.REM &

IDENTIFICATION

PRODUCT CODE: AC-T504A-MC

PRODUCT NAME: C/IXVAO IDV/IAV-11 I/O MOD FAMILY DIAG

PRODUCT DATE: OCT 1983

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1.0 GENERAL INFORMATION

1.1 PROGRAM ABSTRACT

THE CZIXV?? DIAGNOSTIC PROVIDES A SERIES OF TESTS TO VERIFY THE INTEGRITY AND FUNCTIONALITY OF THE IAV/IDV-11 FAMILY. THIS DIAGNOSTIC CAN BE USED BY FIELD SERVICE FOR FUNCTIONAL TESTING, BY THE ENGINEER FOR DESIGN TESTS, AND BY MANUFACTURING FOR CHECKOUT AND REPAIR.

THE FOLLOWING SPECIAL FEATURES ARE IMPLEMENTED.

THE DIAGNOSTIC IS SET UP FOR FIELD SERVICE SO THAT IF THE USER TYPES "N" TO THE "CHANGE HARDWARE" AND "CHANGE SOFTWARE" QUESTIONS, AN AUTOMATIC CONFIGURATION ROUTINE WILL BE RUN. THIS FINDS ALL DEVICES IN THE ADDRESS RANGE 171000 TO 171770, PRINTS A LIST OF ALL IAV/IDV11 DEVICES FOUND, AND CARRIES OUT THE SELECTED TESTS ON THESE DEVICES. THIS FEATURE HAS SPECIAL SIGNIFICANCE WHEN THE XXDP+ SETUP UTILITY IS USED (SEE SECTION 2.9).

NOTE: ALL OF THE DIAGNOSTIC TESTS ARE RUN DURING EVERY PASS, WHICH TO RUN IS DETERMINED BY THE DEVICE BEING TESTED AND BY THE ANSWERS TO THE SOFTWARE QUESTIONS. FOR MORE INFORMATION, SEE SECTION 6.0.

THE "PRINT" COMMAND CAN BE USED TO OBTAIN A LIST OF TEST TITLES, A PRINTOUT OF THE IAV/IDV-11 CONFIGURATION THAT THE DIAGNOSTIC IS USING, OR A PRINTOUT OF THE ERROR STATISTICS ACCUMULATED BY THE DIAGNOSTIC. HELP ON HOW TO REPEAT THE AUTOCONFIGURATION CAN ALSO BE OBTAINED. FOR MORE INFORMATION, SEE SECTION 4.0.

IF THE EVALUATE FLAG "EVL" IS SET, ANY UNIT ON WHICH MORE THAN 5 ERRORS ARE DETECTED FOLLOWING A "START" COMMAND IS DROPPED FROM TESTING.

THE PROGRAM SUPPORTS UP TO 16 UNITS, ALL SELECTED TESTS BEING RUN ON ONE UNIT BEFORE PROCEDING TO THE NEXT UNIT.

THIS DIAGNOSTIC HAS BEEN WRITTEN FOR USE WITH THE DIAGNOSTIC RUNTIME SERVICES SOFTWARE (SUPERVISOR). THESE SERVICES PROVIDE THE INTERFACE TO THE OPERATOR AND TO THE SOFTWARE ENVIRONMENT. THIS PROGRAM CAN BE USED WITH XXDP+.

FOR A COMPLETE DESCRIPTION OF THE RUNTIME SERVICES, REFER TO THE XXDP+ USER'S MANUAL. THERE IS A BRIEF DESCRIPTION OF THE RUNTIME SERVICES IN SECTION 2 OF THIS DOCUMENT.

1.2 SYSTEM REQUIREMENTS

A. 11/[illegible] PROCESSOR WITH A MINIMUM OF [illegible]K OF MEMORY.

B. CONSOLE TERMINAL WITH INTERFACE ADDRESS 777560.

C. XXDP+ LOAD DEVICE (RX,RK,RL ECT.)

D. IDV/IAV-11 MODULES TO BE CHECKED.

E. FIELD CHECKOUT : FOR DIGITAL MODULES, DIGITAL TEST CONNECTOR 2G-M002A.

FOR ANALOGUE MODULES, CALIBRATED VOLTAGE SOURCE, MEASURING EQUIPMENT AND ANALOGUE TEST CONNECTOR.

MANUFACTURING CHECKOUT : FOR DIGITAL MODULES, DATA LOOPBACK EQUIPMENT.

FOR ANALOGUE MODULES, CALIBRATED VOLTAGE SOURCE AND MEASURING EQUIPMENT.

1.3 RUNNING THE DIAGNOSTIC ON A FALCON

TO RUN THE DIAGNOSTIC ON A FALCON BASED SYSTEM, A BOOTSTRAP PROGRAM IS NEEDED IN addition TO THE ABOVE REQUIERMENTS. THIS COULD BE IN THE FALCON MACRO ODT ROM (KXT11-A2), OR ON A MXV-11 BOARD.

IF YOU HAVE INSTALLED THE FALCON MACRO-ODT ROM KXT11-A2 FOR BOOTING THE XXDP+ MEDIA WITH THE DIAGNOSTIC ON IT, SOME OF THE IAV/IDV-11 DEFAULT ADDRESSES ARE USED, PREVENTING THE DIAGNOSTICS AUTOMATIC CONFIGURATION ROUTINE FROM WORKING CORRECTLY. TO USE THE DIAGNOSTIC, THE ADDRESSES MUST BE ENTERED MANUALLY USING THE STARTUP QUESTIONS.

NOTE:
ONES THE XXDP+ MEDIA IS BOOTED, THE CONSOLE "BREAK" KEY SHOULD NOT BE PRESSED AS IT MAY CAUSE ERROR MESSAGES TO BE PRINTED.

1.4 RELATED DOCUMENTS AND STANDARDS

XXDP+ USER MANUAL (CHQUS)
IAV/IDV-11 OPTION DESCRIPTION YG-C03NC-00

1.5 DIAGNOSTIC HIERARCHY PREREQUISITES

BEFORE RUNNING THIS DIAGNOSTIC, THE APPROPRIATE LSI 11 CPU, MEMORY AND PERIPHERAL STANDARD DIAGNOSTICS SHOULD BE RUN TO VERIFY CORRECT OPERATION OF THE SYSTEM.

1.6 EXECUTION TIME

EXECUTION TIMES LISTED BELOW ARE FOR A WHOLE PASS IN NO QUICK

VERIFY MODE WITH "UAM" FLAG SELECTED.
MANY OF THE TESTS NEED MANUAL INTERVENTIONS, SO IT MAKES NO
SENCE TO GIVE THE TIMES WITH UAM NOT SET.
EXECUTION TIMES VARY WITH THE CPU TYPE. THE FOLLOWING TIMES
ARE TYPICAL ON A PDP-11/23 SYSTEM :

FIELD SERVICE TESTS -	1 DIGITAL INPUT MODULE	18 SECONDS
	1 DIGITAL OUTPUT MODULE	18 SECONDS
	1 ANALOGUE INPUT MODULE	18 SECONDS
	1 ANALOGUE OUTPUT MODULE	18 SECONDS
MANUFACTURING TESTS -	1 DIGITAL INPUT MODULE	18 SECONDS
(BASIC LOGIC ONLY)	1 DIGITAL OUTPUT MODULE	18 SECONDS
	1 ANALOGUE INPUT MODULE	18 SECONDS
	1 ANALOGUE OUTPUT MODULE	18 SECONDS
MANUFACTURING TESTS -	1 DIGITAL INPUT MODULE	270 SECONDS
(INCL. LOOPBACK OR	1 DIGITAL OUTPUT MODULE	110 SECONDS
SETUP TESTS)	1 ANALOGUE INPUT MODULE	18 SECONDS
	1 ANALOGUE OUTPUT MODULE	18 SECONDS

2.0 OPERATING INSTRUCTIONS

THIS SECTION CONTAINS A BRIEF DESCRIPTION OF THE RUNTIME SERVICES. FOR DETAILED INFORMATION, REFER TO THE XXDP+ USER'S MANUAL (CHQUS).

2.1 COMMANDS

THERE ARE ELEVEN LEGAL COMMANDS FOR THE DIAGNOSTIC RUNTIME SERVICES (SUPERVISOR). THIS SECTION LISTS THE COMMANDS AND GIVES A VERY BRIEF DESCRIPTION OF THEM. THE XXDP+ USER'S MANUAL HAS MORE DETAILS.

COMMAND	EFFECT
START	START THE DIAGNOSTIC FROM AN INITIAL STATE
RESTART	START THE DIAGNOSTIC WITHOUT INITIALIZING
CONTINUE	CONTINUE AT TEST THAT WAS INTERRUPTED (AFTER ^C)
PROCEED	CONTINUE FROM AN ERROR HALT
EXIT	RETURN TO XXDP+ MONITOR (XXDP+ OPERATION ONLY!)
ADD	ACTIVATE A UNIT FOR TESTING (ALL UNITS ARE CONSIDERED TO BE ACTIVE AT START TIME
DROP	DEACTIVATE A UNIT
PRINT	PRINT TEST TITLES, IAV/IDV-11 CONFIGURATION, ERROR STATISTICS, OR HOW TO RECONFIGURE. (SEE SECTION 4.0)
DISPLAY	TYPE A LIST OF ALL DEVICE INFORMATION
FLAGS	TYPE THE STATE OF ALL FLAGS (SEE SECTION 2.3)
ZFLAGS	CLEAR ALL FLAGS (SEE SECTION 2.3)

A COMMAND CAN BE RECOGNIZED BY THE FIRST THREE CHARACTERS, SO YOU MAY, FOR EXAMPLE, TYPE "STA" INSTEAD OF "START".

2.2 SWITCHES

THERE ARE SEVERAL SWITCHES WHICH ARE USED TO MODIFY SUPERVISOR OPERATION. THESE SWITCHES ARE APPENDED TO THE LEGAL COMMANDS. ALL OF THE LEGAL SWITCHES ARE TABULATED BELOW WITH A BRIEF DESCRIPTION OF EACH. IN THE DESCRIPTIONS BELOW, A DECIMAL NUMBER IS DESIGNATED BY "DDDDD".

SWITCH	EFFECT
/TESTS:LIST	EXECUTE ONLY THOSE TESTS SPECIFIED IN THE LIST. LIST IS A STRING OF TEST NUMBERS, FOR EXAMPLE /TESTS:1:5:7 10. THIS LIST WILL CAUSE TESTS 1,5,7,8,9,10 TO BE RUN. ALL OTHER TESTS WILL NOT BE RUN.
/PASS:DDDDD	EXECUTE DDDDD PASSES (DDDDD = 1 TO 64000)
/FLAGS:FLGS	SET SPECIFIED FLAGS. FLAGS ARE DESCRIBED IN SECTION 2.3.
/EOP:DDDDD	REPORT END OF PASS MESSAGE AFTER EVERY DDDDD PASSES ONLY. (DDDDD = 1 TO 64000)
/UNIT:LIST	TEST/ADD/DROP ONLY THOSE UNITS SPECIFIED

IN THE LIST. LIST EXAMPLE - /UNITS:0:5:10 1.'
USE UNITS 0,5,10,11,12 (UNIT NUMBERS = 0-63)

EXAMPLE OF SWITCH USAGE:

START /TESTS:1 5/PASS:1000/EOP:100

THE EFFECT OF THIS COMMAND WILL BE: 1) TESTS 1 THROUGH 5 WILL BE EXECUTED, 2) ALL UNITS WILL TESTED 1000 TIMES AND 3) THE END OF PASS MESSAGES WILL BE PRINTED AFTER EACH 100 PASSES ONLY. A SWITCH CAN BE RECOGNIZED BY THE FIRST THREE CHARACTERS. YOU MAY, FOR EXAMPLE, TYPE "/TES:1-5" INSTEAD OF "/TESTS:1-5".

BELOW IS A TABLE THAT SPECIFIES WHICH SWITCHES CAN BE USED BY EACH COMMAND.

	TESTS	PASS	FLAGS	EOP	UNITS
START	X	X	X	X	X
RESTART	X	X	X	X	X
CONTINUE		X	X	X	
PROCEED			X		
DROP					X
ADD					X
PRINT					
DISPLAY					X
FLAGS					
ZFLAGS					
EXIT					

2.3 FLAGS

FLAGS ARE USED TO SET UP CERTAIN OPERATIONAL PARAMETERS SUCH AS LOOPING ON ERROR. ALL FLAGS ARE CLEARED AT STARTUP AND REMAIN CLEARED UNTIL EXPLICITLY SET USING THE FLAGS SWITCH. FLAGS ARE ALSO CLEARED AFTER A START COMMAND UNLESS SET USING THE FLAG SWITCH. THE ZFLAGS COMMAND MAY ALSO BE USED TO CLEAR ALL FLAGS.

WITH THE EXCEPTION OF THE START AND ZFLAGS COMMANDS, NO COMMANDS AFFECT THE STATE OF THE FLAGS; THEY REMAIN SET OR CLEARED AS SPECIFIED BY THE LAST FLAG SWITCH.

FLAG	EFFECT
HOE	HALT ON ERROR CONTROL IS RETURNED TO RUNTIME SERVICES COMMAND MODE
LOE	LOOP ON ERROR
IER*	INHIBIT ALL ERROR REPORTS
IBE*	INHIBIT ALL ERROR REPORTS EXCEPT FIRST LEVEL (FIRST LEVEL CONTAINS ERROR TYPE, NUMBER, PC, TEST AND UNIT)
IXE*	INHIBIT EXTENDED ERROR REPORTS (THOSE CALLED BY PRINTX MACROS)
PRI	DIRECT MESSAGES TO LINE PRINTER
BOE	"BELL" ON ERROR

PNT	PRINT TEST NUMBER AS TEST EXECUTES
UAM	UNATTENDED MODE (NO MANUAL INTERVENTION) (IF SET, TEST 15,16,17,18 WILL NOT RUN)
ISR	INHIBIT STATISTICAL REPORTS (NOT APPLICABLE)
IDR	INHIBIT PROGRAM DROPPING OF UNITS (NOT REQUIRED SINCE UNITS ARE ONLY DROPPED IF EVL IS USED.
ADR	EXECUTE AUTODROP CODE
LOT	LOOP ON TEST
EVL	EXECUTE EVALUATION IE, DROP UNIT IF MORE THAN 5 ERRORS OCCUR AFTER A START OR RESTART COMMAND.

*ERROR MESSAGES ARE DESCRIBED IN SECTION 3.1

SEE THE XXDP+ USER'S MANUAL FOR MORE DETAILS ON FLAGS. YOU MAY SPECIFY MORE THAN ONE FLAG WITH THE FLAG SWITCH. FOR EXAMPLE, TO CAUSE THE PROGRAM TO LOOP ON ERROR, INHIBIT ERROR REPORTS AND TYPE A "BELL" ON ERROR, YOU MAY USE THE FOLLOWING STRING:

```
/FLAGS:LOE:IER:BOE
```

2.4 HARDWARE QUESTIONS

WHEN THE DIAGNOSTIC IS STARTED, THE RUNTIME SERVICES WILL PROMPT THE USER FOR HARDWARE INFORMATION BY TYPING "CHANGE HW (L) ?"

THIS DIAGNOSTIC HAS BEEN PRELOADED SUCH THAT IF YOU ANSWER "N" TO THE QUESTION, IT WILL AUTOMATICALLY SEARCH FOR UP TO 16 IAV/IDV11 UNITS IN THE ADDRESS RANGE 171000 TO 171770. DEFAULT VECTORS EQUAL TO THE LOW 9 ADDRESS BITS WILL BE ASSUMED FOR MODULES WITH ADDRESSES OVER 171400.

TO RUN THE DIAGNOSTIC WITH SPECIFIC MODULES WHICH NEED NOT BE IN THE ABOVE ADDRESS RANGE, YOU MUST ANSWER "Y" TO THE "CHANGE HARDWARE" QUESTION. THE RUNTIME SERVICES WILL THEN ASK FOR THE NUMBER OF UNITS (IN DECIMAL). TO KEEP DOWN MEMORY REQUIREMENTS, THE MAXIMUM NUMBER OF UNITS SUPPORTED IS 16. YOU WILL THEN BE ASKED THE FOLLOWING QUESTIONS FOR EACH UNIT:

```
MODE REGISTER ADDRESS (O) 171000 ?
```

IN REPLY, YOU SHOULD ENTER AN ADDRESS IN OCTAL IN THE RANGE 160000 TO 177770.

```
VECTOR ADDRESS (FOR OUTPUT MODULES, TYPE "O") (O) O ?

PRIORITY LEVEL (FOR OUTPUT MODULES, TYPE "O") (O) 4 ?
(FOR LSI WITH FIXED PRI. USE LEVEL 4 ONLY)
```

FOR OUTPUT MODULES (WHICH HAVE NO INTERRUPT LOGIC) YOU SHOULD TYPE "O" FOR THE ABOVE TWO QUESTIONS. THIS CAUSES THE DIAGNOSTIC PRINT ROUTINE TO OUTPUT "NONE" FOR THE VECTOR ADDRESS OF THE MODULES.

```
IS THIS MODULE CONNECTED TO ANOTHER VIA A LOOPBACK CABLE
(ONLY MANUFACTURING SHOULD ANSWER YES) (L) N ?

IF YOU ANSWER "N" TO THIS QUESTION, NO MORE HARDWARE QUESTIONS
ARE ASKED. THIS WILL BE THE NORMAL ANSWER FOR FIELD SERVICE AS
SPECIAL SIGNAL LOOPING EQUIPMENT IS REQUIRED FOR LOOPBACK TESTS.
IF YOU ANSWER "Y", THE FOLLOWING ARE ALSO ASKED:

LOW LEVEL INPUT FOR DIGITAL INPUT LOOPBACK TESTS
(FOR OUTPUT LOOPBACK TYPE "N")          (L) N ?

THIS SELECTS WHETHER TO USE THE 0-5 VOLT OR 0-60 VOLT
SENSITIVITY OF THE DIGITAL INPUT MODULES FOR THE INPUT LOOPBACK TESTS.
TO FULLY TEST THE MODULES, SEVERAL PASSES SHOULD BE MADE AT BOTH
LEVELS. FOR OUTPUT LOOPBACK TESTS THE 0-60 VOLT SENSITIVITY MUST
BE USED ("N" HAS TO BE TYPED).
IF "Y" IS TYPED, THE NEXT QUESTION IS OMITTED.
OTHERWISE, THE DIAGNOSTIC ASKS:

DEBOUNCE PERIOD FOR DIGITAL INPUT LOOPBACK TESTS
500US (0), 5 MS (1), 10MS (2) OR ALL (3) (S) 3 ?

IF THE HIGH LEVEL (0-60 VOLTS) IS USED ON THE DIGITAL INPUT
MODULES, THE HARDWARE CAN BE PROGRAMMED TO WAIT FOR A SPECIFIED
INTERVAL BEFORE INTERRUPTING WITH NEW INPUT DATA. THIS QUESTION
ALLOWS YOU TO SPECIFY THAT A PARTICULAR INTERVAL BE USED. FOR
FULL TESTING OF THE MODULES, "3" SHOULD BE TYPED.
FOR OUTPUT LOOPBACK TESTS THE ANWERING OF THIS QUESTION HAS NO
AFFECT, A FIXED 500 US INPUT DEBOUNCE WILL ALWAYS BE USED.

OTHER MODULE MODE REGISTER ADDRESS (O) 171400 ?

IN REPLY, YOU SHOULD ENTER AN ADDRESS IN OCTAL IN THE RANGE
160000 TO 177770. THE MODULE AT THIS ADDRESS WILL BE USED AS THE
OTHER HALF OF A LOOPED PAIR, BUT WILL NOT ITSELF BE TESTED
UNLESS IT IS ALSO ONE OF THE MODULES SPECIFIED BY THE FIRST
HARDWARE QUESTION UNDER ANOTHER UNIT NUMBER. IF THE UNIT IS
CONNECTED TO SEVERAL OTHER MODULES, ONLY ONE WILL BE USED FOR
LOOPBACK TESTING.

OTHER MODULE VECTOR ADDRESS (IF OUTPUT MODULE, TYPE "0") (O) 400 ?

FOR OUTPUT MODULES (WHICH HAVE NO INTERRUPT LOGIC) YOU SHOULD
TYPE "0" FOR THE ABOVE QUESTION. THIS CAUSES THE DIAGNOSTIC
PRINT ROUTINE TO OUTPUT "NONE" FOR THE VECTOR ADDRESS OF THE
MODULE.

THE FOLLOWING ILLUSTRATES THE RESPONSE TO THE HARDWARE
QUESTIONS. IN THIS EXAMPLE, THE USER RESPONSE IS UNDERLINED :-

CHANGE HARDWARE (L) ? Y <CR>

#UNITS (O) ? 2 <CR>

UNIT 0

MODE REGISTER ADDRESS (O) 171000 ? <CR>
```

```
VECTOR ADDRESS (FOR OUTPUT MODULES, TYPE "O") (O) 0 ? <CR>

PRIORITY LEVEL (FOR OUTPUT MODULES, TYPE "O") (O) 4 ? 0 <CR>
(FOR LSI WITH FIXED PRI. USE LEVEL 4 ONLY)

IS THIS MODULE CONNECTED TO ANOTHER VIA A LOOPBACK CABLE
(ONLY MANUFACTURING SHOULD ANSWER YES) (L) N ? <CR>

UNIT 1

MODE REGISTER ADDRESS (O) 171000 ? 171400 <CR>

VECTOR ADDRESS (FOR OUTPUT MODULES, TYPE RETURN) (O) 0 ? 400 <CR>

PRIORITY LEVEL (FOR OUTPUT MODULES, TYPE RETURN) (O) 0 ? 4 <CR>
(FOR LSI WITH FIXED PRI. USE LEVEL 4 ONLY)

IS THIS MODULE CONNECTED TO ANOTHER VIA A LOOPBACK CABLE
(ONLY MANUFACTURING SHOULD ANSWER YES) (L) N ? Y <CR>

LOW LEVEL INPUT FOR DIGITAL INPUT LOOPBACK TESTS
(FOR OUTPUT LOOPBACK TYPE "N")          (L) N ? <CR>

DEBOUNCE PERIOD FOR DIGITAL INPUT LOOPBACK TESTS
500US (0), 5 MS (1), 10MS (2) OR ALL (3) (S) 3 ? <CR>

OTHER MODULE MODE REGISTER ADDRESS (O) 171000 ? <CR>

OTHER MODULE VECTOR ADDRESS (IF OUTPUT MODULE, TYPE "O") (O) 0 ? <CR>
```

IN THIS EXAMPLE, THE INTERNAL LOGIC OF AN OUTPUT MODULE AT ADDRESS 171000 WILL BE TESTED. THE MODULE WILL THEN BE USED AS THE SIGNAL SOURCE TO TEST AN INPUT MODULE AT ADDRESS 171400.

FOR THE DIGITAL LOOPBACK TESTS THE LOGIC LEVELS USED WILL BE 0 VOLTS FOR THE LOW LEVEL AND UP TO 60 VOLTS FOR THE HIGH LEVEL. IF INPUT LOOPBACK TESTS ARE RUNNING ALL DEBOUNCE INTERVALS WILL BE USED.

NOTICE THAT THE DEFAULT VALUE FOR THE PRIORITY LEVEL CHANGES WHEN A NON-DEFAULT RESPONSE IS GIVEN. THIS IS TRUE FOR ALL OF THE HARDWARE QUESTIONS, SO BE CAREFUL WHEN SPECIFYING MULTIPLE UNITS!

2.5 SOFTWARE QUESTIONS

AFTER YOU HAVE ANSWERED THE HARDWARE QUESTIONS OR AFTER A RESTART OR CONTINUE COMMAND, THE RUNTIME SERVICES WILL ASK FOR SOFTWARE PARAMETERS. THESE PARAMETERS GOVERN THE DIAGNOSTIC OPERATING MODES. YOU WILL BE PROMPTED BY "CHANGE SW (L) ?". THE NORMAL RESPONSE FOR FIELD SERVICE IS TO TYPE "N". THIS CAUSES THE DEVICE INTERNAL LOGIC TESTS AND FIELD INPUT/OUTPUT TESTS TO BE RUN.
IN A MANUFACTURING ENVIRONMENT, THE PARAMETERS SHOULD BE CHANGED

BY TYPING "Y", THE FOLLOWING QUESTIONS WILL THEN BE ASKED :

RUN MANUFACTURING TESTS (L) N ?

ANSWERING "N" TO THIS QUESTION CAUSES THE INTERNAL LOGIC AND
FIELD INPUT/OUTPUT TESTS TO BE RUN. THE NEXT SOFTWARE QUESTION
WILL BE "QUICK VERIFY ?". ANSWERING "Y" CAUSES THE FOLLOWING
QUESTIONS TO BE ASKED:

RUN LOOPBACK AND I/O TESTS (L) Y ?

IF "Y" IS TYPED, LOOPBACK TESTS WILL BE RUN FOR DIGITAL MODULES
AND INPUT/OUTPUT TESTS WILL BE RUN FOR ANALOGUE MODULES.
ANSWERING "N" CAUSES ONLY THE INTERNAL LOGIC TESTS TO BE RUN AND
THE NEXT QUESTION TO BE "QUICK VERIFY MODE ?". THIS IS INTENDED
FOR A QUICK TEST OF THE MODULE INTEGRITY BEFORE CONNECTING UP
TEST EQUIPMENT FOR FULL TESTS.

FIRST PATTERN FOR DIGITAL LOOPBACK TESTS (O) 177777 ?
SECOND PATTERN FOR DIGITAL LOOPBACK TESTS (O) 0 ?

THESE WILL BE USED AS ALTERNATING DATA PATTERNS IN DIGITAL
LOOPBACK TESTS 8 AND 9.

QUICK VERIFY MODE (L) N ?

IF THE ANSWER TO THIS QUESTION IS "Y", ONLY ONE ITERATION OF
EACH TEST WILL BE PERFORMED. OTHERWISE, SOME TESTING IS DONE
MORE THAN ONCE. REPEATEDLY TESTING A PIECE OF LOGIC IN THIS WAY
OFTEN DETECTS FAULTS WHICH A SINGLE TEST WOULD NOT. THEREFORE,
TO FULLY TEST THE HARDWARE, THE ANSWER TO THIS QUESTION SHOULD
BE "N".

THE FOLLOWING ILLUSTRATES THE RESPONSE TO THE SOFTWARE
QUESTIONS. THE USER RESPONSE IS UNDERLINED:

CHANGE SOFTWARE (L) ? Y <CR>

RUN MANUFACTURING TESTS (L) N ? Y <CR>

RUN LOOPBACK AND I/O TESTS (L) Y ? Y <CR>

FIRST PATTERN FOR DIGITAL LOOPBACK TESTS (O) 177777 ? 125252 <CR>

SECOND PATTERN FOR DIGITAL LOOPBACK TESTS (O) 0 ? 52525 <CR>

QUICK VERIFY MODE (L) N ? <CR>

IN THIS EXAMPLE, FULL MANUFACTURING TESTS ARE TO BE RUN,
INCLUDING LOOPBACK TESTS FOR ANY DIGITAL MODULES AND
INPUT/OUTPUT TESTS FOR ANY ANALOGUE MODULES. IN THE DIGITAL
LOOPBACK TESTS WITH ALTERNATING PATTERNS, THE USER HAS CHOSEN TO
SWITCH ALTERNATE BITS OF THE SIGNAL RATHER THAN TO ACCEPT THE
DEFAULT OF ALL ONES THEN ALL ZEROS.

2.6 EXTENDED P-TABLE DIALOGUE

WHEN YOU ANSWER THE HARDWARE QUESTIONS, YOU ARE BUILDING ENTRIES IN A TABLE THAT DESCRIBES THE DEVICES UNDER TEST. THE SIMPLEST WAY TO BUILD THIS TABLE IS TO ANSWER ALL QUESTIONS FOR EACH UNIT TO BE TESTED. IF YOU ARE TESTING SEVERAL IDENTICAL DEVICES, THIS BECOMES TEDIOUS SINCE MOST OF THE ANSWERS ARE THE SAME FOR EACH UNIT.

TO ILLUSTRATE A MORE EFFICIENT METHOD, SUPPOSE YOU ARE TESTING FOUR DIGITAL INPUT MODULES ALL CONNECTED VIA SPECIAL TEST EQUIPMENT TO ONE DIGITAL OUTPUT MODULE FOR LOOPBACK TESTS. YOU COULD ANSWER THE HARDWARE QUESTIONS FOR EACH OF THE FOUR UNITS AS SHOWN IN SECTION 2.4. HOWEVER, APART FROM THE "MODE REGISTER" AND "VECTOR ADDRESS", THE ANSWERS ARE THE SAME FOR ALL OF THE UNITS. THIS PROCEDURE IS NOT VERY EFFICIENT.

THE RUNTIME SERVICES CAN TAKE MULTIPLE UNIT SPECIFICATIONS HOWEVER. LET'S BUILD THE SAME TABLE USING THE MULTIPLE SPECIFICATION FEATURE:

```
CHANGE HARDWARE (L) ? Y <CR>
                      ------

#UNITS (D) ? 4 <CR>
             ------

UNIT 0

MODE REGISTER ADDRESS (O) 171000 ? 171400,171410,171420,171430 <CR>
                                   ---------------------------

VECTOR ADDRESS (FOR OUTPUT MODULES, TYPE "O") (O) 0 ? 400,410,420,430<CR>
                                                      ---------------

PRIORITY LEVEL (FOR OUTPUT MODULES, TYPE "O") (O) 4 ? <CR>
(FOR LSI WITH FIXED PRI, USE LEVEL 4 ONLY)            ---

IS THIS MODULE CONNECTED TO ANOTHER VIA A LOOPBACK CABLE
(ONLY MANUFACTURING SHOULD ANSWER YES) (L) N ? Y <CR>
                                             -----

LOW LEVEL INPUT FOR DIGITAL INPUT LOOPBACK TESTS
(FOR OUTPUT LOOPBACK TYPE "N")          (L) N ? <CR>
                                            ---

DEBOUNCE PERIOD FOR DIGITAL INPUT LOOPBACK TESTS
500US (0), 5 MS (1), 10MS (2) OR ALL (3) (S) 3 ? <CR>
                                               ---

OTHER MODULE MODE REGISTER ADDRESS (O) 171400 ? 171000 <CR>
                                                -- --

OTHER MODULE VECTOR ADDRESS (IF OUTPUT MODULE, TYPE "O") (O) 400 ? 0 <CR>
                                                                   ------
```

AS YOU CAN SEE IN THE ABOVE DIALOGUE, THE RUNTIME SERVICES WILL BUILD AS MANY ENTRIES AS IT CAN WITH THE INFORMATION GIVEN IN ANY ONE PASS THROUGH THE QUESTIONS. IN THIS EXAMPLE, THE 4 INPUT MODULES AT ADDRESSES 174000, 174010, 174020 AND 174030 ARE SET UP WITH VECTORS 400,410,420 AND 430. ALL HAVE PRIORITY LEVEL 4 AND ALL USE HIGH LEVEL WITH ALL THREE DEBOUNCE PERIODS AND ALL ARE CONNECTED TO THE SAME OUTPUT MODULE AT ADDRESS 171000.

2.7 CLOCK QUESTIONS

IF THERE IS NO LINE TIME CLOCK ON THE SYSTEM, THE USER IS ASKED TO TYPE 2 CHARACTERS 6 SECONDS APART ON THE CONSOLE. THIS SHOULD BE DONE AS ACCURATELY AS POSSIBLE SINCE THE INTERVAL IS USED BY THE DIAGNOSTIC TO CALCULATE VALUES FOR DEVICE TIMEOUTS.

2.8 QUICK START-UP PROCEDURE (XXDP+)

TO START-UP THIS PROGRAM:

1. BOOT XXDP+

2. GIVE THE DATE AND ANSWER XXDP + QUESTIONS

3. TYPE "R ZIXV??". (NORMALLY THE REVISION AND PATCH LEVEL ARE TYPED INSTED OF THE QUESTION MARKS. THE FORM SHOWN HERE CAUSES THE LATEST VERSION TO BE RUN.)

4. TYPE "START"

5. FOR STANDARD CONFIGURATIONS USING ADDRESSES 171000 TO 171770 ANSWER THE "CHANGE HW" QUESTION WITH "N" TO TEST SPECIFIC DEVICES OR THOSE AT NON-STANDARD ADDRESSES ANSWER "Y" AND ANSWER ALL OF THE HARDWARE QUESTIONS.

6. ANSWER THE "CHANGE SW" QUESTION WITH "N"

WHEN YOU FOLLOW THIS PROCEDURE YOU WILL BE USING ONLY THE DEFAULTS FOR FLAGS AND SOFTWARE PARAMETERS. THESE DEFAULTS ARE DESCRIBED IN SECTIONS 2.3 AND 2.5.

2.9 USING THE XXDP+ SETUP UTILITY

TO ENABLE THE DIAGNOSTIC TO AUTOMATICALLY ESTABLISH THE IXV11 CONFIGURATION IN THE FIELD, THE HARDWARE P TABLE IS PRESET FOR 16 UNITS, EACH WITH A MODE ADDRESS OF 0. IF THE XXDP+ SETUP UTILITY IS USED TO PRESET THE P TABLE FOR A PARTICULAR CONFIGURATION, THEN THE DIAGNOSTIC WILL NOT AUTOMATICALLY ESTABLISH THE CONFIGURATION AT STARTUP. IN THIS CASE, THE DIAGNOSTIC CAN BE MADE TO DO AUTOMATIC CONFIGURATION BY ANSWERING THE HARDWARE QUESTIONS TO GIVE 16 UNITS WITH MODE ADDRESSES OF 0.

EG. CHANGE HARDWARE (Y) ? Y <CR>

#UNITS (0) ? 16 <CR>

UNIT 0

MODE REGISTER ADDRESS (0) 0 ? 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0 <CR>

```
VECTOR ADDRESS (FOR OUTPUT MODULES, TYPE "O") (O) 0 ? 0 <CR>

PRIORITY LEVEL (FOR OUTPUT MODULES, TYPE "O") (O) 4 ? 0 <CR>
(FOR LSI WITH FIXED PRI, USE LEVEL 4 ONLY)

IS THIS MODULE CONNECTED TO ANOTHER VIA A LOOPBACK CABLE
(ONLY MANUFACTURING SHOULD ANSWER YES) (L) N ? <CR>
```

3.0 ERROR INFORMATION

3.1 TYPES OF ERROR MESSAGES

THERE ARE THREE LEVELS OF ERROR MESSAGES THAT MAY BE ISSUED BY A DIAGNOSTIC : GENERAL, BASIC AND EXTENDED. GENERAL ERROR MESSAGES ARE ALWAYS PRINTED UNLESS THE "IER" FLAG IS SET (SECTION 2.3). THE GENERAL ERROR MESSAGE IS OF THE FORM :

```
NAME  TYPE  NUMBER  ON UNIT NUMBER  TST NUMBER PC:XXXXXX
ERROR MESSAGE
```

WHERE NAME = DIAGNOSTIC NAME
TYPE = ERROR TYPE (SYS FATAL, DEV FATAL, HARD OR SOFT)
NUMBER = ERROR NUMBER
UNIT NUMBER = 0 - N (N IS LAST UNIT IN PTABLE)
TST NUMBER = TEST AND SUBTEST WHERE ERROR OCCURRED
PC:XXXXXX = ADDRESS OF ERROR MESSAGE CALL

BASIC ERROR MESSAGES ARE MESSAGES THAT CONTAIN SOME ADDITIONAL INFORMATION ABOUT THE ERROR. THESE ARE ALWAYS PRINTED UNLESS THE "IER" OR "IBR" FLAGS ARE SET (SECTION 2.3). THESE MESSAGES ARE PRINTED AFTER THE ASSOCIATED GENERAL MESSAGE.

EXTENDED ERROR MESSAGES CONTAIN SUPPLEMENTARY ERROR INFORMATION SUCH AS REGISTER CONTENTS OR GOOD/BAD DATA. THESE ARE ALWAYS PRINTED UNLESS THE "IER", "IBR" OR "IXR" FLAGS ARE SET (SECTION 2.3). THESE MESSAGES ARE PRINTED AFTER THE ASSOCIATED GENERAL ERROR MESSAGE AND ANY ASSOCIATED BASIC ERROR MESSAGES.

3.2 SPECIFIC ERROR MESSAGES

ALL SPECIFIC ERROR MESSAGES ARE EXPLAINED WITH THE TEST DESCRIPTIONS IN SECTION 6.0.

4.0 PERFORMANCE AND PROGRESS REPORTS

AT THE END OF EACH PASS, THE PASS COUNT IS GIVEN ALONG WITH THE TOTAL NUMBER OF ERRORS REPORTED SINCE THE DIAGNOSTIC WAS STARTED. THE "EOP" SWITCH CAN BE USED TO CONTROL HOW OFTEN THE END OF PASS MESSAGE IS PRINTED. SECTION 2.2 DESCRIBES SWITCHES.

4.1 PRINT COMMAND UTILIZATION

THE "PRINT" COMMAND CAN BE USED TO FIND OUT HOW MANY ERRORS HAVE OCCURRED ON EACH UNIT SINCE THE DIAGNOSTIC WAS STARTED.

IN ADDITION, THE COMMAND CAN BE USED TO DISPLAY THE CONFIGURATION THAT THE DIAGNOSTIC IS CURRENTLY USING, TO PRINT A LIST OF TEST TITLES, OR TO SHOW HOW TO MAKE THE DIAGNOSTIC REESTABLISH THE CONFIGURATION.. THE FOLLOWING EXAMPLES SHOW HOW THE PRINT COMMAND CAN BE USED. USER INPUT IS UNDERLINED :

```
PRINT <CR>
.....
TYPE T,R,C,S OR HELP (S) H ? <CR>
                            ....

THE FOLLOWING COMMANDS ARE ACCEPTED :-

T - PRINT TEST TITLES
R - PRINT HOW TO REESTABLISH THE SYSTEM CONFIGURATION
C - PRINT CONFIGURATION TABLE CURRENTLY USED BY DIAGNOSTIC
S - PRINT STATISTICS TABLE
TYPE T,R,C,S OR HELP (S) H ?

IF YOU TYPE "H", "HELP" OR ANY CHARACTER OTHER THEN 'T', 'R',
"C" OR "S", THE ROUTINE PRINTS THE ABOVE HELP MESSAGE LISTING
THE ACCEPTABLE COMMANDS.

PRINT <CR>
.....
TYPE T,R,C,S OR HELP (S) H ? T <CR>
                          . ....

TEST TITLES.

  1  REGISTER NXM TEST
  2  RESET TEST
  3  R-W BIT TEST
  4  INTERNAL INTERRUPT TEST          - DIGITAL INPUT
  5  INTERNAL LOGIC TEST                ANALOGUE INPUT
  6  INTERNAL INTERRUPT TEST          - ANALOGUE INPUT
  7  INTERNAL LOGIC TEST              - ANALOGUE OUTPUT

  8  DIGITAL INPUT LOOPBACK TEST      - PATTERN PAIR SELECTABLE
  9  DIGITAL OUTPUT LOOPBACK TEST     - PATTERN PAIR SELECTABLE
 10  DIGITAL INPUT LOOPBACK TEST      - RANDOM PATTERN
 11  DIGITAL OUTPUT LOOPBACK TEST     - RANDOM PATTERN
 12  DIGITAL INPUT LOOPBACK TEST      - SLIDING PATTERN
 13  DIGITAL OUTPUT LOOPBACK TEST     - SLIDING PATTERN
```

```
 14  DIGITAL INPUT LOOPBACK TEST    - INTERRUPT LINE TEST

 15  ANALOGUE INPUT TEST            - FIELD AND MANUFACTURING
 16  ANALOGUE OUTPUT TEST           - FIELD AND MANUFACTURING
 17  DIGITAL INPUT TEST             - FIELD TEST
 18  DIGITAL OUTPUT TEST            - FIELD TEST

 19  DIGITAL INPUT TEST             - SPECIFICALLY SELECTABLE
 20  DIGITAL OUTPUT TEST            - SPECIFICALLY SELECTABLE
 21  ANALOGUE INPUT (DYNAMIC)       - SPECIFICALLY SELECTABLE
 22  ANALOGUE OUTPUT (DYNAMIC)      - SPECIFICALLY SELECTABLE
 23  ANALOGUE OUTPUT (CALIBR.)      - SPECIFICALLY SELECTABLE
 24  ANALOGUE INPUT  (CALIBR.)      - SPECIFICALLY SELECTABLE
 25  VISUAL LED TEST                - SPECIFICALLY SELECTABLE

DR> PRINT <CR>
    ----------
TYPE T,R,C,S OR HELP (S) T ? S <CR>
                           ------

IDV/IAV-11 MODULE STATISTICS.

UNIT    ERRORS    DROPPED

  0        0        NO
  1        6        YES
  2    UNTESTED     NO

HERE, UNIT 0 HAS SHOWN NO FAULTS, UNIT 1 HAS HAD 6 ERRORS AND
BEEN DROPPED FROM TESTING, AND UNIT 2 HAS NOT YET BEEN TESTED.
UNIT 2 IS SHOWN AS NOT DROPPED, IF THE DIAGNOSTIC HAD NOT YET
BEEN STARTED, THE UNIT WOULD STILL NOT BE SHOWN AS DROPPED
(UNLIKE THE DISPLAY COMMAND).

DR> PRINT <CR>
    ----------
TYPE T,R,C,S OR HELP (S) S ? C <CR>
                           ------

                    IDV/IAV-11 MODULE CONFIGURATION.

UNIT  ADDRESS  VECTOR ASSUMED  ID/MODE  MODULE TYPE  LOOPED  TO        AT       VECTOR

  0   171000      NONE       060/000  DIG. OUT     YES  DIG. IN     171400      400
  1   171400       400       030/002  DIG. IN      YES  DIG. OUT    171000     NONE
  2   171010      NONE       260/000  AN.  OUT     NO
  3   171410       410       100/000  AN.  IN      NO
  4   171700      NONE       320/000  *** CANNOT BE TESTED WITH THIS DIAGNOSTIC ***
  5   171710      NONE       UNKNOWN  UNKNOWN      NO
  6   171020      NONE       060/000  DIG. OUT     YES  UNKNOWN    171420      420

THE THIRD COLUMN IS LABELED "VECTOR ASSUMED" FOR THE FOLLOWING
REASONS. IF THE DIAGNOSTIC IS CONFIGURED AUTOMATICALLY BY
ANSWERING "NO" TO THE "CHANGE HARDWARE" QUESTION, DEVICES WITH
ADDRESSES LOWER THAN 171400 ARE ASSUMED TO HAVE NO VECTOR. ABOVE
```

THIS ADDRESS, THE VECTOR IS ASSUMED TO BE THE SAME AS THE LOW 9 BITS OF THE ADDRESS. IF THE HARDWARE QUESTIONS WERE ANSWERED, THE VECTOR IS PRINTED AS IT WAS TYPED, EXCEPT THAT ZERO VECTORS ARE PRINTED AS "NONE".

THE ABOVE EXAMPLE IS SELECTED TO ILLUSTRATE THE DIFFERENT FEATURES OF THE CONFIGURATION PRINTOUT.

UNIT 4 HAS AN ID CODE GREATER THAN 300. IT IS THEREFORE NOT ONE OF THE IXV11 DEVICES RECOGNISED BY THE DIAGNOSTIC. ALTHOUGH A WARNING IS PRINTED, BASIC LOGIC TESTS WILL BE RUN ON THE UNIT.

IF ADDRESSING THE UNIT UNDER TEST CAUSES A BUS TIMEOUT, THEN "UNKNOWN" IS PRINTED FOR THE ID/MODE AND MODULE TYPE. THIS IS SHOWN FOR UNIT 5. THIS WOULD NORMALLY ONLY OCCUR IF THE ADDRESS WAS INCORRECTLY TYPED IN THE HARDWARE QUESTIONS.

IF ADDRESSING THE OTHER MODULE CAUSES A BUS TIMEOUT, THEN "UNKNOWN" IS PRINTED FOR THE MODULE TYPE OF THE OTHER MODULE IN THE COLUMN HEADED "TO". THIS IS SHOWN FOR UNIT 6. THIS WOULD NORMALLY ONLY OCCUR IF THE ADDRESS WAS INCORRECTLY TYPED IN THE HARDWARE QUESTIONS.

DR> PRINT <CR>

TYPE T,R,C,S OR HELP (S) C ? R <CR>

TO REESTABLISH THE SYSTEM CONFIGURATION, ANSWER THE HARDWARE QUESTION TYPING "0" AS THE MODE ADDRESS FOR 16 UNITS.

EG. MODE REGISTER ADDRESS (0) 0 ? 0,,,,,,,,,,,,,,,

TYPING "R" GIVES YOU INFORMATION ON HOW TO REESTABLISH THE SYSTEM CONFIGURATION. THIS IS NECESSARY IF THE H/W QUESTIONS HAVE BEEN ANSWERED OR THE HARDWARE ITSELF HAS BEEN CHANGED AND YOU WANT TO FIND OUT WHAT IS IN THE SYSTEM WITHOUT REBOOTING THE DIAGNOSTIC.

5.0 DEVICE INFORMATION TABLES

THE HARDWARE P TABLES CONTAIN 6 WORDS FOR EACH DEVICE. THESE ARE USED TO SAVE THE ANSWERS TO THE STARTUP HARDWARE QUESTIONS, AND CAN BE DISPLAYED ON THE CONSOLE BY USING EITHER THE "DISPLAY" COMMAND DESCRIBED IN SECTION 2.1 OR THE "PRINT" COMMAND DESCRIBED IN SECTION 4.

