSD DATA ''IMS ''
00332  02531 00151640
00333  02532 35402533 TVB  DAC  TVBD
00334  02533 00152326 TVBD DATA ''TVB ''
00334  02534 00141240
00335                  *
00336  02535 00000000 DPHD ŻŻŻ  **          DUMP HEADING
00337  02536 03102560      STA  DPSA
00338  02537 04102561      STB  DSVB
00339  02540 02302535      LBA* DPHD       PICK UP CALLING SEQUENCE
00340  02541 04102562      STB  LØC6
00341  02542 14102535      IMS  DPHD
00342  02543 01302535      LAA* DPHD
00343  02544 00000002      NEG
00344  02545 03102557      STA  DNCT       SET UP NEGATIVE WØRD CØUNT
00345  02546 14102535      IMS  DPHD
00346  02547 01302562      LAA* LØC6
00347  02550 12102623      SPB  TCØ        ØUTPUT TWØ CHARACTERS
00348  02551 14102562      IMS  LØC6
00349  02552 14102557      IMS  DNCT
00350  02553 11102547      BRU  *-4
00351  02554 01102560      LAA  DPSA
00352  02555 02102561      LBA  DSVB
00353  02556 11302535      BRU* DPHD       RETURN
00354  02557 00000000 DNCT ŻŻŻ  **
00355  02560 00000000 DPSA ŻŻŻ  **
00356  02561 00000000 DSVB ŻŻŻ  **
00357  02562 00000000 LØC6 ŻŻŻ  **
```

```
00358                          *
00359                          *
00360  02563 00000000 CYØT ZZZ  **          TYPE NUMBER ØF CYCLES [3 ØCTAL DIGITS
00361  02564 03102611       STA  CSVA      SAVE ACCUMULATØRS
00362  02565 04102612       STB  CSVB
00363  02566 02302563       LBA* CYØT      PICK UP CALLING SEQUENCE
00364  02567 04102610       STB  CADD
00365  02570 02302610       LBA* CADD
00366  02571 14102563       IMS  CYØT
00367  02572 00000713       FLL  7
00368  02573 00000003       CLA
00369  02574 00000313       FLL  3
00370  02575 00000516       LSL  5
00371  02576 00000313       FLL  3
00372  02577 05102607       AMA  C10
00373  02600 12102623       SPB  TCØ       ØUTPUT FIRST TWØ CHARACTERS
00374  02601 00001313       FLL  11
00375  02602 05102607       AMA  C10
00376  02603 00170101       AØP  1,W
00377  02604 01102611       LAA  CSVA
00378  02605 02102612       LBA  CSVB
00379  02606 11302563       BRU* CYØT
00380  02607 00130260 C10   DATA '130260
00381  02610 00000000 CADD  ZZZ  **
00382  02611 00000000 CSVA  ZZZ  **
00383  02612 00000000 CSVB  ZZZ  **
00384                          *
00385                          *
00386  02613 00000000 CRØ   ZZZ  **          CARRIAGE RETURN AND LINE FEED
00387  02614 03102621       STA  CRSA      SAVE A ACCUMULATØR
00388  02615 01102622       LAA  C20
00389  02616 12102623       SPB  TCØ       ØUTPUT TWØ CHARACTERS
00390  02617 01102621       LAA  CRSA      RESTØRE A ACC
00391  02620 11302613       BRU* CRØ       RETURN
00392  02621 00000000 CRSA  ZZZ  **
00393  02622 00106612 C20   DATA '106612
00394                          *
00395                          *
00396  02623 00000000 TCØ   ZZZ  **          TWØ CHARACTERS ØUT
00397  02624 00170101       AØP  1,W
00398  02625 00001016       LSL  8
00399  02626 00170101       AØP  1,W
00400  02627 11302623       BRU* TCØ       RETURN
00401  02630 70400000       END
```

ERRØRS 0000 00000

```
...SYMBOLICS...
AMA          157   *  323
AMAD         323   *  324
AMAV         139   *  147       161
AMB          175   *  325
AMBD         325   *  326
AMBV         155   *  163       179
ASC          261   *  289
BIT2          13       20   *   292
BITØ     *   259      265
BRUØ         234   *  240
C10          372      375   *   380
C20          388   *  393
CADD         364      365   *   381
CMA          207   *  329
CMAD         329   *  330
CMAV         190   *  198       211
CNT      *   296
CØN1          71       76        89       92      105      132      135      150      166
             168      184       188      201      213      218  *   286
CØN2         108      122       137      153      171      186  *   287
CØN3          26      219   *   288
CRØ            9       53       248  *   386      391
CRSA         387      390   *   392
CSVA         361      377   *   382
CSVB         362      378   *   383
CYCT          27       58        59  *   312
CYØT          57   *  360       363      366      379
DNCT         344      349   *   354
DPHD          10       54       252  *   336      339      341      342      345      353
DPSA         337      351   *   355
DSVB         338      352   *   356
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ERR           82       98       114      128      143      159      177      194      209
             226      237   *   243      247      266
IMS          224   *  331
IMSD         331   *  332
IMSV         205   *  213       228
IND           80   *  313
INDC           6   *    7
INDD         313   *  314
INDT     *     6
INDV     *    64       84
INDX          65       68   *   297
INME         249   *  267       270      272      273      276      283
INSA         268      281   *   301
INSB         269      282   *   302
INSV     *   305
LAA           96   *  315
LAAD         315   *  316
LAAV          78   *   86       100
LBA          126   *  319
LBAD         319   *  320
LBAV         110   *  118       130
LØ1           11   *  307
LØ2           55   *  308
LØ3           29       48   *   309
LØ4           81       97       113      127      142      158      176      193      208
```

...EXTERNALS...

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MAX              25       39    * 241
N1K              28    * 290
NBC             257      264    * 306
NBCT            256    * 298
NEG1             14    * 293
NMAP             24    * 294
ØKK              41    *  45
ØNTA             37    * 242
ØUT           *  32       47
SAVB             34       36       38       40       43       64       66       69       88
                102      120      134      149      165      183      200      214      232
                255    * 303
SMA             192    * 327
SMAD            327    * 328
SMAV            173    * 181      196
SRCH          *  14       23
STA             112    * 317
STAD            317    * 318
STAV             94    * 102      116
STB             141    * 321
STBD            321    * 322
STBV            124    * 132      145
STMS            271      277    * 300
STRT             32    * 291
SVB           * 304
TCØ             278      347      373      389    * 396      400
TEST             35    *  62      240
TRAN          *  38       44
TVB             235    * 333
TVBD            333    * 334
TVBV            222    * 230      239
VAR1          *   4       91      106      118      133      148      152      164      169
                182      187      199      203      216
VAR2          *   5        7
W               263      376      397      399
XYC           *  28       49       61
```