THE HARDWARE P TABLE IS SET UP FOR FIELD SERVICE FOR 16 UNITS, EACH WITH A MODE ADDRESS OF 0. IF THE USER TYPES "NO" TO THE "CHANGE HARDWARE" AND "CHANGE SOFTWARE" QUESTIONS, AN AUTOMATIC CONFIGURATION ROUTINE WILL BE RUN. THIS FINDS ALL DEVICES IN THE ADDRESS RANGE 171000 TO 171770, PRINTS A LIST OF ALL IXV11 DEVICES FOUND, AND CARRIES OUT THE SELECTED TESTS ON THESE DEVICES. THE HARDWARE TABLE SET UP BY THE CONFIGURATION ROUTINE REMAINS IN EFFECT UNTIL CHANGED BY THE HARDWARE QUESTIONS, EVEN IF THE HARDWARE CONFIGURATION ITSELF IS ALTERED.

USING THE XXDP+ SETUP UTILITY, THE TABLES CAN BE PRELOADED TO CONTAIN INFORMATION FOR SPECIFIC SYSTEMS. HOWEVER, SPECIAL CARE MUST BE TAKEN IF IT IS DESIRED TO RESTORE THE SELF CONFIGURING FEATURE OF THE DIAGNOSTIC. SEE SECTION 2.9.

6.0 TEST SUMMARIES

TESTS ARE DIVIDED INTO 4 TYPES - INTERNAL LOGIC, MANUFACTURING INPUT/OUTPUT, FIELD INPUT/OUTPUT USING FIELD TEST CONNECTORS, AND SPECIFICALLY SELECTABLE INPUT/OUTPUT.

INTERNAL LOGIC TESTS PERFORM DETAILED CHECKS ON EACH SEPARATELY ACCESSABLE PART OF THE DEVICE AND GIVE ERROR MESSAGES WHICH HELP THE FAULTY COMPONENTS TO BE IDENTIFIED. OUTPUT LINES ARE AFFECTED BUT NO TEST CONNECTORS ARE REQUIRED. THESE TESTS ARE ALWAYS RUN FOR FIELD AND MANUFACTURING.

```
  TEST 1 : REGISTER NXM TEST
  TEST 2 : RESET TEST
  TEST 3 : R-W BIT TEST
  TEST 4 : INTERNAL INTERRUPT TEST       - DIGITAL INPUT
  TEST 5 : INTERNAL LOGIC TEST           - ANALOGUE INPUT
  TEST 6 : INTERNAL INTERRUPT TEST       - ANALOGUE INPUT
  TEST 7 : INTERNAL LOGIC TEST           - ANALOGUE OUTPUT
```

MANUFACTURING INPUT/OUTPUT TESTS ARE RUN IF THE USER ANSWERS "YES" TO THE "RUN MANUFACTURING TESTS" AND "RUN LOOPBACK AND I/O TESTS" SOFTWARE QUESTIONS. THE USER MUST EITHER CONNECT TEST CABLES BETWEEN THE MODULE BEING TESTED AND THE "OTHER" MODULE SPECIFIED IN THE HARDWARE QUESTIONS, OR FOR ANALOGUE MODULES, CONNECT VOLTAGE SOURCES OR MEASURING EQUIPMENT. THE ANALOGUE TESTS WILL ONLY BE CARRIED OUT IF THE "UNATTENDED MODE" FLAG IS NOT SELECTED.

```
  TEST 8 : DIGITAL INPUT LOOPBACK TEST   - PATTERN PAIR SELECTABLE
  TEST 9 : DIGITAL OUTPUT LOOPBACK TEST  - PATTERN PAIR SELECTABLE
  TEST10 : DIGITAL INPUT LOOPBACK TEST   - RANDOM PATTERN
  TEST11 : DIGITAL OUTPUT LOOPBACK TEST  - RANDOM PATTERN
  TEST12 : DIGITAL INPUT LOOPBACK TEST   - SLIDING PATTERN
  TEST13 : DIGITAL OUTPUT LOOPBACK TEST  - SLIDING PATTERN
  TEST14 : DIGITAL INPUT LOOPBACK TEST   - INTERRUPT LINE TEST

  TEST15 : ANALOGUE INPUT TEST           - FIELD AND MANUFACTURING
  TEST16 : ANALOGUE OUTPUT TEST          - FIELD AND MANUFACTURING
```

FIELD INPUT/OUTPUT TESTS ARE RUN IF THE USER ANSWERS "NO" TO THE "MANUFACTURING" SOFTWARE QUESTION AND THE "UNATTENDED MODE" FLAG IS NOT SELECTED. THE TESTS GUIDE THE USER THROUGH THE SEQUENCE NECESSARY TO TEST THE USER LINES OF EACH DEVICE USING THE TEST CONNECTORS.

```
  TEST15 : ANALOGUE INPUT TEST       - FIELD AND MANUFACTURING
  TEST16 : ANALOGUE OUTPUT TEST      - FIELD AND MANUFACTURING
  TEST17 : DIGITAL INPUT TEST        - FIELD TEST
  TEST18 : DIGITAL OUTPUT TEST       - FIELD TEST
```

SPECIFICALLY SELECTABLE TESTS ARE ONLY RUN IF THE USER SELECTS THEM BY TEST NUMBER (IE. NOT IN SEQUENCE WITH OTHER TESTS). THEY ALLOW THE USER TO READ FROM OR WRITE TO THE USER INTERFACE OF THE CHOSEN DEVICE. FOR ANALOGUE DEVICES, THE PROGRAM ALSO PERFORMS THE CONVERSIONS BETWEEN BIT PATTERNS AND VOLTAGES. ONCE

STARTED, THESE TESTS WILL RUN INDEFINATELY UNTIL "CONTROL C" IS
TYPED. AT THIS POINT, THEY CAN BE RESTARTED BY TYPING
"CONTINUE", OR ANOTHER TEST CAN BE SELECTED.

```
 TEST19 : DIGITAL INPUT TEST          - SPECIFICALLY SELECTABLE
 TEST20 : DIGITAL OUTPUT TEST         - SPECIFICALLY SELECTABLE
 TEST21 : ANALOGUE INPUT (DYNAMIC)    - SPECIFICALLY SELECTABLE
 TEST22 : ANALOGUE OUTPUT (DYNAMIC)   - SPECIFICALLY SELECTABLE
 TEST23 : ANALOGUE OUTPUT (CALIBR.)   - SPECIFICALLY SELECTABLE
 TEST24 : ANALOGUE INPUT  (CALIBR.)   - SPECIFICALLY SELECTABLE
 TEST25 : VISUAL LED TEST             - SPECIFICALLY SELECTABLE
```

6.1 INTERNAL LOGIC TESTS.

TEST 1 - REGISTER NXM TEST.

THIS TEST CHECKS THAT ACCESSING THE DEVICE MODE, DATA, CSA AND CSB REGISTERS (IF PRESENT) DOES NOT CAUSE A NXM TRAP. THE FOLLOWING ERROR MAY BE PRINTED :

ERROR 101 : REGISTER ADDRESSING ERROR - TRAP TO 4
REGISTER AT XXXXXX DOES NOT RESPOND

THIS COULD MEAN THAT THE DEVICE ADDRESS SWITCH IS INCORRECTLY SET, THAT THE ADDRESS WAS ENTERED INCORRECTLY IN THE STARTUP QUESTIONS, OR THAT THE DEVICE DOES NOT RESPOND.

TEST 2 - RESET TEST.

THIS TEST CHECKS THAT THE DEVICE REGISTERS ARE CORRECTLY SET OR RESET AFTER A BUS RESET. IN THE MOD REGISTER, ONLY THE LED BIT IS TESTED.

ERROR 200 : SPECIAL MODULE FOUND, CAN'T BE TESTED WITH THIS DIAGNOSTIC

ERROR 201 : LED BIT IN MOD REGISTER NOT CLEARED AFTER BUS RESET

ERROR 202 : LED BIT IN MOD REGISTER CAN'T BE SET

ERROR 203 : REGISTER INCORRECT AFTER BUS RESET
ADDRESS:AAAAAA, GOOD:GGGGGG, BAD:BBBBBB

TEST 3 - REGISTER R/W BIT TEST.

THIS TEST CHECKS THAT THE READ/WRITE BITS OF EACH REGISTER CAN ALL BE SET, ALL CLEARED AND INDIVIDUALLY SET. THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 300 : SPECIAL MODULE FOUND - CAN'T BE TESTED WITH THIS DIAGNOSTIC

ERROR 301 : REGISTER READ/WRITE BITS COULD NOT BE SET
ADDRESS:AAAAAA, GOOD:GGGGGG, BAD:BBBBBB, R/W BITS:RRRRRR

ERROR 302 : REGISTER READ/WRITE BITS COULD NOT BE CLEARED
ADDRESS:AAAAAA, GOOD:GGGGGG, BAD:BBBBBB, R/W BITS:RRRRRR

ERROR 303 : REGISTER READ/WRITE BITS COULD NOT BE INDIVIDUALLY SET
ADDRESS:AAAAAA, GOOD:GGGGGG, BAD:BBBBBB, R/W BITS:RRRRRR

ERROR 304 : MOD REGISTER CONTENTS OF DIGITAL INPUT MODULE INCORRECT
ADDRESS:AAAAAA, GOOD:GGGGGG, BAD:BBBBBB

ERROR 305 : MOD REGISTER CONTENTS OF DIGITAL INPUT MODULE INCORRECT
RTI BIT NOT SET
ADDRESS:AAAAAA, GOOD:GGGGGG, BAD:BBBBBB

ERROR 306 : MOD REGISTER CONTENTS OF DIGITAL INPUT MODULE INCORRECT
RTO + RT1 NOT SET
ADDRESS:AAAAAA, GOOD:GGGGGG, BAD:BBBBBB

TEST 4 - INTERNAL INTERRUPT LOGIC TEST - DIGITAL INPUT.

THIS TEST CHECKS THAT THE INTERNAL INTERRUPT LOGIC IS ABLE TO CAUSE AN INTERRUPT USING THE VECTOR AND PRIORITY LEVEL SELECTED IN THE START UP QUESTIONS. THE INTERRUPT IS GENERATED BY SETTING THE INTERRUPT ENABLE AND THEN INTERRUPT TEST BITS. AFTER THE INTERRUPT, THE CSA CONTENTS ARE ALSO CHECKED. THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 401 : NO INTERRUPT AFTER SETTING EI + TST IR BIT IN CSA
CSA REGISTER CONTENTS :DDDDDD

ERROR 402 : INTERRUPT DID NOT OCCUR AT THE SELECTED PRIORITY LEVEL
GOOD: GGGGGG, BAD :BBBBBB

ERROR 403 : CSA REGISTER OF DIGITAL INPUT MODULE INCORRECT AFTER INTERRUPT
GOOD: GGGGGG, BAD :BBBBBB

ERROR 404 : IR15 IN CSA REGISTER OF DIGITAL INPUT NOT CLEARED AFTER INTERRUPT
GOOD: GGGGGG, BAD :BBBBBB

TEST 5 - INTERNAL LOGIC TEST - ANALOGUE INPUT.

THIS TEST PERFORMS A PSEUDO CONVERSION ON EACH CHANNEL THAT IS FOUND, BY SETTING THE A/D START BIT AND THEN POLLING THE "DONE" BIT TO CHECK THAT THE CONVERSION HAS BEEN COMPLETED WITHIN THE ALLOWED TIMEOUT PERIOD (AT LEAST 10MS). BEFORE A/D START IS SET, A CHECK IS MADE THAT THE DONE BIT IS CLEARED. THE ERROR CONDITIONS ARE ALSO CHECKED, BUT NO CHECK IS MADE ON THE RESULTING INPUTS OR ON THE GAIN SETTING. THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 501 : CSA CONTENTS INCORRECT AFTER READ DAT AND CLEAR CSA
GOOD:GGGGGG, BAD:BBBBBB, ADDRESSED CHANNEL IS : CCC

ERROR 502 : DONE BIT IN CSA NOT SET (TIMEOUT) AFTER A/D START
GOOD:GGGGGG, BAD:BBBBBB, ADDRESSED CHANNEL IS : CCC

ERROR 503 : ERR BIT IN CSA NOT SET AFTER A/D STAR WHEN DONE IS SET
GOOD:GGGGGG, BAD:BBBBBB, ADDRESSED CHANNEL IS : CCC

ERROR 504 : ERR, DONE BIT IN CSA NOT CLEARED AFTER READ DAT REG.
GOOD:GGGGGG, BAD:BBBBBB, ADDRESSED CHANNEL IS : CCC

ERROR 505 : ERR BIT IN CSA NOT SET AFTER LOADING A/D START TWICE
GOOD:GGGGGG, BAD:BBBBBB, ADDRESSED CHANNEL IS : CCC

TEST 6 - INTERNAL INTERRUPT LOGIC TEST - ANALOGUE INPUT.

THIS TEST CHECKS THAT THE INTERNAL INTERRUPT LOGIC IS ABLE TO CAUSE A DONE AND AN ERROR INTERRUPT USING THE VECTOR AND PRIORITY LEVEL SELECTED IN THE START UP QUESTIONS. THE DONE INTERRUPT IS GENERATED BY SETTING THE INTERRUPT ENABLE BIT AND THE A/D START BIT. THE ERROR INTERRUPT IS GENERATED BY SETTING THE A/D START BIT TWICE. A TIME OUT IS GENERATED IF THE INTERRUPT HAS NOT OCCURED WITHIN THE ALLOWED TIMEOUT PERIOD. THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 601 : TIME OUT - DONE BIT IN CSA NOT SET AFTER A/D START
 AND 606

ERROR 602 : NO INTERRUPT AFTER SETTING EI + A/D START IN CSA

ERROR 603 : PRIORITY LEVEL INCORRECT
 GOOD:GGGGGG, BAD:BBBBBB

ERROR 604 : CSA CONTENTS INCORRECT AFTER CONVERSION
 GOOD:GGGGGG, BAD:BBBBBB

ERROR 605 : ERROR INTERRUPT OCCURRED

ERROR 607 : NO ERROR INTERRUPT AFTER TWO A/D STARTS

TEST 7 - INTERNAL LOGIC TEST - ANALOGUE OUTPUT.

THIS TEST PERFORMS A CONVERSION ON EACH AVAILABLE CHANNEL, LOADING THE DAT REGISTER AND CHECKING THAT THE CONVERSIONS ARE COMPLETED WITHIN THE ALLOWED TIMEOUT PERIOD (READING THE READY BIT AFTER 150 US). THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 701 : CSA CONTENTS INCORRECT AFTER LOADING NEW CHANNEL
 (IGNORE OPL BIT)
 GOOD:GGGGGG, BAD:BBBBBB

ERROR 702 : CSA CONTENTS INCORRECT AFTER LOADING DAT REG.
 READY TIMEOUT WAS 150 US
 GOOD:GGGGGG, BAD:BBBBBB

6.2 MANUFACTURING I/O TESTS.

TEST 8 - DIGITAL INPUT LOOPBACK WITH SELECTABLE DATA PATTERN PAIR.

DATA TRANSFERS ARE MADE BETWEEN THE MODULE UNDER TEST (IN THIS TEST A DIGITAL INPUT) AND THE MODULE SPECIFIED AS THE "OTHER" IN THE HARDWARE QUESTIONS (IN THIS TEST A DIGITAL OUTPUT). IF LOW LEVEL IS NOT SELECTED, ONE HUNDRED CYCLES ARE PERFORMED USING THE DATA PAIR AND DEBOUNCE PERIOD SPECIFIED IN THE HARD AND SOFTWARE QUESTIONS. A DEBOUNCE PERIOD OF 10 MILLISECONDS IS THEN USED TO CHECK THAT THE DAT REGISTER DOES NOT CHANGE IN THE FIRST 2.5 MILLISECONDS.

IF LOW LEVEL IS SELECTED, ONLY 3 CYCLES ARE PERFORMED AND THE DEBOUNCE FUNCTION IS NOT CHECKED.

BY DEFAULT, THE DATA PAIR IS ALL ZEROS AND ALL ONES, BUT ANY PATTERN PAIR CAN BE SELECTED. IF THE TWO PATTERNS ARE IDENTICAL, A FIXED OUTPUT WILL RESULT.

ERROR 801 : REGISTER ADDRESSING ERROR FOR OTHER MODULE
804 AND 806 REGISTER AT AAAAAA DOSE NOT RESPOND

ERROR 802 : LOOPED DATA IN DATA REGISTER OF DIGITAL INPUT MODULE INCORRECT
AND 807 GOOD:GGGGGG, BAD:BBBBBB, MOD REGISTER CONTENTS:DDDDDD

ERROR 803 : DEBOUNCE FUNCTION ERROR -
AND 805 DATA ACCEPTED BEFORE LOADED DEBOUNCE FINISHED

TEST 9 - DIGITAL OUTPUT LOOPBACK TEST - SELECTABLE DATA PATTERN PAIR.

DATA TRANSFERS ARE MADE BETWEEN THE MODULE UNDER TEST (IN THIS TEST A DIGITAL OUTPUT) AND THE MODULE SPECIFIED AS THE "OTHER" IN THE HARDWARE QUESTIONS (IN THIS TEST A DIGITAL INPUT).

SEVERAL CYCLES ARE PERFORMED USING THE DATA PAIR FROM THE SW P-TABLE AND A DEBOUNCE PERIOD FOUND IN THE MOD REGISTER OF THE DIGITAL OUTPUT MODULE. FOR THE INPUT MODULE A DEBOUNCE OF (500US) IS USED. BY DEFAULT, THE DATA PAIR IS ALL ZEROS AND ALL ONES, BUT ANY PATTERN PAIR CAN BE SELECTED. IF THE TWO PATTERNS ARE IDENTICAL, A FIXED OUTPUT WILL RESULT.

IF A RELAY OUTPUT MODULE IS USED, A CHECK IS ALSO MADE THAT THE DAT REGISTER OF THE DIGITAL INPUT MODULE WILL NOT BE CHANGED WITHIN 2 MS OF LOADING THE OUTPUT DATA REGISTER.

THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 901 : REGISTER ADDRESSING ERROR FOR OTHER MODULE ADDRESS
903, 905 REGISTER AT AAAAAA DOSE NOT RESPOND
AND 907

ERROR 902 : DATA REGISTER OF DIGITAL OUTPUT MODULE INCORRECT
AFTER READ BACK
GOOD:GGGGGG, BAD:BBBBBB, MOD REGISTER CONTENTS:DDDDDD

ERROR 904 : RECEIVED DATA INCORRECT - CHECK OUTPUT LOGIC
GOOD:GGGGGG, BAD:BBBBBB, MOD REGISTER CONTENTS:DDDDDD

ERROR 906 : DEBOUNCE TIME INCORRECT
DATA ACCEPTED TOO FAST (LOADED DEBOUNCE NOT FINISHED)
GOOD:GGGGGG, BAD:BBBBBB, MOD REGISTER CONTENTS:DDDDDD

ERROR 908 : RECEIVED DATA INCORRECT - CHECK OUTPUT LOGIC
GOOD:GGGGGG, BAD:BBBBBB, MOD REGISTER CONTENTS:DDDDDD

TEST 10 - DIGITAL INPUT LOOPBACK TEST - RANDOM PATTERN

THIS TEST CHECKS THE DATA TRANSFER BETWEEN INPUT AND OUTPUT MODULES. THE OUTPUT MODULE IS THAT SPECIFIED AS THE "OTHER" IN THE HARDWARE QUESTIONS. SEVERAL CYCLES ARE PERFORMED USING DATA GENERATED BY A RANDOM PATTERN GENERATOR WITHIN THE PROGRAM.

IF LOW LEVEL TESTING WAS NOT SELECTED IN THE HARDWARE QUESTIONS, THE SELECTED DEBOUNCE PERIOD IS USED. IF "ALL" WAS SPECIFIED, THE PERIOD IS SELECTED AT RANDOM FROM THE 3 ALLOWED VALUES. THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 1001 : REGISTER ADDRESSING ERROR FOR OTHER MODULE
AND 1003 REGISTER AT AAAAAA DOSE NOT RESPOND

ERROR 1002 : DIGITAL INPUT DATA REGISTER INCORRECT
AND 1004 LOADED AND READ DATA NOT THE SAME
GOOD:GGGGGG, BAD:BBBBBB, MOD REGISTER CONTENTS:DDDDDD

TEST 11 - DIGITAL OUTPUT LOOPBACK TEST WITH RANDOM PATTERN

THIS TEST CHECKS THE DATA OUTPUT LINES OF DIGITAL OUTPUT MODULES BY READING THE OUTPUT DATA WITH AN INPUT MODULE. THE INPUT MODULE IS THAT SPECIFIED AS THE "OTHER" IN THE HARDWARE QUESTIONS. 500 CYCLES ARE PERFORMED USING DATA GENERATED BY A RANDOM PATTERN GENERATOR WITHIN THE PROGRAM. THE TIMEOUT PERIOD IS BASED ON THE DEBOUNCE PERIOD FOUND IN THE MOD REGISTER OF THE DIGITAL OUTPUT MODULE.

THE DIGITAL INPUT MODULE IS ALWAYS LOADED WITH A DEBOUNCE PERIOD OF 500 US. THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 1101 : REGISTER ADDRESSING ERROR FOR OTHER MODULE
AND 1103 REGISTER AT AAAAAA DOES NOT RESPOND

ERROR 1102 : DATA REGISTER OF DIGITAL OUTPUT MODULE INCORRECT
DATA CHANGED AFTER LOADING
GOOD:GGGGGG, BAD:BBBBBB, MOD REGISTER CONTENTS:DDDDDD

ERROR 1104 : LOADED AND READ DATA NOT THE SAME CHECK OUTPUT LOGIC
GOOD:GGGGGG, BAD:BBBBBB, MOD REGISTER CONTENTS:DDDDDD

TEST 12 - DIGITAL INPUT LOOPBACK TEST WITH SLIDING PATTERN

THIS TEST TRANSFERS SLIDING ONES AND THEN SLIDING ZEROS BETWEEN
OUTPUT MODULE AND INPUT MODULES. THE OUTPUT MODULE IS THAT
SPECIFIED AS THE "OTHER" IN THE HARDWARE QUESTIONS.

THE TRANSFERS ARE PERFORMED USING THE LEVEL SELECT AND DEBOUNCE
PERIOD SPECIFIED IN THE HARDWARE QUESTIONS.

THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 1201 : REGISTER ADDRESSING ERROR FOR OTHER MODULE
1203, 1205   REGISTER AT AAAAAA DOES NOT RESPOND
 AND 1207

ERROR 1202 : DATA REGISTER OF INPUT MODULE INCORRECT
1204 AND 1208 GOOD:GGGGGG, BAD:BBBBBB, MOD REGISTER CONTENTS:DDDDDD

TEST 13 - DIGITAL OUTPUT LOOPBACK TEST WITH SLIDING PATTERN

THIS TEST CHECKS THE DATA OUTPUT LINES OF DIGITAL OUTPUT MODULES
BY READING THE OUTPUT DATA WITH AN INPUT MODULE. THE INPUT
MODULE IS THAT SPECIFIED AS THE "OTHER" IN THE HARDWARE
QUESTIONS. SEVERAL CYCLES ARE PERFORMED USING SLIDING ONES AND
THEN SLIDING ZEROS.

THE TIMEOUT PERIOD IS DEPENDENT ON THE DEBOUNCE SPECIFIED IN THE
RT BITS FOUND IN THE MOD REGISTER OF THE DIGITAL OUTPUT MODULE.

THE DIGITAL INPUT MODULE IS ALWAYS LOADED WITH A DEBOUNCE PERIOD
OF 5 US.

THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 1301 : REGISTER ADDRESSING ERROR FOR OTHER MODULE ADDRESS
1303 AND 1306 REGISTER AT AAAAAA DOSE NOT RESPOND

ERROR 1302 : DATA REGISTER OF OUTPUT MODULE INCORRECT AFTER LOAD
 AND 1305   GOOD:GGGGGG, BAD:BBBBBB, MOD REGISTER CONTENTS:DDDDDD

ERROR 1304 : RECEIVED DATA INCORRECT - CHECK DIGITAL OUTPUT LINES
 AND 1307   GOOD:GGGGGG, BAD:BBBBBB, MOD REGISTER CONTENTS:DDDDDD

TEST 14 - DIGITAL LOOPBACK TEST INPUT MODULE INTERRUPT LINE.

THIS CHECKS THAT THE CSA INTERRUPT BIT OF THE INPUT MODULE CAN
BE SET TO CAUSE AN INTERRUPT BY THE LEADING OR TRAILING EDGES OF
THE MODULE DATA LINE 15. THE DEBOUNCE PERIOD FOR THE DIGITAL
INPUT MODULE IS DEPENDENT ON THE OUTPUT MODULE THAT YOU SELECT
AS THE "OTHER" IN THE HARDWARE QUESTIONS. A CHECK IS ALSO MADE
THAT BIT 15 REMAINS HIGH AFTER THE LINE HAS REVERTED BACK TO ITS
INITIAL STATE. ALL SIGNALS ARE PROVIDED BY LINES FROM THE OUTPUT
MODULE.

ALSO THE BITS 0 14 ARE SWITCHED ON AND OFF FOUR TIMES
AND THEN A CHECK IS MADE THAT BIT 15 IS NOT AFFECTED.

ALL OF THE FUNCTIONAL TESTS ABOVE ARE ALSO CARRIED OUT IF LOW LEVEL TESTING IS SELECTED.

THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 1401 : REGISTER ADDRESSING ERROR FOR OTHER MODULE
AND 1410 REGISTER AT AAAAAA DOSE NOT RESPOND

ERROR 1402 : DATA REGISTER CONTENTS OF INPUT MODULE INCORRECT
AND 1411 GOOD:GGGGGG, BAD:BBBBBB, MOD REGISTER CONTENTS:DDDDDD

ERROR 1403 : NO INTERRUPT ON LEADING EDGE OF LINE 15
AND 1412 CSA REGISTER CONTENTS IS :DDDDDD

ERROR 1404 : CSA REGISTER INCORRECT AFTER INTERRUPT
1407, 1413 GOOD:GGGGGG, BAD:BBBBBB
AND 1416

ERROR 1405 : CSA REGISTER NOT LOADABLE WITH THE CORRECT DATA
AND 1414 GOOD:GGGGGG, BAD:BBBBBB

ERROR 1406 : NO INTERRUPT ON TRAILING EDGE OF LINE 15
CSA REGISTER CONTENT IS : DDDDDD

ERROR 1408 : INTERRUPT OCCURRED WHEN SWITCHING DATA BITS 0 14
AND 1417 CSA REGISTER CONTENT IS : DDDDDD

ERROR 1409 : CSA REGISTER CHANGED AFTER SWITCHING DATA BITS 0-14
AND 1418 GOOD:GGGGGG, BAD:BBBBBB

TEST 15 - ANALOGUE INPUT TEST, (FIELD AND MANUFACTURING TEST)

AT FIRST THE USER IS TOLD THAT THE TEST WILL ONLY RUN CORRECTLY IF THE MODULE HAS BEEN CALIBRATED. THEN HE IS ASKED HOW MANY MUX BOARDS ARE CONNECTED TO THE CONTROLLER. THEN HE IS ASKED TO CONNECT A CALIBRATED VOLTAGE SOURCE ON THE EVEN INPUTS TO THE MODULE VIA THE ANALOGUE TEST CONNECTOR.

PROMPTED BY THE PROGRAM, THE USER THEN SETS UP A SERIES OF VOLTAGES, TYPING "CARRIAGE RETURN" AFTER EACH SO THAT THE PROGRAM CAN CHECK THE D/A CONVERSIONS. THE CONVERSIONS FOR 48.828 MV ARE PERFORMED ON ALL GAINS. OTHER CONVERSIONS ARE PERFORMED ONLY AT GAIN 1. IF "N" TO THE SW QUESTION "RUN MANUFACTURING TEST" IS ANSWERED THE FOLLERING TOLLERANCES WILL BE USED, FOR GAIN 1,2,5 IS 2 LSB, FOR GAIN 10 IS 4 LSB, FOR GAIN 20 IS 6 LSB, FOR GAIN 50 IS 7 LSB, FOR GAIN 100 IS 12 LSB AND FOR GAIN 200 IS 20 LSB.
IF "Y" WAS ANSWERD THE TOLLERANCE WILL BE, FOR GAIN 1,2,5 IS 2 LSB, FOR GAIN 10 IS 3 LSB,FOR GAIN 20 IS 3, FOR GAIN 50 IS 5 LSB, FOR GAIN 100 IS 10 LSB AND FOR GAIN 200 IS 15 LSB.
IF MUX BOARDS ARE CONNECTED THE TOLLERANCE WILL BE 2 LSB MORE FOR GAINS OVER 10.

NEXT, THE USER IS PROMPTED TO CONNECT THE VOLTAGE SOURCE TO THE ODD INPUTS AND DO THE SAME AS FOR THE EVEN LINES AS ABOVE.

THE VALUES USED DEPEND ON WHETHER THE MODULE IS SET UP FOR
UNIPOLAR OR BIPOLAR INPUT.

FINALLY, THE EXTERNAL TRIGGER FUNCTION IS TESTED BY SWITCHING
THE ENABLE EXTERNAL TRIGGER ON AND OFF TO DO THE EXTERNAL START
(EET IS LOOPED BACK TO THE EXTERNAL TRIGGER INPUT VIA THE
ANALOGUE TEST CONNECTOR). THE EXTERNAL TRIGGER FUNCTION IS
TESTED UNDER INTERRUPT.

IF THE "UAM" FLAG IS SET, THE TEST IS NOT CARRIED OUT.

THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 1501,1504: CSA CONTENTS INCORRECT
GOOD:GGGGGG, BAD:BBBBBB, ADDRESSED CHANNEL IS: CCC

ERROR 1502 : TIMEOUT - DONE BIT NOT SET AFTER A/D START
AND 1505 CSA REGISTER CONTENTS IS : DDDDDD

ERROR 1503,1506 : CONVERSION VALUE INCORRECT
GOOD:GGGGGG, BAD:BBBBBB, CSA REGISTER CONTENTS:DDDDD

ERROR 1507 : NO DONE INTERRUPT AFTER EXTERNAL TRIGGER

ERROR 1508 : CSA CONTENTS INCORRECT AFTER EXTERNAL TRIGGER
GOOD:GGGGGG, BAD:BBBBBB, ADDRESSED CHANNEL IS: CCC

TEST 16 - ANALOGUE OUTPUT TEST. (FIELD AND MANUFACTURING TEST)

THE USER IS TOLD THAT THA TEST WILL ONLY
RUN CORRECTLY IF THE MODULE HAS BEEN CALIBRATED.

NEXT, THE OPERATOR IS ASKED WHETHER THE MODULE IS VOLTAGE
CALIBRATED OR CURRENT CALIBRATED. DEPENDING ON THE RESPONSE, THE
PROGRAM PROMPTS WITH VOLTAGE OR CURRENT VALUES.
IF CURRENT IS SELECTED A CHECK IS MADE THAT ALL CHANNELS ARE SHOWN
AS "OPEN LINE"IN THE CSA REGISTER. THIS ASSUMES THAT NOTHING
IS CONNECTED TO THE CURRENT OUTPUTS.
THE USER IS THEN ASKED TO CONNECT A DVM WITH THE CORRECT RANGE
TO THE MODULE OUTPUT AT THE SPECIFIED CHANNEL. IF CURRENT WAS
SELECTED, THE PROGRAM USES THE OFFSET BIT IN THE MOD REGISTER
AND CHECK THAT THE OPL BIT IN THE CSA REGISTER IS CLEAR.

THE OPERATOR THEN HAS TO CHECK SEVERAL VALUES TO ENSURE THAT THE
READING OF THE DVM IS THE SAME AS THE OUTPUT VALUE. ALL
VALUES HAVE BEEN CHECKED BY ASWERING THE QUESTION "IS VALUE ON
DVM IN RANGE. THE PROCESS IS REPEATED FOR ALL CHANNELS.

IF "UAM" FLAG IS SET, THIS TEST WILL NOT BE CARRIED OUT.

N.B. THE DVM READINGS MAY DIFFER FROM THE PRINTED VALUES IF THE
MODULE HAS BEEN RECALIBRATED BY THE CUSTOMER.

THE FOLLOWING ERRORS MAY BE PRINTED :

```
ERROR 1601 : OPL BIT IN CSA NOT SET
             MAKE SURE THAT NOTHING IS CONNECTED TO CURRENT OUTPUT
             CSA REGISTER CONTENTS IS :DDDDDD

ERROR 1602 : OPL BIT IN CSA NOT CLEARED
             IS DVM CONNECTED TO THE ADDRESSED CHANNEL ?
             CSA REGISTER CONTENTS IS :DDDDDD

ERROR 1603 : READY BIT IN CSA NOT SET AFTER LOADING DAT REGISTER (TIMEOUT)
 AND  1606   GOOD:GGGGGG, BAD:BBBBBB

ERROR 1604 : CSA CONTENTS INCORRECT
 AND  1607   GOOD:GGGGGG, BAD:BBBBBB

ERROR 1605 : MODULE DEFECT OR INCORRECTLY CALIBRATED - TRY TEST 23
 AND  1608
```

6.3 FIELD INPUT/OUTPUT TESTS USING FIELD TEST CONNECTORS.

TEST 15 - ANALOGUE INPUT TEST. (FIELD AND MANUFACTURING TEST)

AT FIRST THE USER IS TOLD THAT THE TEST WILL ONLY RUN CORRECTLY IF THE MODULE HAS BEEN CALIBRATED. THEN HE IS ASKED HOW MANY MUX BOARDS ARE CONNECTED TO THE CONTROLLER. THEN HE IS ASKED TO CONNECT A CALIBRATED VOLTAGE SOURCE ON THE EVEN INPUTS TO THE MODULE VIA THE ANALOGUE TEST CONNECTOR.

PROMPTED BY THE PROGRAM, THE USER THEN SETS UP A SERIES OF VOLTAGES, TYPING "CARRIAGE RETURN" AFTER EACH SO THAT THE PROGRAM CAN CHECK THE D/A CONVERSIONS. THE CONVERSIONS FOR 48.828 MV ARE PERFORMED ON ALL GAINS. OTHER CONVERSIONS ARE PERFORMED ONLY AT GAIN 1. IF "N" TO THE SW QUESTION "RUN MANUFACTURING TEST" IS ANSWERED THE FOLLERING TOLLERANCES WILL BE USED, FOR GAIN 1,2,5 IS 2 LSB, FOR GAIN 10 IS 4 LSB, FOR GAIN 20 IS 6 LSB, FOR GAIN 50 IS 7 LSB, FOR GAIN 100 IS 12 LSB AND FOR GAIN 200 IS 20 LSB.
IF "Y" WAS ANSWERD THE TOLLERANCE WILL BE, FOR GAIN 1,2,5 IS 2 LSB, FOR GAIN 10 IS 3 LSB,FOR GAIN 20 IS 3, FOR GAIN 50 IS 5 LSB, FOR GAIN 100 IS 10 LSB AND FOR GAIN 200 IS 15 LSB.
IF MUX BOARDS ARE CONNECTED THE TOLLERANCE WILL BE 2 LSB MORE FOR GAINS OVER 10.

NEXT, THE USER IS PROMPTED TO CONNECT THE VOLTAGE SOURCE TO THE ODD INPUTS AND DO THE SAME AS FOR THE EVEN LINES AS ABOVE.

THE VALUES USED DEPEND ON WHETHER THE MODULE IS SET UP FOR UNIPOLAR OR BIPOLAR INPUT.

FINALLY, THE EXTERNAL TRIGGER FUNCTION IS TESTED BY SWITCHING THE ENABLE EXTERNAL TRIGGER ON AND OFF TO DO THE EXTERNAL START (EET IS LOOPED BACK TO THE EXTERNAL TRIGGER INPUT VIA THE ANALOGUE TEST CONNECTOR). THE EXTERNAL TRIGGER FUNCTION IS TESTED UNDER INTERRUPT.

IF THE "UAM" FLAG IS SET, THE TEST IS NOT CARRIED OUT.

THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 1501,1504: CSA CONTENTS INCORRECT
GOOD:GGGGGG, BAD:BBBBBB, ADDRESSED CHANNEL IS: CCC

ERROR 1502 : TIMEOUT - DONE BIT NOT SET AFTER A/D START
AND 1505 CSA REGISTER CONTENTS IS : DDDDDD

ERROR 1503,1506 : CONVERSION VALUE INCORRECT
GOOD:GGGGGG, BAD:BBBBBB, CSA REGISTER CONTENTS:DDDDD

ERROR 1507 : NO DONE INTERRUPT AFTER EXTERNAL TRIGGER

ERROR 1508 : CSA CONTENTS INCORRECT AFTER EXTERNAL TRIGGER
GOOD:GGGGGG, BAD:BBBBBB, ADDRESSED CHANNEL IS: CCC

TEST 16 - ANALOGUE OUTPUT TEST. (FIELD AND MANUFACTURING TEST)

THE USER IS TOLD THAT THA TEST WILL ONLY
RUN CORRECTLY IF THE MODULE HAS BEEN CALIBRATED.

NEXT, THE OPERATOR IS ASKED WHETHER THE MODULE IS VOLTAGE
CALIBRATED OR CURRENT CALIBRATED. DEPENDING ON THE RESPONSE, THE
PROGRAM PROMPTS WITH VOLTAGE OR CURRENT VALUES.
IF CURRENT IS SELECTED A CHECK IS MADE THAT ALL CHANNELS ARE SHOWN
AS "OPEN LINE"IN THE CSA REGISTER. THIS ASSUMES THAT NOTHING IS
CONNECTED TO THE CURRENT OUTPUTS.
THE USER IS THEN ASKED TO CONNECT A DVM WITH THE CORRECT RANGE
TO THE MODULE OUTPUT AT THE SPECIFIED CHANNEL. IF CURRENT WAS
SELECTED, THE PROGRAM USES THE OFFSET BIT IN THE MOD REGISTER
AND CHECK THAT THE OPL BIT IN THE CSA REGISTER IS CLEAR.

THE OPERATOR THEN HAS TO CHECK SEVERAL VALUES TO ENSURE THAT THE
READING OF THE DVM IS THE SAME AS THE OUTPUT VALUE. WHEN ALL
VALUES HAVE BEEN CHECKED AND NO ERROR FOUND, THE USER HAS TO
TYPE "CARRIAGE RETURN". THE PROCESS IS REPEATED FOR ALL
CHANNELS.

IF "UAM" FLAG IS SET, THIS TEST WILL NOT BE CARRIED OUT.

N.B. THE DVM READINGS MAY DIFFER FROM THE PRINTED VALUES IF THE
     MODULE HAS BEEN RECALIBRATED BY THE CUSTOMER.

THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 1601 : OPL BIT IN CSA NOT SET
             MAKE SURE THAT NOTHING IS CONNECTED TO CURRENT OUTPUT
             CSA REGISTER CONTENTS IS :DDDDDD

ERROR 1602 : OPL BIT IN CSA NOT CLEARED
             IS DVM CONNECTED TO THE ADDRESSED CHANNEL ?
             CSA REGISTER CONTENTS IS :DDDDDD

ERROR 1603 : READY BIT IN CSA NOT SET AFTER LOADING DAT REGISTER (TIMEOUT)
 AND 1606   GOOD:GGGGGG, BAD:BBBBBB

ERROR 1604 : CSA CONTENTS INCORRECT
 AND 1607   GOOD:GGGGGG, BAD:BBBBBB

ERROR 1605 : MODULE DEFECT OR INCORRECTLY CALIBRATED - TRY TEST 23
 AND 1608

TEST 17 - DIGITAL INPUT TEST.

FIRST OF ALL, THE USER IS PROMPTED TO INSERT THE TEST CONNECTOR
INTO THE MODULE ON WHICH THE LED IS FLASHING. THEN A CHECK IS
MADE THAT THE INPUT DATA MATCHES THE ODD PATTERNS AVAILABLE FROM
THE CONNECTOR. AFTER THIS, THE USER IS ASKED TO SWITCH THE
CONNECTOR TO THE EVEN POSITION AND THE DATA IS CHECKED TO BE
CORRECT. THE PROGRAM THEN PROMPTS THE USER TO MOVE THE SWITCH
"ON" AND "OFF" TWICE MORE. THIS CHECKS THAT THE CSA INTERRUPT

BIT IR15 CAN BE SET TO CAUSE AN INTERRUPT BY THE LEADING OR
TRAILING EDGES OF THE MODULE DATA LINE 15, AND THAT IR15 OF THE
CSA REMAINS SET AFTER THE DATA LINE 15 HAS REVERTED TO ITS
ORIGINAL STATE.

IF THE "UAM" FLAG IS SET, THIS TEST WILL NOT BE CARRIED OUT.

THIS TEST IS CARRIED OUT IN LOW LEVEL MODE.

THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 1701 : DATA REGISTER OF DIGITAL INPUT NOT LOADED WITH EVEN DATA
GOOD:GGGGGG, BAD:BBBBBB, MOD REGISTER CONTENS IS:DDDDDD

ERROR 1702 : DATA REGISTER OF DIGITAL INPUT NOT LOADED WITH ODD DATA
GOOD:GGGGGG, BAD:BBBBBB, MOD REGISTER CONTENS IS:DDDDDD

ERROR 1703 : NO INTERRUPT ON LEADING EDGE OF DATA LINE 15
CSA REGISTER CONTENTS IS:DDDDDD

ERROR 1704 : CSA REGISTER OF DIGITAL INPUT MODULE INCORRECT
AND 1706 AFTER INTERRUPT
GOOD:GGGGGG, BAD:BBBBBB, MOD REGISTER CONTENS IS:DDDDDD

ERROR 1705 : NO INTERRUPT ON TRAILING EDGE OF DATA LINE 15
CSA REGISTER CONTENTS IS:DDDDDD

ERROR 1707 : CSA DATA BIT IR15 IS NOT CORRECT CLEARED BY DATA LINE 15
GOOD:GGGGGG, BAD:BBBBBB, MOD REGISTER CONTENS IS:DDDDDD

TEST 18 - DIGITAL OUTPUT TEST.

THE USER IS PROMPTED TO INSERT THE DIGITAL TEST CONNECTOR INTO
THE MODULE ON WHICH THE LED IS FLASHING. THEN HE IS PROMPTED TO
CHECK THAT A SLIDING ONES PATTERN APPEARS ON THE TEST CONNECTOR
LEDS. AFTER 15 SECONDS THE PROGRAM PROMPTS THE USER TO LOOK FOR
A SLIDING ZEROS PATTERN, WHICH IS OUTPUT FOR 15 SECONDS BEFORE
TERMINATING THE TEST. THIS CHECKS THAT ALL OUTPUT LINES CAN BE
UNIQUELY SET AND CLEARED.

IF THE "UAM" FLAG IS SET, THIS TEST WILL NOT BE CARRIED OUT.

ERRORS : THIS TEST IS A VISUAL TEST AND HAS NO ERROR PRINTOUT.

6.4 SPECIFICALLY SELECTABLE INPUT/OUTPUT TESTS.

TEST 19 - DIGITAL INPUT TEST - SPECIFICALLY SELECTABLE

THIS TEST CONTINOUSLY READS THE INPUT LINES AND PRINTS THE DATA TO THE CONSOLE.

THE USER IS ASKED WHICH INPUT RANGE (LOW LEVEL OR NORMAL) AND IF NORMAL IS SELECTED, WHICH DEBOUNCE PERIOD TO USE. THEN THE INPUT LINES OF THE MODULE ARE CONTINUOUSLY READ AND, IF THE SUPERVISOR FLAG "INHIBIT ERROR REPORT" IS NOT SET, THE BIT PATTERN IS OUTPUT TO THE CONSOLE. BY USING DIFFERENT INPUT VOLTAGES, THIS TEST CAN BE USED TO CHECK THE SWITCHING LEVELS. THIS TEST IS A VISUAL TEST. AN ERROR REPORT IS ONLY MADE IF THE LLS AND RT BITS IN THE MOD REGISTER CAN'T CLEAR OR SET. THE INTERRUPT FUNCTION OF THE MODULE IS NOT TESTED. TO ABORT THE TEST, THE USER MUST TYPE "CNTL C".

THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 1901 : LOW LEVEL BIT IN MOD REGISTER OF DIGITAL INPUT COULD NOT BE CLEARED

ERROR 1902 : DEBOUNCE BITS IN MOD REGISTER COULD NOT BE SET
GOOD:GGGGGG, BAD:BBBBBB

ERROR 1903 : LOW LEVEL BIT IN MOD REGISTER OF DIGITAL INPUT COULD NOT BE SET

TEST 20 - DIGITAL OUTPUT TEST - SPECIFICALLY SELECTABLE.

THE USER IS FIRST ASKED TO SELECT A PATTERN TYPE - SLIDING ONES, SLIDING ZEROS, OR A PATTERN PAIR. IN THE LAST CASE, HE IS ALSO ASKED TO ENTER THE DATA PAIR. THE PROGRAM THEN REQUESTS A TIME INTERVAL IN MILLISECONDS (DEFAULT IS ZERO) TO WAIT BETWEEN EACH PATTERN CHANGE. THE SELECTED PATTERN IS THEN OUTPUT TO THE USER LINES OF THE MODULE.

AFTER LOADING THE OUTPUT, THE DATA REGISTER IS READ BACK AND AN ERROR REPORTED IF THE LOADED DATA AND THE READ DATA ARE NOT THE SAME. THIS IS THE ONLY ERROR REPORT IN THE TEST, AL OTHER CHECKING IS VISUAL.

TO ABORT THE TEST, "CNTL C" MUST BE TYPED.

THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 2001 : DATA REGISTER INCORRECT AFTER READ BACK
 AND 2002   GOOD:GGGGG, BAD:BBBBBB

TEST 21 - ANALOGUE INPUT (DYNAMIC ROUTINE) - SPECIFICALLY SELECTABLE.

THE USER IS ASKED WHICH CHANNELS ARE TO BE READ, WHICH GAIN AND WHICH TRIGGER (INTERNAL OR EXTERNAL) ARE TO BE USED . AFTER THIS HE IS TOLD WHICH RANGE (UNI OR BIPOLAR) THE MODULE IS SWITCHED

TO.

CONVERSIONS ARE THEN MADE TWICE ON EACH SELECTED CHANNEL. THE VALUES READ ARE PRINTED OUT AS A DUMP AFTER ALL CONVERSIONS. THE DUMPED VALUES ARE OCTAL.

PRINTOUT CAN BE DISABLED USING THE SUPERVISOR FLAG "INHIBIT ERROR REPORTS".

TO ABORT THE TEST, "CNTL C" MUST BE TYPED.

THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 2101 : CSA CONTENTS INCORRECT - SELECTED CHANNEL NOT AVAILABLE
GOOD:GGGGGG, BAD:BBBBBB, ADDRESSED CHANNEL IS:CCC

ERROR 2102 : MODULE NOT READY FOR CONVERSION - DONE BIT IN CSA IS SET

ERROR 2103 : DONE BIT IN CSA NOT SET (TIMEOUT) AFTER CONVERSION START
AND 2105

ERROR 2104 : DONE BIT IN CSA NOT CLEARED AFTER READING DATA REGISTER
AND 2106

ERROR 2107 : DUMP BUFFER FULL - MORE THEN 127 CHANNELS ADDRESSED ?
AND 2115

ERROR 2108 : CSA CONTENTS INCORRECT
2110, 2112 GOOD:GGGGGG, BAD:BBBBBB, ADDRESSED CHANNEL IS:CCC
AND 2114

ERROR 2109 : TIMEOUT - NO DONE INTERRUPT OCCURRED
AND 2111

ERROR 2113 : ERRONEOUS INTERRUPT OCCURRED

TEST 22 - ANALOGUE OUTPUT (DYNAMIC TEST) - SPECIFICALLY SELECTABLE.

THIS TEST GENERATES EITHER A PERMANENT LOADED STATIC VALUE, OR AN ENDLESS SYMMETRICAL VOLTAGE RAMP.

THE USER IS ASKED TO ENTER THE NUMBER OF THE FIRST AND LAST CHANNEL WHICH HE WANTS TO USE. HE THEN SELECTS THE OUTPUT PATTERN TYPE - SINGLE FIXED VALUE OR RAMP. FOR THE FIRST OF THESE, THE USER TYPES THE DESIRED OUTPUT BINARY VALUE. FOR THE RAMP PATTERN, AN ENDLESS SYMETRICAL VOLTAGE RAMP IS GENERATED. IN THIS CASE, THE USER IS ASKED TO ENTER A VALUE "DELTA U", THIS VALUE IS THE NUMBER OF BITS BY WHICH THE PROGRAM CHANGES THE OUTPUT FOR EACH STEP OF THE RAMP, AND MUST BE IN THE RANGE 1 TO 4096. THE USER MUST ALSO SELECT A TIME INTERVAL "DELTA T" IN INCREMENT STEPS, WHICH WILL DETERMINE THE PERIOD BETWEEN EACH VALUE CHANGE. IF ZERO IS TYPED, THE VALUE WILL BE VARIED AS FAST AS THE HARDWARE ALLOWS IT.

THE CONTROL STATUS REGISTER STATUS PRINTOUT CAN BE INHIBITED BY

SETTING THE "IBE' FLAG.

THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 2201 : READY BIT IN CSA NOT SET AFTER LOADING DATA REGISTER (TIMEOUT)
2202 AND 2203 CSA REGISTER CONTENTS IS:DDDDDD

TEST 23 - ANALOGUE OUTPUT (CALIBRATION ROUTINE) - SPECIFICALLY SELECTABLE.

THIS TEST IS FOR CALIBRATION AND ALLOWS THE USER TO FOLLOW A CALIBRATION PROCEDURE OR TO DO A MANUAL CALIBRATION.

FIRST OF ALL, THE USER GETS SOME INFORMATION ABOUT THE CALIBRATION EPUIPMENT. HE IS THEN IS PROMPTED FOR THE CHANNEL AND THE OUTPUT TYPE (VOLTAGE OR CURRENT). IF CURRENT IS SELECTED, THE PROGRAM LOOKS AT THE OOFS BIT IN THE CSA TO FIND OUT THE OFFSET CONFIGURATION. NOW THE OPERATOR CAN CHOOSE BETWEEN THE CALIBRATION PROCEDURE OR MANUAL VALUES; IF MANUAL IS USED, THE OPERATOR CAN TYPE IN A VALUE IN MILLIVOLTS OR MICROAMPS.

OTHERWISE HE IS PROMPTED TO CALIBRATE FIRST THE OFFSET AND THEN THE GAIN. THEN HE IS REQUIRED TO TEST THE HALF FULL SCALE. TO GO FROM ONE STEP TO THE NEXT, THE USER MUST TYPE CARRIAGE RETURN. ALL STEPS (OFFSET,GAIN AND HALF FULL SCALE) MUST BE REPEATED BEFORE GOING ON TO THE NEXT CHANNEL.

THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 2301 : READY BIT IN CSA NOT SET AFTER LOADING DATA REGISTER
2302, 2303 CSA REGISTER CONTENTS IS:DDDDDD
 AND 2304

TEST 24 - ANALOGUE INPUT (CALIBRATION ROUTINE) - SPECIFICALLY SELECTABLE.

THIS TEST IS FOR CALIBRATING AN ANALOGUE INPUT MODULE .

FIRST OF ALL, THE USER IS ASKED WHETHER HE NEEDS INFORMATION ABOUT THE CALIBRATION PROCEDURE.

HE IS THEN PROMPTED FOR THE CHANNEL ON WHICH HE HAS PUT THE PRECISION VOLTAGE REFERENCE SOURCE .

AFTER THIS HE IS INFORMED WHICH RANGE IS SWITCHED (UNIPOLAR OR BIPOLAR) AND ASKED TO SELECT THE DESIRED GAIN.

NOW THE PROGRAM CONTINUOUSLY READS THE INPUT AND PRINTS THE RESULT AS AN OCTAL AND VOLTAGE VALUE.

TO ABORT THE TEST, "CNTL C" MUST BE TYPED.

THE FOLLOWING ERRORS MAY BE PRINTED :

ERROR 2401 : CSA CONTENTS INCORRECT AFTER READING DATA REGISTER
GOOD:GGGGGG, BAD:BBBBBB

ERROR 2402 : TIMEOUT - DONE NOT SET AFTER A/D START
GOOD:GGGGGG, BAD:BBBBBB

TEST 25 - VISUAL LED TEST - SPECIFICALLY SELECTABLE.

THIS TEST IS A VISUAL TEST. IT FLASHES THE LED ON AND OFF ON EVERY MODULE IN THE SYSTEM THAT IS FOUND BY THE AUTOMATIC CONFIGURATION ROUTINE OR SELECTED IN THE HARDWARE QUESTIONS.

MUX BOARDS ARE NOT INDEPENDENTLY ADDRESSABLE, SO THEIR LEDS ARE NOT FLASHED.

THE TEST RUNS UNTIL "CNTL C" IS TYPED.

ERRORS : THIS TEST HAS NO ERROR MESSAGES.

```
                                .TITLE PROGRAM HEADER AND TABLES
                                .SBTTL  PROGRAM HEADER


000000                                  .ENABL  ABS,AMA
        002000                          .       =       2000

002000                                  BGNMOD

                                ;++
                                ; THE PROGRAM HEADER IS THE INTERFACE BETWEEN
                                ; THE DIAGNOSTIC PROGRAM AND THE SUPERVISOR.
                                ;--

002000                                  POINTER ALL


002000                                  HEADER  CZIXV,A,0,150,0,340
002000                                                          L$NAME::
002000  103                                                             .ASCII /C/
002001  132                                                             .ASCII /Z/
002002  111                                                             .ASCII /I/
002003  130                                                             .ASCII /X/
002004  126                                                             .ASCII /V/
002005  000                                                             .BYTE   0
002006  000                                                             .BYTE   0
002007  000                                                             .BYTE   0
002010                                                          L$REV::
002010  101                                                             .ASCII  /A/
002011                                                          L$DEPO::
002011  060                                                             .ASCII  /0/
002012                                                          L$UNIT::
002012  000020                                                          .WORD   T$PTHV
002014                                                          L$TIML::
002014  000150                                                          .WORD   150
002016                                                          L$HPCP::
002016  002246                                                          .WORD   L$HARD
002020                                                          L$SPCP::
002020  003376                                                          .WORD   L$SOFT
002022                                                          L$HPTP::
002022  002210                                                          .WORD   L$HW
002024                                                          L$SPTP::
002024  002232                                                          .WORD   L$SW
002026                                                          L$LADP::
002026  104004                                                          .WORD   L$LAST
002030                                                          L$STA::
002030  000000                                                          .WORD   0
002032                                                          L$CO::
002032  000000                                                          .WORD   0
002034                                                          L$DTYP::
002034  000000                                                          .WORD   0
002036                                                          L$APT::
002036  000000                                                          .WORD   0
002040                                                          L$DTP::
002040  002124                                                          .WORD   L$DISPATCH
002042                                                          L$PRIO::
002042  000340                                                          .WORD   340
```

PROGRAM HEADER

```
002044
002044  000000          L$ENVI::
                                .WORD   0
002046                  L$EXP1::
002046  000000                  .WORD   0
002050                  L$MREV::
002050     003                  .BYTE   C$REVISION
002051     003                  .BYTE   C$EDIT
002052                  L$EF::
002052  000000                  .WORD   0
002054  000000                  .WORD   0
002056                  L$SPC::
002056  000000                  .WORD   0
002060                  L$DEVP::
002060  007206                  .WORD   L$DVTYP
002062                  L$REPP::
002062  017320                  .WORD   L$RPT
002064                  L$EXP4::
002064  000000                  .WORD   0
002066                  L$EXP5::
002066  000000                  .WORD   0
002070                  L$AUT::
002070  026702                  .WORD   L$AU
002072                  L$DUT::
002072  026610                  .WORD   L$DU
002074                  L$LUN::
002074  000000                  .WORD   0
002076                  L$DESP::
002076  007222                  .WORD   L$DESC
002100                  L$LOAD::
002100  104035                  EMT     E$LOAD
002102                  L$ETP::
002102  007176                  .WORD   L$ERRTBL
002104                  L$ICP::
002104  022350                  .WORD   L$INIT
002106                  L$CCP::
002106  026600                  .WORD   L$CLEAN
002110                  L$ACP::
002110  026514                  .WORD   L$AUTO
002112                  L$PRT::
002112  022342                  .WORD   L$PROT
002114                  L$TEST::
002114  000000                  .WORD   0
002116                  L$DLY::
002116  000000                  .WORD   0
002120                  L$HIME::
002120  000000                  .WORD   0
1880
```

DISPATCH TABLE

```
1892                                    .SBTTL  DISPATCH TABLE
1893
1894                                    ;++
1895                                    ; THE DISPATCH TABLE CONTAINS THE STARTING ADDRESS OF EACH TEST.
1896                                    ; IT IS USED BY THE SUPERVISOR TO DISPATCH TO EACH TEST.
1897                                    ;--
1898
1899 002122                                    DISPATCH 25.
     002122  000031                                                .WORD   25
     002124                                                 L$DISPATCH::
     002124  026714                                                .WORD   T1
     002126  027220                                                .WORD   T2
     002130  030144                                                .WORD   T3
     002132  031326                                                .WORD   T4
     002134  032414                                                .WORD   T5
     002136  033674                                                .WORD   T6
     002140  035154                                                .WORD   T7
     002142  035720                                                .WORD   T8
     002144  037076                                                .WORD   T9
     002146  040216                                                .WORD   T10
     002150  041076                                                .WORD   T11
     002152  041674                                                .WORD   T12
     002154  042776                                                .WORD   T13
     002156  043702                                                .WORD   T14
     002160  046404                                                .WORD   T15
     002162  052510                                                .WORD   T16
     002164  056536                                                .WORD   T17
     002166  061070                                                .WORD   T18
     002170  062124                                                .WORD   T19
     002172  063254                                                .WORD   T20
     002174  064500                                                .WORD   T21
     002176  070704                                                .WORD   T22
     002200  072532                                                .WORD   T23
     002202  077110                                                .WORD   T24
     002204  102102                                                .WORD   T25
1900
```

```
                        .SBTTL  DEFAULT HARDWARE P-TABLE

                        ;++
                        ; THE DEFAULT HARDWARE P-TABLE CONTAINS DEFAULT VALUES OF
                        ; THE TEST-DEVICE PARAMETERS.  THE STRUCTURE OF THIS TABLE
                        ; IS IDENTICAL TO THE STRUCTURE OF THE HARDWARE P-TABLES,
                        ; AND IS USED AS A "TEMPLATE" FOR BUILDING THE P-TABLES.
                        ;-

002206                          BGNHW   DFPTBL
002206  000010                                                         .WORD   L10000-L$HW/2
002210                                                          L$HW::
002210                                                          DFPTBL::

002210  171000                          .WORD   171000          ; MODE REGISTER ADDRESS
002212  000000                          .WORD   0               ; VECTOR ADDRESS
002214  000200                          .WORD   PRI04           ; PRIORITY LEVEL
002216  000000                          .WORD   0               ; LOOPED ?
002220  000000                          .WORD   0               ; LOW LEVEL INPUT ? (0 = NO)
002222  000003                          .WORD   3               ; DEBOUNCE FOR DIGITAL LOOPBACK
                                                                ; 3=ALL, 0=LOW, 1=NORMAL, 2=HIGH
002224  171400                          .WORD   171400          ; OTHER MODULE ADDRESS
002226  000400                          .WORD   400             ; OTHER MODULE VECTOR ADDRESS

002230                          ENDHW
002230                                                          L10000:
```

SOFTWARE P-TABLE

```
                                .SBTTL  SOFTWARE P-TABLE

                                ;++
                                ; THE SOFTWARE TABLE CONTAINS VARIOUS DATA USED BY THE
                                ; PROGRAM AS OPERATIONAL PARAMETERS.  THESE PARAMETERS ARE
                                ; SET UP AT ASSEMBLY TIME AND MAY BE VARIED BY THE OPERATOR
                                ; AT RUN TIME.
                                ;--

002230                                  BGNSW   SFPTBL
002230  000005                                                                  .WORD   L10001-L$SW/2
002232                                                                  L$SW::
002232                                                                  SFPTBL::

002232  000000                  MANTST::      .WORD   0       ; RUN MANUFACTURING TESTS ? (0 = NO)
002234  000000                  MANIO::       .WORD   0       ; RUN LOOPBACK TESTS ? (0 = NO)
002236  177777                  PAT1::        .WORD   177777  ; 1ST PATTERN FOR DIGITAL LOOPBACK
002240  000000                  PAT2::        .WORD   0       ; 2ND PATTERN FOR DIGITAL LOOPBACK
002242  000000                  QVP::         .WORD   0       ; QUICK VERIFY ? (0 = NO)

002244                                  ENDSW
002244                                                                  L10001:
```

HARDWARE PARAMETER CODING SECTION

```
                                        .SBTTL  HARDWARE PARAMETER CODING SECTION

                                        ;++
                                        ; THE HARDWARE PARAMETER CODING SECTION CONTAINS MACROS
                                        ; THAT ARE USED BY THE SUPERVISOR TO BUILD P-TABLES.  THE
                                        ; MACROS ARE NOT EXECUTED AS MACHINE INSTRUCTIONS BUT ARE
                                        ; INTERPRETED BY THE SUPERVISOR AS DATA STRUCTURES.  THE
                                        ; MACROS ALLOW THE SUPERVISOR TO ESTABLISH COMMUNICATIONS
                                        ; WITH THE OPERATOR.
                                        ;--

002244                                          BGNHRD
002244  000042                                                                    .WORD L10002-L$HARD/2
002246                                                                  L$HARD::

                                        GPRMA   G1,0,0,0,177776,YES             ; MODE ADDRESS
002246  000031                                                                  .WORD   T$CODE
002250  002352                                                                  .WORD   G1
002252  000000                                                                  .WORD   T$LOLIM
002254  177776                                                                  .WORD   T$HILIM
                                        GPRMA   G2,2,0,0,770,YES                ; VECTOR
002256  001031                                                                  .WORD   T$CODE
002260  002400                                                                  .WORD   G2
002262  000000                                                                  .WORD   T$LOLIM
002264  000770                                                                  .WORD   T$HILIM
                                        GPRMD   G3,4,0,340,0,6,YES              ; PRIORITY
002266  002032                                                                  .WORD   T$CODE
002270  002456                                                                  .WORD   G3
002272  000340                                                                  .WORD   340
002274  000000                                                                  .WORD   T$LOLIM
002276  000006                                                                  .WORD   T$HILIM
                                        GPRML   G4,6,-1,YES                     ; LOOPED ?
002300  003130                                                                  .WORD   T$CODE
002302  002610                                                                  .WORD   G4
002304  177777                                                                  .WORD   -1
                                        XFERT   10$                             ; IF NOT, BRANCH
002306  022044                                                                  .WORD   T$CODE
                                        GPRML   G14,10,-1,YES                   ; LOWLEVEL INPUT ?
002310  004130                                                                  .WORD   T$CODE
002312  002751                                                                  .WORD   G14
002314  177777                                                                  .WORD   -1
                                        XFERT   20$                             ; IF YES, BRANCH
002316  006024                                                                  .WORD   T$CODE
                                        GPRMD   G15,12,D,-1,0,3,YES             ; DEBOUNCE PERIOD
002320  005052                                                                  .WORD   T$CODE
002322  003077                                                                  .WORD   G15
002324  177777                                                                  .WORD   -1
002326  000000                                                                  .WORD   T$LOLIM
002330  000003                                                                  .WORD   T$HILIM
002332                          20$:    GPRMA   G5,14,0,160000,177776,YES       ; OTHER MODE ADDRESS
002332  006031                                                                  .WORD   T$CODE
002334  003237                                                                  .WORD   G5
002336  160000                                                                  .WORD   T$LOLIM
002340  177776                                                                  .WORD   T$HILIM
002342                                  GPRMA   G6,16,0,0,770,YES               ; OTHER VECTOR ADDRESS
002342  007031                                                                  .WORD   T$CODE
```

HARDWARE PARAMETER CODING SECTION

```
      002344  003302                                                          .WORD   G6
      002346  000000                                                          .WORD   T$LOLIM
      002350  000770                                                          .WORD   T$HILIM
2000
2001  002352                          10$:    ENDHRD
                                                                              .EVEN
      002352                                                          L10002:
2002
2009
2010                                          .NLIST  BEX
2011  002352    115     117     104   G1:     .ASCIZ  /MODE REGISTER ADDRESS/
2012  002400    126     105     103   G2:     .ASCIZ  /VECTOR ADDRESS (FOR OUTPUT MODULES, TYPE "O")/
2013  002456    120     122     111   G3:     .ASCII  /PRIORITY LEVEL (FOR OUTPUT MODULES, TYPE "O")/
2014  002533    012     015     050           .ASCIZ  <12><15>/(FOR LSI WITH FIXED PRI, USE LEVEL 4 ONLY)/
2015  002610    111     123     040   G4:     .ASCII  /IS THIS MODULE CONNECTED TO ANOTHER VIA A LOOPBACK /
2016  002673    103     101     102           .ASCII  /CABLE/<15><12>/(ONLY MANUFACTURING SHOULD ANSWER /
2017  002744    131     105     123           .ASCIZ  /YES)/
2018  002751    114     117     127   G14:    .ASCII  /LOW LEVEL INPUT FOR DIGITAL INPUT LOOPBACK TESTS/
2019  003031    015     012     050           .ASCII  <15><12>/(FOR OUTPUT LOOPBACK  TYPE "N")    /
2020  003077    104     105     102   G15:    .ASCII  /DEBOUNCE PERIOD FOR DIGITAL INPUT LOOPBACK TESTS ONLY/<15><12>
2021  003166    035     060     060           .ASCIZ  /500US (0), 5MS (1), 10MS (2), OR ALL (3)/
2022  003237    117     124     110   G5:     .ASCIZ  /OTHER MODULE MODE REGISTER ADDRESS/
2023  003302    117     124     110   G6:     .ASCII  /OTHER MODULE VECTOR ADDRESS (IF OUTPUT MODULE, /
2024  003361    124     131     120           .ASCIZ  /TYPE "O")/
2025                                          .LIST   BEX
2026                                          .EVEN
```

```
                                .SBTTL  SOFTWARE PARAMETER CODING SECTION

                                ;++
                                ; THE SOFTWARE PARAMETER CODING SECTION CONTAINS MACROS
                                ; THAT ARE USED BY THE SUPERVISOR TO BUILD P-TABLES.  THE
                                ; MACROS ARE NOT EXECUTED AS MACHINE INSTRUCTIONS BUT ARE
                                ; INTERPRETED BY THE SUPERVISOR AS DATA STRUCTURES.  THE
                                ; MACROS ALLOW THE SUPERVISOR TO ESTABLISH COMMUNICATIONS
                                ; WITH THE OPERATOR.
                                ;--

003374                                  BGNSFT
003374  000025                                                          .WORD L10003-L$SOFT/2
003376                                                          L$SOFT::
003376                                  GPRML   G10,0,-1,YES            ; MANUFACTURING TESTS ?
003376  000130                                                          .WORD   T$CODE
003400  003450                                                          .WORD   G10
003402  177777                                                          .WORD   -1
003404                                  XFERF   10$                     ; IF NOT, BRANCH
003404  017044                                                          .WORD   T$CODE
003406                                  GPRML   G11,2,-1,YES            ; MANUFACTURING I/O TESTS ?
003406  001130                                                          .WORD   T$CODE
003410  003500                                                          .WORD   G11
003412  177777                                                          .WORD   -1
003414                                  XFERF   10$                     ; IF NOT, BRANCH
003414  013044                                                          .WORD   T$CODE
003416                                  GPRMD   G12,4,0,-1,0,177777,YES ; LOOPBACK PATTERN 1
003416  002032                                                          .WORD   T$CODE
003420  003533                                                          .WORD   G12
003422  177777                                                          .WORD   -1
003424  000000                                                          .WORD   T$LOLIM
003426  177777                                                          .WORD   T$HILIM
003430                                  GPRMD   G13,6,0,-1,0,177777,YES ; LOOPBACK PATTERN 2
003430  003032                                                          .WORD   T$CODE
003432  003604                                                          .WORD   G13
003434  177777                                                          .WORD   -1
003436  000000                                                          .WORD   T$LOLIM
003440  177777                                                          .WORD   T$HILIM
003442                          10$:    GPRML   G16,10,-1,YES           ; QUICK VERIFY MODE ?
003442  004130                                                          .WORD   T$CODE
003444  003656                                                          .WORD   G16
003446  177777                                                          .WORD   -1

                                        .EVEN

003450                                  ENDSFT
                                                                        .EVEN
003450                                                          L10003:

                                        .NLIST  BEX

003450  122 125 116     G10:    .ASCIZ  /RUN MANUFACTURING TESTS/
003500  122 125 116     G11:    .ASCIZ  \RUN LOOPBACK AND I/O TESTS\
003533  106 111 122     G12:    .ASCIZ  /FIRST PATTERN FOR DIGITAL LOOPBACK TESTS/
003604  123 105 103     G13:    .ASCIZ  /SECOND PATTERN FOR DIGITAL LOOPBACK TESTS/
```

SOFTWARE PARAMETER CODING SECTION

```
2074 003656      121     125     111  G16:     .ASCIZ  /QUICK VERIFY MODE/
2075                                           .LIST   BEX
2076                                           .EVEN
2077
2078
2079 003700                                    ENDMOD
2080
```

SOFTWARE PARAMETER CODING SECTION

```
                                .TITLE GLOBAL AREAS
                                .SBTTL  GLOBAL EQUATES SECTION
                                        ASNMOD
                                ;++
                                ; THE GLOBAL EQUATES SECTION CONTAINS PROGRAM EQUATES THAT
                                ; ARE USED IN MORE THAN ONE TEST.
                                ;--
                                        EQUALS
                                ;
                                ; BIT DEFINITIONS
                                ;
100000                          BIT15== 100000
040000                          BIT14== 40000
020000                          BIT13== 20000
010000                          BIT12== 10000
004000                          BIT11== 4000
002000                          BIT10== 2000
001000                          BIT09== 1000
000400                          BIT08== 400
000200                          BIT07== 200
000100                          BIT06== 100
000040                          BIT05== 40
000020                          BIT04== 20
000010                          BIT03== 10
000004                          BIT02== 4
000002                          BIT01== 2
000001                          BIT00== 1
                                ;
001000                          BIT9==  BIT09
000400                          BIT8==  BIT08
000200                          BIT7==  BIT07
000100                          BIT6==  BIT06
000040                          BIT5==  BIT05
000020                          BIT4==  BIT04
000010                          BIT3==  BIT03
000004                          BIT2==  BIT02
000002                          BIT1==  BIT01
000001                          BIT0==  BIT00
                                ;
                                ; EVENT FLAG DEFINITIONS
                                ;   EF32:EF17 RESERVED FOR SUPERVISOR TO PROGRAM COMMUNICATION
                                ;
000040                          EF.START==      32.                     ; START COMMAND WAS ISSUED
000037                          EF.RESTART==    31.                     ; RESTART COMMAND WAS ISSUED
000036                          EF.CONTINUE==   30.                     ; CONTINUE COMMAND WAS ISSUED
000035                          EF.NEW==        29.                     ; A NEW PASS HAS BEEN STARTED
000034                          EF.PWR==        28.                     ; A POWER FAIL/POWER-UP OCCURRED
                                ;
                                ;
                                ; PRIORITY LEVEL DEFINITIONS
                                ;
000340                          PRI07== 340
```

GLOBAL EQUATES SECTION

```
                000300                  PRIO6=  300
                000240                  PRIO5=  240
                000200                  PRIO4=  200
                000140                  PRIO3=  140
                000100                  PRIO2=  100
                000040                  PRIO1=  40
                000000                  PRIO0=  0
                                        ;
                                        ;OPERATOR FLAG BITS
                                        ;
                000004                  EVL=      4
                000010                  LOI=     10
                000020                  ADR=     20
                000040                  IDU=     40
                000100                  ISR=    100
                000200                  UAM=    200
                000400                  BOE=    400
                001000                  PNT=   1000
                002000                  PRI=   2000
                004000                  IXE=   4000
                010000                  IBE=  10000
                020000                  IER=  20000
                040000                  LOE=  40000
                100000                  HUE= 100000
    2155
    2156        171000                          ;STA=  171000           ; FIRST STANDARD IDV/IAV 11 ADDRESS
    2157        171770                          ;ND=   171770           ; LAST STANDARD IDV/IAV-11 ADDRESS
    2158
    2159                                ;       NB. SEE ALSO MESSAGE "NODEV" BELOW.
```

GLOBAL DATA SECTION

```
                                .SBTTL  GLOBAL DATA SECTION

                                ;++
                                ; THE GLOBAL DATA SECTION CONTAINS DATA THAT ARE USED
                                ; IN MORE THAN ONE TEST.
                                ;--

003700  000000          MOD::           .WORD   0       ; MODE REGISTER ADDRESS OF CURRENT UUT
003702  000000          DAT::           .WORD   0       ; DATA REGISTER ADDRESS OF CURRENT UUT
003704  000000          CSA::           .WORD   0       ; CSR REGISTER A ADDRESS OF CURRENT UUT
003706  000000          CSB::           .WORD   0       ; CSR REGISTER B ADDRESS OF CURRENT UUT
003710  000000          VEC::           .WORD   0       ; VECTOR ADDRESS OF CURRENT UUT
003712  000000          PRIO::          .WORD   0       ; PRIORITY LEVEL OF CURRENT UUT
003714  000000          COND::          .WORD   0       ; SET IF UUT IS CONNECTED TO ANOTHER
003716  000000          LOWLVL::        .WORD   0       ; LOW LEVEL FOR DIGITAL INPUT LOOPBACK
003720  000003          DBOUNC::        .WORD   3       ; DEBOUNC PERIOD FOR DIGITAL INPUT LOOPB.
003722  000000          OTHMOD::        .WORD   0       ; OTHER MODULE MODE REGISTER ADDRESS
003724  000000          OTHDAT::        .WORD   0       ; OTHER MODULE DATA REGISTER ADDRESS
003726  000000          OTHCSA::        .WORD   0       ; OTHER MODULE REGISTER A ADDRESS
003730  000000          OTHCSB::        .WORD   0       ; OTHER MODULE REGISTER B ADDRESS
003732  000000          OTHVEC::        .WORD   0       ; OTHER MODULE VECTOR ADDRESS

003734  100000          ECNT::          .WORD   100000  ; ERROR COUNT FOR UUT 0 - BIT 15 IS SET TO
003736  100000                          .WORD   100000  ; ERROR COUNT FOR UUT 1 - FLAG NOT TESTED.
003740  100000                          .WORD   100000  ; ERROR COUNT FOR UUT 2
003742  100000                          .WORD   100000  ; ERROR COUNT FOR UUT 3
003744  100000                          .WORD   100000  ; ERROR COUNT FOR UUT 4
003746  100000                          .WORD   100000  ; ERROR COUNT FOR UUT 5
003750  100000                          .WORD   100000  ; ERROR COUNT FOR UUT 6
003752  100000                          .WORD   100000  ; ERROR COUNT FOR UUT 7
003754  100000                          .WORD   100000  ; ERROR COUNT FOR UUT 8
003756  100000                          .WORD   100000  ; ERROR COUNT FOR UUT 9
003760  100000                          .WORD   100000  ; ERROR COUNT FOR UUT 10
003762  100000                          .WORD   100000  ; ERROR COUNT FOR UUT 11
003764  100000                          .WORD   100000  ; ERROR COUNT FOR UUT 12
003766  100000                          .WORD   100000  ; ERROR COUNT FOR UUT 13
003770  100000                          .WORD   100000  ; ERROR COUNT FOR UUT 14
003772  100000                          .WORD   100000  ; ERROR COUNT FOR UUT 15

003774  000000          GPADD::         .WORD   0       ; PARAMETER ADDRESS FOR UNIT 0
003776  000000                          .WORD   0       ; PARAMETER ADDRESS FOR UNIT 1
004000  000000                          .WORD   0       ; PARAMETER ADDRESS FOR UNIT 2
004002  000000                          .WORD   0       ; PARAMETER ADDRESS FOR UNIT 3
004004  000000                          .WORD   0       ; PARAMETER ADDRESS FOR UNIT 4
004006  000000                          .WORD   0       ; PARAMETER ADDRESS FOR UNIT 5
004010  000000                          .WORD   0       ; PARAMETER ADDRESS FOR UNIT 6
004012  000000                          .WORD   0       ; PARAMETER ADDRESS FOR UNIT 7
004014  000000                          .WORD   0       ; PARAMETER ADDRESS FOR UNIT 8
004016  000000                          .WORD   0       ; PARAMETER ADDRESS FOR UNIT 9
004020  000000                          .WORD   0       ; PARAMETER ADDRESS FOR UNIT 10
004022  000000                          .WORD   0       ; PARAMETER ADDRESS FOR UNIT 11
004024  000000                          .WORD   0       ; PARAMETER ADDRESS FOR UNIT 12
004026  000000                          .WORD   0       ; PARAMETER ADDRESS FOR UNIT 13
004030  000000                          .WORD   0       ; PARAMETER ADDRESS FOR UNIT 14
004032  000000                          .WORD   0       ; PARAMETER ADDRESS FOR UNIT 15

004034          DROPED::        .BLKB   16.     ; UNIT DROPPED FLAGS
```

GLOBAL DATA SECTION

```
2218
2219 004054  000000              TSTFLG::        .WORD   0       ; CLEARED AT START OF EACH PASS
2220                                                              ; SET IF ANY TEST IS SELECTED
2221 004056  000000              TSUFLG::        .WORD   0       ; CLEARED AT START OF EACH UNIT'S PASS
2222                                                              ; SET IF ANY TEST IS SELECTED
2223
2224 004060  000000              NXMFLG::        .WORD   0       ; SET IF NXM TRAP OCCURS
2225
2226 004062  000000              GOOD::          .WORD   0       ; EXPECTED CONTENTS
2227 004064  000000              BAD::           .WORD   0       ; ACTUAL CONTENTS
2228 004066  000000              SFI::           .WORD   0       ; FLAG TO FORCE ERROR PRINTOUTS
2229
2230 004070  000000              LOPFLG::        .WORD   0       ; SET IF LOOP CHECK ROUTINE CALLED FOR UNIT 0
2231 004072  000000                              .WORD   0       ; SET IF LOOP CHECK ROUTINE CALLED FOR UNIT 1
2232 004074  000000                              .WORD   0       ; SET IF LOOP CHECK ROUTINE CALLED FOR UNIT 2
2233 004076  000000                              .WORD   0       ; SET IF LOOP CHECK ROUTINE CALLED FOR UNIT 3
2234 004100  000000                              .WORD   0       ; SET IF LOOP CHECK ROUTINE CALLED FOR UNIT 4
2235 004102  000000                              .WORD   0       ; SET IF LOOP CHECK ROUTINE CALLED FOR UNIT 5
2236 004104  000000                              .WORD   0       ; SET IF LOOP CHECK ROUTINE CALLED FOR UNIT 6
2237 004106  000000                              .WORD   0       ; SET IF LOOP CHECK ROUTINE CALLED FOR UNIT 7
2238 004110  000000                              .WORD   0       ; SET IF LOOP CHECK ROUTINE CALLED FOR UNIT 8
2239 004112  000000                              .WORD   0       ; SET IF LOOP CHECK ROUTINE CALLED FOR UNIT 9
2240 004114  000000                              .WORD   0       ; SET IF LOOP CHECK ROUTINE CALLED FOR UNIT 10
2241 004116  000000                              .WORD   0       ; SET IF LOOP CHECK ROUTINE CALLED FOR UNIT 11
2242 004120  000000                              .WORD   0       ; SET IF LOOP CHECK ROUTINE CALLED FOR UNIT 12
2243 004122  000000                              .WORD   0       ; SET IF LOOP CHECK ROUTINE CALLED FOR UNIT 13
2244 004124  000000                              .WORD   0       ; SET IF LOOP CHECK ROUTINE CALLED FOR UNIT 14
2245 004126  000000                              .WORD   0       ; SET IF LOOP CHECK ROUTINE CALLED FOR UNIT 15
2246
2247 004130  000000              LOTFLA::        .WORD   0       ; SET BY INIT CODE IF LOOP ON TEST IS SELECTED
2248
2249 004132  000000              CONMSK::        .WORD   0       ; TEST CONTROL MASK SET UP BY INIT CODE
2250
2251                                                             ; BIT 0 IS SET IF UUT IS DIGITAL INPUT
2252                                                             ; BIT 1 IS SET IF UUT IS DIGITAL OUTPUT
2253                              ; LOW BYTE IS DEVICE CODE      ; BIT 2 IS SET IF UUT IS ANALOGUE INPUT
2254                                                             ; BIT 3 IS SET IF UUT IS ANALOGUE OUTPUT
2255                                                             ; BIT 4 IS SET IF UUT IS NONE OF THE
2256                                                             ; ABOVE
2257                                                             ; BITS 5, 6 AND 7 ARE UNUSED
2258
2259                                                             ; BIT 8 IS ALWAYS SET TO SELECT BASIC
2260                                                             ; INTERNAL LOGIC TESTS
2261
2262                                                             ; BIT 9 SET TO SELECT FIELD INPUT/OUTPUT
2263                                                             ; TESTS
2264
2265                                                             ; BIT 10 IS SET IF LOOPBACK TESTING IS
2266                                                             ; SELECTED AND ALLOWED FOR CURRENT UUT
2267
2268                                                             ; BIT 11 IS SET IF MANUFACTURING LOOPBACK
2269                                                             ; AND INPUT/OUTPUT TESTS ARE SELECTED
2270
2271                                                             ; BIT 12 IS SET IF A SPECIFICALLY
2272                                                             ; SELECTABLE TEST IS CHOSEN
2273
2274                                                             ; BITS 13, 14 AND 15 ARE UNUSED
```

GLOBAL DATA SECTION

```
2275
2276 004134  000000                MODE::  .WORD   0               ; MODE FOR DIGITAL/ANALOGUE CONVERSIONS
2277 004136  000000                GAIN::  .WORD   0               ; GAIN FOR DIGITAL/ANALOGUE CONVERSIONS
2278
2279 004140  000000                PADD::  .WORD   0               ; ADDRESS OF PROMPT FOR DECIMAL INPUT ROUTINE
2280
2281                               ;THE FOLLOWING EQUATES ARE ONLY USED IN THE TESTS
2282
2283 004142  000000                ANS::           .WORD   0       ; TEMPORARY STORE FOR MANUAL INPUTS
2284 004144  000000                ITRCNT::        .WORD   0       ; ITERRATION COUNTER
2285 004146  000010                ITRDEF::        .WORD   10      ; ITERRATION DEFAULT
2286 004150  000000                INTFLA::        .WORD   0       ; DONE INTERRUPT FLAG
2287 004152  000000                INTFL2::        .WORD   0       ; ERROR INTERRUPT FLAG
2288 004154  000020                CYCLE::         .WORD   20      ; CYCLE COUNTER FOR PATTERN PAIR LOOPBACK
2289 004156  000003                CYCLLS::        .WORD   3       ; CYCLE COUNTER FOR LLS AND SLIDING TESTS
2290 004160  000500                CYCRAD::        .WORD   500     ; CYCLE COUNTER FOR RANDOM LOOPBACK TESTS
2291 004162  000020                LLWC::          .WORD   16.     ; INPUT MODULE LOW LEVEL WAIT VALUE (10MS)
2292 004164  007777                REDTIM::        .WORD   7777    ; READY TIMEOUT COUNTER
2293 004166  000001                OUTDE1::        .WORD   1       ; OPTO OUTPUT DEBOUNCE WAIT VALUE
2294 004170  000012                OUTDE2::        .WORD   12      ; RELAY OUTPUT DEBOUNCE WAIT VALUE
2295
2296                               ;THE FOLLOWING TABEL GIVE THE LOAD VALUE OF HOW OFTEN THE 500 US
2297                               ;WAIT LOOP WILL BE EXECUTED.
2298                               ;THE TABLE IS FOR DIGITAL INPUT MODULES ONLY AND WILL BE USED IN THE
2299                               ;DIGITAL INPUT LOOPBACK TESTS.(TEST 8,10,12)
2300
2301 004172  000                   DBTAB::         .BYTE   0       ; DUMMY LOCATION FOR USE OF R5
2302 004173  001                                   .BYTE   1       ; VALUE FOR INPUT MODULE DEB. 500US
2303 004174  013                                   .BYTE   11.     ; VALUE FOR INPUT MODULE DEB. 5MS
2304 004175  025                                   .BYTE   21.     ; VALUE FOR INPUT MODULE DEB. 10MS
2305
2306                                               .EVEN
2307
2308
```

GLOBAL DATA SECTION

```
2310          000012                          .RADIX  10
2311                                          .NLIST  BEX
2312
2313                                  ; ANALOGUE/DIGITAL CONVERSION TABLES USED BY ROUTINES DACON AND ADCON.
2314
2315                                  ; VOLTAGE UNIPOLAR TABLE MODE 0 (0-10V)
2316
2317                                  ; BITS    11   10    9    8    7    6    5    4    3    2    1    0
2318
2319 004176  011610  004704  002342  VUPTAB:: 5000,2500,1250, 625, 312, 156,  78,  39,  19,   9,   4,   2 ; MV G=1
2320 004226  000000  000000  000000             0,   0,   0,   0, 500, 250, 125,  63, 531, 766, 883, 441 ; UV
2321
2322 004256  004704  002342  001161            2500,1250, 625, 312, 156,  78,  39,  19,   9,   4,   2,   1 ; MV G=2
2323 004306  000000  000000  000000               0,   0,   0, 500, 250, 125,  63, 531, 766, 883, 441, 221 ; UV
2324
2325 004336  001750  000764  000372            1000, 500, 250, 125,  62,  31,  15,   7,   3,   1,   0,   0 ; MV G=5
2326 004366  000000  000000  000000               0,   0,   0,   0, 500, 250, 625, 813, 906, 953, 977, 488 ; UV
2327
2328 004416  000764  000372  000175             500, 250, 125,  62,  31,  15,   7,   3,   1,   0,   0,   0 ; MV G=10
2329 004446  000000  000000  000000               0,   0,   0, 500, 250, 625, 813, 906, 953, 977, 488, 244 ; UV
2330
2331 004476  000372  000175  000076             250, 125,  62,  31,  15,   7,   3,   1,   0,   0,   0,   0 ; MV G=20
2332 004526  000000  000000  000764               0,   0, 500, 250, 625, 813, 906, 953, 977, 488, 244, 122 ; UV
2333
2334 004556  000144  000062  000031             100,  50,  25,  12,   6,   3,   1,   0,   0,   0,   0,   0 ; MV G=50
2335 004606  000000  000000  000000               0,   0,   0, 500, 250, 125, 563, 781, 391, 195,  98,  49 ; UV
2336
2337 004636  000062  000031  000014              50,  25,  12,   6,   3,   1,   0,   0,   0,   0,   0,   0 ; MV G=100
2338 004666  000000  000000  000764               0,   0, 500, 250, 125, 563, 781, 391, 195,  98,  49,  24 ; UV
2339
2340 004716  000031  000014  000006              25,  12,   6,   3,   1,   0,   0,   0,   0,   0,   0,   0 ; MV G=200
2341 004746  000000  000764  000372               0, 500, 250, 125, 563, 781, 391, 195,  98,  49,  24,  12 ; UV
2342
```

GLOBAL DATA SECTION

```
2344                                    ;VOLTAGE BIPOLAR TABLE (-10 - +10V) MODE 1
2345
2346                                    ; BITS    11   10    9    8    7    6    5    4    3    2    1    0
2347
2348 004776  023420  011610  004704  VBPTAB::10000,5000,2500,1250, 625, 312, 156,  78,  39,  19,   9,   4 ; MV G=1
2349 005026  000000  000000  000000            0,   0,   0,   0,   0, 500, 250, 125,  63, 531, 766, 883 ; UV
2350
2351 005056  011610  004704  002342         5000,2500,1250, 625, 312, 156,  78,  39,  19,   9,   4,   2 ; MV G=2
2352 005106  000000  000000  000000            0,   0,   0,   0, 500, 250, 125,  63, 531, 766, 883, 441 ; UV
2353
2354 005136  003720  001750  000764         2000,1000, 500, 250, 125,  62,  31,  15,   7,   3,   1,   0 ; MV G=5
2355 005166  000000  000000  000000            0,   0,   0,   0,   0, 500, 250, 625, 813, 906, 953, 977 ; UV
2356
2357 005216  001750  000764  000372         1000, 500, 250, 125,  62,  31,  15,   7,   3,   1,   0,   0 ; MV G=10
2358 005246  000000  000000  000000            0,   0,   0,   0, 500, 250, 625, 813, 906, 953, 977, 488 ; UV
2359
2360 005276  000764  000372  000175          500, 250, 125,  62,  31,  15,   7,   3,   1,   0,   0,   0 ; MV G=20
2361 005326  000000  000000  000000            0,   0,   0, 500, 250, 625, 813, 906, 953, 977, 488, 244 ; UV
2362
2363 005356  000310  000144  000062          200, 100,  50,  25,  12,   6,   3,   1,   0,   0,   0,   0 ; MV G=50
2364 005406  000000  000000  000000            0,   0,   0,   0, 500, 250, 125, 563, 781, 391, 195,  98 ; UV
2365
2366 005436  000144  000062  000031          100,  50,  25,  12,   6,   3,   1,   0,   0,   0,   0,   0 ; MV G=100
2367 005466  000000  000000  000000            0,   0,   0, 500, 250, 125, 563, 781, 391, 195,  98,  49 ; UV
2368
2369 005516  000062  000031  000014           50,  25,  12,   6,   3,   1,   0,   0,   0,   0,   0,   0 ; MV G=200
2370 005546  000000  000000  000764            0,   0, 500, 250, 125, 563, 781, 391, 195,  98,  49,  24 ; UV
2371
```

GLOBAL DATA SECTION

```
2373                                    ;CURRENT 0-20 MA TABLE - MODE 2
2374
2375                                    ; BITS    11   10    9    8    7    6    5    4    3    2    1    0
2376
2377 005576  023420  011610  004704  IOTAB:: 10000,5000,2500,1250, 625, 312, 156,  78,  39,  19,   9,   4 ; UA G=1
2378 005626  000000  000000  000000            0,   0,   0,   0,   0, 500, 250, 125,  63, 531, 766, 883 ; NA
2379
2380 005656  011610  004704  002342          5000,2500,1250, 625, 312, 156,  78,  39,  19,   9,   4,   2 ; UA G=2
2381 005706  000000  000000  000000            0,   0,   0,   0, 500, 250, 125,  63, 531, 766, 883, 441 ; NA
2382
2383 005736  003720  001750  000764          2000,1000, 500, 250, 125,  62,  31,  15,   7,   3,   1,   0 ; MA G=5
2384 005766  000000  000000  000000            0,   0,   0,   0   0, 500, 250, 625, 813, 906, 953, 977 ; NA
2385
2386 006016  001750  000764  000372          1000, 500, 250, 125,  62,  31,  15,   7,   3,   1,   0,   0 ; UA G=10
2387 006046  000000  000000  000000            0,   0,   0,   0, 500, 250, 625, 813, 906, 953, 977, 488 ; NA
2388
2389 006076  000764  000372  000175           500, 250, 125,  62,  31,  15,   7,   3,   1,   0,   0,   0 ; UA G=20
2390 006126  000000  000000  000000            0,   0,   0, 500, 250, 625, 813, 906, 953, 977, 488, 244 ; NA
2391
2392 006156  000310  000144  000062           200, 100,  50,  25,  12,   6,   3,   1,   0,   0,   0,   0 ; UA G=50
2393 006206  000000  000000  000000            0,   0,   0,   0, 500, 250, 125, 563, 781, 391, 195,  98 ; NA
2394
2395 006236  000144  000062  000031           100,  50,  25,  12,   6,   3,   1,   0,   0,   0,   0,   0 ; UA G=100
2396 006266  000000  000000  000000            0,   0,   0, 500, 250, 125, 563, 781, 391, 195,  98,  49 ; NA
2397
2398 006316  000062  000031  000014            50,  25,  12,   6,   3,   1,   0,   0,   0,   0,   0,   0 ; UA G=200
2399 006346  000000  000000  000764            0,   0, 500, 250, 125, 563, 781, 391, 195,  98,  49,  24 ; NA
2400
```

GLOBAL DATA SECTION

```
2402
2403                                    ; CURRENT 4 - 20 MA TABLE (MODE 3)
2404
2405                                    ; BITS    11   10    9    8    7    6    5    4    3    2    1    0
2406
2407 006376  017500  007640  003720  I4TAB::  8000,4000,2000,1000, 500, 250, 125,  62,  31,  15,   7,   3 ; UA G=1
2408 006426  000000  000000  000000             0,   0,   0,   0,   0,   0,   0, 500, 250, 625, 813, 906 ; NA
2409
2410 006456  007640  003720  001750           4000,2000,1000, 500, 250, 125,  62,  31,  15,   7,   3,   1 ; UA G=2
2411 006506  000000  000000  000000             0,   0,   0,   0,   0,   0, 500, 250, 625, 813, 906, 953 ; NA
2412
2413 006536  003100  001440  000620           1600, 800, 400, 200, 100,  50,  25,  12,   6,   3,   1,   0 ; UA G=5
2414 006566  000000  000000  000000             0,   0,   0,   0,   0,   0,   0, 500, 250, 125, 563, 781 ; NA
2415
2416 006616  001440  000620  000310            800, 400, 200, 100,  50,  25,  12,   6,   3,   1,   0,   0 ; UA G=10
2417 006646  000000  000000  000000              0,   0,   0,   0,   0,   0, 500, 250, 125, 563, 781, 390 ; NA
2418
2419 006676  000620  000310  000144            400, 200, 100,  50,  25,  12,   6,   3,   1,   0,   0,   0 ; UA G=20
2420 006726  000000  000000  000000              0,   0,   0,   0,   0, 500, 250, 125, 563, 781, 390, 195 ; NA
2421
2422 006756  000240  000120  000050            160,  80,  40,  20,  10,   5,   2,   1,   0,   0,   0,   0 ; UA G=50
2423 007006  000000  000000  000000              0,   0,   0,   0,   0,   0, 500, 250, 625, 313, 156,  78 ; NA
2424
2425 007036  000120  000050  000024             80,  40,  20,  10,   5,   2,   1,   0,   0,   0,   0,   0 ; UA G=100
2426 007066  000000  000000  000000              0,   0,   0,   0,   0, 500, 250, 625, 313, 156,  78,  39 ; NA
2427
2428 007116  000050  000024  000012             40,  20,  10,   5,   2,   1,   0,   0,   0,   0,   0,   0 ; UA G=200
2429 007146  000000  000000  000000              0,   0,   0,   0, 500, 250, 625, 313, 156,  78,  39,  20 ; NA
2430
2431
2432                 000010                     .RADIX  8
2433                                            .LIST   BEX
```

GLOBAL DATA SECTION

```
2435
2448
2449 007176                                ERRTBL
     007176                                                    L$ERRTBL::
     007176  000000          ERRTYP::        .WORD   0
     007200  000000          ERRNBR::        .WORD   0
     007202  000000          ERRMSG::        .WORD   0
     007204  000000          ERRBLK::        .WORD   0
```

GLOBAL TEXT SECTION

```
                                .SBTTL  GLOBAL TEXT SECTION

                                ;++
                                ; THE GLOBAL TEXT SECTION CONTAINS FORMAT STATEMENTS,
                                ; MESSAGES, AND ASCII INFORMATION THAT ARE USED IN
                                ; MORE THAN ONE TEST.
                                ;--

                                        .NLIST  BEX

                                ;
                                ; NAMES OF DEVICES SUPPORTED BY PROGRAM
                                ;
007206                                  DEVTYP  <IDV\IAV-11>
007206                                                                  L$DVTYP::
007206  111     104     126                                                     .ASCIZ  /IDV\IAV-11/
                                                                                .EVEN

                                ;
                                ; TEST DESCRIPTION
                                ;
007222                                  DESCRIPT        <IDV\IAV-11 DIAGNOSTIC>
007222                                                                  L$DESC::
007222  111     104     126                                                     .ASCIZ  /IDV\IAV-11 DIAGNOST
IC/
                                                                                .EVEN

                                ;
                                ; FORMAT STATEMENTS USED IN PRINT CALLS
                                ;

007250  045     116     045  NODEV:: .ASCIZ  \%N%A*** NO DEVICES FOUND IN RANGE 171000 TO 171770 ***%N\

                                        .LIST   BEX
                                        .EVEN
```

GLOBAL ERROR REPORT SECTION

```
                                .SBTTL  GLOBAL ERROR REPORT SECTION

                                ;++
                                ; THE GLOBAL ERROR REPORT SECTION CONTAINS MESSAGE PRINTING AREAS
                                ; USED BY MORE THAN TEST TO OUTPUT ADDITIONAL ERROR INFORMATION.  PRINTB
                                ; (BASIC) AND PRINTX (EXTENDED) CALLS ARE USED TO CALL PRINT SERVICES.
                                ;--


                                        BGNMSG  EER1                                    EER1::
                                        PRINTB  #GOOBAD,GOOD,BAD        ; PRINT GOOD AND BAD
                                                                                        MOV     BAD,-(SP)
                                                                                        MOV     GOOD,-(SP)
                                                                                        MOV     #GOOBAD,-(SP)
                                                                                        MOV     #3,-(SP)
                                                                                        MOV     SP,R0
                                                                                        TRAP    C$PNTB
                                                                                        ADD     #10,SP
                                        JSR     PC,CHKMAX               ; CHECK FOR TOO MANY ERRORS
                                        ENDMSG                                          L10004:
                                                                                        TRAP    C$MSG


                                        BGNMSG  EER2                                    EER2::
                                        PRINTB  #EMG3,GOOD,BAD,@MOD                     MOV     @MOD,-(SP)
                                                                                        MOV     BAD,-(SP)
                                                                                        MOV     GOOD,-(SP)
                                                                                        MOV     #EMG3,-(SP)
                                                                                        MOV     #4,-(SP)
                                                                                        MOV     SP,R0
                                                                                        TRAP    C$PNTB
                                                                                        ADD     #12,SP
                                        JSR     PC,CHKMAX
                                        ENDMSG                                          L10005:
                                                                                        TRAP    C$MSG


                                        BGNMSG  EER3                                    EER3::
                                        PRINTB  #EMG4,@CSA                              MOV     @CSA,-(SP)
                                                                                        MOV     #EMG4,-(SP)
                                                                                        MOV     #2,-(SP)
                                                                                        MOV     SP,R0
                                                                                        TRAP    C$PNTB
                                                                                        ADD     #6,SP
                                        JSR     PC,CHKMAX
                                        ENDMSG                                          L10006:
                                                                                        TRAP    C$MSG
```

GLOBAL ERROR REPORT SECTION

```
2553 007474                          BGNMSG  EER4
     007474                                                  EER4::
2554 007474  000304                  SWAB    R4
2555 007476                          PRINTB  #EMG5,GOOD,BAD,R4
     007476  010446                                              MOV     R4,-(SP)
     007500  013746  004064                                      MOV     BAD,-(SP)
     007504  013746  004062                                      MOV     GOOD,-(SP)
     007510  012746  010230                                      MOV     #EMG5,-(SP)
     007514  012746  000004                                      MOV     #4,-(SP)
     007520  010600                                              MOV     SP,R0
     007522  104414                                              TRAP    C$PNTB
     007524  062706  000012                                      ADD     #12,SP
2556 007530  000304                  SWAB    R4
2557 007532  004737  011342          JSR     PC,CHKMAX
2558 007536                          ENDMSG
     007536                                                  L10007:
     007536  104423                                              TRAP    C$MSG
2559
2560
2561 007540                          BGNMSG  EER5
     007540                                                  EER5::
2562 007540                          PRINTB  #EMG6,GOOD,BAD,@CSA
     007540  017746  174140                                      MOV     @CSA,-(SP)
     007544  013746  004064                                      MOV     BAD,-(SP)
     007550  013746  004062                                      MOV     GOOD,-(SP)
     007554  012746  010314                                      MOV     #EMG6,-(SP)
     007560  012746  000004                                      MOV     #4,-(SP)
     007564  010600                                              MOV     SP,R0
     007566  104414                                              TRAP    C$PNTB
     007570  062706  000012                                      ADD     #12,SP
2563 007574  004737  011342          JSR     PC,CHKMAX
2564 007600                          ENDMSG
     007600                                                  L10010:
     007600  104423                                              TRAP    C$MSG
2565
2566
2567 007602                          BGNMSG  EER6
     007602                                                  EER6::
2568 007602                          PRINTB  #EMG4,BAD
     007602  013746  004064                                      MOV     BAD,-(SP)
     007606  012746  010166                                      MOV     #EMG4,-(SP)
     007612  012746  000002                                      MOV     #2,-(SP)
     007616  010600                                              MOV     SP,R0
     007620  104414                                              TRAP    C$PNTB
     007622  062706  000006                                      ADD     #6,SP
2569 007626  004737  011342          JSR     PC,CHKMAX
2570 007632                          ENDMSG
     007632                                                  L10011:
     007632  104423                                              TRAP    C$MSG
2571
2572
2573
2574 007634                          BGNMSG  EERA
     007634                                                  EERA::
2575 007634                          PRINTB  #EMG1,R1
     007634  010146                                              MOV     R1,-(SP)
     007636  012746  007762                                      MOV     #EMG1,-(SP)
```

GLOBAL ERROR REPORT SECTION

```
                007642  012746  000002
                007646  010600
                007650  104414
                007652  062706  000006
2576            007656  004737  011342          JSR     PC,CHKMAX
2577            007662                          ENDMSG
                007662
                007662  104423
2578
2579
2580            007664                          BGNMSG  EERB
                007664
2581            007664                          PRINTB  #EMG2,R5,GOOD,BAD
                007664  013746  004064
                007670  013746  004062
                007674  010546
                007676  012746  010031
                007702  012746  000004
                007706  010600
                007710  104414
                007712  062706  000012
2582            007716  004737  011342          JSR     PC,CHKMAX
2583            007722                          ENDMSG
                007722
                007722  104423
2584
2585
2586            007724                          BGNMSG  EERG
                007724
2587            007724  004737  011342          JSR     PC,CHKMAX
2588            007730                          ENDMSG
                007730
                007730  104423
2589
2590                                    .NLIST BEX
2591 007732        045     101     107 GOOBAD: .ASCIZ  /%AGOOD:%O6%A, BAD:%O6%N/
2592 007762        045     101     122 EMG1:   .ASCIZ  /%AREGISTER AT %O6%A DOES NOT RESPOND%N/
2593 010031        045     101     101 EMG2:   .ASCIZ  /%AADDRESS: %O6%A, GOOD:%O6%A, BAD:%O6%N/
2594 010101        045     101     107 EMG3:   .ASCIZ  /%AGOOD:%O6%A, BAD:%O6%A, MOD REGISTER CONTENTS:%O6%N/
2595 010166        045     101     103 EMG4:   .ASCIZ  /%ACSA REGISTER CONTENTS IS :%O6%N/
2596 010230        045     101     107 EMG5:   .ASCIZ  /%AGOOD:%O6%A, BAD:%O6%A, ADDRESSED CHANNEL IS:%D3%N/
2597 010314        045     101     107 EMG6:   .ASCIZ  /%AGOOD:%O6%A, BAD:%O6%A, CSA REGISTER CONTENTS:%O6%N/
2598                                    .LIST BEX
2599                                    .EVEN
2600
```

```
                MOV     #2,-(SP)
                MOV     SP,R0
                TRAP    C$PNTB
                ADD     #6,SP
L10012:
                TRAP    C$MSG

EERB::
                MOV     BAD,-(SP)
                MOV     GOOD,-(SP)
                MOV     R5,-(SP)
                MOV     #EMG2,-(SP)
                MOV     #4,-(SP)
                MOV     SP,R0
                TRAP    C$PNTB
                ADD     #12,SP
L10013:
                TRAP    C$MSG

EERG::
L10014:
                TRAP    C$MSG
```

GLOBAL SUBROUTINES SECTION

```
                        .SBTTL  GLOBAL SUBROUTINES SECTION

                        ;**
                        ; THE GLOBAL SUBROUTINES SECTION CONTAINS THE SUBROUTINES
                        ; THAT ARE USED IN MORE THAN ONE TEST.
                        ;

                        ; SUBROUTINE REGTST - GENERAL PURPOSE REGISTER TEST.

                        ;**
                        ; FUNCTIONAL DESCRIPTION:
                        ;
                        ;       CHECKS THAT ALL READ/WRITE BITS OF THE SELECTED REGISTER CAN BE
                        ;       SET, CLEARED, AND INDIVIDUALLY SET (SLIDING ONES PATTERN).
                        ;
                        ; INPUTS:
                        ;
                        ;       IF ENTERED AT LOCATION REGTST, THE LOCATIONS FOLLOWING THE
                        ;       SUBROUTINE CALL MUST CONTAIN THE READ/WRITE BIT MASK, THE
                        ;       ADDRESS OF THE REGISTER TO BE TESTED, AND THE FIRST ERROR NUMBER
                        ;       TO BE USED (SEE CALLING SEQUENCE).
                        ;
                        ;       IF ENTERED AT LOCATION REGTST1, THE READ/WRITE BIT MASK, REGISTER
                        ;       ADDRESS TO BE TESTED, AND THE FIRST ERROR NUMBER MUST BE LOADED
                        ;       INTO LOCATIONS MASK, REGADD, AND ERRNBR RESPECTIVELY. THIS
                        ;       ALLOWS THE ARGUMENTS TO BE VARIED AT RUN TIME.
                        ;
                        ; IMPLICIT INPUTS:
                        ;
                        ;       NONE.
                        ;
                        ; OUTPUTS:
                        ;
                        ;       ERROR MESSAGES IF ERRORS OCCUR.
                        ;
                        ; IMPLICIT OUTPUTS:
                        ;
                        ;       IF ENTERED AT LOCATION REGTST,
                        ;
                        ;       MASK    - CONTAINS THE READ/WRITE BIT MASK
                        ;       REGADD  - CONTAINS THE ADDRESS OF THE REGISTER BEING TESTED
                        ;
                        ;       ALWAYS,
                        ;
                        ;       MASCOM  - CONTAINS THE COMPLEMENT OF THE MASK
                        ;       GOOD    - CONTAINS LAST EXPECTED DATA
                        ;       BAD     - CONTAINS LAST ACTUAL DATA
                        ;       ERRNBR  - CONTAINS THE INPUT ERROR NUMBER + 2
                        ;       ERRTYP  - CONTAINS 3 (SOFT ERROR)
                        ;       ERRBLK  - CONTAINS ADDRESS OF REGERR (REGISTER ERROR MESSAGE)
                        ;       ERRMSG  - CONTAINS 3RD REGISTER ERROR MESSAGE
                        ;
                        ; SUBORDINATE ROUTINES USED:
                        ;
                        ;       INSERT  - ERROR INSERTION ROUTINE
                        ;       CHKMAX  - ERROR COUNT CHECKING ROUTINE
                        ;       DR5 ERROR MACRO
```

GLOBAL SUBROUTINES SECTION

```
                                        ;
                                        ; FUNCTIONAL SIDE EFFECTS:
                                        ;
                                        ;       NONE.
                                        ;
                                        ; CALLING SEQUENCE:
                                        ;
                                        ;       EITHER FIXED PARAMETERS FOLLOW THE SUBROUTINE CALL :
                                        ;
                                        ;       EG.     CALL    REGTST
                                        ;               177                     ; BIT MASK OF R/W BITS
                                        ;               CSR                     ; REGISTER ADDRESS
                                        ;               200.                    ; FIRST ERROR NUMBER
                                        ;
                                        ;       OR PARAMETERS ARE SET DYNAMICALLY :
                                        ;
                                        ;       EG.     MOV     #177,MASK       ; BIT MASK OF R/W BITS
                                        ;               MOV     CSR,REGADD      ; REGISTER ADDRESS
                                        ;               MOV     #200.,ERRNBR    ; FIRST ERROR NUMBER
                                        ;               CALL    REGTS1
                                        ;
                                        ;--
                                        REGTST::
010402  017637  000000  010754          MOV     @(SP),MASK              ; GET R/W BIT MASK
010410  062716  000002                  ADD     #2,(SP)                 ; JUMP OVER ARGUMENT
010414  017637  000000  010760          MOV     @(SP),REGADD            ; GET REGISTER ADDRESS
010422  062716  000002                  ADD     #2,(SP)                 ; JUMP OVER ARGUMENT
010426  017637  000000  007200          MOV     @(SP),ERRNBR            ; GET FIRST ERROR NUMBER
010434  062716  000002                  ADD     #2,(SP)                 ; JUMP OVER ARGUMENT
010440                                  REGTS1::
010440  013737  010754  010756          MOV     MASK,MASCOM             ; SET UP COMPLEMENT
010446  005137  010756                  COM     MASCOM                  ; OF R/W BIT MASK
010452  012737  000003  007176          MOV     #3,ERRTYP               ; SET UP FOR SOFT ERROR
010460  012737  010762  007204          MOV     #REGERR,ERRBLK          ; SET UP ERROR MESSAGE ROUTINE
010466  012737  011030  007202          MOV     #ERR1,ERRMSG            ; FIRST ERROR MESSAGE
                                        ;
                                        ; CHECK THAT ALL R/W BITS CAN BE SET
                                        ;
010474  013737  010754  004062          MOV     MASK,GOOD               ; SET UP EXPECTED DATA
010502                                  BGNSEG
010502  104404                                                                  TRAP    C$BSEG
010504  053777  004062  000246          BIS     GOOD,@REGADD            ; SET ALL R/W BITS
010512  017737  000242  004064          MOV     @REGADD,BAD             ; READ THE RESULT
010520  043737  010756  004064          BIC     MASCOM,BAD              ; KEEP ONLY R/W BITS
010526  023737  004064  004062          CMP     BAD,GOOD                ; ALL R/W BITS SET?
010534  004737  012146                  CALL    INSERT                  ; ALLOW FORCED ERROR PRINTOUT
010540  001401                          BEQ     10$                     ; IF OK, BRANCH
010542                                  ERROR                           ; ELSE REPORT ERROR
010542  104460                                                                  TRAP    C$ERROR
010544                                  10$:    ENDSEG
010544                                                                      10000$:
010544  104405                                                                  TRAP    C$ESEG
                                        ;
                                        ; CHECK THAT ALL R/W BITS CAN BE CLEARED
                                        ;
010546  005037  004062                  CLR     GOOD                    ; SET UP EXPECTED DATA
```

```
2712 010552  005237  007200                    INC     ERRNBR                  ; NEXT ERROR NUMBER
2713 010556  012737  011102  007202            MOV     #ERR2,ERRMSG            ; NEXT ERROR MESSAGE
2714
2715 010564                                    BGNSEG
     010564  104404                                                            TRAP    C$BSEG
2716 010566  043777  010754  000164            BIC     MASK,@REGADD            ; CLEAR ALL R/W BITS
2717 010574  017737  000160  004064            MOV     @REGADD,BAD             ; READ THE RESULT
2718 010602  043737  010756  004064            BIC     MASCOM,BAD              ; KEEP ONLY R/W BITS
2719 010610  023737  004064  004062            CMP     BAD,GOOD                ; ALL R/W BITS CLEAR?
2720 010616  004737  012146                    CALL    INSERT                  ; ALLOW FORCED ERROR PRINTOUT
2721 010622  001401                            BEQ     20$                     ; IF OK, BRANCH
2722 010624                                    ERROR                           ; ELSE REPORT ERROR
     010624  104460                                                            TRAP    C$ERROR
2723 010626                            20$:    ENDSEG                                  10001$:
     010626                                                                    TRAP    C$ESEG
     010626  104405
2724                                           ;
2725                                           ; CHECK THAT EACH R/W BIT CAN BE SET
2726                                           ;
2727 010630  005237  007200                    INC     ERRNBR                  ; NEXT ERROR NUMBER
2728 010634  012737  011160  007202            MOV     #ERR3,ERRMSG            ; NEXT ERROR MESSAGE
2729 010642  012737  000001  004062            MOV     #1,GOOD                 ; FIRST BIT TO TEST
2730 010650  033737  004062  010754    30$:    BIT     GOOD,MASK               ; R/W BIT?
2731 010656  001004                            BNE     50$                     ; IF YES, TEST IT
2732 010660  006337  004062            40$:    ASL     GOOD                    ; ELSE FIND NEXT R/W BIT
2733 010664  103427                            BCS     70$                     ; IF ALL DONE, RETURN
2734 010666  000770                            BR      30$                     ; ELSE CHECK IF NEXT IS R/W
2735
2736 010670                            50$:    BGNSEG
     010670  104404                                                            TRAP    C$BSEG
2737 010672  043777  010754  000060            BIC     MASK,@REGADD            ; CLEAR ALL R/W BITS
2738 010700  053777  004062  000052            BIS     GOOD,@REGADD            ; SET ONE BIT
2739 010706  017737  000046  004064            MOV     @REGADD,BAD             ; READ IT BACK
2740 010714  043737  010756  004064            BIC     MASCOM,BAD              ; KEEP ONLY R/W BITS
2741 010722  023737  004064  004062            CMP     BAD,GOOD                ; ALL OTHER BITS CLEAR?
2742 010730  004737  012146                    CALL    INSERT                  ; ALLOW FORCED ERROR PRINTOUT
2743 010734  001401                            BEQ     60$                     ; IF OK, BRANCH
2744 010736                                    ERROR                           ; ELSE REPORT ERROR
     010736  104460                                                            TRAP    C$ERROR
2745 010740                            60$:    ENDSEG                                  10002$:
     010740                                                                    TRAP    C$ESEG
     010740  104405
2746 010742  000746                            BR      40$                     ; TEST NEXT BIT
2747
2748 010744  043777  010754  000006    70$:    BIC     MASK,@REGADD            ; LEAVE THE R/W BITS CLEAR
2749 010752  000207                            RETURN
2750
2751
2752 010754  000000                    MASK::  .WORD   0                       ; BIT MASK OF READ/WRITE BITS
2753 010756  000000                    MASCOM: .WORD   0                       ; COMPLEMENT OF MASK
2754 010760  000000                    REGADD::.WORD   0                       ; ADDRESS OF REGISTER TO BE TESTED
2755
2756 010762                                    BGNMSG  REGERR
     010762                                                                                REGERR::
2757 010762                                    PRINTB  #REGMSG,REGADD,GOOD,BAD,MASK
     010762  013746  010754                                                    MOV     MASK,-(SP)
     010766  013746  004064                                                    MOV     BAD,-(SP)
```

GLOBAL SUBROUTINES SECTION

```
        010772  013746  004062                                                  MOV     GOOD,-(SP)
        010776  013746  010760                                                  MOV     REGADD,-(SP)
        011002  012746  011247                                                  MOV     #REGMSG,-(SP)
        011006  012746  000005                                                  MOV     #5,-(SP)
        011012  010600                                                          MOV     SP,R0
        011014  104414                                                          TRAP    C$PNTB
        011016  062706  000014                                                  ADD     #14,SP
  2758  011022  004737  011342                JSR     PC,CHKMAX               ; CHECK FOR TOO MANY ERRORS
  2759  011026                                ENDMSG
        011026                                                          L10015:
        011026  104423                                                          TRAP    C$MSG
  2760
  2761                                        .NLIST BEX
  2762
  2763  011030     122     105     107  RERR1:  .ASCIZ  %REGISTER READ/WRITE BITS COULD NOT BE SET%
  2764  011102     122     105     107  RERR2:  .ASCIZ  %REGISTER READ/WRITE BITS COULD NOT BE CLEARED%
  2765  011160     122     105     107  RERR3:  .ASCIZ  %REGISTER READ/WRITE BITS COULD NOT BE INDIVIDUALLY SET%
  2766
  2767  011247     045     101     101  REGMSG: .ASCIZ  .%AADDRESS: %06%A, GOOD: %06%A, BAD: %06%A, R/W BITS: %06%N.
  2768
  2769                                        .LIST BEX
  2770                                        .EVEN
```

```
2772                            ; SUBROUTINE CHKMAX - ERROR COUNT CHECKING ROUTINE.
2773                            ;
2774                            ;++
2775                            ; FUNCTIONAL DESCRIPTION:
2776                            ;
2777                            ;       SUBROUTINE TO UPDATE UNIT ERROR COUNT. IF THE PROGRAM IS LOOPING
2778                            ;       ON AN ERROR, THE SUBROUTINE DOES NOTHING. OTHERWISE, THE ERROR
2779                            ;       COUNT FOR THE UNIT IS INCREMENTED. IF THE ERROR COUNT EXCEEDS 5
2780                            ;       AND THE USER FLAG EVL HAS BEEN SELECTED AND THE FLAG IDU IS NOT
2781                            ;       SELECTED, THE UNIT IS DROPPED FROM THE TEST CYCLE.
2782                            ;
2783                            ; INPUTS:
2784                            ;
2785                            ;       NONE.
2786                            ;
2787                            ; IMPLICIT INPUTS:
2788                            ;
2789                            ;       L$LUN CONTAINS THE NUMBER OF THE UNIT CURRENTLY BEING TESTED.
2790                            ;       ECNT IS THE ADDRESS OF THE ERROR COUNT FOR UNIT 0.
2791                            ;
2792                            ; OUTPUTS:
2793                            ;
2794                            ;       NONE.
2795                            ;
2796                            ; IMPLICIT OUTPUTS:
2797                            ;
2798                            ;       THE ERROR COUNT FOR THE LOGICAL UNIT BEING TESTED IS
2799                            ;       INCREMENTED IF THE PROGRAM IS NOT LOOPING.
2800                            ;
2801                            ; SUBORDINATE ROUTINES USED:
2802                            ;
2803                            ;       NONE.
2804                            ;
2805                            ; FUNCTIONAL SIDE EFFECTS:
2806                            ;
2807                            ;       IF THE ERROR COUNT EXCEEDS 5 AND THE USER EVL FLAG IS SELECTED,
2808                            ;       AND THE 'LOOP ON TEST' AND 'INHIBIT DROPPING OF UNITS' FLAGS ARE
2809                            ;       NOT SELECTED, THE UNIT WILL BE DROPPED FROM TESTING.
2810                            ;
2811                            ; CALLING SEQUENCE:
2812                            ;
2813                            ;       JSR PC,CHKMAX
2814                            ;
2815                            ;--
2816
2817 011342                     CHKMAX::INLOOP                  ; LOOPING ON ERROR?
    011342  104420                                                                  TRAP    C$INLP
2818 011344                             BCOMPLETE 10$           ; IF YES, EXIT
    011344  103436                                                                  BCS     10$
2819
2820 011346  013700  002074            MOV     L$LUN,R0        ; GET CURRENT UNIT
2821 011352  006300                    ASL     R0              ; CONVERT TO ERROR COUNT OFFSET
2822 011354  005260  003734            INC     ECNT(R0)        ; UPDATE THE ERROR COUNT
2823 011360  026027  003734  000005    CMP     ECNT(R0),#5     ; TOO MANY ERRORS?
2824 011366  003425                    BLE     10$             ; IF NOT, JUMP
2825
2826 011370                            RFLAGS  R0              ; GET OPERATOR FLAGS
```

GLOBAL SUBROUTINES SECTION

```
      011370  104421                                                          TRAP    C$RFLA
2827  011372  032700  000040            BIT     #IDU,R0         ; IS DROPPING INHIBITED?
2828  011376  001021                    BNE     10$             ; IF YES, EXIT
2829  011400  032700  000004            BIT     #EVL,R0         ; EVALUATE FLAG SELECTED ?
2830  011404  001416                    BEQ     10$             ; IF NOT, EXIT
2831
2832  011406                            PRINTF  #NERRS,L$LUN    ; 'TOO MANY ERRORS'
      011406  013746  002074                                                  MOV     L$LUN, (SP)
      011412  012746  011444                                                  MOV     #NERRS,-(SP)
      011416  012746  000002                                                  MOV     #2,-(SP)
      011422  010600                                                          MOV     SP,R0
      011424  104417                                                          TRAP    C$PNTF
      011426  062706  000006                                                  ADD     #6,SP
2833  011432                            DODU    L$LUN           ; DROP THE UNIT
      011432  013700  002074                                                  MOV     L$LUN,R0
      011436  104451                                                          TRAP    C$DODU
2834
2835  011440                            DOCLN                   ; END THE SUBPASS
      011440  104444                                                          TRAP    C$DCLN
2836
2837  011442  000207                10$:RTS     PC
2838
2839                                    .NLIST  BEX
2840  011444     045     116     045  NERRS:  .ASCIZ  /%N%AMORE THAN 5 ERRORS ON UNIT%D2/
2841                                    .LIST   BEX
2842                                    .EVEN
2843
2844
2845
```

GLOBAL SUBROUTINES SECTION

```
2847                                    ; SUBROUTINES WT25M, WT500 AND WT25 - DELAY ROUTINES.
2848                                    ;
2849                                    ;++
2850                                    ; FUNCTIONAL DESCRIPTION:
2851                                    ;
2852                                    ;       SUBROUTINE TO WAIT FOR 25 MILLISECONDS, 500 MICROSECONDS OR 25
2853                                    ;       MICROSECONDS.
2854                                    ;
2855                                    ;       NOTE. BECAUSE OF THE SMALL NUMBER OF PROGRAM WAIT LOOPS USED FOR
2856                                    ;             THE 25 MICROSECOND COUNTER, THE ACCURACY OF THE WT25 ROUTINE
2857                                    ;             IS LOW. THE DELAY MAY LAST UP TO 50 MICROSECONDS ON SOME
2858                                    ;             SLOW PROCESSORS.
2859                                    ;
2860                                    ; INPUTS:
2861                                    ;
2862                                    ;       NONE.
2863                                    ;
2864                                    ; IMPLICIT INPUTS:
2865                                    ;
2866                                    ;       THE VARIABLES CNT25M, CNT500, AND CNT25 MUST HAVE BEEN SET UP BY
2867                                    ;       ROUTINE SETCLK.
2868                                    ;
2869                                    ; OUTPUTS:
2870                                    ;
2871                                    ;       NONE.
2872                                    ;
2873                                    ; IMPLICIT OUTPUTS:
2874                                    ;
2875                                    ;       NONE.
2876                                    ;
2877                                    ; SUBORDINATE ROUTINES USED:
2878                                    ;
2879                                    ;       NONE.
2880                                    ;
2881                                    ; FUNCTIONAL SIDE EFFECTS:
2882                                    ;
2883                                    ;       NONE.
2884                                    ;
2885                                    ; CALLING SEQUENCE:
2886                                    ;
2887                                    ;       JSR     PC,WT25M        ; WAIT FOR 25 MILLISECONDS
2888                                    ;    OR JSR     PC,WT500        ; WAIT FOR 500 MICROSECONDS
2889                                    ;    OR JSR     PC,WT25         ; WAIT FOR 25 MICROSECONDS
2890                                    ;
2891                                    ;--
2892
2893 011506  013700  011534    WT25M:: MOV     CNT25M,R0       ; GET 25 MILLISECOND WAIT COUNT
2894 011512  000405                    BR      WAIT            ;
2895
2896 011514  013700  011536    WT500:: MOV     CNT500,R0       ; GET 500 MICROSECOND WAIT COUNT
2897 011520  000402                    BR      WAIT            ;
2898
2899 011522  013700  011540    WT25::  MOV     CNT25,R0        ; GET 25 MICROSECOND WAIT COUNT
2900
2901 011526  005300            WAIT:   DEC     R0              ; ALL DONE?
2902 011530  001376                    BNE     WAIT            ; IF NOT, WAIT SOME MORE
2903 011532  000207                    RTS     PC              ; ELSE RETURN
```

GLOBAL SUBROUTINES SECTION

```
2904
2905 011534  000000          CNT25M::.WORD   0       ; COUNTER FOR 25 MILLISECOND DELAY
2906 011536  000000          CNT500::.WORD   0       ; COUNTER FOR 500 MICROSECOND DELAY
2907 011540  000000          CNT25::.WORD    0       ; COUNTER FOR 25 MICROSECOND DELAY
2908
```

GLOBAL SUBROUTINES SECTION

```
2910                                    ; SUBROUTINE CRLF - ROUTINE TO PRINT CARRIAGE RETURN, LINE FEED.
2911                                    ;
2912                                    ;**
2913                                    ; FUNCTIONAL DESCRIPTION:
2914                                    ;
2915                                    ;       PRINTS A CARRIAGE RETURN AND LINE FEED.
2916                                    ;
2917                                    ; INPUTS:
2918                                    ;
2919                                    ;       NONE.
2920                                    ;
2921                                    ; IMPLICIT INPUTS:
2922                                    ;
2923                                    ;       NONE.
2924                                    ;
2925                                    ; OUTPUTS:
2926                                    ;
2927                                    ;       A CARRIAGE RETURN AND LINE FEED ARE PRINTED.
2928                                    ;
2929                                    ; IMPLICIT OUTPUTS:
2930                                    ;
2931                                    ;       NONE.
2932                                    ;
2933                                    ; SUBORDINATE ROUTINES USED:
2934                                    ;
2935                                    ;       SUPERVISOR PRINTF MACRO.
2936                                    ;
2937                                    ; FUNCTIONAL SIDE EFFECTS:
2938                                    ;
2939                                    ;       NONE.
2940                                    ;
2941                                    ; CALLING SEQUENCE:
2942                                    ;
2943                                    ;       JSR     PC,CRLF
2944                                    ;
2945                                    ;--
2946
2947 011542                            CRLF::
2948 011542                                    PRINTF  #LF
      011542  012746  011564                                            MOV     #LF,-(SP)
      011546  012746  000001                                            MOV     #1,-(SP)
      011552  010600                                                    MOV     SP,R0
      011554  104417                                                    TRAP    C$PNTF
      011556  062706  000004                                            ADD     #4,SP
2949 011562  000207                            RTS     PC
2950
2951 011564     045     116     000    LF:     .ASCIZ  /%N/
2952                                           .EVEN
```

GLOBAL SUBROUTINES SECTION

```
                        ; SUBROUTINE WRDY - SUBROUTINE TO WAIT FOR OPERATOR READY
                        ;
                        ;++
                        ; FUNCTIONAL DESCRIPTION:
                        ;
                        ;       THIS PRINTS A MESSAGE FOR THE OPERATOR TO TYPE 'CARRIAGE RETURN'
                        ;       TO CONTINUE. THE ROUTINE IS NORMALLY USED TO ALLOW A MESSAGE TO
                        ;       BE READ BEFORE PROCEDING.
                        ;
                        ;       IF MANUAL INTERVENTION IS NOT ALLOWED, THE ROUTINE DOES NOTHING.
                        ;
                        ; INPUTS:
                        ;
                        ;       NONE.
                        ;
                        ; IMPLICIT INPUTS:
                        ;
                        ;       NONE.
                        ;
                        ; OUTPUTS:
                        ;
                        ;       'TYPE 'CARRIAGE RETURN' TO CONTINUE OR 'CONRTOL C' TO ABORT.
                        ;
                        ; IMPLICIT OUTPUTS:
                        ;
                        ;       NONE.
                        ;
                        ; SUBORDINATE ROUTINES USED:
                        ;
                        ;       SUPERVISOR GMANID MACRO.
                        ;
                        ; FUNCTIONAL SIDE EFFECTS:
                        ;
                        ;       NONE.
                        ;
                        ; CALLING SEQUENCE:
                        ;
                        ;       JSR     PC,WRDY
                        ;
                        ;--
                        ;
011570                  WRDY::
011570                          MANUAL                                  ; IS MANUAL INTERVENTION ALLOWED ?
011570  104450                                                                  TRAP    C$MANI
011572                          BNCOMPLETE 10$                          ; IF NOT, EXIT
011572  103010                                                                  BCC     10$
011574                          GMANID  WRDY1,WFLG,A,377,0,1,YES        ; 'TYPE RETURN TO CONTINUE
011574  104443                                                                  TRAP    C$GMAN
011576  000406                                                                  BR      10000$
011600  011616                                                                  .WORD   WFLG
011602  000152                                                                  .WORD   T$CODE
011604  011620                                                                  .WORD   WRDY1
011606  000377                                                                  .WORD   377
011610  000000                                                                  .WORD   T$LOLIM
011612  000001                                                                  .WORD   T$HILIM
011614                                                                  10000$:
011614  000207                  10$:    RTS     PC
```

GLOBAL SUBROUTINES SECTION

```
3000
3001 011616  000000                  WFLG:   .WORD   0               ; FLAG FOR WARNING MESSAGE INPUT
3002
3003                                          .NLIST  BEX
3004 011620     124     131     120  WRDY1:  .ASCIZ  /TYPE "CARRIAGE RETURN" TO CONTINUE OR "CONTROL C" TO ABORT./
3005                                          .LIST   BEX
3006                                          .EVEN
```

GLOBAL SUBROUTINES SECTION

```
                        ; SUBROUTINE SELECT - TEST SELECT ROUTINE
                        ;
                        ;**
                        ; FUNCTIONAL DESCRIPTION:
                        ;
                        ;       THIS IS CALLED BY EACH TEST TO DECIDE WHETHER THE TEST SHOULD
                        ;       BE RUN BASED ON THE DEVICE TYPE AND THE TEST MODE SELECTED IN
                        ;       THE STARTUP QUESTIONS. A TEST SELECT MASK SUPPLIED BY THE TEST
                        ;       IS COMPARED WITH A CONTROL MASK SET UP BY THE INITIALISATION
                        ;       ROUTINE TO DECIDE WHETHER THE TEST IS RUN.
                        ;
                        ;       IF THE SOFTWARE FAULT INSERTION FLAG SFI IS SET, ALL NON-SPECIFIC
                        ;       TESTS ARE SELECTED.
                        ;
                        ; INPUTS:
                        ;
                        ;       THE LOCATION FOLLOWING THE SUBROUTINE CALL CONTAINS THE TEST
                        ;       SELECT MASK IN THE FOLLOWING FORMAT :
                        ;
                        ;               BIT 0 IS SET IF DIGITAL INPUT MODULES ARE TO BE TESTED
                        ;               BIT 1 IS SET IF DIGITAL OUTPUT MODULES ARE TO BE TESTED
                        ;               BIT 2 IS SET IF ANALOGUE INPUT MODULES ARE TO BE TESTED
                        ;               BIT 3 IS SET IF ANALOGUE OUTPUT MODULES ARE TO BE TESTED
                        ;               BIT 4 IS SET TO FORCE TESTING OF MODULES WHICH ARE NOT
                        ;               IDENTIFIED AS ANALOGUE OR DIGITAL
                        ;               BITS 5, 6 AND 7 ARE UNUSED
                        ;               BIT 8 IS SET TO INDICATE A BASIC INTERNAL LOGIC TEST
                        ;               BIT 9 IS SET FOR FIELD INPUT/OUTPUT TESTS
                        ;               BIT 10 IS SET FOR LOOPBACK TESTS
                        ;               BIT 11 IS SET FOR ANALOGUE INPUT/OUTPUT TESTS USED BY
                        ;               MANUFACTURING AND FIELD SERVICE
                        ;               BIT 12 IS SET FOR SPECIFICALLY SELECTABLE TESTS
                        ;               BITS 13, 14 AND 15 ARE UNUSED
                        ;
                        ;       THE SECOND LOCATION FOLLOWING THE SUBROUTINE CALL CONTAINS THE
                        ;       ADDRESS OF A TEST HEADER MESSAGE TO BE PRINTED IF THE TEST IS
                        ;       SELECTED AND THE USER 'PNT' FLAG IS SELECTED.
                        ;
                        ; IMPLICIT INPUTS:
                        ;
                        ;       CONMSK - TEST CONTROL MASK SET UP BY INIT CODE AT THE BEGINING
                        ;                OF EACH SUBPASS. THE FORMAT IS AS FOLLOWS :
                        ;
                        ;                       BIT 0 IS SET IF UUT IS DIGITAL INPUT
                        ;                       BIT 1 IS SET IF UUT IS DIGITAL OUTPUT
                        ;                       BIT 2 IS SET IF UUT IS ANALOGUE INPUT
                        ;                       BIT 3 IS SET IF UUT IS ANALOGUE OUTPUT
                        ;                       BIT 4 IS SET IF UUT IS NONE OF THE ABOVE
                        ;                       BITS 5, 6 AND 7 ARE UNUSED
                        ;                       BIT 8 IS ALWAYS SET TO SELECT BASIC INTERNAL
                        ;                       LOGIC TESTS
                        ;                       BIT 9 SET TO SELECT FIELD INPUT/OUTPUT TESTS
                        ;                       BIT 10 IS SET IF LOOPBACK TESTING IS SELECTED
                        ;                       AND ALLOWED FOR CURRENT UUT
                        ;                       BIT 11 IS SET IF MANUFACTURING HAVE SELECTED LOOPBACK
                        ;                       AND I/O TESTS
                        ;                       BIT 12 IS SET IF A SPECIFICALLY SELECTABLE TEST
```

```
3065                    ;                       IS CHOSEN
3066                    ;                       BITS 13, 14 AND 15 ARE UNUSED
3067                    ;
3068                    ;       SFI - IF THIS IS NON ZERO, ALL TESTS ARE SELECTED.
3069                    ;
3070                    ;
3071                    ; OUTPUTS:
3072                    ;
3073                    ;       IF THE TEST MATCHES THE DEVICE TYPE AND TEST MODE CHOSEN VIA THE
3074                    ;       STARTUP QUESTIONS, THE ROUTINE EXITS WITH THE CARRY BIT CLEAR.
3075                    ;       IN THIS CASE, IF THE 'PNT' FLAG IS SELECTED, THE TEST HEADER IS
3076                    ;       PRINTED AND THE FLAGS TSTFLG AND TSUFLG ARE SET TO SHOW THAT A
3077                    ;       TEST HAS BEEN SELECTED.
3078                    ;
3079                    ;       IF THE TEST IS NOT SELECTED, THE CARRY BIT IS SET AND, IF THE
3080                    ;       'PNT' FLAG IS SELECTED, A MESSAGE 'TEST DISABLED BY STARTUP
3081                    ;       QUESTIONS' IS PRINTED.
3082                    ;
3083                    ;       IF THE TEST IS NOT SPECIFICALLY SELECTABLE (BIT 11 IS CLEAR IN
3084                    ;       THE TEST SELECT MASK), BIT 11 IS CLEARED IN THE CONTROL MASK TO
3085                    ;       PREVENT SUBSEQUENT SPECIFICALLY SELECTABLE TESTS FROM BEING RUN.
3086                    ;
3087                    ;       R0, R1 AND R2 ARE CORRUPTED.
3088                    ;
3089                    ; IMPLICIT OUTPUTS:
3090                    ;
3091                    ;       NONE.
3092                    ;
3093                    ; SUBORDINATE ROUTINES USED:
3094                    ;
3095                    ;       NONE.
3096                    ;
3097                    ; FUNCTIONAL SIDE EFFECTS:
3098                    ;
3099                    ;       NONE.
3100                    ;
3101                    ; CALLING SEQUENCE:
3102                    ;
3103                    ;       FIXED PARAMETERS FOLLOW THE SUBROUTINE CALL :
3104                    ;
3105                    ;       EG.     CALL    SELECT
3106                    ;               777                     ; TEST SELECT MASK (BASIC TEST
3107                    ;                                       ; ON ALL DEVICE TYPES
3108                    ;               TNAME                   ; ADDRESS OF TEST HEADER
3109                    ;               BCS     TSTEND          ; BRANCH IF TEST NOT SELECTED
3110                    ;
3111                    ;--
3112
3113 011714
3114 011714  017601  000000    SELECT::MOV     @(SP),R1                ; SAVE TEST SELECT MASK
3115 011720  062716  000002            ADD     #2,(SP)                 ; JUMP OVER THE ARGUEMENT
3116 011724  017602  000000            MOV     @(SP),R2                ; SAVE TEST HEADER ADDRESS
3117 011730  062716  000002            ADD     #2,(SP)                 ; JUMP OVER THE ARGUEMENT
3118
3119 011734                            RFLAGS  R0                      ; READ OPERATOR FLAGS INTO R0
     011734  104421                                                                  TRAP    C$RFLA
3120
```

GLOBAL SUBROUTINES SECTION

```
3121 011736  032701  010000            BIT     #10000,R1          ; SPECIFICALLY SELECTABLE TEST ?
3122 011742  001003                    BNE     10$                ; IF YES, BRANCH
3123 011744  042737  010000  004132    BIC     #10000,CONMSK      ; ELSE PREVENT SUCH TESTS
3124 011752  005737  004066      10$:  TST     SFI                ; SOFTWARE FAULT INSERTION ?
3125 011756  001007                    BNE     20$                ; IF YES, SELECT THE TEST
3126 011760  130137  004132            BITB    R1,CONMSK          ; IS DEVICE THE CORRECT TYPE ?
3127 011764  001426                    BEQ     30$                ; IF NOT, BRANCH
3128 011766  105001                    CLRB    R1                 ; IF YES, DISCARD LOW BYTE
3129 011770  030137  004132            BIT     R1,CONMSK          ; AND CHECK TEST TYPE
3130 011774  001422                    BEQ     30$                ; IF WRONG, BRANCH
3131
3132                               ; TEST IS SELECTED
3133
3134 011776  012737  000001  004054  20$:  MOV     #1,TSTFLG          ; FLAG THAT TEST IS SELECTED
3135 012004  012737  000001  004056        MOV     #1,TSUFLG          ;
3136
3137 012012  032700  001000            BIT     #PNT,R0            ; PRINT TEST HEADER ?
3138 012016  001425                    BEQ     50$                ; IF NOT, EXIT (CARRY IS CLEAR)
3139 012020                            PRINTF  R2                 ; ELSE PRINT THE HEADER
     012020  010246                                                        MOV     R2,-(SP)
     012022  012746  000001                                                MOV     #1,-(SP)
     012026  010600                                                        MOV     SP,R0
     012030  104417                                                        TRAP    C$PNTF
     012032  062706  000004                                                ADD     #4,SP
3140 012036  000241                    CLC                        ; CLEAR THE CARRY
3141 012040  000414                    BR      50$                ; AND EXIT
3142
3143                               ; TEST IS NOT SELECTED
3144
3145 012042  032700  001000      30$:  BIT     #PNT,R0            ; PRINT TEST HEADER ?
3146 012046  001410                    BEQ     40$                ; IF NOT, EXIT
3147 012050                            PRINTF  #TNA               ; ELSE PRINT 'NOT APPLICABLE'
     012050  012746  012074                                                MOV     #TNA,-(SP)
     012054  012746  000001                                                MOV     #1,-(SP)
     012060  010600                                                        MOV     SP,R0
     012062  104417                                                        TRAP    C$PNTF
     012064  062706  000004                                                ADD     #4,SP
3148 012070  000261                    SEC                        ; SET THE CARRY BIT
3149
3150 012072  000207                    RETURN                     ; COMMON RETURN
3151
3152                                   .NLIST  BEX
3153 012074      045      101      040  TNA:    .ASCIZ  /%A  TEST DISABLED BY STARTUP QUESTIONS%N/
3154                                   .LIST   BEX
3155                                   .EVEN
```

GLOBAL SUBROUTINES SECTION

```
                                ; SUBROUTINE INSERT - SUBROUTINE TO FORCE ERROR PRINTOUTS
                                ;
                                ;++
                                ; FUNCTIONAL DESCRIPTION:
                                ;
                                ;       THIS SUBROUTINE CAN BE USED TO FORCE PRINTOUT OF ERROR MESSAGES
                                ;       FOR QUALITY CHECKING. IF THE FLAG 'SFI' IS NONE ZERO, THE BRANCH
                                ;       INSTRUCTION FOLLOWING THE SUBROUTINE CALL IS SKIPPED OVER,
                                ;       CAUSING THE ERROR MESSAGE TO BE PRINTED. IF 'SFI' IS SET TO 1,
                                ;       THE ADDRESS OF THE SUBROUTINE CALL IS COMPARED WITH THAT OF THE
                                ;       LAST CALL AND, IF IT HAS NOT CHANGED, THE MESSAGE IS NOT
                                ;       PRINTED.
                                ;
                                ; INPUTS:
                                ;
                                ;       SFI - IF ZERO, THE ROUTINE DOES NOTHING.
                                ;             IF ONE, ERROR MESSAGES ARE PRINTED ONCE.
                                ;             IF ANY OTHER VALUE, ERROR MESSAGES ARE ALWAYS PRINTED.
                                ;
                                ; IMPLICIT INPUTS:
                                ;
                                ;       SEE CALLING SEQUENCE.
                                ;
                                ; OUTPUTS:
                                ;
                                ;       LASTFA - IF THE ERROR MESSAGE IS TO BE PRINTED ONCE ONLY, LASTFA
                                ;                IS LOADED WITH THIS SUBROUTINE RETURN ADDRESS.
                                ;
                                ; IMPLICIT OUTPUTS:
                                ;
                                ;       NONE.
                                ;
                                ; SUBORDINATE ROUTINES USED:
                                ;
                                ;       NONE.
                                ;
                                ; FUNCTIONAL SIDE EFFECTS:
                                ;
                                ;       IF 'SFI' IS NONE ZERO, THE ROUTINE RETURN ADDRESS IS INCREMENTED
                                ;       BY ONE WORD.
                                ;
                                ; CALLING SEQUENCE:
                                ;
                                ;       A ONE WORD BRANCH INSTRUCTION MUST FOLLOW THE SUBROUTINE CALL
                                ;       BEFORE THE ERROR PRINT CALL.
                                ;
                                ;       EG.     CMP     BAD,GOOD        ; REGISTER CORRECT ?
                                ;               CALL    INSERT          ; SKIP BRANCH IF SFI FLAG SET
                                ;               BEQ     10$             ; BRANCH IF REGISTER CORRECT
                                ;               ERROR                   ; ELSE PRINT OUT ERROR MESSAGE
                                ;
                                ;
012146                          INSERT::
012146  106746                          MFPS    -(SP)                   ; SAVE CONDITION CODES
012150  023727  004066  000001          CMP     SFI,#1                  ; INSERT FAULTS ?
012156  103413                         BLO     20$                     ; IF NOT, BRANCH
```

GLOBAL SUBROUTINES SECTION

```
3214 012160  001007                          BNE     10$                 ; IF ALWAYS, BRANCH
3215 012162  026637  000002  012212          CMP     2(SP),LASTFA        ; IS THIS FAULT ALREADY PRINTED?
3216 012170  001406                          BEQ     20$                 ; IF YES, EXIT
3217 012172  016637  000002  012212          MOV     2(SP),LASTFA        ; ELSE, SAVE FAULT ADDRESS
3218 012200  062766  000002  000002  10$:    ADD     #2,2(SP)            ; SKIP BRANCH TO FORCE PRINTOUT
3219 012206  106426                  20$:    MTPS    (SP)+               ; RESTORE CONDITION CODES
3220 012210  000207                          RETURN                      ; AND RETURN
3221
3222 012212  000000                  LASTFA: .WORD   0                   ; ADDRESS OF ROUTINE CALL
3223
```

GLOBAL SUBROUTINES SECTION

```
3225                    ; SUBROUTINE CONFIG - ROUTINE TO FIND THE DEVICE CONFIGURATION AUTOMATICALLY.
3226                    ;
3227                    ;++
3228                    ; FUNCTIONAL DESCRIPTION:
3229                    ;
3230                    ;       THIS ROUTINE SEARCHES THE IDV/IAV-11 ADDRESS RANGE (171000-171770) FOR A
3231                    ;       RESPONDING ADDRESS. FOR THE FIRST ADDRESS ON A 4 WORD BOUNDARY (171XX0)
3232                    ;       WHICH DOES NOT CAUSE AN NXM TRAP, AN ENTRY IS MADE IN THE HARDWARE
3233                    ;       P TABLE FOR UNIT L$LUN. FOR ADDRESSES OVER 171400, A VECTOR IS
3234                    ;       ASSUMED BASED ON THE LOW 8 BITS OF THE DEVICE ADDRESS.
3235                    ;
3236                    ;       EACH CALL TO THE ROUTINE WILL CAUSE ONE MORE UNIT TO BE SEARCHED FOR.
3237                    ;       IF THE UNIT FOUND IS THE LAST IN THE IDV/IAV-11 RANGE, L$UNITS IS SET TO
3238                    ;       THE TOTAL NUMBER OF UNITS. IF NO UNIT IS FOUND, THE PROGRAM EXITS
3239                    ;       WITH THE CARRY BIT SET AND L$UNIT SET TO L$LUN.
3240                    ;
3241                    ;       MODULES WITH MODE REGISTER CONTENTS NOT CORRESPONDING TO AN IDV/IAV11
3242                    ;       ARE SET UP, BUT CAUSE AN 'UNIDENTIFIED MODULE' MESSAGE TO BE OUTPUT.
3243                    ;
3244                    ; INPUTS:
3245                    ;
3246                    ;       L$LUN - NUMBER FOR THE NEXT UNIT FOUND.
3247                    ;
3248                    ; IMPLICIT INPUTS:
3249                    ;
3250                    ;       STADD MUST BE SET TO 171000 PRIOR TO THE FIRST CALL TO INITIALISE
3251                    ;       THE SEARCH AREA.
3252                    ;
3253                    ;       ADDRESSES DEFINED BY "IXSTA" TO "IXEND" OF THE I/O PAGE ARE READ.
3254                    ;
3255                    ;       THE WORD L$LUN*2 AFTER LABEL GPADD MUST CONTAIN THE PARAMETER
3256                    ;       TABLE ADDRESS FOR THE UNIT.
3257                    ;
3258                    ; OUTPUTS:
3259                    ;
3260                    ;       THE HARDWARE P TABLE AND L$UNIT ARE SET UP TO INCLUDE UP TO 16
3261                    ;       UNITS FOUND IN THE ABOVE ADDRESS RANGE.
3262                    ;
3263                    ;       A MESSAGE 'UNIDENTIFIED MODULE FOUND AT ADDRESS NNNNNN' MAY BE
3264                    ;       PRINTED.
3265                    ;
3266                    ; IMPLICIT OUTPUTS:
3267                    ;
3268                    ;       IF THE UNIT FOUND IS THE LAST IN THE IDV/IAV 11 RANGE, L$UNIT IS SET UP
3269                    ;       TO CONTAIN THE TOTAL NUMBER OF UNITS FOUND (L$LUN+1).
3270                    ;
3271                    ;       IF NO MORE UNITS ARE FOUND, THE CARRY BIT IS SET AND L$LUN IS
3272                    ;       PLACED IN L$UNIT.
3273                    ;
3274                    ; SUBORDINATE ROUTINES USED:
3275                    ;
3276                    ;       NXM - NON EXISTANT MEMORY TRAP ROUTINE.
3277                    ;       WRDY - ROUTINE TO WAIT FOR OPERATOR TO TYPE 'RETURN'.
3278                    ;
3279                    ; FUNCTIONAL SIDE EFFECTS:
3280                    ;
3281                    ;       NXMFLG MAY BE SET.
```

```
                                        ;
                                        ; CALLING SEQUENCE:
                                        ;
                                        ;   EG. JSR     PC,CONFIG
                                        ;       BCS     INIUUT          ; IF NO MORE UNITS, START AGAIN
                                        ;
                                        ;--

                                        CONFIG::
012214                                          MOV     R1,-(SP)        ; SAVE R1 TO R4
012214  010146                                  MOV     R2,-(SP)        ;
012216  010246                                  MOV     R3,-(SP)        ;
012220  010346                                  MOV     R4,-(SP)        ;
012222  010446
012224  013702  012514                          MOV     STADD,R2        ; START SEARCH FROM THIS ADDRESS
012230  012737  000001  012516                  MOV     #1,NOUNIT       ; ASSUME NO UNIT WILL BE FOUND
012236                                          SETVEC  #4,#NXM,#340    ; SET UP NXM TRAP
012236  012746  000340                                                          MOV     #340,-(SP)
012242  012746  017266                                                          MOV     #NXM,-(SP)
012246  012746  000004                                                          MOV     #4,-(SP)
012252  012746  000003                                                          MOV     #3,-(SP)
012256  104437                                                                  TRAP    C$SVEC
012260  062706  000010                                                          ADD     #10,SP

012264  005037  004060                  10$:    CLR     NXMFLG          ; CLEAR THE NXM FLAG
012270  005712                                  TST     (R2)            ; CHECK THE ADDRESS
012272  005737  004060                          TST     NXMFLG          ; ANYTHING THERE ?
012276  001006                                  BNE     20$             ; IF NOT  TRY NEXT DEVICE ADDRESS
012300  005737  012516                          TST     NOUNIT          ; IF YES, IS IT THE 2ND ONE THIS CALL ?
012304  001422                                  BEQ     30$             ; IF YES, SET UP THE P TABLE
012306  005037  012516                          CLR     NOUNIT          ; IF IT'S THE FIRST, FLAG UNIT FOUND
012312  010201                                  MOV     R2,R1           ; AND SAVE THE ADDRESS

012314  062702  000010                  20$:    ADD     #10,R2          ; GET THE NEXT ADDRESS
012320  020227  171770                          CMP     R2,#IXEND       ; OUT OF THE IXV11 RANGE ?
012324  003757                                  BLE     10$             ; IF NOT, GO BACK
012326  012702  171000                          MOV     #IXSTA,R2       ; ELSE START AGAIN NEXT CALL
012332  013737  002074  002012                  MOV     L$LUN,L$UNIT    ; SAVE THE UNIT NUMBER
012340  005737  012516                          TST     NOUNIT          ; WERE ANY UNITS FOUND ?
012344  001047                                  BNE     70$             ; IF NOT, EXIT
012346  005237  002012                          INC     L$UNIT          ; ELSE WE HAVE THE LAST UNIT

012352  021127  140000                  30$:    CMP     (R1),#140000    ; IS MODULE ID OK ?
012356  103413                                  BLO     40$             ; IF YES, BRANCH
012360                                          PRINTF  #C01,R1         ; ELSE PRINT 'UNIDENTIFIED'
012360  010146                                                                  MOV     R1,(SP)
012362  012746  012520                                                          MOV     #C01,(SP)
012366  012746  000002                                                          MOV     #2,(SP)
012372  010600                                                                  MOV     SP,R0
012374  104417                                                                  TRAP    C$PNTF
012376  062706  000006                                                          ADD     #6,SP
012402  004737  011570                          JSR     PC,WRDY         ; WAIT FOR OPERATOR TO TYPE 'RETURN'

012406  013700  002074                  40$:    MOV     L$LUN,R0        ; FORM OFFSET FOR LUN
012412  006300                                  ASL     R0              ;
012414  016003  003774                          MOV     GPADD(R0),R3    ; GET P TABLE ADDRESS IN R3
012420  010123                                  MOV     R1,(R3)+        ; SAVE THE DEVICE ADDRESS
```

GLOBAL SUBROUTINES SECTION

```
3327
3328 012422  042701  177000              BIC     #177000,R1          ; CALCULATE THE VECTOR ADDRESS
3329 012426  032701  000400              BIT     #400,R1             ; ADDRESS OVER 171400 ?
3330 012432  001001                      BNE     50$                 ; IF YES, BRANCH
3331 012434  005001                      CLR     R1                  ; ELSE ZERO THE VECTOR
3332 012436  010123              50$:    MOV     R1,(R3)+            ; AND SAVE IT
3333 012440  001402                      BEQ     60$                 ; IF 0, BRANCH
3334 012442  012701  000200              MOV     #200,R1             ; ELSE SET UP DEFAULT PRIORITY
3335 012446  010123              60$:    MOV     R1,(R3)+            ; SAVE THE PRIORITY
3336 012450  005023                      CLR     (R3)+               ; FLAG NOT LOOPED
3337 012452  005023                      CLR     (R3)+               ; NO LOW LEVEL
3338 012454  012723  000003              MOV     #3,(R3)+            ; ALL DEBOUNCE PERIODS
3339 012460  005023                      CLR     (R3)+               ; NO OTHER DEVICE
3340 012462  005023                      CLR     (R3)+               ; OR VECTOR
3341
3342 012464  010237  012514      70$:    MOV     R2,STADD            ; SAVE THE NEXT SEARCH ADDRESS
3343 012470                              CLRVEC  #4                  ; RESTORE THE NXM TRAP CATCHER
     012470  012700  000004                                                  MOV     #4,R0
     012474  104436                                                          TRAP    C$CVEC
3344 012476  012604                      MOV     (SP)+,R4            ; RESTORE R4 TO R1
3345 012500  012603                      MOV     (SP)+,R3            ;
3346 012502  012602                      MOV     (SP)+,R2            ;
3347 012504  012601                      MOV     (SP)+,R1            ;
3348 012506  006237  012516              ASR     NOUNIT              ; IF NO UNIT, SET THE CARRY BIT
3349 012512  000207                      RTS     PC                  ; AND RETURN
3350
3351 012514  171000              STADD:: .WORD   IXSTA               ; START ADDRESS OF SEARCH AREA
3352 012516  000000              NOUNIT: .WORD   0                   ; SET TO SHOW NO UNIT FOUND
3353
3354
3355 012520      045     116     045     C01:    .NLIST  BEX
3356                             .ASCIZ  /<N><A>UNIDENTIFIED MODULE FOUND AT ADDRESS <06><A>./
3357                             .LIST   BEX
                                 .EVEN
```

GLOBAL SUBROUTINES SECTION

```
                        ;+
                        ; SUBROUTINE CONPRI - SUBROUTINE TO PRINT A CONFIGURATION TABLE.
                        ;
                        ;**
                        ; FUNCTIONAL DESCRIPTION:
                        ;
                        ;       THIS ROUTINE PRINTS A CONFIGURATION TABLE OF ALL UNITS LISTED IN
                        ;       THE HARDWARE PARAMETER TABLE. LISTED ARE THE MODE REGISTER ADDRESS,
                        ;       VECTOR, DEVICE TYPE, WHETHER LOOPED AND IF SO, THE ADDRESS AND VECTOR
                        ;       OF THE DEVICE TO WHICH IT IS LOOPED.
                        ;
                        ; INPUTS:
                        ;
                        ;       NONE.
                        ;
                        ; IMPLICIT INPUTS:
                        ;
                        ;       THE HARDWARE P TABLE.
                        ;
                        ;       IF NO UNITS ARE CONFIGURED, THE GLOBAL MESSAGE LABELLED "NODEV"
                        ;       IS PRINTED.
                        ;
                        ; OUTPUTS:
                        ;
                        ;       THE CONFIGURATION TABLE IS PRINTED.
                        ;
                        ; IMPLICIT OUTPUTS:
                        ;
                        ;       IF NO UNITS ARE CONFIGURED (L$UNIT = 0), A MESSAGE 'NO DEVICES
                        ;       FOUND' IS PRINTED.
                        ;
                        ; SUBORDINATE ROUTINES USED:
                        ;
                        ;       NXM - NON EXISTANT MEMORY TRAP ROUTINE.
                        ;       CRLF - LINE FEED PRINT ROUTINE.
                        ;
                        ; FUNCTIONAL SIDE EFFECTS:
                        ;
                        ;       REGISTERS R1 TO R5 ARE CORRUPTED.
                        ;
                        ; CALLING SEQUENCE:
                        ;
                        ;       JSR     PC,CONPRI
                        ;
                        ;-
012600                  CONPRI::
012600                          SETVEC  #4,#NXM,#340            ; CATCH REFERENCES TO NXM
012600  012746  000340                                                  MOV     #340,-(SP)
012604  012746  017266                                                  MOV     #NXM,-(SP)
012610  012746  000004                                                  MOV     #4,-(SP)
012614  012746  000003                                                  MOV     #3,-(SP)
012620  104437                                                          TRAP    C$SVEC
012622  062706  000010                                                  ADD     #10,SP
012626  005737  002012                  TST     L$UNIT                  ; ANY UNITS CONFIGURED ?
012632  001012                          BNE     10$                     ; IF YES, BRANCH
012634                                  PRINTF  #NODEV                  ; ELSE PRINT 'NO DEVICES FOUND'
012634  012746  007250                                                  MOV     #NODEV,-(SP)
```

GLOBAL SUBROUTINES SECTION

```
                012640  012746  000001                                                  MOV     #1,-(SP)
                012644  010600                                                          MOV     SP,R0
                012646  104417                                                          TRAP    C$PNTF
                012650  062706  000004                                                  ADD     #4,SP
3409            012654  000137  013704                  JMP     CONEX           ; AND EXIT
3410
3411            012660                          10$:    PRINTF  #CP1            ; PRINT CONFIGURATION HEADER
                012660  012746  013720                                                  MOV     #CP1,-(SP)
                012664  012746  000001                                                  MOV     #1,-(SP)
                012670  010600                                                          MOV     SP,R0
                012672  104417                                                          TRAP    C$PNTF
                012674  062706  000004                                                  ADD     #4,SP
3412            012700                          PRINTF  #CP1A           ;
                012700  012746  013771                                                  MOV     #CP1A,-(SP)
                012704  012746  000001                                                  MOV     #1,-(SP)
                012710  010600                                                          MOV     SP,R0
                012712  104417                                                          TRAP    C$PNTF
                012714  062706  000004                                                  ADD     #4,SP
3413            012720                          PRINTF  #CP1B           ;
                012720  012746  014043                                                  MOV     #CP1B,-(SP)
                012724  012746  000001                                                  MOV     #1,-(SP)
                012730  010600                                                          MOV     SP,R0
                012732  104417                                                          TRAP    C$PNTF
                012734  062706  000004                                                  ADD     #4,SP
3414            012740                          PRINTF  #CP1C           ;
                012740  012746  014146                                                  MOV     #CP1C,-(SP)
                012744  012746  000001                                                  MOV     #1,-(SP)
                012750  010600                                                          MOV     SP,R0
                012752  104417                                                          TRAP    C$PNTF
                012754  062706  000004                                                  ADD     #4,SP
3415            012760  005001                  CLR     R1              ; START WITH FIRST UNIT
3416            012762  010100          20$:    MOV     R1,R0           ; FORM PARAMETER TABLE OFFSET
3417            012764  006300                  ASL     R0              ;
3418            012766  016002  003774          MOV     GPADD(R0),R2    ; GET THE UNIT P TABLE
3419            012772  012203                  MOV     (R2)+,R3        ; SAVE THE UNIT ADDRESS
3420            012774                          PRINTF  #CP2,R1,R3      ; PRINT UNIT NO. AND ADDRESS
                012774  010346                                                          MOV     R3,-(SP)
                012776  010146                                                          MOV     R1,-(SP)
                013000  012746  014217                                                  MOV     #CP2,-(SP)
                013004  012746  000003                                                  MOV     #3,-(SP)
                013010  010600                                                          MOV     SP,R0
                013012  104417                                                          TRAP    C$PNTF
                013014  062706  000010                                                  ADD     #10,SP
3421            013020  005722                  TST     (R2)+           ; IS THERE A VALID VECTOR ?
3422            013022  001413                  BEQ     30$             ; IF NOT, BRANCH
3423            013024                          PRINTF  #CP3,-2(R2)     ; ELSE PRINT THE VECTOR
                013024  016246  177776                                                  MOV     -2(R2),-(SP)
                013030  012746  014230                                                  MOV     #CP3,-(SP)
                013034  012746  000002                                                  MOV     #2,-(SP)
                013040  010600                                                          MOV     SP,R0
                013042  104417                                                          TRAP    C$PNTF
                013044  062706  000006                                                  ADD     #6,SP
3424            013050  000410                  BR      40$             ;
3425            013052          30$:    PRINTF  #CP4            ; PRINT 'NONE'
                013052  012746  014237                                                  MOV     #CP4,-(SP)
                013056  012746  000001                                                  MOV     #1,-(SP)
                013062  010600                                                          MOV     SP,R0
```

GLOBAL SUBROUTINES SECTION

```
        013064  104417                                                    TRAP    C$PNTF
        013066  062706  000004                                            ADD     #4,SP
3426
3427 013072  005037  004060          40$:    CLR     NXMFLG          ; GET READY FOR NXM TRAP
3428 013076  112305                  MOVB    (R3)+,R5        ; GET MODE REGISTER LOW BYTE
3429 013100  111304                  MOVB    (R3),R4         ; AND HIGH BYTE
3430 013102  042704  177400          BIC     #177400,R4      ; DISCARD REGISTER HIGH BYTE
3431 013106  005737  004060          TST     NXMFLG          ; WAS THERE AN NXM TRAP ?
3432 013112  001421                  BEQ     50$             ; IF NOT, BRANCH
3433 013114                          PRINTF  #CP10           ; ELSE PRINT UNKNOWN ID/MODE
        013114  012746  014400                                            MOV     #CP10,-(SP)
        013120  012746  000001                                            MOV     #1,-(SP)
        013124  010600                                                    MOV     SP,R0
        013126  104417                                                    TRAP    C$PNTF
        013130  062706  000004                                            ADD     #4,SP
3434 013134                          PRINTF  #CP10A          ; AND UNKNOWN MODULE TYPE
        013134  012746  014415                                            MOV     #CP10A,-(SP)
        013140  012746  000001                                            MOV     #1,-(SP)
        013144  010600                                                    MOV     SP,R0
        013146  104417                                                    TRAP    C$PNTF
        013150  062706  000004                                            ADD     #4,SP
3435 013154  000464                  BR      110$            ; AND SEE IF LOOPED
3436
3437 013156                          50$:    PRINTF  #CP5,R4,R5      ; PRINT OUT ID/MODE
        013156  010546                                                    MOV     R5,-(SP)
        013160  010446                                                    MOV     R4,-(SP)
        013162  012746  014251                                            MOV     #CP5,-(SP)
        013166  012746  000003                                            MOV     #3,-(SP)
        013172  010600                                                    MOV     SP,R0
        013174  104417                                                    TRAP    C$PNTF
        013176  062706  000010                                            ADD     #10,SP
3438
3439 013202  020427  000037                  CMP     R4,#37          ; IS MODULE DIGITAL INPUT ?
3440 013206  101003                          BHI     60$             ; IF NOT, BRANCH
3441 013210  012703  014446                  MOV     #DI,R3          ; ELSE SAVE 'DIG. IN' STRING
3442 013214  000421                          BR      90$             ; GO TO PRINT MODULE TYPE
3443 013216  020427  000077          60$:    CMP     R4,#77          ; IS MODULE DIGITAL OUTPUT ?
3444 013222  101003                          BHI     70$             ; IF NOT, BRANCH
3445 013224  012703  014457                  MOV     #DO,R3          ; ELSE SAVE 'DIG OUT' STRING
3446 013230  000413                          BR      90$             ; GO TO PRINT MODULE TYPE
3447 013232  020427  000177          70$:    CMP     R4,#177         ; IS MODULE ANALOGUE INPUT ?
3448 013236  101003                          BHI     80$             ; IF NOT, BRANCH
3449 013240  012703  014470                  MOV     #AI,R3          ; ELSE SAVE 'AN IN' STRING
3450 013244  000405                          BR      90$             ; GO TO PRINT MODULE TYPE
3451 013246  020427  000277          80$:    CMP     R4,#277         ; IS MODULE ANALOGUE OUTPUT ?
3452 013252  101014                          BHI     100$            ; IF NOT, BRANCH
3453 013254  012703  014501                  MOV     #AO,R3          ; ELSE SAVE 'AN OUT' STRING
3454 013260                          90$:    PRINTF  #CP6,R3         ; PRINT OUT DEVICE TYPE
        013260  010346                                                    MOV     R3,-(SP)
        013262  012746  014266                                            MOV     #CP6,-(SP)
        013266  012746  000002                                            MOV     #2,-(SP)
        013272  010600                                                    MOV     SP,R0
        013274  104417                                                    TRAP    C$PNTF
        013276  062706  000006                                            ADD     #6,SP
3455 013302  000411                          BR      110$            ;
3456 013304                          100$:   PRINTF  #CP7            ; PRINT 'CANNOT BE TESTED'
        013304  012746  014274                                            MOV     #CP7,-(SP)
```

GLOBAL SUBROUTINES SECTION

```
        013310  012746  000001                                                  MOV     #1,-(SP)
        013314  010600                                                          MOV     SP,R0
        013316  104417                                                          TRAP    C$PNTF
        013320  062706  000004                                                  ADD     #4,SP
3457    013324  000561                  BR      210$           ; GO TO NEXT DEVICE
3458
3459    013326  005722          110$:   TST     (R2)+          ; SKIP THE PRIORITY
3460    013330  005722                  TST     (R2)+          ; IS DEVICE LOOPED ?
3461    013332  001012                  BNE     120$           ; IF YES, BRANCH
3462    013334                          PRINTF  #CP9           ; ELSE PRINT 'NO'
        013334  012746  014367                                                  MOV     #CP9,-(SP)
        013340  012746  000001                                                  MOV     #1,-(SP)
        013344  010600                                                          MOV     SP,R0
        013346  104417                                                          TRAP    C$PNTF
        013350  062706  000004                                                  ADD     #4,SP
3463    013354  000137  013670                  JMP     210$           ; AND GO TO NEXT DEVICE
3464
3465    013360          120$:   PRINTF  #CP8           ; PRINT 'YES'
        013360  012746  014356                                                  MOV     #CP8,-(SP)
        013364  012746  000001                                                  MOV     #1,-(SP)
        013370  010600                                                          MOV     SP,R0
        013372  104417                                                          TRAP    C$PNTF
        013374  062706  000004                                                  ADD     #4,SP
3466
3467    013400  005037  004060          CLR     NXMFLG         ; GET READY FOR NXM TRAP
3468    013404  005722                  TST     (R2)+          ; SKIP LOW LEVEL QUESTION
3469    013406  005722                  TST     (R2)+          ; SKIP DBOUNCE QUESTION
3470    013410  012203                  MOV     (R2)+,R3       ; GET OTHER MODULE ADDRESS
3471    013412  105723                  TSTB    (R3)+          ; GET ID CODE
3472    013414  111304                  MOVB    (R3),R4        ; INTO R4
3473    013416  042704  177400          BIC     #177400,R4     ; DISCARD REGISTER TOP BYTE
3474    013422  005737  004060          TST     NXMFLG         ; WAS THERE AN NXM TRAP ?
3475    013426  001411                  BEQ     130$           ; IF NOT, BRANCH
3476    013430                          PRINTF  #CP10A         ; ELSE PRINT UNKNOWN OTHER MODULE TYPE
        013430  012746  014415                                                  MOV     #CP10A,(SP)
        013434  012746  000001                                                  MOV     #1,-(SP)
        013440  010600                                                          MOV     SP,R0
        013442  104417                                                          TRAP    C$PNTF
        013444  062706  000004                                                  ADD     #4,SP
3477    013450  000451                  BR      190$           ;
3478
3479    013452  020427  000037  130$:   CMP     R4,#37         ; IS MODULE DIGITAL INPUT ?
3480    013456  101003                  BHI     140$           ; IF NOT, BRANCH
3481    013460  012703  014446          MOV     #DI,R3         ; ELSE SAVE 'DIG. IN' STRING
3482    013464  000421                  BR      170$           ; GO TO PRINT MODULE TYPE
3483    013466  020427  000077  140$:   CMP     R4,#77         ; IS MODULE DIGITAL OUTPUT ?
3484    013472  101003                  BHI     150$           ; IF NOT, BRANCH
3485    013474  012703  014457          MOV     #DO,R3         ; ELSE SAVE 'DIG OUT' STRING
3486    013500  000413                  BR      170$           ; GO TO PRINT MODULE TYPE
3487    013502  020427  000177  150$:   CMP     R4,#177        ; IS MODULE ANALOGUE INPUT ?
3488    013506  101003                  BHI     160$           ; IF NOT, BRANCH
3489    013510  012703  014470          MOV     #AI,R3         ; ELSE SAVE 'AN IN' STRING
3490    013514  000405                  BR      170$           ; GO TO PRINT MODULE TYPE
3491    013516  020427  000277  160$:   CMP     R4,#277        ; IS MODULE ANALOGUE OUTPUT ?
3492    013522  101014                  BHI     180$           ; IF NOT, BRANCH
3493    013524  012703  014501          MOV     #AO,R3         ; ELSE SAVE 'AN OUT' STRING
3494    013530          170$:   PRINTF  #CP6,R3        ; PRINT OUT DEVICE TYPE
```

GLOBAL SUBROUTINES SECTION

```
        013530  010346                                                          MOV     R3,-(SP)
        013532  012746  014266                                                  MOV     #CP6,-(SP)
        013536  012746  000002                                                  MOV     #2,-(SP)
        013542  010600                                                          MOV     SP,R0
        013544  104417                                                          TRAP    C$PNTF
        013546  062706  000006                                                  ADD     #6,SP
3495    013552  000410                 BR      190$            ;
3496    013554                  180$:   PRINTF  #CP10           ; PRINT 'UNKNOWN'
        013554  012746  014400                                                  MOV     #CP10,-(SP)
        013560  012746  000001                                                  MOV     #1,-(SP)
        013564  010600                                                          MOV     SP,R0
        013566  104417                                                          TRAP    C$PNTF
        013570  062706  000004                                                  ADD     #4,SP
3497
3498    013574                  190$:   PRINTF  #CP11,-2(R2)    ; PRINT OTHER MODULE ADDRESS
        013574  016246  177776                                                  MOV     -2(R2),-(SP)
        013600  012746  014433                                                  MOV     #CP11,-(SP)
        013604  012746  000002                                                  MOV     #2,-(SP)
        013610  010600                                                          MOV     SP,R0
        013612  104417                                                          TRAP    C$PNTF
        013614  062706  000006                                                  ADD     #6,SP
3499    013620  005712                 TST     (R2)            ; IS THERE A VALID VECTOR ?
3500    013622  001011                 BNE     200$            ; IF YES, BRANCH
3501    013624                  PRINTF  #CP4            ; ELSE PRINT 'NONE'
        013624  012746  014237                                                  MOV     #CP4,-(SP)
        013630  012746  000001                                                  MOV     #1,-(SP)
        013634  010600                                                          MOV     SP,R0
        013636  104417                                                          TRAP    C$PNTF
        013640  062706  000004                                                  ADD     #4,SP
3502    013644  000411                 BR      210$                    ; AND GO TO NEXT UNIT
3503    013646                  200$:   PRINTF  #CP12,(R2)              ; PRINT OTHER VECTOR
        013646  011246                                                          MOV     (R2),-(SP)
        013650  012746  014437                                                  MOV     #CP12,-(SP)
        013654  012746  000002                                                  MOV     #2,-(SP)
        013660  010600                                                          MOV     SP,R0
        013662  104417                                                          TRAP    C$PNTF
        013664  062706  000006                                                  ADD     #6,SP
3504
3505    013670  005201                  210$:  INC     R1                      ; PREPARE FOR NEXT UNIT
3506    013672  020137  002012                 CMP     R1,L$UNIT               ; ALL UNITS DONE ?
3507    013676  002002                 BGE     CONEX                   ; IF YES, EXIT
3508    013700  000137  012762                 JMP     20$                     ; ELSE DISPLAY THE NEXT
3509    013704  004737  011542          CONEX: JSR     PC,CRLF                 ; PRINT A LINE FEED
3510    013710                  CLRVEC  #4                      ; RESTORE SUPERVISOR NXM TRAP CATCHER
        013710  012700  000004                                                  MOV     #4,R0
        013714  104436                                                          TRAP    C$CVEC
3511    013716  000207                 RTS     PC
3512
3513                                    .NLIST  BEX
3514
3515    013720      045     116     045 CP1:    .ASCIZ  \#N#S24#AIDV/IAV-11 MODULE CONFIGURATION.\
3516    013771      045     116     045 CP1A:   .ASCIZ  /#N#S24#A------------------------------/
3517    014043      045     116     062 CP1B:   .ASCII  \#N2#AUNIT  ADDRESS  VECTOR  ID/MODE    MODULE    LOOPED    TO\
3518    014136      045     123     071         .ASCIZ  \#S9#AAT\
3519    014146      045     101     040 CP1C:   .ASCIZ  \#A     VECTOR#N#S15#AASSUMED#S13#ATYPE#N\
3520
3521    014217      045     116     045 CP2:    .ASCIZ  \#N#D3#09\
```

GLOBAL SUBROUTINES SECTION

```
3522 014230      045      123      065  CP3:     .ASCIZ  \#S5#03\
3523 014237      045      123      064  CP4:     .ASCIZ  \#S4#ANONE\
3524 014251      045      123      063  CP5:     .ASCIZ  \#S3#03#A/#03\
3525 014266      045      123      063  CP6:     .ASCIZ  \#S3#T\
3526 014274      045      101      040  CP7:     .ASCIZ  \#A  *** CANNOT BE TESTED WITH THIS DIAGNOSTIC ***\
3527 014356      045      101      040  CP8:     .ASCIZ  \#A    YES\
3528 014367      045      101      040  CP9:     .ASCIZ  \#A     NO\
3529 014400      045      101      040  CP10:    .ASCIZ  \#A    UNKNOWN\
3530 014415      045      101      040  CP10A:   .ASCIZ  \#A    UNKNOWN \
3531 014433      045      117      071  CP11:    .ASCIZ  \#09\
3532 014437      045      123      065  CP12:    .ASCIZ  \#S5#03\
3533
3534 014446      104      111      107  DI:      .ASCIZ  /DIG. IN /
3535 014457      104      111      107  DO:      .ASCIZ  /DIG. OUT/
3536 014470      101      116      056  AI:      .ASCIZ  /AN.  IN /
3537 014501      101      116      056  AO:      .ASCIZ  /AN.  OUT/
3538
3539                                               .LIST   BEX
3540                                               .EVEN
```

```
                        ; SUBROUTINE DACON - DIGITAL TO ANALOGUE CONVERSION ROUTINE.
                        ;
                        ;++
                        ; FUNCTIONAL DESCRIPTION:
                        ;
                        ;       THIS CONVERTS A 12 BIT DIGITAL PATTERN INTO A 2 WORD ANALOGUE
                        ;       OUTPUT VALUE.
                        ;
                        ; INPUTS:
                        ;
                        ;       MODE : 0 = UNIPOLAR (0 TO 10 VOLTS)     BINARY CODED
                        ;              1 = BIPOLAR  (-10 TO +10 VOLTS)  OFFSET BINARY CODED
                        ;              2 = 0 - 20 MA                    BINARY CODED
                        ;              3 = 4 - 20 MA                    BINARY CODED
                        ;
                        ;       GAIN : 0 - 7 = GAINS 1,2,5,10,20,50,100,200
                        ;
                        ;       R1   : 12 BIT INPUT PATTERN.
                        ;
                        ; IMPLICIT INPUTS:
                        ;
                        ;       VITAB AND ITAB : DIGITAL/ANALOGUE CONVERSION TABLES.
                        ;
                        ; OUTPUTS:
                        ;
                        ;       R1 - MILLIVOLTS (MODES 0 AND 1)
                        ;            MICROAMPS  (MODES 2 AND 3)
                        ;
                        ;       R2 - MICROVOLTS (MODES 0 AND 1)
                        ;            NANOAMPS   (MODES 2 AND 3)
                        ;
                        ; IMPLICIT OUTPUTS:
                        ;
                        ;       NONE.
                        ;
                        ; SUBORDINATE ROUTINES USED:
                        ;
                        ;       NONE.
                        ;
                        ; FUNCTIONAL SIDE EFFECTS:
                        ;
                        ;       NONE.
                        ;
                        ; CALLING SEQUENCE:
                        ;
                        ;  EG.  MOV     #1,MODE                 ; BIPOLAR CONVERSION
                        ;       MOV     #6,GAIN                 ; GAIN = 100
                        ;       MOV     #7777,R1                ; ALL BITS SET
                        ;       JSR     PC,DACON
                        ;
                        ;
                        DACON::
014512                          MOV     R3,-(SP)                ; SAVE R3
014512  010346                  MOV     R4,-(SP)                ; AND R4
014514  010446                  MOV     MODE,R3                 ; GET MODE
014516  013703  004134          TST     R3                      ; MODE 0 ?
014522  005703
```

GLOBAL SUBROUTINES SECTION

```
3599 014524  001003                    BNE     10$                 ; IF NOT, BRANCH
3600 014526  012700  004176              MOV     #VUPTAB,R0          ; GET CONVERSION TABLE FOR MODE 0
3601 014532  000414                    BR      PSDA                ;
3602
3603 014534  005303              10$:  DEC     R3                  ; MODE 1 ?
3604 014536  001003                    BNE     20$                 ; IF NOT, BRANCH
3605 014540  012700  004776              MOV     #VBPTAB,R0          ; GET CONVERSION TABLE FOR MODE 1
3606 014544  000407                    BR      PSDA
3607
3608 014546  005303              20$:  DEC     R3                  ; MODE 2 ?
3609 014550  001003                    BNE     30$                 ; IF NOT, BRANCH
3610 014552  012700  005576              MOV     #IOTAB,R0           ; GET CONVERSION TABLE FOR MODE 2
3611 014556  000402                    BR      PSDA                ;
3612
3613 014560  012700  006376        30$:  MOV     #I4TAB,R0           ; USE I4TAB FOR MODE 3
3614
3615 014564  013703  004136        PSDA: MOV     GAIN,R3             ; GET THE GAIN
3616 014570  005303              30$:  DEC     R3                  ; HAVE WE GOT THE CORRECT TABLE ?
3617 014572  100403                    BMI     40$                 ; IF YES, BRANCH
3618 014574  062700  000060              ADD     #48.,R0             ; ELSE INCREASE THE TABLE OFFSET
3619 014600  000773                    BR      30$                 ; AND TRY AGAIN
3620
3621 014602  011004              40$:  MOV     (R0),R4             ; SAVE HIGH BIT VALUE
3622 014604  010103                    MOV     R1,R3               ; SAVE THE BIT PATTERN
3623 014606  005001                    CLR     R1                  ; CLEAR THE OUTPUT REGISTERS
3624 014610  005002                    CLR     R2                  ;
3625 014612  006303                    ASL     R3                  ; SHIFT OUT UNUSED BITS
3626 014614  006303                    ASL     R3                  ; ( BITS 15 - 12 )
3627 014616  006303                    ASL     R3                  ;
3628 014620  006303                    ASL     R3                  ;
3629
3630 014622  006303              50$:  ASL     R3                  ; TEST A BIT
3631 014624  103011                    BCC     70$                 ; IF CLEAR, BRANCH
3632 014626  066002  000030              ADD     24.(R0),R2          ; ELSE ADD IN LOW VALUE
3633 014632  020227  001750              CMP     R2,#1000.           ; OVERFLOW OF LOW WORD ?
3634 014636  002403                    BLT     60$                 ; IF NOT, BRANCH
3635 014640  162702  001750              SUB     #1000.,R2           ; ELSE CARRY FROM LOW WORD
3636 014644  005201                    INC     R1                  ; TO HIGH WORD
3637 014646  061001              60$:  ADD     (R0),R1             ; AND ADD IN HIGH VALUE
3638 014650  062700  000002        70$:  ADD     #2,R0               ; GET NEXT TABLE ENTRY
3639 014654  005703                    TST     R3                  ; ALL BITS PROCESSED ?
3640 014656  001361                    BNE     50$                 ; IF NOT, DO MORE BITS
3641
3642 014660  023727  004134  000001  80$:  CMP     MODE,#1             ; BIPOLAR VOLTAGE CONVERSION ?
3643 014666  001007                    BNE     90$                 ; IF NOT,BRANCH
3644 014670  160401                    SUB     R4,R1               ; ELSE MAKE BIPOLAR
3645 014672  002005                    BGE     90$                 ; IF STILL POSITIVE, BRANCH
3646 014674  005702                    TST     R2                  ; DECIMAL PART ZERO ?
3647 014676  001403                    BEQ     90$                 ; IF YES, BRANCH
3648 014700  162702  001750              SUB     #1000.,R2           ; ELSE BORROW FROM HIGH PART
3649 014704  005201                    INC     R1                  ;
3650
3651 014706  023727  004134  000003  90$:  CMP     MODE,#3             ; 4 - 20 MA MODE ?
3652 014714  001002                    BNE     100$                ; IF NOT, BRANCH
3653 014716  062701  007640              ADD     #4000.,R1           ; ELSE ADD IN BASE VALUE
3654
3655 014722  012604              100$: MOV     (SP)+,R4            ; RESTORE R4
```

GLOBAL SUBROUTINES SECTION

```
3656 014724  012603                    MOV     (SP)+,R3            ; AND R3
3657 014726  000207                    RTS     PC                  ;
```

GLOBAL SUBROUTINES SECTION

```
                        ; SUBROUTINE ADCON - ANALOGUE TO DIGITAL CONVERSION ROUTINE.
                        ;
                        ;++
                        ; FUNCTIONAL DESCRIPTION:
                        ;
                        ;       THIS CONVERTS A 2 WORD ANALOGUE VALUE INTO A 12 BIT DIGITAL OUTPUT
                        ;       PATTERN. THE INPUT IS ROUNDED UP OR DOWN TO THE NEAREST LSB VALUE.
                        ;
                        ; INPUTS:
                        ;
                        ;       MODE : 0 = UNIPOLAR (0 TO 10 VOLTS)     BINARY CODED
                        ;              1 = BIPOLAR  (-10 TO +10 VOLTS)  OFFSET BINARY CODED
                        ;              2 = 0 - 20 MA                    BINARY CODED
                        ;              3 = 4 - 20 MA                    BINARY CODED
                        ;
                        ;       GAIN : 0 - 7 = GAINS 1,2,5,10,20,50,100,200
                        ;
                        ;       R1 - MILLIVOLTS (MODES 0 AND 1)
                        ;            MICROAMPS  (MODES 2 AND 3)
                        ;
                        ;       R2 - MICROVOLTS (MODES 0 AND 1)
                        ;            NANOAMPS   (MODES 2 AND 3)
                        ;
                        ; IMPLICIT INPUTS:
                        ;
                        ;       VITAB AND ITAB : DIGITAL/ANALOGUE CONVERSION TABLES.
                        ;
                        ; OUTPUTS:
                        ;
                        ;       R1    : 12 BIT INPUT PATTERN.
                        ;
                        ; IMPLICIT OUTPUTS:
                        ;
                        ;       NONE.
                        ;
                        ; SUBORDINATE ROUTINES USED:
                        ;
                        ;       NONE.
                        ;
                        ; FUNCTIONAL SIDE EFFECTS:
                        ;
                        ;       NONE.
                        ;
                        ; CALLING SEQUENCE:
                        ;
                        ;  EG.  MOV     #1,MODE                 ; BIPOLAR CONVERSION
                        ;       MOV     #6,GAIN                 ; GAIN = 100
                        ;       MOV     #4,R1                   ;  4.001 MILLIVOLTS
                        ;       MOV     #1,R2                   ; IN R1/R2
                        ;       JSR     PC,ADCON
                        ;
                        ;
014730                  ADCON::
014730  010346                  MOV     R3,-(SP)                ; SAVE R3
014732  010446                  MOV     R4,-(SP)                ; AND R4
014734  013703  004134          MOV     MODE,R3                 ; GET MODE
```

GLOBAL SUBROUTINES SECTION

```
3716 014740  005703                        TST     R3              ; MODE 0 ?
3717 014742  001003                        BNE     10$             ; IF NOT, BRANCH
3718 014744  012700  004176                MOV     #VUPTAB,R0      ; GET CONVERSION TABLE FOR MODE 0
3719 014750  000416                        BR      PSAD            ;
3720
3721 014752  005303                 10$:   DEC     R3              ; MODE 1 ?
3722 014754  001003                        BNE     20$             ; IF NOT, BRANCH
3723 014756  012700  004776                MOV     #VBPTAB,R0      ; GET CONVERSION TABLE FOR MODE 1
3724 014762  000411                        BR      PSAD
3725
3726 014764  005303                 20$:   DEC     R3              ; MODE 2 ?
3727 014766  001003                        BNE     30$             ; IF NOT, BRANCH
3728 014770  012700  005576                MOV     #IOTAB,R0       ; GET CONVERSION TABLE FOR MODE 2
3729 014774  000404                        BR      PSAD            ;
3730
3731 014776  012700  006376          30$:   MOV     #I4TAB,R0       ; USE I4TAB FOR MODE 3
3732 015002  162701  007640                SUB     #4000.,R1       ; AND SUBTRACT BASE VALUE
3733
3734 015006  013703  004136          PSAD:  MOV     GAIN,R3         ; GET THE GAIN
3735 015012  005303                 10$:   DEC     R3              ; HAVE WE GOT THE CORRECT TABLE ?
3736 015014  100403                        BMI     20$             ; IF YES, BRANCH
3737 015016  062700  000060                ADD     #48.,R0         ; ELSE INCREASE THE TABLE OFFSET
3738 015022  000773                        BR      10$             ; AND TRY AGAIN
3739
3740 015024  023727  004134  000001  20$:   CMP     MODE,#1         ; BIPOLAR MODE ?
3741 015032  001011                        BNE     30$             ; IF NOT, BRANCH
3742 015034  061001                        ADD     (R0),R1         ; ELSE CONVERT BIPOLAR TO UNIPOLAR
3743 015036  020127  023420                CMP     R1,#10000.      ; WAS PREVIOUS VALUE NEGATIVE ?
3744 015042  001005                        BNE     30$             ; IF NOT, BRANCH
3745 015044  005702                        TST     R2              ; IS DECIMAL PART ZERO ?
3746 015046  001403                        BEQ     30$             ; IF YES, BRANCH
3747 015050  062702  001750                ADD     #1000.,R2       ; ELSE BORROW FROM HIGH PART
3748 015054  005301                        DEC     R1              ;
3749
3750 015056  016003  000026          30$:   MOV     22.(R0),R3      ; GET ROUNDING VALUES FROM LOWEST
3751 015062  016004  000056                MOV     46.(R0),R4      ; SIGNIFICANT BIT
3752 015066  006203                        ASR     R3              ; DIVIDE BY 2
3753 015070  103002                        BCC     40$             ; IF NO CARRY SKIP NEXT COMMAND
3754 015072  062704  001000                ADD     #1000,R4        ; ADD CARRY
3755 015076  006204                 40$:   ASR     R4              ; DIDIDE BY 2
3756 015100  060402                        ADD     R4,R2           ; ROUND UP THE INPUT VALUE
3757 015102  020227  001750                CMP     R2,#1000.       ; LOWER PART IS MODULO 1000
3758 015106  002403                        BLT     50$             ;
3759 015110  162702  001750                SUB     #1000.,R2       ; IF OVERFLOW, CARRY OVER TO
3760 015114  005201                        INC     R1              ; HIGH PART
3761 015116  060301                 50$:   ADD     R3,R1           ; ADD IN HIGH PART OF ROUNDING FACTOR
3762 015120  012703  000020                MOV     #20,R3          ; INITIALISE WORKING REGISTER
3763
3764 015124  020110                 60$:   CMP     R1,(R0)         ; COMPARE HIGH VALUE WITH TABLE ENTRY
3765 015126  002415                        BLT     90$             ; IF LESS, DON'T SET BIT
3766 015130  003003                        BGT     70$             ; IF MORE, SET THE BIT
3767 015132  020260  000030                CMP     R2,24.(R0)      ; OTHERWISE, MUST CHECK THE LOW VALUE
3768 015136  002411                        BLT     90$             ; IF LESS, DON'T SET THE BIT
3769
3770 015140  166002  000030          70$:   SUB     24.(R0),R2      ; SUBTRACT THE TABLE ENTRIES
3771 015144  002003                        BGE     80$             ; BRANCH IF NO BORROW NEEDED
3772 015146  062702  001750                ADD     #1000.,R2       ; ELSE ADD TO LOW WORD
```

GLOBAL SUBROUTINES SECTION

```
3773 015152  005301                    DEC     R1              ; FROM HIGH WORD
3774 015154  161001              80$:  SUB     (R0),R1         ; AND LOW WORDS
3775 015156  052703  000001            BIS     #1,R3           ; AND SET THE OUTPUT BIT
3776 015162  062700  000002      90$:  ADD     #2,R0           ; AND NEXT TABLE ENTRY
3777 015166  006303                    ASL     R3              ; READY FOR NEXT BIT
3778 015170  103355                    BCC     60$             ; IF 12 BITS NOT DONE, GO BACK
3779
3780 015172  006203              100$: ASR     R3              ; GET THE PATTERN AGAIN
3781 015174  010301                    MOV     R3,R1           ; SET UP OUTPUT REGISTER
3782 015176  012604                    MOV     (SP)+,R4        ; RESTORE R4
3783 015200  012603                    MOV     (SP)+,R3        ; AND R3
3784 015202  000207                    RTS     PC              ;
```

```
                        ;
                        ; SUBROUTINE DECIN - SIGNED DECIMAL INPUT ROUTINE.
                        ;
                        ;++
                        ; FUNCTIONAL DESCRIPTION:
                        ;
                        ;       THIS SOLICITS A SIGNED DECIMAL NUMBER FROM THE OPERATOR.
                        ;
                        ; INPUTS:
                        ;
                        ;       PADD - THE ADDRESS OF THE PROMPT STRING FOR THE INPUT.
                        ;
                        ;       THE OPERATOR IS PROMPTED FOR A NUMBER WHICH CAN BE UP TO 10 DIGITS
                        ;       LONG INCLUDING AN OPTIONAL + OR - SIGN AND DECIMAL POINT. THE
                        ;       STRING SHOULD BE IN 'PRINT' FORMAT ( IE.,ASCIZ /%N%AINPUT VALUE/ ).
                        ;
                        ; IMPLICIT INPUTS:
                        ;
                        ;       NONE.
                        ;
                        ; OUTPUTS:
                        ;
                        ;       R1 - INTEGER PART OF OPERATOR INPUT
                        ;       R2 - DECIMAL PART OF OPERATOR INPUT
                        ;
                        ;
                        ; IMPLICIT OUTPUTS:
                        ;
                        ;       ERROR MESSAGES ARE PRINTED IF THE OPERATOR TYPES AN ILLEGAL CHARACTER,
                        ;       AN INTEGER PART OVER 32767, OR A DECIMAL PART WITH MORE THAN 3 DIGITS.
                        ;
                        ;       AN EXAMPLE STRING IS APPENDED TO THE INPUT PROMPT.
                        ;
                        ; SUBORDINATE ROUTINES USED:
                        ;
                        ;       NONE.
                        ;
                        ; FUNCTIONAL SIDE EFFECTS:
                        ;
                        ;       NONE.
                        ;
                        ; CALLING SEQUENCE:
                        ;
                        ;   EG. MOV     #MADD,PADD          ; LOAD THE PROMPT MESSAGE ADDRESS
                        ;       JSR     PC,DECIN
                        ;
                        ;--
015204                  DECIN::
015204  012700  015556          MOV     #NR1,R0             ; CLEAR NUMBER AND STRING LOCATIONS
015210  012701  000007          MOV     #7,R1               ; 2 WORDS FOR INTEGER AND DECIMAL
015214  005020          10$:    CLR     (R0)+               ; PARTS AND 10 BYTES FOR THE INPUT
015216  005301                  DEC     R1                  ; STRING.
015220  001375                  BNE     10$                 ;
                                PRINTF  PADD                ; PRINT THE PROMPT
015222                                                                  MOV     PADD,-(SP)
015222  013746  004140                                                   MOV     #1,-(SP)
015226  012746  000001
```

GLOBAL SUBROUTINES SECTION

```
        015232  010600                                                                  MOV     SP,R0
        015234  104417                                                                  TRAP    C$PNTF
        015236  062706  000004                                                         ADD     #4,SP
3841    015242                          GMANID  GETNUM,SNUM,A,-1,0,10.,NO ; GET THE NUMBER STRING
        015242  104443                                                                  TRAP    C$GMAN
        015244  000406                                                                  BR      10001$
        015246  015562                                                                  .WORD   SNUM
        015250  000142                                                                  .WORD   T$CODE
        015252  015575                                                                  .WORD   GETNUM
        015254  177777                                                                  .WORD   -1
        015256  000000                                                                  .WORD   T$LOLIM
        015260  000012                                                                  .WORD   T$HILIM
        015262                                                                  10001$:
3842    015262  012700  015562                  MOV     #SNUM,R0        ; POINT TO THE START
3843    015266  012701  015556                  MOV     #NR1,R1         ; ASSUME INTEGER PART FIRST
3844
3845    015272  121027  000053                  CMPB    (R0),#'+        ; IS 1ST CHARACTER A + ?
3846    015276  001430                          BEQ     60$             ; IF YES, BRANCH
3847    015300  121027  000055                  CMPB    (R0),#'-        ; IS IT A - ?
3848    015304  001425                          BEQ     60$             ; IF YES, BRANCH
3849    015306  121027  000056          20$:    CMPB    (R0),#'.        ; IS IT A . ?
3850    015312  001017                          BNE     50$             ; IF NOT, BRANCH
3851
3852    015314  012701  015560          30$:    MOV     #NR2,R1         ; START ON DECIMAL PART
3853    015320  105760  000002                  TSTB    2(R0)           ; FORCE TO 3 DIGITS
3854    015324  001003                          BNE     40$             ;
3855    015326  112760  000060  000002          MOVB    #'0,2(R0)       ; IE. REPLACE NULLS
3856    015334  105760  000003          40$:    TSTB    3(R0)           ;
3857    015340  001007                          BNE     60$             ; WITH ZEROS
3858    015342  112760  000060  000003          MOVB    #'0,3(R0)       ;
3859    015350  000403                          BR      60$             ;
3860
3861    015352  105710                  50$:    TSTB    (R0)            ; END OF STRING ?
3862    015354  001451                          BEQ     110$            ; IF YES, FINISH UP
3863    015356  000402                          BR      70$             ; ELSE GET NEXT DIGIT
3864
3865    015360  005200                  60$:    INC     R0              ; SKIP OVER THE SIGN OR POINT
3866    015362  000751                          BR      20$             ;
3867
3868    015364  121027  000060          70$:    CMPB    (R0),#60        ; IS CHARACTER A VALID NUMBER ?
3869    015370  002403                          BLT     80$             ; IF TOO LOW, ASK AGAIN
3870    015372  121027  000071                  CMPB    (R0),#71        ;
3871    015376  003411                          BLE     90$             ; IF NOT TOO HIGH, BRANCH
3872
3873    015400                          80$:    PRINTF  #DECIN$         ; PRINT 'ILLEGAL CHARACTER'
        015400  012746  015734                                                  MOV     #DECIN$,-(SP)
        015404  012746  000001                                                  MOV     #1,-(SP)
        015410  010600                                                          MOV     SP,R0
        015412  104417                                                          TRAP    C$PNTF
        015414  062706  000004                                                  ADD     #4,SP
3874    015420  000671                          BR      DECIN           ; AND ASK AGAIN
3875
3876    015422  021127  006314          90$:    CMP     (R1),#3276.     ; NUMBER TOO HIGH ?
3877    015426  101013                          BHI     100$            ; IF YES, BRANCH
3878
3879    015430  006311                          ASL     (R1)            ; ELSE MULTIPLY BY 10
3880    015432  011102                          MOV     (R1),R2         ;
```

GLOBAL SUBROUTINES SECTION

```
3881 015434  006311                          ASL     (R1)                    ; READY FOR NEXT CHARACTER
3882 015436  006311                          ASL     (R1)                    ;
3883 015440  060211                          ADD     R2,(R1)                 ;
3884
3885 015442  112002                          MOVB    (R0)+,R2                ; SAVE THE CHARACTER
3886 015444  162702  000060                  SUB     #60,R2                  ; CONVERT TO NUMBER
3887 015450  060211                          ADD     R2,(R1)                 ; AND ADD TO ACCUMULATOR
3888 015452  100401                          BMI     100$                    ; IF OVERFLOW, REPORT ERROR
3889
3890 015454  000714                          BR      20$                     ; AND GET NEXT CHARACTER
3891
3892 015456                          100$:   PRINTF  #DECIN1                 ; PRINT 'NUMBER TOO BIG'
     015456  012746  015615                                                          MOV     #DECIN1,-(SP)
     015462  012746  000001                                                          MOV     #1,-(SP)
     015466  010600                                                                  MOV     SP,R0
     015470  104417                                                                  TRAP    C$PNTF
     015472  062706  000004                                                          ADD     #4,SP
3893 015476  000642                          BR      DECIN                   ; AND GET ANOTHER
3894
3895 015500  013701  015556          110$:   MOV     NR1,R1                  ; SET UP OUTPUT REGISTERS
3896 015504  013702  015560                  MOV     NR2,R2                  ;
3897 015510  020227  001750                  CMP     R2,#1000.               ; DECIMAL PART TOO BIG ?
3898 015514  103411                          BLO     120$                    ; IF NOT, BRANCH
3899 015516                                  PRINTF  #DECIN2                 ; PRINT 'ONLY 3 DIGITS ALLOWED'
     015516  012746  015653                                                          MOV     #DECIN2,-(SP)
     015522  012746  000001                                                          MOV     #1,-(SP)
     015526  010600                                                                  MOV     SP,R0
     015530  104417                                                                  TRAP    C$PNTF
     015532  062706  000004                                                          ADD     #4,SP
3900 015536  000622                          BR      DECIN
3901
3902 015540  123727  015562  000055  120$:   CMPB    SNUM,#'-                ; WAS STRING NEGATIVE ?
3903 015546  001002                          BNE     130$                    ; IF NOT, BRANCH
3904 015550  005401                          NEG     R1                      ; ELSE NEGATE THE OUTPUT
3905 015552  005402                          NEG     R2                      ;
3906
3907 015554  000207                  130$:   RTS     PC                      ; AND RETURN
3908
3909                                          .NLIST  BEX
3910
3911 015556  000000                  NR1:    .WORD   0                       ; STORE FOR INTEGER PART
3912 015560  000000                  NR2:    .WORD   0                       ; STORE FOR DECIMAL PART
3913 015562     055     061     062  SNUM:   .ASCIZ  /-12345.678/            ; STORE FOR INPUT STRING
3914
3915 015575     050     105     107  GETNUM: .ASCIZ  /(EG. 12345.678)/               ; PROMPT FOR INPUT
3916 015615     045     116     045  DECIN1: .ASCIZ  /%N%AMUST BE LESS THAN 32768%N/
3917 015653     045     116     045  DECIN2: .ASCIZ  /%N%AONLY 3 DIGITS MAY FOLLOW THE DECIMAL POINT%N/
3918 015734     045     116     045  DECIN3: .ASCIZ  /%N%AILLEGAL CHARACTER%N/
3919
3920                                          .LIST   BEX
3921                                          .EVEN
```

GLOBAL SUBROUTINES SECTION

```
                                ; SUBROUTINE DECOUT - SIGNED DECIMAL OUTPUT ROUTINE
                                ;
                                ;++
                                ; FUNCTIONAL DESCRIPTION:
                                ;
                                ;       ROUTINE TO PRINT A SIGNED DECIMAL NUMBER.
                                ;
                                ; INPUTS:
                                ;
                                ;       R1 - INTEGER PART OF NUMBER TO BE PRINTED
                                ;       R2 - DECIMAL PART OF NUMBER TO BE PRINTED
                                ;
                                ; IMPLICIT INPUTS:
                                ;
                                ;       NONE.
                                ;
                                ; OUTPUTS:
                                ;
                                ;       THE NUMBER IS PRINTED AS FOLLOWS : -12345.678
                                ;       ( NO SIGN IS PRINTED FOR POSITIVE NUMBERS )
                                ;       IF THE DECIMAL PART (R2) IS ZERO, THE NUMBER
                                ;       IS PRINTED AS -12345
                                ;
                                ; IMPLICIT OUTPUTS:
                                ;
                                ;       NONE.
                                ;
                                ; SUBORDINATE ROUTINES USED:
                                ;
                                ;       NONE.
                                ;
                                ; FUNCTIONAL SIDE EFFECTS:
                                ;
                                ;       NONE.
                                ;
                                ; CALLING SEQUENCE:
                                ;
                                ;   EG. MOV     #-10.,R1            ; PRINT -10.001
                                ;       MOV     #-1,R2              ;
                                ;       JSR     PC,DECOUT
                                ;
                                ;--
                                DECOUT::
                                        MOV     R1,-(SP)            ; SAVE R1
                                        MOV     R2,-(SP)            ; SAVE R2
                                        TST     R1                  ; R1 > 0 ?
                                        BLT     10$                 ; IF NOT, BRANCH
                                        TST     R2                  ; R2 POSITIVE ?
                                        BGE     20$                 ; IF YES, BRANCH
                                10$:    NEG     R1                  ; ELSE MAKE POSITIVE
                                        NEG     R2                  ;
                                        PRINTF  #DEC01              ; AND PRINT '-'
016004  012746  016102                                                      MOV     #DEC01,-(SP)
016010  012746  000001                                                      MOV     #1,-(SP)
016014  010600                                                              MOV     SP,R0
```

GLOBAL SUBROUTINES SECTION

```
        016016  104417                                                          TRAP    C$PNTF
        016020  062706  000004                                                  ADD     #4,SP
   3977
   3978 016024                          20$:    PRINTF  #DEC02,R1               ; PRINT THE INTEGER PART
        016024  010146                                                          MOV     R1,-(SP)
        016026  012746  016106                                                  MOV     #DEC02,-(SP)
        016032  012746  000002                                                  MOV     #2,-(SP)
        016036  010600                                                          MOV     SP,R0
        016040  104417                                                          TRAP    C$PNTF
        016042  062706  000006                                                  ADD     #6,SP
   3979 016046  005702                          TST     R2                      ; DECIMAL PART = 0 ?
   3980 016050  001411                          BEQ     DECEX                   ; IF YES BRANCH
   3981 016052                                  PRINTF  #DEC03,R2               ; ELSE, PRINT DECIMAL PART
        016052  010246                                                          MOV     R2,-(SP)
        016054  012746  016112                                                  MOV     #DEC03,-(SP)
        016060  012746  000002                                                  MOV     #2,-(SP)
        016064  010600                                                          MOV     SP,R0
        016066  104417                                                          TRAP    C$PNTF
        016070  062706  000006                                                  ADD     #6,SP
   3982 016074  012602                  DECEX:  MOV     (SP)+,R2                ; RESTORE R2
   3983 016076  012601                          MOV     (SP)+,R1                ; AND R1
   3984 016100  000207                          RTS     PC                      ; AND RETURN
   3985
   3986                                         .NLIST  BEX
   3987 016102      045     101     055  DEC01:  .ASCIZ  /%A-/
   3988 016106      045     104     065  DEC02:  .ASCIZ  /%D5/
   3989 016112      045     101     056  DEC03:  .ASCIZ  /%A.%Z3/
   3990                                         .LIST   BEX
   3991                                         .EVEN
   3992
```

GLOBAL SUBROUTINES SECTION

```
3994                    ;+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
3995                    ; SUBROUTINE WRITE - WRITE ROUTINE FOR OTHER MODULE ADDRESS
3996                    ;-----------------------------------------------------------------------
3997                    ; FUNCTIONAL DESCRIPTION:
3998                    ;
3999                    ;       SUBROUTINE FOR LOADING THE DATA REGISTER OF A DIGITAL OUTPUT
4000                    ;       MODULE. THE OUTPUT MODULE IS SPECIFIED FOR THE LOOPBACK TESTS
4001                    ;       AS 'OTHER' IN THE HARWARE P TABLE.
4002                    ;       THIS SUBROUTINE ALSO DOES A CHECK TO THE OTHER MODULE
4003                    ;       ADDRESS. IF THE ADDRESS IS NOT AVAILABLE IT WILL REPORT
4004                    ;       AN ERROR.
4005                    ;
4006                    ; INPUTS:
4007                    ;
4008                    ;       THE CONTENTS OF R1 WILL BE USED TO LOAD THE DATA REGISTER
4009                    ;
4010                    ; IMPLICIT INPUTS:
4011                    ;
4012                    ;       ERRNBR - CONTAINS THE ERROR NUMBER
4013                    ;
4014                    ; OUTPUTS:
4015                    ;
4016                    ;       ERROR MESSAGES IF OUTPUT ADDRESS IS NOT AVAILABLE (NXM).
4017                    ;
4018                    ; SUBORDINATE ROUTINES USED:
4019                    ;
4020                    ;       DRS ERROR MACRO
4021                    ;
4022                    ;  CALLING SEQUENCE:
4023                    ;
4024                    ;       CALL WRITE  OR  JSR PC,WRITE
4025                    ;
4026                    ;---------------------
4027
4028 016122  010146              WRITE:: MOV     R1,-(SP)        ;SAVE R1
4029 016124                             SETVEC #4,#NXM,#PRIO7   ;SET UP VECTOR
     016124  012746  000340                                                  MOV     #PRIO7,-(SP)
     016130  012746  017266                                                  MOV     #NXM,-(SP)
     016134  012746  000004                                                  MOV     #4,-(SP)
     016140  012746  000003                                                  MOV     #3,-(SP)
     016144  104437                                                          TRAP    C$SVEC
     016146  062706  000010                                                  ADD     #10,SP
4030 016152  005037  004060              CLR     NXMFLG          ;CLEAR NXM FLAG
4031 016156  010177  165542              MOV     R1,@OTHDAT      ;LOAD DIGITAL OUTPUT REGISTER
4032 016162                             CLRVEC  #4              ;VECTOR 4 TO NORMAL STATE
     016162  012700  000004                                                  MOV     #4,R0
     016166  104436                                                          TRAP    C$CVEC
4033 016170  005737  004060              TST     NXMFLG          ;WAS MODULE ADDRESS AVAILABLE
4034 016174  000241                     CLC                     ;CLEAR CARRY
4035 016176  004737  012146              CALL    INSERT          ;SKIP BRANCH IF 'SFI' IS SET
4036 016202  001415                     BEQ     10$             ;BRANCH IF YES
4037 016204  013701  003722              MOV     OTHMOD,R1       ;SET UP DATA FOR ERROR REPORT
4038 016210  012737  000003  007176      MOV     #3,ERRTYP       ;SET UP FOR SOFT ERROR
4039 016216  012737  016242  007202      MOV     #WRERM,ERRMSG   ;LOAD ERROR MESSAGES
4040 016224  012737  007634  007204      MOV     #EERA,ERRBLK    ;LOAD ERROR MESSAGES ROUTINE
4041 016232                             ERROR                   ;ERROR HANDLER
     016232  104460                                                          TRAP    C$ERROR
```

GLOBAL SUBROUTINES SECTION

```
4042 016234  000261                    SEC                     ;SET CARRY FOR MARK THE ERROR
4043 016236  012601                10$: MOV     (SP)+,R1        ;RESTORE R1
4044 016240  000207                    RETURN                  ;AND RETURN
4045
4046                                    .NLIST  BEX
4047 016242     122     105     107 WRERM: .ASCIZ  /REGISTER ADDRESSING ERROR FOR OTHER MODULE ADDRESS/
4048                                    .LIST   BEX
4049                                    .EVEN
4050
```

REPORT CODING SECTION

```
4528 017672  012703  000022          10$:    MOV     #18.,R3                 ; WAIT AFTER 18 LINES
4529
4530 017676                          20$:    PRINTF  #TNUM,R1                ; PRINT TEST NUMBER
     017676  010146                                                                  MOV     R1,-(SP)
     017700  012746  020650                                                          MOV     #TNUM,-(SP)
     017704  012746  000002                                                          MOV     #2,-(SP)
     017710  010600                                                                  MOV     SP,R0
     017712  104417                                                                  TRAP    C$PNTF
     017714  062706  000006                                                          ADD     #6,SP
4531 017720                                  PRINTF  (R2)                    ; AND TITLE
     017720  011246                                                                  MOV     (R2),-(SP)
     017722  012746  000001                                                          MOV     #1,-(SP)
     017726  010600                                                                  MOV     SP,R0
     017730  104417                                                                  TRAP    C$PNTF
     017732  062706  000004                                                          ADD     #4,SP
4532 017736  062702  000002                  ADD     #2,R2                   ; GET ADDRESS OF NEXT TITLE
4533 017742  005201                          INC     R1                      ; AND NEXT TEST NUMBER
4534 017744  020127  000031                  CMP     R1,#NTESTS              ; ALL PRINTED ?
4535 017750  003015                          BGT     30$                     ; IF YES, EXIT
4536 017752  005303                          DEC     R3                      ; 18 LINES OUTPUT ?
4537 017754  001350                          BNE     20$                     ; IF NOT, BRANCH
4538 017756                                  GMANID  RDY,RFLG,A,377,0,1,YES  ; ELSE WAIT FOR OPERATOR TO READ
     017756  104443                                                                  TRAP    C$GMAN
     017760  000406                                                                  BR      10001$
     017762  020462                                                                  .WORD   RFLG
     017764  000152                                                                  .WORD   T$CODE
     017766  020612                                                                  .WORD   RDY
     017770  000377                                                                  .WORD   377
     017772  000000                                                                  .WORD   T$LOLIM
     017774  000001                                                                  .WORD   T$HILIM
     017776                                                                  10001$:
4539 017776  004737  011542                  JSR     PC,CRLF                 ; PRINT A LINE FEED
4540 020002  000733                          BR      10$                     ; AND THEN CONTINUE
4541
4542 020004  000137  020444          30$:    JMP     PREX                    ; EXIT
4543
4544 020010  005037  020450          CON:    CLR     STFLG                   ; ASSUME DIAGNOSTIC IS NOT STARTED
4545 020014  005037  020452                  CLR     GPFLG                   ; FLAG NO GPHARDS YET EXECUTED
4546 020020  005737  003774                  TST     GPADD                   ; ARE ANY PARAMETER ADDRESSES SET UP ?
4547 020024  001402                          BEQ     10$                     ; IF NOT, BRANCH
4548 020026  005237  020450                  INC     STFLG                   ; ELSE FLAG DIAGNOSTIC IS STARTED
4549
4550 020032  005737  002012          10$:    TST     L$UNIT                  ; ANY UNITS SET UP ?
4551 020036  001404                          BEQ     20$                     ; IF NOT, BRANCH
4552 020040  023727  002012  000020          CMP     L$UNIT,#16.             ; TOO MANY UNITS SET UP ?
4553 020046  003403                          BLE     30$                     ; IF NOT, BRANCH
4554 020050  012737  000020  002012  20$:    MOV     #16.,L$UNIT             ; SET UP 16 UNITS
4555
4556 020056  013746  002074          30$:    MOV     L$LUN,-(SP)             ; SAVE THE UNIT NUMBER BEING TESTED
4557 020062  005037  002074                  CLR     L$LUN                   ; START WITH UNIT 0
4558
4559 020066  013701  003774                  MOV     GPADD,R1                ; GET FIRST PARAM. ADDRESS
4560 020072  005711                          TST     (R1)                    ; ANYTHING IN IT
4561 020074  001003                          BNE     40$                     ; IF YES, BRANCH
4562 020076  012737  171000  012514          MOV     #171000,STADD           ; ELSE START FOR FIRST IAV-IDV ADDR.
4563
4564 020104  013701  002074          40$:    MOV     L$LUN,R1                ; FORM OFFSET FOR UNIT TABLES
```

GLOBAL SUBROUTINES SECTION

```
4101 016432  012737  007634  007204          MOV     #EERA,ERRBLK    ;LOAD ERROR MESSAGES ROUTINE
4102 016440                                   ERROR                   ;ERROR HANDLER
     016440  104460                                                                TRAP    C$ERROR
4103 016442  000261                          SEC                     ;SET CARRY FOR MARK THE ERROR
4104 016444  012601                  10$:    MOV     (SP)+,R1        ;RESTORE R1
4105 016446  000207                          RETURN                  ;AND RETURN
4106
4107                                          .NLIST  BEX
4108 016450     122     105     107  REERM:  .ASCIZ  /REGISTER ADDRESSING ERROR FOR OTHER MODULE ADDRESS/
4109                                          .LIST   BEX
4110                                          .EVEN
4111
```

GLOBAL SUBROUTINES SECTION

```
4113                    ;*******************************************************************
4114                    ;       SUBROUTINE - RANDOM
4115                    ;-------------------------------------------------------------------
4116                    ; FUNCTIONAL DESCRIPTION:
4117                    ;
4118                    ;       THIS ROUTINE GENERATES A RANDOM PATTERN. THE PATTERN IS
4119                    ;       STORED IN LOCATION RB.
4120                    ;
4121                    ; INPUTS:
4122                    ;
4123                    ;       NONE.
4124                    ;
4125                    ; IMPLICIT INPUTS:
4126                    ;
4127                    ;       RA AND RB
4128                    ;
4129                    ; OUTPUTS:
4130                    ;
4131                    ;       RB - CONTAINS THE RANDOM PATTERN
4132                    ;       RA - CONTAINS A SECOND RANDOM PATTERN
4133                    ;
4134                    ; IMPLICIT OUTPUTS:
4135                    ;
4136                    ;       NONE.
4137                    ;
4138                    ; SUBORDINATE ROUTINES USED:
4139                    ;
4140                    ;       NONE.
4141                    ;
4142                    ; CALLING SEQUENCE:
4143                    ;
4144                    ;       CALL RANDOM  OR  JSR PC,RANDOM
4145                    ;
4146                    ;-------------------------------------------------------------------
4147 016534  013746  016572  RANDOM::MOV     RA, (SP)                ;PUSH RA TO STACK
4148 016540  013700  016574          MOV     RB,R0                   ;GET THE LAST RANDOM PATTERN
4149 016544  006316                  ASL     @SP                     ;SIFT SP (=RA) LEFT
4150 016546  005500                  ADC     R0                      ;IF CARRY IS SET ADD TO R0 (=RB)
4151 016550  006200                  ASR     R0                      ;THEN SHIFT THE RESULT RITH
4152 016552  005516                  ADC     @SP                     ;IF CARRY IS SET ADD TO SP (=RA)
4153 016554  061600                  ADD     @SP,R0                  ;ADD SP (=RA) AND R0 (=RB)
4154 016556  005600                  SBC     R0                      ;SUBTRACT CARRY IF SET FROM RB
4155 016560  012637  016572          MOV     (SP)+,RA                ;LOAD NEW VALUE INTO LOCATION RA
4156 016564  010037  016574          MOV     R0,RB                   ;LOAD LOCATION RB WITH NEW PAT.
4157 016570  000207                  RETURN                          ;
4158
4159 016572  135753  RA::    .WORD   135753                          ;START PATTERN FOR RB
4160 016574  024674  RB::    .WORD   24674                           ;STORAGE FOR RANDOM PATTERN
4161
```

GLOBAL SUBROUTINES SECTION

```
4163                            ;+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
4164                            ;       SUBROUTINE - FLASH
4165                            ;---------- ---------- ---------- ---------- ---------- ----------
4166                            ; FUNCTIONAL DESCRIPTION:
4167                            ;
4168                            ;       THIS SUBROUTINE FLASHES THE SELECTED MODULE
4169                            ;       LED ON AND OFF WHILE READING THE CONSOLE KEYBOARD INPUT.
4170                            ;       THE EXPECTED INPUTS ARE 'Y' OR 'N' OTHER INPUTS
4171                            ;       (EXEPT THE CNTL C) WILL CAUSE A PROMT TO REPEAT
4172                            ;       WITH THE CORRECT CHARACTER.
4173                            ;
4174                            ; INPUTS:
4175                            ;
4176                            ;       CONSOLE KEYBOARD INPUT.
4177                            ;
4178                            ; IMPLICIT INPUTS:
4179                            ;
4180                            ;       NONE.
4181                            ;
4182                            ; OUTPUTS:
4183                            ;
4184                            ;       FLSANS - CONTAINS THE KEYBOARD INPUT YES OR NO
4185                            ;                FLSANS ZERO = NO
4186                            ;                FLSANS ONE  = YES
4187                            ;
4188                            ; IMPLICIT OUTPUTS:
4189                            ;
4190                            ;       NONE.
4191                            ;
4192                            ; SUBORDINATE ROUTINES USED:
4193                            ;
4194                            ;       BREAK - DRS MACRO (THIS MACRO LOOKS FOR CNTL C)
4195                            ;       PRINTF- DRS MACRO, THIS MACRO PRINTS A MESSAGES ON THE CONSOLE
4196                            ;
4197                            ; CALLING SEQUENCE:
4198                            ;
4199                            ;       CALL FLASH OR  JSR PC,FLASH
4200                            ;
4201                            ;---------- ---------- ---------- ---------- ---------- ----------
4202 016576  105737  177560     FLASH:: TSTB    TKS             ;TEST THE KEYBOARD STATUS REG.
4203 016602  100002                     BPL     10$             ;BRANCH IF NOTHING FOUND
4204 016604                             BREAK                   ;LOOK FOR 'CNTL C'
      016604  104422                                                            TRAP    C$BRK
4205 016606  000421                     BR      20$             ;
4206 016610  042777  000100  165062 10$:    BIC     #100,@MOD       ;SWITH MODULE LED OFF
4207 016616  012701  000012     40$:    MOV     #10.,R1         ;SET UP WAIT COUNTER
4208 016622  004737  011506     30$:    CALL    WT25M           ;WAIT FOR 25 MS
4209 016626  005301                     DEC     R1              ;ARE 250 MS OVER
4210 016630  001374                     BNE     30$             ;BRANCH IF NO
4211 016632  032777  000100  165040     BIT     #100,@MOD       ;IS THE MODULE LED SWITCHED ON
4212 016640  001356                     BNE     FLASH           ;BRANCH IF YES
4213 016642  052777  000100  165030     BIS     #100,@MOD       ;OTHERWISE SWITCH IT ON
4214 016650  000762                     BR      40$             ;AND BRANCH TO WAIT LOOP
4215 016652  012737  000001  017000 20$:    MOV     #1,FLSANS       ;SAVE 'YES' ANSWER
4216 016660  013737  177562  004064     MOV     TKB,BAD         ;GET CHARACTER
4217 016666  042737  000200  004064     BIC     #200,BAD        ;DISCARD PARITY BIT
4218 016674  122737  000131  004064     CMPB    #'Y,BAD         ;WAS THE TYPED CHARACTER A 'Y' ?
```

GLOBAL SUBROUTINES SECTION

```
4219 016702  001432                    BEQ     50$             ;BRANCH IF YES
4220 016704  122737  000131  004064    CMPB    #'Y,BAD         ;WAS IT A LOWESCASE 'Y' ?
4221 016712  001426                    BEQ     50$             ;BRANCH IF YES
4222 016714  005037  017000            CLR     FLSANS          ;SAVE 'NO' ANSWER
4223 016720  122737  000116  004064    CMPB    #'N,BAD         ;WAS THE TYPED CHARACTER A 'N' ?
4224 016726  001420                    BEQ     50$             ;BRANCH IF YES
4225 016730  122737  000116  004064    CMPB    #'N,BAD         ;WAS IT A LOWERCASE 'N' ?
4226 016736  001414                    BEQ     50$             ;BRANCH IF YES
4227 016740  013737  177562  177566    MOV     TKB,TPB         ;ECHO THE CHARACTER
4228 016746                            PRINTF  #PROMT          ;IF NO PRINT A PROMT
     016746  012746  017002                                                    MOV     #PROMT,-(SP)
     016752  012746  000001                                                    MOV     #1,-(SP)
     016756  010600                                                            MOV     SP,R0
     016760  104417                                                            TRAP    C$PNTF
     016762  062706  000004                                                    ADD     #4,SP
4229 016766  000703                    BR      FLASH           ;AND GO BACK
4230 016770  013737  177562  177566  50$:  MOV     TKB,TPB         ;ECHO THE CHARACTER
4231 016776  000207                    RETURN
4232
4233                                ; CONSOLE EQUATES
4234
4235         177560                         TKS = 177560        ;KEYBOARD STATUS REGISTER
4236         177562                         TKB = 177562        ;KEYBOARD DATA REGISTER
4237         177566                         TPB = 177566        ;PRINTER DATA BUFFER
4238
4239 017000  000000                FLSANS::        .WORD   0       ;SAVE LOCATION FOR KEYBOARD BUFFER
4240
4241                                        .NLIST  BEX
4242 017002      045      116      045  PROMT:  .ASCIZ  /*N*AUNAUTHORIZED CHARACTER, TYPE ONLY 'Y' OR 'N'   /
4243                                        .LIST   BEX
4244                                        .EVEN
```

GLOBAL SUBROUTINES SECTION

```
                        ;+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                        ; SUBROUTINE CALRET - CONSOLE READ ROUTINE
                        ;+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                        ;
                        ; FUNCTIONAL DESCRIPTION:
                        ;
                        ;       THIS SUBROUTINE READS THE CONSOLE KEYBOARD WITHOUT STOPPING
                        ;       THE PROGRAM SEQUENCING. THE READING WILL BE DONE WHEN YOU
                        ;       CALL THIS SOUBROUTINE BUT NOT UNDER INTERRUPT.
                        ;       CALRET AFFECTS THE CARRY BIT. IF THE OPERATOR TYPED A CARRIGE
                        ;       RETURN, THE CARRY BIT WILL BE SET. IF THE OPERATOR TYPED
                        ;       ANY OTHER CHARACTERS OR NO CHARACTER, THE CARRY BIT WILL BE CLEARED.
                        ;       THE ROUTINE WILL ALSO TAKE CARE OF THE 'CNTL C'.
                        ;
                        ; INPUTS:
                        ;
                        ;       CONSOLE KEYBOARD BUFFER AND STATUS
                        ;
                        ; IMPLICIT INPUTS:
                        ;
                        ;       NONE
                        ;
                        ; OUTPUTS:
                        ;
                        ;       IF READ CHARACTER WAS A CARRIGE RETURN, THE CARRY BIT IS SET.
                        ;       IF READ CHARACTER WAS ANY OTHER CHARACTERS  OR NO CHARACTER
                        ;       WAS TYPED, THE CARRY BIT WILL BE CLEARED.
                        ;       IF READ CHARACTER WAS A CNTL C, THE SUPERVISOR WILL HANDLE IT.
                        ;
                        ; SUBORDINATE ROUTINES USED:
                        ;
                        ;       BREAK - DRS MACRO       ;THIS MACRO TAKES CARE OF CNTL C
                        ;
                        ; CALLING SEQUENCE:
                        ;
                        ;       CALL CALRET     OR      JSR PC,CALRET
                        ;
                        ;++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
017066                  CALRET::
017066  005037  017172          CLR     CARRFL          ;TEMPORY STORE FOR CARRY BIT
017072  105737  177560          TSTB    TKS             ;TEST THE KEYBOARD STATUS REG.
017076  100032                  BPL     10$             ;BRANCH IF NOTHING WAS TYPED
017100                          BREAK                   ;WAS THE TYPED CHAR. A 'CNTL C'
017100  104422                                                          TRAP    C$BRK
017102  013737  177562  004064          MOV     TKB,BAD         ;GET OPERATOR INPUT
017110  042737  000200  004064          BIC     #200,BAD        ;CLEAR KEYBOARD BUFFER PARITY BIT
017116  022737  000015  004064          CMP     #15,BAD         ;WAS THE TYPED CHARACTER A RETURN ?
017124  001004                  BNE     20$             ;BRANCH IF NO
017126  012737  000001  017172          MOV     #1,CARRFL       ;SET CARRY FLAG
017134  000413                  BR      10$             ;AND BRANCH
017136  013737  177562  177566  20$:    MOV     TKB,TPB         ;ECHO THE CHARACTER
017144                          PRINTF  #RETME1         ;PRINT THAT ONLY CARRIGE RETURN WILL
017144  012746  017174                                                  MOV     #RETME1,-(SP)
017150  012746  000001                                                  MOV     #1, (SP)
017154  010600                                                          MOV     SP,R0
017156  104417                                                          TRAP    C$PNTF
017160  062706  000004                                                  ADD     #4,SP
```

GLOBAL SUBROUTINES SECTION

```
4297                                                        ;DO SOMETHING
4298 017164  006237  017172          10$:    ASR     CARRFL          ;AFFECT THE CARRY
4299 017170  000207                         RETURN
4300
4301                                ; CONSOLE EQUATES
4302
4303         177560                         TKS = 177560            ;KEYBOARD STATUS REGISTER
4304         177562                         TKB = 177562            ;KEYBOARD DATA REGISTER
4305         177566                         TPB = 177566            ;PRINTER DATA BUFFER
4306
4307 017172  000000                CARRFL: .WORD   0       ;SAVE LOCATION FOR CARRY BIT
4308
4309                                        .NLIST  BEX
4310 017174     045     116     045 RETME1: .ASCIZ  /<N><A>TYPE CNTL C TO ABORT OR RETURN TO GO TO THE NEXT STEP/
4311                                        .LIST   BEX
4312                                        .EVEN
4313
```

GLOBAL SUBROUTINES SECTION

```
                                        ;*******************************;
                                        ; INTERRUPT SERVICE ROUTINES ;
                                        ;*******************************;

                                ; INTERRUPT SERVICE ROUTINE NXM - NON EXISTANT MEMORY TRAP.

                                ;++
                                ; THIS ROUTINE SETS A FLAG NXMFLG TO 1. IT IS EXECUTED WHEN A NON
                                ; EXISTANT MEMORY TRAP OCCURS IF VECTOR 4 HAS BEEN LOADED WITH THE
                                ; ADDRESS NXM.
                                ;
                                ; NXMFLG SHOULD BE CLEARED IMMEDIATELY BEFORE EXECUTING CODE WHICH MAY
                                ; ADDRESS NON EXISTANT MEMORY.
                                ;--

017266                                  BGNSRV  NXM
017266                                                                  NXM::
017266  012737  000001  004060          MOV     #1,NXMFLG               ; FLAG NXM TRAP
017274                                  ENDSRV
017274                                                                  L10016:
017274  000002                                                                  RTI

                                ;*************************************************************
                                ; INTERRUPT SERVICE ROUTINE - INTSR
                                ;*************************************************************

                                ;++
                                ;THIS ROUTINE SETS A FLAG (INTFLA) TO 1. IT WILL BE EXECUTED
                                ;WHEN AN DONE INTERRUPT HAS OCCURRED.
                                ;--

017276                                  BGNSRV  INTSR
017276                                                                  INTSR::
017276  012737  000001  004150          MOV     #1,INTFLA               ; INTERRUPT FLAG
017304                                  ENDSRV
017304                                                                  L10017:
017304  000002                                                                  RTI

                                ;*************************************************************
                                ; INTERRUPT SERVICE ROUTINE   INTSR2
                                ;*************************************************************

                                ;++
                                ;THIS ROUTINE SETS A FLAG (INTFL2) TO 1. IT WILL BE EXECUTED
                                ;WHEN AN ERROR INTERRUPT HAS OCCURRED.
                                ;--

017306                                  BGNSRV  INTSR2
017306                                                                  INTSR2::
017306  012737  000001  004152          MOV     #1,INTFL2               ; ERROR INTERRUPT FLAG
017314                                  ENDSRV
017314                                                                  L10020:
017314  000002                                                                  RTI
```

GLOBAL SUBROUTINES SECTION

```
4363                                    ;+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
4364                                    ; INTERRUPT SERVICE ROUTINE - CLINT
4365                                    ;+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
4366
4367                                    ;+++
4368                                    ;THIS ROUTINE IS A DUMY SERVICE FOR THE LINE TIME CLOCK INTERRUPTS
4369                                    ;IT WILL BE EXECUTED WHEN AN INTERRUPT AT VECTOR 100 IS OCCURED.
4370                                    ;---
4371
4372 017316                                       BGNSRV  CLINT
      017316                                                                    CLINT::
4373                                                          ;NO ACTION IN THIS ROUTINE
4374 017316                                       ENDSRV
      017316                                                                    L10021:
      017316  000002                                                                   RTI
4375
```

GLOBAL SUBROUTINES SECTION

```
4377
4378
4379
4380 017320                                    ENDMOD
4381
4382
```

GLOBAL SUBROUTINES SECTION

```
                                .TITLE MISCELLANEOUS SECTIONS
                                .SBTTL  REPORT CODING SECTION

017320                                  BGNMOD

                                ; PRINT ROUTINE

                                ;++
                                ; FUNCTIONAL DESCRIPTION:
                                ;
                                ;       PRINTS OUT TEST TITLES, A CONFIGURATION TABLE OR A STATISTICS
                                ;       TABLE FOR THE UNITS UNDER TEST. WHICH TO PRINT IS DETERMINED BY
                                ;       USER INPUT.
                                ;
                                ;       THE CONFIGURATION TABLE SHOWS THE HARDWARE CHARACTERISTICS OF
                                ;       THE UNIT UNDER TEST AND IF PRESENT, OF THE UNIT TO WHICH IT IS
                                ;       CONNECTED FOR LOOPBACK TESTING. IF THE FIRST UNIT MODE ADDRESS
                                ;       IS ZERO (IE. NO TESTS HAVE BEEN RUN AND NO HARDWARE PARAMETERS
                                ;       HAVE BEEN SET UP) THE AUTOMATIC CONFIGURATION ROUTINE 'CONFIG'
                                ;       IS CALLED TO ASCERTAIN THE HARDWARE CONFIGURATION.
                                ;
                                ;       THE STATISTICS TABLE DISPLAYS THE NUMBER OF ERRORS WHICH THE
                                ;       DIAGNOSTIC HAS DETECTED FOR EACH UNIT, AND WHETHER THE UNIT HAS
                                ;       BEEN DROPPED FROM TESTING.
                                ;
                                ; INPUTS:
                                ;
                                ;       THE USER IS ASKED TO TYPE A CHARACTER INDICATING WHETHER TO
                                ;       PRINT THE TEST TITLES, THE CONFIGURATION TABLE, THE STATISTICS
                                ;       TABLE OR HOW TO REESTABLISH THE SYSTEM CONFIGURATION.
                                ;
                                ; IMPLICIT INPUTS:
                                ;
                                ;       THE HARDWARE PARAMETER TABLE IS READ FOR THE CONFIGURATION
                                ;       PRINTOUT.
                                ;
                                ;       THE ERROR TABLE 'ECNT' IS USED FOR THE STATISTICS PRINTOUT.
                                ;
                                ;       TEST TITLES ARE ASSUMED TO BE LABELLED WITH THE FORMAT TDHDNN,
                                ;       WHERE NN IS THE TEST NUMBER. NTESTS AT THE START OF THE ROUTINE
                                ;       MUST EQUAL THE NUMBER OF TESTS IN THE DIAGNOSTIC.
                                ;
                                ; OUTPUTS:
                                ;
                                ;       EITHER A LIST OF TEST TITLES, A CONFIGURATION TABLE OR A
                                ;       STATISTICS TABLE ARE OUTPUT.
                                ;
                                ;       IF ANY UNIT HAS BEEN DROPPED OR DESELECTED USING THE "UNITS"
                                ;       SWITCH, A MESSAGE "PLEASE TYPE ADD" MAY BE PRINTED.
                                ;
                                ; IMPLICIT OUTPUTS:
                                ;
                                ;       NONE.
                                ;
                                ; SUBORDINATE ROUTINES USED:
                                ;
                                ;       CONFIG - AUTOMATIC CONFIGURATION ROUTINE.
```

REPORT CODING SECTION

```
                                ;       CONPRI - CONFIGURATION PRINT ROUTINE.
                                ;       CRLF   - LINE FEED PRINT ROUTINE.
                                ;
                                ; FUNCTIONAL SIDE EFFECTS:
                                ;
                                ;       IF NO HARDWARE PARAMETERS ARE SET UP, THE AUTOMATIC
                                ;       CONFIGURATION ROUTINE IS CALLED TO GENERATE A HARDWARE P TABLE.
                                ;
                                ;       REGISTERS R1 TO R5 ARE CORRUPTED.
                                ;
                                ; CALLING SEQUENCE:
                                ;
                                ;       INVOKED BY THE OPERATOR PRINT COMMAND.
                                ;
                                ;--

                        000031          NTESTS=25.                      ; 25 TESTS FOT TITLE PRINTOUT

017320                          BGNRPT
017320                                                                  L$RPT::
017320                  ASK:    MANUAL                                  ; IS MANUAL INTERVATION ALLOWED ?
017320  104450                                                          TRAP    C$MANI
017322                          BCOMPLETE 10$                           ; IF YES, BRANCH (UAM NOT SET)
017322  103412                                                          BCS     10$
017324                          PRINTF  @PRA                            ; PRINT THAT UAM HAS TO BE SET
017324  012746  020654                                                  MOV     @PRA,-(SP)
017330  012746  000001                                                  MOV     #1,-(SP)
017334  010600                                                          MOV     SP,R0
017336  104417                                                          TRAP    C$PNTF
017340  062706  000004                                                  ADD     #4,SP
017344                          EXIT    RPT                             ; EXIT PRINT ROUTINE
017344  000167                                                          .WORD   J$JMP
017346  002770                                                          .WORD   L10022-2-.
017350                  10$:    GMANID  PR1,CHAR,A,377,1,4,YES; PROMPT FOR A COMMAND
017350  104443                                                          TRAP    C$GMAN
017352  000406                                                          BR      10000$
017354  020454                                                          .WORD   CHAR
017356  000152                                                          .WORD   T$CODE
017360  020746                                                          .WORD   PR1
017362  000377                                                          .WORD   377
017364  000001                                                          .WORD   T$LOLIM
017366  000004                                                          .WORD   T$HILIM
017370                                                                  10000$:
017370  023727  020454  000122          CMP     CHAR,@'R                ; REESTABLISH SYSTEM CONFIG. ?
017376  001457                          BEQ     RECON                   ; IF YES, OUTPUT INFORMATION
017400  023727  020454  000124          CMP     CHAR,@'T                ; TEST LIST REQUESTED ?
017406  001515                          BEQ     TITLE                   ; IF YES, OUTPUT TITLES
017410  023727  020454  000103          CMP     CHAR,@'C                ; CONFIGURATION REQUESTED ?
017416  001574                          BEQ     CON                     ; IF YES, OUTPUT CONFIGURATION
017420  023727  020454  000123          CMP     CHAR,@'S                ; STATISTICS REQUESTED ?
017426  001002                          BNE     HEL                     ; IF NOT, PRINT THE HELP MESSAGE
017430  000137  020260                  JMP     STAT                    ; IF YES, OUTPUT STATISTICS

017434                  HEL:    PRINTF  @PR2                            ; OTHERWISE, PRINT THE HELP MESSAGE
017434  012746  020773                                                  MOV     #PR2,-(SP)
017440  012746  000001                                                  MOV     #1,-(SP)
017444  010600                                                          MOV     SP,R0
```

```
REPORT CODING SECTION

                017446  104417                                                          TRAP    C$PNTF
                017450  062706  000004                                                  ADD     #4,SP
   4513         017454                          PRINTF  #PR2A           ;               MOV     #PR2A,-(SP)
                017454  012746  021100                                                  MOV     #1,-(SP)
                017460  012746  000001                                                  MOV     SP,R0
                017464  010600                                                          TRAP    C$PNTF
                017466  104417                                                          ADD     #4,SP
                017470  062706  000004
   4514         017474                          PRINTF  #PR2B           ;               MOV     #PR2B,-(SP)
                017474  012746  021177                                                  MOV     #1,-(SP)
                017500  012746  000001                                                  MOV     SP,R0
                017504  010600                                                          TRAP    C$PNTF
                017506  104417                                                          ADD     #4,SP
                017510  062706  000004
   4515         017514                          PRINTF  #PR2C           ;               MOV     #PR2C,-(SP)
                017514  012746  021271                                                  MOV     #1,-(SP)
                017520  012746  000001                                                  MOV     SP,R0
                017524  010600                                                          TRAP    C$PNTF
                017526  104417                                                          ADD     #4,SP
                017530  062706  000004
   4516         017534  000671                  BR      ASK             ; AND PROMPT FOR COMMAND AGAIN
   4517
   4518         017536                  RECON:  PRINTF  #PR2D           ; PRINT HOW TO REESTABLISH
                017536  012746  021332                                                  MOV     #PR2D,-(SP)
                017542  012746  000001                                                  MOV     #1,-(SP)
                017546  010600                                                          MOV     SP,R0
                017550  104417                                                          TRAP    C$PNTF
                017552  062706  000004                                                  ADD     #4,SP
   4519         017556                          PRINTF  #PR2E           ; THE SYSTEM CONFIGURATION
                017556  012746  021422                                                  MOV     #PR2E,-(SP)
                017562  012746  000001                                                  MOV     #1,-(SP)
                017566  010600                                                          MOV     SP,R0
                017570  104417                                                          TRAP    C$PNTF
                017572  062706  000004                                                  ADD     #4,SP
   4520         017576                          PRINTF  #PR2F           ; ...
                017576  012746  021525                                                  MOV     #PR2F,-(SP)
                017602  012746  000001                                                  MOV     #1,-(SP)
                017606  010600                                                          MOV     SP,R0
                017610  104417                                                          TRAP    C$PNTF
                017612  062706  000004                                                  ADD     #4,SP
   4521         017616                          PRINTF  #PR2G           ; ...
                017616  012746  021621                                                  MOV     #PR2G,-(SP)
                017622  012746  000001                                                  MOV     #1,-(SP)
                017626  010600                                                          MOV     SP,R0
                017630  104417                                                          TRAP    C$PNTF
                017632  062706  000004                                                  ADD     #4,SP
   4522         017636  000137  020444          JMP     PREX            ; AND EXIT
   4523
   4524         017642                  TITLE:  PRINTF  #TT             ; TEST LIST HEADER
                017642  012746  020546                                                  MOV     #TT,-(SP)
                017646  012746  000001                                                  MOV     #1,-(SP)
                017652  010600                                                          MOV     SP,R0
                017654  104417                                                          TRAP    C$PNTF
                017656  062706  000004                                                  ADD     #4,SP
   4525         017662  012701  000001          MOV     #1,R1           ; START WITH TEST 1
   4526         017666  012702  020464          MOV     #TADS,R2        ; START OF LIST OF TITLE ADDRESSES
   4527
```

REPORT CODING SECTION

```
4528 017672  012703  000022          10$:    MOV     #18.,R3                 ; WAIT AFTER 18 LINES
4529
4530 017676                          20$:    PRINTF  #TNUM,R1                ; PRINT TEST NUMBER
     017676  010146                                                                  MOV     R1,-(SP)
     017700  012746  020650                                                          MOV     #TNUM,-(SP)
     017704  012746  000002                                                          MOV     #2,-(SP)
     017710  010600                                                                  MOV     SP,R0
     017712  104417                                                                  TRAP    C$PNTF
     017714  062706  000006                                                          ADD     #6,SP
4531 017720                                  PRINTF  (R2)                    ; AND TITLE
     017720  011246                                                                  MOV     (R2),-(SP)
     017722  012746  000001                                                          MOV     #1,-(SP)
     017726  010600                                                                  MOV     SP,R0
     017730  104417                                                                  TRAP    C$PNTF
     017732  062706  000004                                                          ADD     #4,SP
4532 017736  062702  000002                  ADD     #2,R2                   ; GET ADDRESS OF NEXT TITLE
4533 017742  005201                          INC     R1                      ; AND NEXT TEST NUMBER
4534 017744  020127  000031                  CMP     R1,#NTESTS              ; ALL PRINTED ?
4535 017750  003015                          BGT     30$                     ; IF YES, EXIT
4536 017752  005303                          DEC     R3                      ; 18 LINES OUTPUT ?
4537 017754  001350                          BNE     20$                     ; IF NOT, BRANCH
4538 017756                                  GMANID  RDY,RFLG,A,377,0,1,YES  ; ELSE WAIT FOR OPERATOR TO READ
     017756  104443                                                                  TRAP    C$GMAN
     017760  000406                                                                  BR      10001$
     017762  020462                                                                  .WORD   RFLG
     017764  000152                                                                  .WORD   T$CODE
     017766  020612                                                                  .WORD   RDY
     017770  000377                                                                  .WORD   377
     017772  000000                                                                  .WORD   T$LOLIM
     017774  000001                                                                  .WORD   T$HILIM
     017776                                                                  10001$:
4539 017776  004737  011542                      JSR     PC,CRLF                 ; PRINT A LINE FEED
4540 020002  000733                              BR      10$                     ; AND THEN CONTINUE
4541
4542 020004  000137  020444          30$:    JMP     PREX                    ; EXIT
4543
4544 020010  005037  020450          CON:    CLR     STFLG                   ; ASSUME DIAGNOSTIC IS NOT STARTED
4545 020014  005037  020452                  CLR     GPFLG                   ; FLAG NO GPHARDS YET EXECUTED
4546 020020  005737  003774                  TST     GPADD                   ; ARE ANY PARAMETER ADDRESSES SET UP ?
4547 020024  001402                          BEQ     10$                     ; IF NOT, BRANCH
4548 020026  005237  020450                  INC     STFLG                   ; ELSE FLAG DIAGNOSTIC IS STARTED
4549
4550 020032  005737  002012          10$:    TST     L$UNIT                  ; ANY UNITS SET UP ?
4551 020036  001404                          BEQ     20$                     ; IF NOT, BRANCH
4552 020040  023727  002012  000020          CMP     L$UNIT,#16.             ; TOO MANY UNITS SET UP ?
4553 020046  003403                          BLE     30$                     ; IF NOT, BRANCH
4554 020050  012737  000020  002012  20$:    MOV     #16.,L$UNIT             ; SET UP 16 UNITS
4555
4556 020056  013746  002074          30$:    MOV     L$LUN, (SP)             ; SAVE THE UNIT NUMBER BEING TESTED
4557 020062  005037  002074                  CLR     L$LUN                   ; START WITH UNIT 0
4558
4559 020066  013701  003774                  MOV     GPADD,R1                ; GET FIRST PARAM. ADDRESS
4560 020072  005711                          TST     (R1)                    ; ANYTHING IN IT
4561 020074  001003                          BNE     40$                     ; IF YES, BRANCH
4562 020076  012737  171000  012514          MOV     #171000,STADD           ; ELSE START FOR FIRST IAV IDV ADDR.
4563
4564 020104  013701  002074          40$:    MOV     L$LUN,R1                ; FORM OFFSET FOR UNIT TABLES
```

REPORT CODING SECTION

```
4565 020110  006301                        ASL     R1                      ;
4566 020112  005761  003774                TST     GPADD(R1)               ; PARAMETER ADDRESS SET UP ?
4567 020116  001010                        BNE     50$                     ; IF YES, BRANCH
4568 020120                                GPHARD  L$LUN,GPADD(R1)         ; ELSE, GET P TABLE ADDRESS
     020120  013700  002074                                                        MOV     L$LUN,R0
     020124  104442                                                                TRAP    C$GPHRD
     020126  010061  003774                                                        MOV     R0,GPADD(R1)
4569 020132                                BNCOMPLETE ASKADD               ; IF DESELECTED, REQUEST OPERATOR ADD
     020132  103040                                                                BCC     ASKADD
4570 020134  005237  020452                INC     GPFLG                   ; FLAG THAT GPHARD HAS BEEN USED
4571
4572 020140  005771  003774          50$:  TST     @GPADD(R1)              ; MODE ADDRESS OF UNIT = 0 ?
4573 020144  001002                        BNE     60$                     ; IF NOT, BRANCH
4574 020146  004737  012214          55$:  JSR     PC,CONFIG               ; DO AUTO CONFIGURATION
4575
4576 020152  005237  002074          60$:  INC     L$LUN                   ; NEXT UNIT
4577 020156  023737  002074  002012        CMP     L$LUN,L$UNIT            ; ALL DONE ?
4578 020164  002747                        BLT     40$                     ; IF NOT, DO THE NEXT
4579 020166  012637  002074                MOV     (SP)+,L$LUN             ; RESTORE THE UNIT NUMBER
4580
4581 020172  004737  012600          70$:  JSR     PC,CONPR1               ; PRINT THE CONFIGURATION
4582
4583 020176  005737  020450                TST     STFLG                   ; WAS DIAGNOSTIC STARTED ?
4584 020202  001520                        BEQ     PREX                    ; IF NOT, EXIT
4585 020204  005737  020452                TST     GPFLG                   ; HAVE WE USED ANY GPHARDS ?
4586 020210  001515                        BEQ     PREX                    ; IF NOT, EXIT
4587 020212                          80$:  PRINTF  @PR7                    ; ELSE PRINT 'USE STA OR RES'
     020212  012746  022234                                                        MOV     @PR7,-(SP)
     020216  012746  000001                                                        MOV     #1,-(SP)
     020222  010600                                                                MOV     SP,R0
     020224  104417                                                                TRAP    C$PNTF
     020226  062706  000004                                                        ADD     #4,SP
4588 020232  000504                        BR      PREX                    ; AND EXIT
4589
4590 020234                          ASKADD: PRINTF  @PR6                    ; ASK OPERATOR TO ADD UNITS
     020234  012746  022133                                                        MOV     @PR6,-(SP)
     020240  012746  000001                                                        MOV     #1,-(SP)
     020244  010600                                                                MOV     SP,R0
     020246  104417                                                                TRAP    C$PNTF
     020250  062706  000004                                                        ADD     #4,SP
4591 020254  000137  020444                JMP     PREX                    ; AND EXIT
4592
4593 020260                          STAT:   PRINTF  @PR3                    ; PRINT STATISTICS HEADER
     020260  012746  021715                                                        MOV     @PR3,-(SP)
     020264  012746  000001                                                        MOV     #1,-(SP)
     020270  010600                                                                MOV     SP,R0
     020272  104417                                                                TRAP    C$PNTF
     020274  062706  000004                                                        ADD     #4,SP
4594 020300                                PRINTF  @PR3A                   ;
     020300  012746  022022                                                        MOV     @PR3A,-(SP)
     020304  012746  000001                                                        MOV     #1,-(SP)
     020310  010600                                                                MOV     SP,R0
     020312  104417                                                                TRAP    C$PNTF
     020314  062706  000004                                                        ADD     #4,SP
4595
4596 020320  005001                        CLR     R1                      ; START WITH FIRST UNIT
4597
```

REPORT CODING SECTION

```
4598 020322  020137  002012          20$:    CMP     R1,L$UNIT               ; ALL UNITS REPORTED ?
4599 020326  001444                          BEQ     60$                     ; IF YES, EXIT
4600 020330  010104                          MOV     R1,R4                   ; FORM OFFSET TO ERROR COUNT
4601 020332  006304                          ASL     R4                      ;
4602 020334  016405  003734                  MOV     ECNT(R4),R5             ; GET UNIT'S ERROR COUNT
4603 020340  005705                          TST     R5                      ; IS IT NEGATIVE ?
4604 020342  100423                          BMI     40$                     ; IF YES, REPORT UNTESTED
4605
4606 020344  012703  022334                  MOV     #NO,R3                  ; ASSUME UNIT IS NOT DROPPED
4607 020350  105761  004034                  TSTB    DROPED(R1)              ; CHECK IF IT IS
4608 020354  001402                          BEQ     30$                     ; IF IT IS NOT, BRANCH
4609 020356  012703  022330                  MOV     #YES,R3                 ; OTHERWISE PRINT YES
4610 020362                          30$:    PRINTF  #PR5,R1,R5,R3           ; ELSE PRINT STATISTICS
     020362  010346                                                                  MOV     R3,-(SP)
     020364  010546                                                                  MOV     R5,-(SP)
     020366  010146                                                                  MOV     R1,-(SP)
     020370  012746  022112                                                          MOV     #PR5,-(SP)
     020374  012746  000004                                                          MOV     #4,-(SP)
     020400  010600                                                                  MOV     SP,R0
     020402  104417                                                                  TRAP    C$PNTF
     020404  062706  000012                                                          ADD     #12,SP
4611 020410  000411                          BR      50$                     ; AND LOOK FOR MORE UNITS
4612
4613 020412                          40$:    PRINTF  #PR4,R1                 ; PRINT 'UNTESTED'
     020412  010146                                                                  MOV     R1,-(SP)
     020414  012746  022061                                                          MOV     #PR4,-(SP)
     020420  012746  000002                                                          MOV     #2,-(SP)
     020424  010600                                                                  MOV     SP,R0
     020426  104417                                                                  TRAP    C$PNTF
     020430  062706  000006                                                          ADD     #6,SP
4614
4615 020434  005201                  50$:    INC     R1                      ; PREPARE FOR NEXT UNIT
4616 020436  000731                          BR      20$                     ; IF NOT, REPORT THE NEXT
4617
4618 020440  004737  011542          60$:    JSR     PC,CRLF                 ; PRINT A LINE FEED
4619
4620 020444                          PREX:   EXIT    RPT
     020444  000167                                                                  .WORD   J$JMP
     020446  001670                                                                  .WORD   L10022-2-.
4621
4622 020450  000000                  STFLG:  .WORD   0                       ; SET IF DIAGNOSTIC HAS BEEN STARTED
4623 020452  000000                  GPFLG:  .WORD   0                       ; SET IF ANY GPHARDS ARE EXECUTED
4624 020454    110     040     040  CHAR:   .ASCIZ  /H    /                 ; STORE FOR OPERATOR INPUT
     020457    040     040     000
4625 020462  000000                  RFLG:   .WORD   0                       ; FLAG FOR 'TYPE RETURN FOR MORE TITLES
4626
4650
4651 020464                          TADS:   TITLES                          ; LIST OF TEST TITLE ADDRESSES

     020464  027116                          .WORD   TSHD1
     020466  027562                          .WORD   TSHD2
     020470  030626                          .WORD   TSHD3
     020472  031760                          .WORD   TSHD4
     020474  033204                          .WORD   TSHD5
     020476  034524                          .WORD   TSHD6
     020500  035424                          .WORD   TSHD7
     020502  036570                          .WORD   TSHD8
```

REPORT CODING SECTION

```
        020504  037616                          .WORD   TSHD9
        020506  040676                          .WORD   TSHD10
        020510  041400                          .WORD   TSHD11
        020512  042572                          .WORD   TSHD12
        020514  043450                          .WORD   TSHD13
        020516  045612                          .WORD   TSHD14
        020520  051006                          .WORD   TSHD15
        020522  054530                          .WORD   TSHD16
        020524  057454                          .WORD   TSHD17
        020526  061424                          .WORD   TSHD18
        020530  062450                          .WORD   TSHD19
        020532  063746                          .WORD   TSHD20
        020534  067340                          .WORD   TSHD21
        020536  071566                          .WORD   TSHD22
        020540  075120                          .WORD   TSHD23
        020542  100100                          .WORD   TSHD24
        020544  102236                          .WORD   TSHD25
4655
4656                                            .NLIST BEX
4657
4658 020546     045     116     045  TT:        .ASCII  /%N%ATEST TITLES./
4659 020566     045     116     045             .ASCIZ  /%N%A-----------%N2/
4660
4661 020612     124     131     120  RDY:       .ASCIZ  /TYPE "RETURN" FOR MORE TITLES/
4662
4663 020650     045     104     063  TNUM:      .ASCIZ  /%D3/
4664
4665 020654     045     116     045  PRA:       .ASCIZ  /%N%ATO USE THE PRINT COMMAND, PLEASE CLEAR THE "UAM" FLAG/
4666
4667 020746     124     131     120  PR1:       .ASCIZ  /TYPE T,R,C,S OR HELP/
4668
4669 020773     045     116     045  PR2:       .ASCII  /%N%ATHE FOLLOWING COMMANDS ARE ACCEPTED :-/
4670 021045     045     116     062             .ASCIZ  /%N2%AT - PRINT TEST TITLES/
4671 021100     045     116     045  PR2A:      .ASCIZ  /%N%AC - PRINT CONFIGURATION TABLE CURRENTLY USED BY DIAGNOSTIC/
4672 021177     045     116     045  PR2B:      .ASCIZ  /%N%AR - PRINT HOW TO REESTABLISH THE SYSTEM CONFIGURATION/
4673 021271     045     116     045  PR2C:      .ASCIZ  /%N%AS - PRINT STATISTICS TABLE%N/
4674
4675 021332     045     116     045  PR2D:      .ASCIZ  /%N%ATO REESTABLISH THE SYSTEM CONFIGURATION, ANSWER THE/
4676 021422     045     116     045  PR2E:      .ASCIZ  /%N%AHARDWARE QUESTION TYPING "0" AS THE MODE ADDRESS FOR 16 UNITS./
4677 021525     045     116     045  PR2F:      .ASCIZ  /%N%N%AEG.  MODE REGISTER ADDRESS (O) O ?  O,,,,,,,,,,,,,,,,/
4678 021621     045     116     045  PR2G:      .ASCIZ  /%N%A                                      ----------------/
4679 021715     045     116     062  PR3:       .ASCII  \%N2%AIDV/IAV-11 MODULE STATISTICS.\
4680 021757     045     116     045             .ASCIZ  /%N%A-----------------------------/
4681 022022     045     116     062  PR3A:      .ASCIZ  /%N2%AUNIT    ERRORS    DROPPED%N/
4682
4683 022061     045     116     045  PR4:       .ASCIZ  /%N%D3%A    UNTESTED     NO/
4684
4685 022112     045     116     045  PR5:       .ASCIZ  /%N%D3%S5%D3%S7%T/
4686
4687 022133     045     116     045  PR6:       .ASCII  /%N%AUNIT DROPPED OR DESELECTED - PLEASE TYPE "ADD"/
4688 022215     040     101     116             .ASCIZ  / AND TRY AGAIN/
4689
4690 022234     045     116     045  PR7:       .ASCIZ  /%N%APLEASE TYPE "START" OR "RESTART" TO CONTINUE TESTING.%N
4691
4692 022330     131     105     123  YES:       .ASCIZ  /YES/
4693 022334     116     117     000  NO:        .ASCIZ  /NO/
4694
```

REPORT CODING SECTION

```
4695                                    .LIST BEX
4696                                    .EVEN
4697
4698 022340                             ENDRPT
     022340                                                 L10022:
     022340  104425                                                 TRAP    C$RPT
```

```
                                .SBTTL  PROTECTION TABLE

                                ;++
                                ; THIS TABLE IS USED BY THE RUNTIME SERVICES
                                ; TO PROTECT THE LOAD MEDIA.
                                ;--

                                        BGNPROT
                                                                                L$PROT::

                                        0               ;OFFSET INTO P-TABLE FOR MODE ADDRESS
                                        -1              ;OFFSET INTO P-TABLE FOR MASSBUS ADDRESS
                                        -1              ;OFFSET INTO P-TABLE FOR DRIVE NUMBER

                                        ENDPROT
```

INITIALIZE SECTION

```
                                .SBTTL  INITIALIZE SECTION

                                ;++
                                ; THE INITIALIZE SECTION CONTAINS THE CODING THAT IS PERFORMED
                                ; AT THE BEGINNING OF EACH PASS.
                                ;--

022350                                  BGNINIT
022350                                                                  L$INIT::

                                START:  READEF  #EF,START       ; IS THIS A  NEW START ?
022350  012700  000040                                                  MOV     #EF,START,R0
022354  104447                                                         TRAP    C$REFG
022356                                  BNCOMPLETE RESTRT       ; IF NOT, BRANCH
022356  103126                                                         BCC     RESTRT
022360                                  SETVEC  #14,#106736,#340; *** JUST FOR DEBUG PROGRAM ***
022360  012746  000340                                                  MOV     #340,-(SP)
022364  012746  106736                                                  MOV     #106736,-(SP)
022370  012746  000014                                                  MOV     #14,-(SP)
022374  012746  000003                                                  MOV     #3,-(SP)
022400  104437                                                         TRAP    C$SVEC
022402  062706  000010                                                  ADD     #10,SP
022406                                  SETVEC  #100,#CLINT,#340; IGNORE FURTHER INTERRUPTS TO VECTOR 100
022406  012746  000340                                                  MOV     #340,-(SP)
022412  012746  017316                                                  MOV     #CLINT,-(SP)
022416  012746  000100                                                  MOV     #100,-(SP)
022422  012746  000003                                                  MOV     #3,-(SP)
022426  104437                                                         TRAP    C$SVEC
022430  062706  000010                                                  ADD     #10,SP
022434  005737  002232                  TST     MANTST          ; DOING MANUFACTURING TESTS ?
022440  001024                          BNE     10$             ; IF YES, BRANCH
022442                                  PRINTF  #WARN           ; PRINT 'DISCONNECT EXTERNAL EQUIPMENT'
022442  012746  023652                                                  MOV     #WARN,-(SP)
022446  012746  000001                                                  MOV     #1,-(SP)
022452  010600                                                          MOV     SP,R0
022454  104417                                                         TRAP    C$PNTF
022456  062706  000004                                                  ADD     #4,SP
022462                                  PRINTF  #WARN1          ;
022462  012746  023756                                                  MOV     #WARN1,-(SP)
022466  012746  000001                                                  MOV     #1,-(SP)
022472  010600                                                          MOV     SP,R0
022474  104417                                                         TRAP    C$PNTF
022476  062706  000004                                                  ADD     #4,SP
022502  004737  011570                  JSR     PC,WRDT         ; WAIT FOR OPERATOR TO TYPE 'RETURN'
022506  004737  011542                  JSR     PC,CRLF         ; PRINT A LINE FEED
022512                          10$:    BRESET                  ; RESET THE SYSTEM
022512  104433                                                         TRAP    C$RESET
022514  004737  024222                  JSR     PC,SETCLK       ; SET UP CLOCK COUNTER

022520  005737  002012                  TST     L$UNIT          ; ANY UNITS CONFIGURED ?
022524  001404                          BEQ     20$             ; IF NOT, BRANCH
022526  023727  002012  000020          CMP     L$UNIT,#16.     ; TOO MANY UNITS SET UP ?
022534  003403                          BLE     30$             ; IF NOT, BRANCH
022536  012737  000020  002012  20$:    MOV     #16.,L$UNIT     ; ELSE, SET UP 16 UNITS

022544  005037  023650          30$:    CLR     ACFLG           ; CLEAR AUTO CONFIGURATION FLAG
```

INITIALIZE SECTION

```
4782 022550  012737  171000  012514          MOV     #171000,STADD   ; START ADDRESS FOR SEARCH
4783 022556  012700  004070                  MOV     #LOPFLG,R0      ; FLAG THAT LOOP CONFIGURATION IS NOT CHECKED
4784 022562  012701  000020                  MOV     #16.,R1         ; FOR POSSIBLE 16 UNITS
4785 022566  005020                  50$:    CLR     (R0)+           ; CLEAR THE FLAG
4786 022570  005301                          DEC     R1              ; ALL DONE ?
4787 022572  001375                          BNE     50$             ; IF NOT, DO THE NEXT
4788
4789
4790 022574  012700  003734                  MOV     #DROPED,R0      ; GET UNIT DROPPED TABLE ADDERSS
4791 022600  012701  000020                  MOV     #16.,R1         ; THERE ARE 16 UNITS
4792 022604  105020                  55$:    CLRB    (R0)+           ; CLEAR ALL 16 DROPPED UNIT FLAGS
4793 022606  005301                          DEC     R1              ; ...
4794 022610  001375                          BNE     55$             ; ...
4795 022612  012700  003734                  MOV     #ECNT,R0        ; GET ERROR COUNT FOR UUT 0
4796 022616  012701  000020                  MOV     #16.,R1         ; THERE ARE 16 UUT'S
4797 022622  012720  100000          60$:    MOV     #100000,(R0)+   ; INIT THE ERROR COUNT
4798 022626  005301                          DEC     R1              ; ALL CLEARED ?
4799 022630  001374                          BNE     60$             ; IF NOT, CLEAR NEXT COUNT
4800 022632  000404                          BR      STARES          ; ELSE, START TESTING WITH FIRST UUT
4801
4802 022634                          RESTRT: READEF  #EF.RESTART     ; IS THIS A RESTART ?
     022634  012700  000037                                                  MOV     #EF.RESTART,R0
     022640  104447                                                          TRAP    C$REFG
4803 022642                                  BNCOMPLETE NEWST        ; IF NOT, BRANCH
     022642  103005                                                          BCC     NEWST
4804
4805 022644  005037  004054          STARES: CLR     TSTFLG          ; SHOW NO TESTS HAVE BEEN RUN THIS PASS
4806 022650  005037  004056                  CLR     TSUFLG          ; OR FOR THIS UNIT
4807 022654  000536                          BR      INIUUT          ; START TESTING WITH FIRST UUT
4808
4809 022656                          NEWST:  READEF  #EF.NEW         ; IS THIS A NEW PASS ?
     022656  012700  000035                                                  MOV     #EF.NEW,R0
     022662  104447                                                          TRAP    C$REFG
4810 022664                                  BNCOMPLETE CONT         ; IF NOT, BRANCH
     022664  103030                                                          BCC     CONT
4811 022666  005737  004054                  TST     TSTFLG          ; WERE ANY TESTS SELECTED LAST TIME ?
4812 022672  001011                          BNE     10$             ; IF YES, BRANCH
4813 022674                                  PRINTF  #NTEST          ; IF NOT, TELL THE USER
     022674  012746  024056                                                  MOV     #NTEST,-(SP)
     022700  012746  000001                                                  MOV     #1,-(SP)
     022704  010600                                                          MOV     SP,R0
     022706  104417                                                          TRAP    C$PNTF
     022710  062706  000004                                                  ADD     #4,SP
4814 022714                                  DOCLN                   ; AND RETURN TO THE SUPERVISOR
     022714  104444                                                          TRAP    C$DCLN
4815
4816 022716  005037  004054          10$:    CLR     TSTFLG          ; INIT TEST FLAG AGAIN
4817 022722  005737  023650                  TST     ACFLG           ; JUST DONE A RUN OF AUTO CONFIGURATION ?
4818 022726  001511                          BEQ     INIUUT          ; IF NOT, TEST FIRST UNIT
4819 022730  005037  023650                  CLR     ACFLG           ; ELSE, FLAG THAT THE RUN IS FINISHED
4820 022734  004737  012600                  JSR     PC,CONPRI       ; PRINT THE CONFIGURATION
4821 022740  004737  011570                  JSR     PC,WRDY         ; WAIT FOR OPERATOR TO TYPE 'RETURN'
4822 022744  000502                          BR      INIUUT          ; THEN TEST THE FIRST UNIT
4823
4824 022746                          CONT:   READEF  #EF.CONTINUE    ; IS THIS A CONTINUE ?
     022746  012700  000036                                                  MOV     #EF.CONTINUE,R0
     022752  104447                                                          TRAP    C$REFG
```

INITIALIZE SECTION

```
                                                BNCOMPLETE PWRFL         ; IF NOT, BRANCH
 022754  103025                                                                 BCC     PWRFL
                                                SETVEC  #4,#NXM,#PRI07   ; IGNORE NXM TRAPS
 022756  012746  000340                                                         MOV     #PRI07,-(SP)
 022762  012746  017266                                                         MOV     #NXM,-(SP)
 022766  012746  000004                                                         MOV     #4,-(SP)
 022772  012746  000003                                                         MOV     #3,-(SP)
 022776  104437                                                                 TRAP    C$SVEC
 023000  062706  000010                                                         ADD     #10,SP
                                                BIS     #100,@MOD        ; ELSE, LIGHT OUT LED
                                                CLRVEC  #4               ; RESTORE THE SUPERVISOR NXM VECTOR
 023012  012700  000004                                                         MOV     #4,R0
 023016  104436                                                                 TRAP    C$CVEC
                                                JSR     PC,LOPCHK        ; CHECK THE LOOP CONFIGURATION
                                                JMP     END              ; AND CONTINUE

                                        PWRFL:  READEF  #EF.PWR          ; IS THIS A POWER FAIL
 023030  012700  000034                                                         MOV     #EF.PWR,R0
 023034  104447                                                                 TRAP    C$REFG
                                                BNCOMPLETE NXTUUT        ; IF NOT, MUST BE NEXT UNIT
 023036  103023                                                                 BCC     NXTUUT
                                                SETVEC  #4,#NXM,#PRI07   ; IGNORE NXM TRAPS
 023040  012746  000340                                                         MOV     #PRI07,-(SP)
 023044  012746  017266                                                         MOV     #NXM,-(SP)
 023050  012746  000004                                                         MOV     #4,-(SP)
 023054  012746  000003                                                         MOV     #3,-(SP)
 023060  104437                                                                 TRAP    C$SVEC
 023062  062706  000010                                                         ADD     #10,SP
                                                BIS     #100,@MOD        ; ELSE, LIGHT OUT LED
                                                CLRVEC  #4               ; RESTORE THE SUPERVISOR NXM VECTOR
 023074  012700  000004                                                         MOV     #4,R0
 023100  104436                                                                 TRAP    C$CVEC
                                                JMP     PSEUL1           ; AND CONTINUE

                                        NXTUUT: TST     TSUFLG           ; WERE ANY TESTS RUN ON THE LAST UNIT ?
                                                BNE     10$              ; IF YES, BRANCH
                                                PRINTF  #NTEST1,L$LUN    ; ELSE PRINT A WARNING
 023114  013746  002074                                                         MOV     L$LUN,-(SP)
 023120  012746  024152                                                         MOV     #NTEST1,-(SP)
 023124  012746  000002                                                         MOV     #2,-(SP)
 023130  010600                                                                 MOV     SP,R0
 023132  104417                                                                 TRAP    C$PNTF
 023134  062706  000006                                                         ADD     #6,SP
                                                JSR     PC,WRDY          ; LET THE OPERATOR READ IT
                                        10$:    CLR     TSUFLG           ; SHOW NO TESTS FOR NEXT UNIT
                                                BR      NEXT             ; AND TEST THE NEXT UNIT

                                        INIUUT: MOV     #-1,L$LUN        ; INITIALIZE LOGICAL UNIT NUMBER.
                                        NEXT:   INC     L$LUN            ; NEXT LOGICAL UNIT TO BE TESTED ?
                                                CMP     L$LUN,L$UNIT     ; ALL UNITS TRIED ?
                                                BGE     INIUUT           ; IF YES, START AGAIN

                                                MOV     L$LUN,R5         ; SAVE UNIT NUMBER
                                                ASL     R5               ; FORM OFFSET

                                                GPHARD  L$LUN,R1         ; GET PARAMETER TABLE ADDRESS IN R1
 023202  013700  002074                                                         MOV     L$LUN,R0
```

INITIALIZE SECTION

```
                023206  104442                                                          TRAP    C$GPHRD
                023210  010001                                                          MOV     R0,R1
        4855    023212                          BNCOMPLETE NEXT         ; IF DROPPED, GET THE NEXT
                023212  103362                                                          BCC     NEXT
        4856    023214  010165  003774          MOV     R1,GPADD(R5)    ; ELSE SAVE THE ADDRESS
        4857    023220  005711                  TST     (R1)            ; MODE ADDRESS = 0 ?
        4858    023222  001024                  BNE     20$             ; IF NOT, BRANCH
        4859    023224  004737  012214          JSR     PC,CONFIG       ; ELSE DO AUTO CONFIGURATION FOR THIS UNIT
        4860    023230  012737  000001  023650  MOV     #1,ACFLG        ; AND FLAG THAT WE ARE DOING IT
        4861    023236  103014                  BCC     10$             ; BRANCH IF ANOTHER UNIT FOUND
        4862    023240  005737  002012          TST     L$UNIT          ; ARE THERE ANY UNITS TO TEST ?
        4863    023244  001342                  BNE     INIUUT          ; IF YES, START AGAIN WITH THE FIRST UNIT
        4864    023246                          PRINTF  #NODEV          ; ELSE PRINT "NO UNITS FOUND"
                023246  012746  007250                                                  MOV     #NODEV,-(SP)
                023252  012746  000001                                                  MOV     #1,-(SP)
                023256  010600                                                          MOV     SP,R0
                023260  104417                                                          TRAP    C$PNTF
                023262  062706  000004                                                  ADD     #4,SP
        4865    023266                          DOCLN                   ; AND RETURN TO THE SUPERVISOR
                023266  104444                                                          TRAP    C$DCLN
        4866
        4867    023270  016501  003774  10$:    MOV     GPADD(R5),R1    ; GET PARAMETER TABLE ADDRESS IN R1
        4868
        4869    023274  004737  025146  20$:    JSR     PC,LOPCHK       ; CHECK THE LOOP CONFIGURATION
        4870
        4871    023300  042765  100000  003734  BIC     #100000,ECNT(R5); FLAG UNIT IS BEING TESTED
        4872
        4873    023306  011137  003700          MOV     (R1),MOD        ; SAVE NEW MODE REGISTER ADDRESS
        4874    023312  011137  003702          MOV     (R1),DAT        ; SAVE NEW DATA REGISTER ADDRESS
        4875    023316  062737  000002  003702  ADD     #2,DAT          ;
        4876    023324  011137  003704          MOV     (R1),CSA        ; SAVE NEW CSA REGISTER ADDRESS
        4877    023330  062737  000004  003704  ADD     #4,CSA          ;
        4878    023336  012137  003706          MOV     (R1)+,CSB       ; SAVE NEW CSB REGISTER ADDRESS
        4879    023342  062737  000006  003706  ADD     #6,CSB          ;
        4880
        4881    023350  012137  003710          MOV     (R1)+,VEC       ; SAVE NEW VECTOR ADDRESS
        4882    023354  012137  003712          MOV     (R1)+,PRIO      ; SAVE NEW PRIORITY
        4883    023360  012137  003714          MOV     (R1)+,COND      ; SAVE WHETHER OTHER MODULE CONNECTED
        4884    023364  012137  003716          MOV     (R1)+,LOWLVL    ; SAVE LOW LEVEL AND
        4885    023370  012137  003720          MOV     (R1)+,DBOUNC    ; DEBOUNCE ANSWER FOR DIGITAL INPUT LOOPB.
        4886    023374  011137  003722          MOV     (R1),OTHMOD     ; SAVE OTHER MODULE MODE ADDRESS
        4887    023400  011137  003724          MOV     (R1),OTHDAT     ; AND DATA REGISTER ADDRESS
        4888    023404  062737  000002  003724  ADD     #2,OTHDAT       ;
        4889    023412  011137  003726          MOV     (R1),OTHCSA     ; AND REGISTER A ADDRESS
        4890    023416  062737  000004  003726  ADD     #4,OTHCSA       ;
        4891    023424  012137  003730          MOV     (R1)+,OTHCSB    ; AND REGISTER B ADDRESS
        4892    023430  062737  000006  003730  ADD     #6,OTHCSB       ;
        4893    023436  011137  003732          MOV     (R1),OTHVEC     ; AND OTHER MODULE VECTOR ADDRESS
        4894
        4895    023442                          SETVEC  #4,#NXM,#PRI07  ; IGNORE NXM TRAPS
                023442  012746  000340                                                  MOV     #PRI07,-(SP)
                023446  012746  017266                                                  MOV     #NXM,-(SP)
                023452  012746  000004                                                  MOV     #4,-(SP)
                023456  012746  000003                                                  MOV     #3,-(SP)
                023462  104437                                                          TRAP    C$SVEC
                023464  062706  000010                                                  ADD     #10,SP
        4896    023470  052777  000100  160202  BIS     #100,@MOD       ; SWITCH ON UUT LED
```

INITIALIZE SECTION

```
4897 023476  017701  160176                MOV     @MOD,R1         ; GET MODE REGISTER CONTENTS
4898 023502                                CLRVEC  #4              ; RESTORE NXM TRAP CATCHER
     023502  012700  000004                                                 MOV     #4,R0
     023506  104436                                                         TRAP    C$CVEC
4899
4900 023510  012702  000020                MOV     #20,R2          ; ASSUME UNIDENTIFIABLE MODULE
4901 023514  020127  140000                CMP     R1,#140000      ; IS ID TOO BIG ?
4902 023520  103013                        BHIS    PSEUL1          ; IF YES, BRANCH
4903 023522  012702  000010                MOV     #10,R2          ; ELSE ASSUME ANALOGUE OUTPUT
4904 023526  006301                        ASL     R1              ; SHIFT OUT TOP BIT
4905 023530  103407                        BCS     PSEUL1          ; IF ID > 177, ID IS ANALOGUE OUTPUT
4906 023532  006202                        ASR     R2              ; ELSE ASSUME ANALOGUE INPUT
4907 023534  006301                        ASL     R1              ; SHIFT OUT NEXT BIT
4908 023536  103404                        BCS     PSEUL1          ; IF ID > 77, ID IS ANALOGUE INPUT
4909 023540  006202                        ASR     R2              ; ELSE ASSUME DIGITAL OUTPUT
4910 023542  006301                        ASL     R1              ; SHIFT OUT TOP BIT
4911 023544  103401                        BCS     PSEUL1          ; IF ID > 37, ID IS DIGITAL OUTPUT
4912 023546  006202                        ASR     R2              ; ELSE ID IS DIGITAL INPUT
4913
4914 023550  052702  000400        PSEUL1: BIS     #400,R2         ; FORCE BASIC TESTS TO BE RUN
4915 023554  005737  002232                TST     MANTST          ; MANUFACTURING TESTS SELECTED ?
4916 023560  001003                        BNE     40$             ; IF YES, BRANCH
4917 023562  052702  001000                BIS     #1000,R2        ; ELSE FORCE FIELD I/O TESTS
4918 023566  000412                        BR      50$             ;
4919 023570  005737  002234        40$:    TST     MANIO           ; MANUFACTURING I/O TESTS SELECTED ?
4920 023574  001407                        BEQ     50$             ; IF NOT, BRANCH
4921 023576  052702  004000                BIS     #4000,R2        ; IF YES, SELECT THEM
4922 023602  005737  003714                TST     COND            ; OTHER MODULE CONNECTED ?
4923 023606  001402                        BEQ     50$             ; IF NOT, BRANCH
4924 023610  052702  002000                BIS     #2000,R2        ; ELSE SELECT LOOPBACK TESTS
4925 023614  052702  010000        50$:    BIS     #10000,R2       ; ASSUME SPECIFICALLY SELECTED TEST
4926 023620  010237  004132                MOV     R2,CONMSK       ; SAVE TEST CONTROL MASK
4927
4928 023624  005037  004130                CLR     LOTFLA          ; INIT LOOP ON TEST FLAG
4929 023630                                RFLAGS  R0              ; GET OPERATOR FLAGS
     023630  104421                                                        TRAP    C$RFLA
4930 023632  032700  000010                BIT     #LOT,R0         ; LOOP ON TEST SELECTED ?
4931 023636  001402                        BEQ     END             ; IF NOT, BRANCH
4932 023640  005237  004130                INC     LOTFLA          ; ELSE SET FLAG
4933
4934 023644                        END:    EXIT    INIT
     023644  104432                                                         TRAP    C$EXIT
     023646  000352                                                         .WORD   L10024-.
4935
4936 023650  000000                ACFLG:  .WORD   0               ; SET IF AUTO CONFIGURATION IS TO BE DONE
4937
4938                                        .NLIST  BEX
4939 023652     045     116     045 WARN:   .ASCIZ  /#N#ATHE FOLLOWING TESTS MAY GENERATE SIGNALS ON THE OUTPUT MODULES./
4940 023756     045     116     045 WARN1:  .ASCII  /#N#AEXTERNAL EQUIPMENT SHOULD BE DISCONNECTED BEFORE/
4941 024042     040     120     122         .ASCIZ  / PROCEDING./
4942
4943 024056     045     116     045 NTEST:  .ASCIZ  /#N#ANO TESTS WERE RUN - CHECK ANSWERS TO STARTUP QUESTIONS.
4944 024152     045     116     045 NTEST1: .ASCIZ  /#N#ANO TESTS WERE RUN ON UNIT #D3#A./
4945                                        .LIST   BEX
4946                                        .EVEN
4947
4948 024220                                ENDINIT
```

INITIALIZE SECTION

```
                024220
                024220  104411                  L10024:  TRAP    C$INIT
          4949
          4961
```

```
4963                    ;*****************************************
4964                    ; SUBROUTINES USED DURING INITIALISATION. *
4965                    ;*****************************************
4966
4967                    .SBTTL  SETCLK - ROUTINE TO SET UP DELAY COUNTS
4968
4969                    ;++
4970                    ; FUNCTIONAL DESCRIPTION:
4971                    ;
4972                    ;       THIS ROUTINE SETS UP 3 DELAY VARIABLES CALLED CNT25M, CNT500, AND
4973                    ;       CNT25. THESE GIVE DELAYS OF APPROXIMATELY 25 MILLISECONDS, 500
4974                    ;       MICROSECONDS OR 25 MICROSECONDS RESPECTIVELY IF USED AS FOLLOWS:-
4975                    ;
4976                    ;               MOV     CNTXXX,R0
4977                    ;           1$: DEC     R0
4978                    ;               BNE     1$
4979                    ;
4980                    ;       THE COUNTS ARE DERIVED FROM AN L CLOCK IF THERE IS ONE.
4981                    ;       OTHERWISE, THE OPERATOR IS ASKED TO TYPE 2 CHARACTERS ON THE
4982                    ;       CONSOLE 6 SECONDS APART.
4983                    ;
4984                    ; INPUTS:
4985                    ;
4986                    ;       NONE.
4987                    ;
4988                    ; IMPLICIT INPUTS:
4989                    ;
4990                    ;       IF CNT25M IS NOT ZERO (ALREADY SET UP), THE ROUTINE DOES NOTHING.
4991                    ;
4992                    ; OUTPUTS:
4993                    ;
4994                    ;       CONSOLE MESSAGE IF THERE IS NO L CLOCK ON THE SYSTEM.
4995                    ;
4996                    ; IMPLICIT OUTPUTS:
4997                    ;
4998                    ;       CNT25M CONTAINS THE COUNT REQUIRED FOR 25 MILLISECONDS.
4999                    ;       CNT500 CONTAINS THE COUNT REQUIRED FOR 500 MICROSECONDS.
5000                    ;       CNT25 CONTAINS THE COUNT REQUIRED FOR 25 MICROSECONDS.
5001                    ;
5002                    ; SUBORDINATE ROUTINES USED:
5003                    ;
5004                    ;       CRLF  - LINE FEED PRINT ROUTINE.
5005                    ;       CLINT - DUMMY CLOCK INTERRUPT SERVICE ROUTINE
5006                    ;
5007                    ; FUNCTIONAL SIDE EFFECTS:
5008                    ;
5009                    ;       R0 TO R5 ARE CORRUPTED.
5010                    ;
5011                    ;       IF A LINE TIME CLOCK IS FOUND, VECTOR 100 IS SET UP SO THAT
5012                    ;       INTERRUPTS TO IT ARE IGNORED. THE SETVEC MACRO CAN BE USED TO
5013                    ;       SET UP THE VECTOR FOR A DEVICE INTERRUPT.
5014                    ;
5015                    ; CALLING SEQUENCE:
5016                    ;
5017                    ;       JSR     PC,SETCLK
5018                    ;
5019                    ;--
```

SETCLK - ROUTINE TO SET UP DELAY COUNTS

```
5020
5021 024222  005737  011534          SETCLK: TST     CNT25M          ; COUNTERS ALREADY SET UP?
5022 024226  001402                          BEQ     10$             ; IF NOT, BRANCH
5023 024230  000137  025072                  JMP     SETEX           ; IF YES, EXIT
5024
5025 024234  005004                  10$:    CLR     R4              ; CLEAR A COUNTER
5026 024236                                  GETPRI  R2              ; SAVE CURRENT PRIORITY IN R2
     024236  104440                                                                  TRAP    C$GPRI
     024240  010002                                                                  MOV     R0,R2
5027 024242  005037  025074                  CLR     CLKFLG          ; ASSUME THERE IS NO CLOCK WITH A CSR
5028 024246                                  CLOCK   L,R1            ; GET ADDRESS OF CLOCK TABLE
     024246  012700  000114                                                          MOV     #'L,R0
     024252  104462                                                                  TRAP    C$CLCK
     024254  010001                                                                  MOV     R0,R1
5029 024256                                  SETVEC  #4,#NXM,#340    ; SET UP CLOCK CSA TRAP
     024256  012746  000340                                                          MOV     #340,-(SP)
     024262  012746  017266                                                          MOV     #NXM,-(SP)
     024266  012746  000004                                                          MOV     #4,-(SP)
     024272  012746  000003                                                          MOV     #3,-(SP)
     024276  104437                                                                  TRAP    C$SVEC
     024300  062706  000010                                                          ADD     #10,SP
5030 024304  005037  004060                  CLR     NXMFLG          ; CLEAR NXM FLAG
5031 024310  005771  000000                  TST     @(R1)           ; ACCESS THE CLOCK ADDRESS
5032 024314  005737  004060                  TST     NXMFLG          ; DOES THE CLOCK HAVE A REGISTER ?
5033 024320  001005                          BNE     LCLOCK          ; IF NOT, BRANCH
5034 024322  005237  025074                  INC     CLKFLG          ; ELSE FLAG THERE IS A CLOCK CSR
5035 024326  012771  000100  000000          MOV     #100,@(R1)      ; AND SET IT UP TO INTERRUPT
5036                                         ;
5037                                         ; USE THE L CLOCK
5038                                         ;
5039 024334                          LCLOCK: CLRVEC  #4              ; SET VECTOR 4 TO UNUSED POOL
     024334  012700  000004                                                          MOV     #4,R0
     024340  104436                                                                  TRAP    C$CVEC
5040 024342  012703  000006                  MOV     #6,R3           ; IF 50 HZ, 100 MS = 5 INTERRUPTS
5041 024346  026127  000006  000062          CMP     6(R1),#50.      ; 50 HZ CORRECT?
5042 024354  001401                          BEQ     10$             ; IF YES, BRANCH
5043 024356  005203                          INC     R3              ; ELSE ALLOW 6 INTERRUPTS
5044
5045 024360  010305                  10$:    MOV     R3,R5           ; SAVE NUMBER OF INTERRRUPTS
5046 024362                                  SETVEC  #100,#KLINT,#340; SET UP THE CLOCK VECTOR
     024362  012746  000340                                                          MOV     #340,-(SP)
     024366  012746  024450                                                          MOV     #KLINT,-(SP)
     024372  012746  000100                                                          MOV     #100,-(SP)
     024376  012746  000003                                                          MOV     #3,-(SP)
     024402  104437                                                                  TRAP    C$SVEC
     024404  062706  000010                                                          ADD     #10,SP
5047                                                                 ; TO WAIT FOR 1ST INTERRUPT
5048 024410                                  SETPRI  #0              ; AND DROP THE PRIORITY
     024410  012700  000000                                                          MOV     #0,R0
     024414  104441                                                                  TRAP    C$SPRI
5049 024416  005000                          CLR     R0              ; CLEAR R0 AND THE CARRY BIT
5050 024420  020305                  20$:    CMP     R3,R5           ; HAS COUNT BEEN DROPPED ?
5051 024422  001004                          BNE     30$             ; IF YES, START THE COUNTERS
5052 024424  005300                          DEC     R0              ; WAITED TOO LONG ?
5053 024426  001374                          BNE     20$             ; IF NOT, WAIT LONGER
5054 024430  000137  024542                  JMP     USCLOK          ; IF YES, ASSUME NO CLOCK
5055
```

SETCLK ROUTINE TO SET UP DELAY COUNTS

```
5056 024434  005005                  30$:   CLR     R5              ; CLEAR THE HIGH COUNTER
5057 024436  005204                  40$:   INC     R4              ; COUNT THE DELAY FOR 5 OR 6 INTERRUPTS
5058 024440  001376                         BNE     40$             ;
5059 024442  105205                         INCB    R5              ;
5060 024444  001374                         BNE     40$             ;
5061 024446  000435                         BR      USCLOK          ; IF TOO LONG, ASSUME NO CLOCK
5062
5063 024450  005303                  KLINT: DEC     R3              ; 5 OR 6 INTERRUPTS?
5064 024452  001401                         BEQ     40$             ; IF YES, TIDY UP
5065 024454  000002                         RTI                     ; ELSE KEEP COUNTING
5066
5067 024456                          40$:   SETPRI  R2              ; RESTORE THE PRIORITY
     024456  010200                                                                  MOV     R2,R0
     024460  104441                                                                  TRAP    C$SPRI
5068 024462                                 SETVEC  #100,#CLINT,#340; IGNORE FURTHER INTERRUPTS TO VECTOR 100
     024462  012746  000340                                                         MOV     #340,-(SP)
     024466  012746  017316                                                         MOV     #CLINT,-(SP)
     024472  012746  000100                                                         MOV     #100,-(SP)
     024476  012746  000003                                                         MOV     #3,-(SP)
     024502  104437                                                                 TRAP    C$SVEC
     024504  062706  000010                                                         ADD     #10,SP
5069 024510  022626                         CMP     (SP)+,(SP)+     ; TIDY UP THE STACK
5070 024512  005737  025074                 TST     CLKFLG          ; CAN WE DISABLE A CLOCK ?
5071 024516  001402                         BEQ     50$             ; IF NOT, BRANCH
5072 024520  005071  000000                 CLR     @(R1)           ; ELSE, DISABLE CLOCK INTERRUPTS
5073
5074 024524  000241                  50$:   CLC                     ; DIVIDE THE 100 MILLISECOND COUNTERS
5075 024526  006005                         ROR     R5              ; BY 4 TO GIVE 25 MILLISECONDS
5076 024530  006004                         ROR     R4              ;
5077 024532  000241                         CLC                     ;
5078 024534  006005                         ROR     R5              ;
5079 024536  006004                         ROR     R4              ;
5080 024540  000524                         BR      SAVCNT          ; AND SAVE THE COUNT
5081                                 ;
5082                                 ; COME HERE IF NOT ENOUGH CLOCK INTERRUPTS OCCUR BEFORE THE COUNTERS OVERFLOW
5083                                 ;
5084 024542                          USCLOK: SETPRI  R2             ; RESTORE THE PRIORITY
     024542  010200                                                                  MOV     R2,R0
     024544  104441                                                                  TRAP    C$SPRI
5085 024546                                 SETVEC  #100,#CLINT,#340; IGNORE FURTHER INTERRUPTS TO VECTOR 100
     024546  012746  000340                                                         MOV     #340,-(SP)
     024552  012746  017316                                                         MOV     #CLINT,-(SP)
     024556  012746  000100                                                         MOV     #100,-(SP)
     024562  012746  000003                                                         MOV     #3,-(SP)
     024566  104437                                                                 TRAP    C$SVEC
     024570  062706  000010                                                         ADD     #10,SP
5086 024574  005737  025074                 TST     CLKFLG          ; CAN WE DISABLE A CLOCK ?
5087 024600  001402                         BEQ     NOCLOK          ; IF NOT, BRANCH
5088 024602  005071  000000                 CLR     @(R1)           ; ELSE DISABLE CLOCK INTERRUPTS
5089                                 ;
5090                                 ; USE THE CONSOLE FOR TIMING
5091                                 ;
5092         177560                  TKS=177560                     ; KEYBOARD STATUS REGISTER
5093         177562                  TKB=177562                     ; KEYBOARD DATA BUFFER
5094         177564                  TPS=177564                     ; PRINTER STATUS REGISTER
5095         177566                  TPB=177566                     ; PRINTER DATA BUFFER
5096
```

SETCLK - ROUTINE TO SET UP DELAY COUNTS

```
5097 024606                                NOCLOK: SETVEC  #60,#TTINT,#340 ; SET UP INTERRUPT VECTOR
     024606  012746  000340                                                MOV     #340,-(SP)
     024612  012746  024740                                                MOV     #TTINT,-(SP)
     024616  012746  000060                                                MOV     #60,-(SP)
     024622  012746  000003                                                MOV     #3,-(SP)
     024626  104437                                                        TRAP    C$SVEC
     024630  062706  000010                                                ADD     #10,SP
5098 024634                                        PRINTF  #TIMMSG         ; 'TYPE 2 CHARACTERS 6 SECONDS APART'
     024634  012746  025076                                                MOV     #TIMMSG,-(SP)
     024640  012746  000001                                                MOV     #1,-(SP)
     024644  010600                                                        MOV     SP,R0
     024646  104417                                                        TRAP    C$PNTF
     024650  062706  000004                                                ADD     #4,SP
5099
5100 024654  105737  177560            10$:    TSTB    TKS             ; IS FIRST CHARACTER READY?
5101 024660  100375                            BPL     10$             ; IF NOT, WAIT
5102 024662  013700  ..1562                    MOV     TKB,R0          ; ELSE GET THE CHARACTER
5103 024666  042700  177600                    BIC     #177600,R0      ; DISCARD UNWANTED BITS
5104 024672  020027  000003                    CMP     R0,#3           ; IF ^C, RETURN TO SUPERVISOR
5105 024676  001001                            BNE     20$             ;
5106 024700                                    DOCLN                   ;
     024700  104444                                                    TRAP    C$DCLN
5107
5108 024702  013737  177562  177566  20$:    MOV     TKB,TPB         ; NOW ECHO THE CHARACTER
5109 024710                                    SETPRI  #0              ; DROP THE PRIORITY
     024710  012700  000000                                            MOV     #0,R0
     024714  104441                                                    TRAP    C$SPRI
5110 024716  012737  000100  177560            MOV     #100,TKS        ; ALLOW INTERRUPTS
5111
5112 024724  012705  000360            30$:    MOV     #240.,R5        ; SET UP MODULO 240 COUNTER
5113 024730  005305                    40$:    DEC     R5              ; START COUNTING
5114 024732  001376                            BNE     40$             ; R5 IS MODULO 240 COUNTER
5115 024734  005204                            INC     R4              ; UPDATE THE COUNTER
5116 024736  000772                            BR      30$             ; 6 SECONDS/240 = 25 MILLISECONDS
5117
5118 024740                                TTINT:  SETPRI  R2              ; RESTORE THE PRIORITY
     024740  010200                                                    MOV     R2,R0
     024742  104441                                                    TRAP    C$SPRI
5119 024744                                    CLRVEC  #60             ; AND THE KEYBOARD VECTOR
     024744  012700  000060                                            MOV     #60,R0
     024750  104436                                                    TRAP    C$CVEC
5120 024752  022626                            CMP     (SP)+,(SP)+     ; TIDY UP THE STACK
5121 024754  005037  177560                    CLR     TKS             ; DISABLE INTERRUPTS
5122 024760  013700  177562                    MOV     TKB,R0          ; ELSE GET THE CHARACTER
5123 024764  042700  177600                    BIC     #177600,R0      ; DISCARD UNWANTED BITS
5124 024770  020027  000003                    CMP     R0,#3           ; IF ^C, RETURN TO SUPERVISOR
5125 024774  001001                            BNE     10$             ;
5126 024776                                    DOCLN                   ;
     024776  104444                                                    TRAP    C$DCLN
5127 025000  013737  177562  177566  10$:    MOV     TKB,TPB         ; ELSE, ECHO THE CHARACTER
5128 025006  004737  011542                    JSR     PC,CRLF         ; AND PRINT A LINE FEED
5129                                        ;
5130                                        ; SAVE THE COUNTERS
5131                                        ;
5132 025012  010437  01155?            SAVCNT: MOV     R4,CNT25M       ; SAVE THE 25 MILLISECONDS COUNTER
5133 025016  012700  000062                    MOV     #50.,R0         ; NOW DIVIDE BY 50
5134 025022  062704  000031                    ADD     #25.,R4         ; TO NEAREST 50
```

SETCLK - ROUTINE TO SET UP DELAY COUNTS

```
5135 025026  005001                        CLR     R1              ; INITIALISE RESULT
5136 025030  160004                10$:    SUB     R0,R4           ; REMAINDER < 0 ?
5137 025032  002402                        BLT     20$             ; IF YES, BRANCH
5138 025034  005201                        INC     R1              ; ELSE INCREMENT RESULT
5139 025036  000774                        BR      10$             ; AND TRY AGAIN
5140 025040  010137  011536          20$:    MOV     R1,CNT500       ; SAVE THE 500 MICROSECONDS COUNTER
5141
5142 025044  012700  000024                MOV     #20.,R0         ; NOW DIVIDE BY 20
5143 025050  062701  000012                ADD     #10.,R1         ; TO NEAREST 20
5144 025054  005002                        CLR     R2              ; INITIALISE RESULT
5145 025056  160001                30$:    SUB     R0,R1           ; REMAINDER < 0 ?
5146 025060  002402                        BLT     40$             ; IF YES, BRANCH
5147 025062  005202                        INC     R2              ; ELSE INCREMENT RESULT
5148 025064  000774                        BR      30$             ; AND TRY AGAIN
5149 025066  010237  011540          40$:    MOV     R2,CNT25        ; SAVE THE 25 MICROSECONDS COUNTER
5150
5151 025072  000207                SETEX:  RTS     PC              ; RETURN
5152
5153 025074  000000                CLKFLG: .WORD   0               ; SET IF DRS FINDS A CLOCK WITH A CSR
5154
5155                                       .NLIST  BEX
5156 025076     045     116     045  TIMMSG: .ASCIZ  /<N><ATYPE 2 CHARACTERS 6 SECONDS APART >/
5157                                       .LIST   BEX
5158                                       .EVEN
```

```
5160                                    .SBTTL  LOPCHK - LOOPBACK CHECKING ROUTINE.
5161
5162                                    ;++
5163                                    ; FUNCTIONAL DESCRIPTION:
5164                                    ;
5165                                    ;       IF UNIT L$LUN IN THE HARDWARE P TABLE IS SPECIFIED AS LOOPED, THE
5166                                    ;       ROUTINE CHECKS THAT THE OTHER MODULE CAN BE ADDRESSED AND THAT IT
5167                                    ;       IS THE CORRECT TYPE FOR LOOPING TO THE UUT. IF EITHER CHECK FAILS,
5168                                    ;       A MESSAGE IS PRINTED AND THE UNIT IS FLAGGED IN THE P TABLE AS NOT
5169                                    ;       LOOPED.
5170                                    ;
5171                                    ; INPUTS:
5172                                    ;
5173                                    ;       L$LUN   - NUMBER OF UNIT TO CHECK
5174                                    ;       LOPFLG - ADDRESS OF FLAG FOR UNIT 0. IF THE FLAG FOR UNIT L$LUN
5175                                    ;                IS NON ZERO, THE UNIT HAS BEEN CHECKED AND THE ROUTINE
5176                                    ;                DOES NOTHING.
5177                                    ;
5178                                    ; IMPLICIT INPUTS:
5179                                    ;
5180                                    ;       THE HARDWARE P TABLE.
5181                                    ;
5182                                    ; OUTPUTS:
5183                                    ;
5184                                    ;       IF MODULES SPECIFIED AS 'OTHER' IN THE HARDWARE QUESTIONS DO NOT
5185                                    ;       RESPOND OR ARE NOT OF THE CORRECT TYPE FOR LOOPING, AN ERROR
5186                                    ;       MESSAGE IS PRINTED.
5187                                    ;
5188                                    ;       LOPFLG FOR THE SPECIFIED UNIT IS SET TO FLAG THAT THE LOOPBACK
5189                                    ;       CONFIGURATION HAS BEEN CHECKED.
5190                                    ;
5191                                    ; IMPLICIT OUTPUTS:
5192                                    ;
5193                                    ;       IF THE CONFIGURATION IS NOT CORRECT, THE INCORRECT MODULES ARE
5194                                    ;       FLAGGED AS NO LONGER LOOPED IN THE HARDWARE P TABLE.
5195                                    ;
5196                                    ; SUBORDINATE ROUTINES USED:
5197                                    ;
5198                                    ;       NXM : NON EXISTANT MEMORY TRAP ROUTINE.
5199                                    ;
5200                                    ; FUNCTIONAL SIDE EFFECTS:
5201                                    ;
5202                                    ;       IF A LOOPED MODULE DOES NOT CHECK CORRECTLY, IT IS FLAGGED AS
5203                                    ;       NOT LOOPED IN THE HARDWARE P TABLE.
5204                                    ;
5205                                    ; CALLING SEQUENCE:
5206                                    ;
5207                                    ;       JSR     PC,LOPCHK
5208                                    ;
5209                                    ;--
5210
5211 025146                            LOPCHK:
5212 025146  010146                             MOV     R1,-(SP)        ; SAVE REGISTERS R1 TO R3
5213 025150  010246                             MOV     R2,-(SP)        ;
5214 025152  010346                             MOV     R3,-(SP)        ;
5215
5216 025154  013701  002074                     MOV     L$LUN,R1        ; GET UNIT OFFSET
```

LOPCHK - LOOPBACK CHECKING ROUTINE.

```
 5217 025160  006301                        ASL     R1              ;
 5218 025162  005761  004070                TST     LOPFLG(R1)      ; LOOP CONFIGURATION ALREADY CHECKED ?
 5219 025166  001402                        BEQ     20$             ; IF NOT, CHECK IT
 5220 025170  000137  025630          10$:  JMP     LOPEX           ; EXIT
 5221
 5222 025174  005237  004070          20$:  INC     LOPFLG          ; SHOW CONFIGURATION IS CHECKED
 5223 025200                                SETVEC  #4,#NXM,#PRIO7  ; SET UP NXM VECTOR
      025200  012746  000340                                                  MOV     #PRIO7,-(SP)
      025204  012746  017266                                                  MOV     #NXM,-(SP)
      025210  012746  000004                                                  MOV     #4,-(SP)
      025214  012746  000003                                                  MOV     #3,-(SP)
      025220  104437                                                          TRAP    C$SVEC
      025222  062706  000010                                                  ADD     #10,SP
 5224
 5225 025226  016102  003774          30$:  MOV     GPADD(R1),R2    ; GET UNIT'S P TABLE
 5226 025232  005762  000006                TST     6(R2)           ; IS UNIT LOOPED ?
 5227 025236  001574                        BEQ     LOPEX           ; IF NOT, EXIT
 5228 025240  005037  004060                CLR     NXMFLG          ; ELSE CLEAR NXM FLAG
 5229 025244  005772  000010                TST     @10(R2)         ; ACCESS THE OTHER UNIT ADDRESS
 5230 025250  005737  004060                TST     NXMFLG          ; DOES OTHER UNIT EXIST ?
 5231 025254  001413                        BEQ     40$             ; IF YES, BRANCH
 5232 025256                                PRINTF  #LOP1,14(R2)    ; ELSE PRINT 'OTHER UNIT DOESN'T RESPOND'
      025256  016246  000014                                                  MOV     14(R2),-(SP)
      025262  012746  025646                                                  MOV     #LOP1,-(SP)
      025266  012746  000002                                                  MOV     #2,-(SP)
      025272  010600                                                          MOV     SP,R0
      025274  104417                                                          TRAP    C$PNTF
      025276  062706  000006                                                  ADD     #6,SP
 5233 025302  000534                        BR      110$            ; AND DESELECT LOOPING
 5234
 5235 025304  027227  000014  140000  40$:  CMP     @14(R2),#140000 ; IS OTHER UNIT IXV11 ?
 5236 025312  103413                        BLO     50$             ; IF YES, BRANCH
 5237 025314                                PRINTF  #LOP2,14(R2)    ; ELSE PRINT 'OTHER UNIT NOT IXV11'
      025314  016246  000014                                                  MOV     14(R2),-(SP)
      025320  012746  025723                                                  MOV     #LOP2,-(SP)
      025324  012746  000002                                                  MOV     #2,-(SP)
      025330  010600                                                          MOV     SP,R0
      025332  104417                                                          TRAP    C$PNTF
      025334  062706  000006                                                  ADD     #6,SP
 5238 025340  000515                        BR      110$            ; DESELECT LOOPING
 5239
 5240 025342  027227  000000  020000  50$:  CMP     @(R2),#20000    ; IS OUT DIGITAL INPUT ?
 5241 025350  103013                        BHIS    60$             ; IF NOT, BRANCH
 5242 025352  012703  025771                MOV     #LOP3,R3        ; SAVE DIGITAL INPUT MESSAGE ADDRESS
 5243 025356  027227  000014  020000        CMP     @14(R2),#20000  ; IS OTHER UNIT DIGITAL OUTPUT ?
 5244 025364  103471                        BLO     100$            ; IF NOT, DESELECT LOOPING
 5245 025366  027227  000014  037400        CMP     @14(R2),#37400  ;
 5246 025374  101065                        BHI     100$            ;
 5247 025376  000514                        BR      LOPEX           ; OTHERWISE, DO NOTHING
 5248
 5249 025400  027227  000000  040000  60$:  CMP     @(R2),#40000    ; IS OUT DIGITAL OUTPUT ?
 5250 025406  103007                        BHIS    70$             ; IF NOT, BRANCH
 5251 025410  012703  026067                MOV     #LOP4,R3        ; SAVE DIGITAL OUTPUT MESSAGE ADDRESS
 5252 025414  027227  000014  017400        CMP     @14(R2),#17400  ; IS OTHER UNIT DIGITAL INPUT ?
 5253 025422  101052                        BHI     100$            ; IF NOT, DESELECT LOOPING
 5254 025424  000501                        BR      LOPEX           ; OTHERWISE DO NOTHING
 5255
```

LOPCHK LOOPBACK CHECKING ROUTINE.

```
5256 025426  027227  000000  100000  70$:    CMP     @(R2),#100000   ; IS UNIT ANALOGUE INPUT ?
5257 025434  103013                          BHIS    80$             ; IF NOT, BRANCH
5258 025436  012703  026166                  MOV     #LOP5,R3        ; SAVE ANALOGUE INPUT MESSAGE ADDRESS
5259 025442  027227  000014  100000          CMP     @14(R2),#100000 ; IS OTHER UNIT ANALOGUE OUTPUT ?
5260 025450  103437                          BLO     100$            ; IF NOT, DESELECT LOOPING
5261 025452  027227  000014  137400          CMP     @14(R2),#137400 ;
5262 025460  101033                          BHI     100$            ;
5263 025462  000462                          BR      LOPEX           ; OTHERWISE, DO NOTHING
5264
5265 025464  027227  000000  140000  80$:    CMP     @(R2),#140000   ; IS OUT ANALOGUE INPUT ?
5266 025472  103012                          BHIS    90$             ; IF NOT, BRANCH
5267 025474  012703  026265                  MOV     #LOP6,R3        ; SAVE ANALOGUE OUTPUT MESSAGE ADDRESS
5268 025500  027227  000014  040000          CMP     @14(R2),#40000  ; IS OTHER UNIT ANALOGUE INPUT ?
5269 025506  103420                          BLO     100$            ; IF NOT, DESELECT LOOPING
5270 025510  027227  000014  077400          CMP     @14(R2),#77400  ;
5271 025516  101444                          BLOS    LOPEX           ; IF YES, DO NOTHING
5272
5273 025520                          90$:    PRINTF  #LOP7,(R2)      ; PRINT 'UNKNOWN MODULE CANNOT BE LOOPED'
     025520  011246                                                                  MOV     (R2),-(SP)
     025522  012746  026365                                                          MOV     #LOP7,-(SP)
     025526  012746  000002                                                          MOV     #2,(SP)
     025532  010600                                                                  MOV     SP,R0
     025534  104417                                                                  TRAP    C$PNTF
     025536  062706  000006                                                          ADD     #6,SP
5274 025542  005062  000006                  CLR     6(R2)           ; CLEAR P.TABLE LOOPED PARAMETER
5275 025546  000430                          BR      LOPEX           ; AND EXIT
5276
5277 025550                          100$:   PRINTF  R3,(R2),14(R2)  ; PRINT 'CAN'T BE LOOPED'
     025550  016246  000014                                                          MOV     14(R2),-(SP)
     025554  011246                                                                  MOV     (R2),-(SP)
     025556  010346                                                                  MOV     R3,-(SP)
     025560  012746  000003                                                          MOV     #3,-(SP)
     025564  010600                                                                  MOV     SP,R0
     025566  104417                                                                  TRAP    C$PNTF
     025570  062706  000010                                                          ADD     #10,SP
5278
5279 025574  005062  000006          110$:   CLR     6(R2)           ; CLEAR P.TABLE LOOPED PARAMETER
5280 025600                                  PRINTF  #LOPDES,L$LUN   ; PRINT 'LOOPING DESELECTED'
     025600  013746  002074                                                          MOV     L$LUN,-(SP)
     025604  012746  026444                                                          MOV     #LOPDES,-(SP)
     025610  012746  000002                                                          MOV     #2,(SP)
     025614  010600                                                                  MOV     SP,R0
     025616  104417                                                                  TRAP    C$PNTF
     025620  062706  000006                                                          ADD     #6,SP
5281 025624  004737  011570                  JSR     PC,WRD1         ; WAIT FOR OPERATOR TO TYPE 'RETURN'
5282
5283 025630                          LOPEX:  CLRVEC  #4              ; RESTORE SUPERVISOR NXM TRAP
     025630  012700  000004                                                          MOV     #4,R0
     025634  104436                                                                  TRAP    C$CVEC
5284 025636  012603                          MOV     (SP)+,R3        ; RESTORE REGISTERS R1 TO R3
5285 025640  012602                          MOV     (SP)+,R2        ;
5286 025642  012601                          MOV     (SP)+,R1        ;
5287 025644  000207                          RTS     PC              ; AND RETURN
5288
5289                                         .NLIST  BEX
5290
5291 025646      045     116     062  LOP1:   .ASCIZ  /%N2%ANOTHER DEVICE AT %06%A DOES NOT RESPOND.
```

```
5292
5293 025723  045  116  062  LOP2:   .ASCIZ  \%N2%AOTHER DEVICE AT %O6%A NOT IXV11.\
5294
5295 025771  045  116  062  LOP3:   .ASCII  /%N2%ADIGITAL INPUT AT %O6%A CANNOT BE LOOPED TO DEVICE AT/
5296 026062  040  045  117          .ASCIZ  / %O6/
5297
5298 026067  045  116  062  LOP4:   .ASCII  /%N2%ADIGITAL OUTPUT AT %O6%A CANNOT BE LOOPED TO DEVICE AT/
5299 026161  040  045  117          .ASCIZ  / %O6/
5300
5301 026166  045  116  062  LOP5:   .ASCII  /%N2%AANALOGUE INPUT AT %O6%A CANNOT BE LOOPED TO DEVICE AT/
5302 026260  040  045  117          .ASCIZ  / %O6/
5303
5304 026265  045  116  062  LOP6:   .ASCII  /%N2%AANALOGUE OUTPUT AT %O6%A CANNOT BE LOOPED TO DEVICE AT/
5305 026360  040  045  117          .ASCIZ  / %O6/
5306
5307 026365  045  116  062  LOP7:   .ASCIZ  /%N2%AUNKNOWN MODULE AT %O6%A CANNOT BE LOOPED./
5308
5309 026444  045  116  045  LOPDES: .ASCIZ  \%N%ALOOPING DESELECTED FOR UNIT %D2%A.\
5310
5311                                 .LIST   BEX
5312                                 .EVEN
```

AUTODROP SECTION

```
                                .SBTTL  AUTODROP SECTION

                                ;++
                                ; THIS CODE IS EXECUTED IMMEDIATELY AFTER THE INITIALIZE CODE IF
                                ; THE "ADR" FLAG WAS SET.  THE UNIT(S) UNDER TEST ARE CHECKED TO
                                ; SEE IF THEY WILL RESPOND.  THOSE THAT DON'T ARE IMMEDIATELY
                                ; DROPPED FROM TESTING.
                                ;--

                                        BGNAUTO
                                                                                L$AUTO::
                                        SETVEC  #4,#NXM,#PRI07  ; SET UP NON - EXISTENT MEMORY TRAP VECTOR.
                                                                                MOV     #PRI07,-(SP)
                                                                                MOV     #NXM,-(SP)
                                                                                MOV     #4,-(SP)
                                                                                MOV     #3,-(SP)
                                                                                TRAP    C$SVEC
                                                                                ADD     #10,SP
                                        CLR     NXMFLG          ; CLEAR NON - EXISTENT MEMORY FLAG
                                        TST     @MOD            ; REFERENCE MEMORY ADDRESS FOR THE DEVICE
                                                                ; TO SEE IF IT EXISTS.

                                ; IF THE DEVICE DOESN'T EXIST, THE RESULTANT TRAP TO VECTOR 04 WILL
                                ; CAUSE THE FLAG NXMFLG TO BE SET (SEE INTERRUPT ROUTINE NXM).

                                        TST     NXMFLG          ; WAS THERE A TRAP ?
                                        BEQ     10$             ; BRANCH IF NOT
                                        DODU    L$LUN           ; ELSE DROP THE DEVICE
                                                                                MOV     L$LUN,R0
                                                                                TRAP    C$DODU
                                        DOCLN                   ; CLEAN UP CODE.
                                                                                TRAP    C$DCLN
                                10$:    CLRVEC  #4              ; RETURN VECTOR 04 TO NORMAL STATE
                                                                                MOV     #4,R0
                                                                                TRAP    C$CVEC
                                        ENDAUTO
                                                                        L10025:
                                                                                TRAP    C$AUTO
```

CLEANUP CODING SECTION

```
                                .SBTTL  CLEANUP CODING SECTION

                                ;**
                                ; THE CLEANUP CODING SECTION CONTAINS THE CODING THAT IS PERFORMED
                                ; AFTER THE HARDWARE TESTS HAVE BEEN PERFORMED.
                                ;--

026600                                  BGNCLN
026600                                                                  L$CLEAN::

                                        BRESET                  ; DO A BUS RESET TO SWITCH OFF ALL LEDS
026600  104433                                                          TRAP    C$RESET
                                        EXIT    CLN
026602  104432                                                          TRAP    C$EXIT
026604  000002                                                          .WORD   L10026-.

                                        .EVEN

                                        ENDCLN
026606                                                                  L10026:
026606  104412                                                          TRAP    C$CLEAN
```

DROP UNIT SECTION

```
                                .SBTTL  DROP UNIT SECTION

                                ;++
                                ; THE DROP-UNIT SECTION CONTAINS THE CODING THAT CAUSES A DEVICE
                                ; TO NO LONGER BE TESTED.
                                ;--

026610                                  BGNDU
026610                                                                          L$DU::

026610  010026                         MOV     R0,(SP)+                ; SAVE R0 CONTENTS
026612  112760  000001  004034         MOVB    #1,DROPED(R0)           ; FLAG UNIT DROPPED IN PARAM TABLE
026620  014600                         MOV     -(SP),R0                ; GET ORIGINAL R0 CONTENTS
026622                                  PRINTF  #DROPD,R0               ; 'UNIT DROPPED'
026622  010046                                                                  MOV     R0,-(SP)
026624  012746  026650                                                          MOV     #DROPD,-(SP)
026630  012746  000002                                                          MOV     #2,-(SP)
026634  010600                                                                  MOV     SP,R0
026636  104417                                                                  TRAP    C$PNTF
026640  062706  000006                                                          ADD     #6,SP

026644                                  EXIT    DU
026644  000167                                                                  .WORD   J$JMP
026646  000030                                                                  .WORD   L10027-2-.

                                .NLIST  BEX
026650      045     116     045 DROPD:  .ASCIZ  /%N%AUNIT %D2%A DROPPED/
                                .LIST   BEX
                                .EVEN

026700                                  ENDDU
026700                                                                  L10027:
026700  104453                                                                  TRAP    C$DU
```

ADD UNIT SECTION

```
                                .SBTTL  ADD UNIT SECTION

                                ;++
                                ; THE ADD-UNIT SECTION CONTAINS ANY CODE THE PROGRAMMER WISHES
                                ;  TO BE EXECUTED IN CONJUNCTION WITH THE ADDING OF A UNIT BACK
                                ;  TO THE TEST CYCLE.
                                ;--

026702                                  BGNAU
026702                                                                  L$AU::
                                
                                
026702  105060  004034                    CLRB    DROPED(R0)              ; FLAG UNIT NOT DROPPED IN PARAM TABLE
                                
026706                                  EXIT    AU
026706  000167                                                                 .WORD   J$JMP
026710  000000                                                                 .WORD   L10030-2-.
                                
                                
                                        .EVEN
                                
026712                                  ENDAU
026712                                                                  L10030:
026712  104452                                                                 TRAP    C$AU
                                
026714                                  ENDMOD
                                
                                
```

```
                                .TITLE HARDWARE TESTS
                                .SBTTL  TEST 1: REGISTER NXM TEST.
                                        BGNMOD
                                ;*******************************************************************************
                                ;               TEST 1 - REGISTER NXM TEST.
                                ;
                                ;       THIS TEST CHECKS THAT ACCESSING THE DEVICE MODE, DATA, CSA AND
                                ;       CSB REGISTERS (IF PRESENT) DOES NOT CAUSE A NXM TRAP.
                                ;*******************************************************************************
                                        BGNTST
                                                                                        T1::
                                        CALL    SELECT                  ;CALL SELECT ROUTINE
                                        .WORD   417                     ;GIVE TEST PARAMETER
                                        TSHD1                           ;GIVE TEST HEADER ADDRESS
                                        BCS     EXQV1                   ;IF CARRY IS SET, EXIT TEST
                                        CLR     ITRCNT                  ;CLEAR ITERATION COUNTER
                                        SETVEC  #4,#LOCATE,#PRIO7       ;SET UP INTERRUPT ROUTINE
                                                                                        MOV     #PRIO7,-(SP)
                                                                                        MOV     #LOCATE,-(SP)
                                                                                        MOV     #4,-(SP)
                                                                                        MOV     #3,-(SP)
                                                                                        TRAP    C$SVEC
                                                                                        ADD     #10,SP
026760 013701 003700    ITRAC1: MOV     MOD,R1                  ;GET FIRST REGISTER ADDRESS
026764 162701 000002            SUB     #2,R1                   ;
026770 012702 000004            MOV     #4,R2                   ;SET COUNTER FOR 4 REGISTERS
026774 005003                   CLR     R3                      ;CLEAR LOCATION FOR ERROR MARK
026776 062701 000002    10$:    ADD     #2,R1                   ;GET REGISTER ADDRESS
027002                          BGNSEG                          ;
                                                                                        TRAP    C$BSEG
027004 005004                   CLR     R4                      ;
027006 005711                   TST     (R1)                    ;TEST REGISTER ADDRESS
027010 005704                   TST     R4                      ;WAS THERE A TRAP?
027012 004737 012146            CALL    INSERT                  ;SKIP BRANCH IF "SFI" IS SET
027016 001405                   BEQ     20$                     ;IF NO, BRANCH
027020 005203                   INC     R3                      ;MARK THE ERROR
027022                          ERRHRD  101,E101,EERA           ;ERROR HANDLER
                                                                                        TRAP    C$ERHRD
                                                                                        .WORD   101
                                                                                        .WORD   E101
                                                                                        .WORD   EERA
027032                  20$:    ENDSEG                          ;
                                                                                10000$:
                                                                                        TRAP    C$ESEG
027034 005302                   DEC     R2                      ;ALL REGISTERS TESTED
027036 001357                   BNE     10$                     ;IF NO, BRANCH
027040 005703                   TST     R3                      ;WAS THERE AN ERROR
027042 001404                   BEQ     30$                     ;IF NO, DON'T DROP THE UNIT
027044                          DODU    L$LUN                   ;DROP THE UNIT UNDER TEST
                                                                                        MOV     L$LUN,R0
                                                                                        TRAP    C$DODU
027052                          DOCLN                           ;RUN THE CLEAN UP ROUTINE
                                                                                        TRAP    C$DCLN
027054 005737 002242    30$:    TST     QVP                     ;IS QUICK VERIFY PASS SELECTED?
```

SEQ 0138

TEST 1: REGISTER NXM TEST.

```
5566 027060  001007                          BNE     EXQV1                   ;IF YES EXIT TEST
5567 027062  005237  004144                  INC     ITRCNT                  ;ITERATION COUNTER + 1
5568 027066  023737  004146  004144          CMP     ITRDEF,ITRCNT           ;DEFAULT ITERATION EXECUTED
5569 027074  001401                          BEQ     EXQV1                   ;IF YES EXIT TEST
5570 027076  000730                          BR      ITRAC1                  ;IF NO, TEST ITERATION
5571 027100                          EXQV1:  CLRVEC  #4                      ;
     027100  012700  000004                                                          MOV     #4,R0
     027104  104436                                                                 TRAP    C$CVEC
5577 027106                          TSTEN1: EXIT    TST
     027106  104432                                                                 TRAP    C$EXIT
     027110  000106                                                                 .WORD   L10031-.
5578
5590 027112                          BGNSRV  LOCATE                  ;SERVICE ROUTINE LOCATE
     027112                                                                                 LOCATE::
5591 027112  005204                          INC     R4                      ;INCREMENTS R4 IF A TRAP TO 4
5592 027114                          ENDSRV                          ;HAS OCCURRED
     027114                                                                         L10032:
     027114  000002                                                                 RTI
5593
5594                                         .NLIST  BEX
5595 027116     045     123     062  TSMD1:: .ASCIZ  /%S2%AREGISTER NXM TEST.%N/
5596 027150     122     105     107  E101:   .ASCIZ  /REGISTER ADDRESSING ERROR - TRAP TO 4/
5597                                         .LIST   BEX
5598                                         .EVEN
5599
5600 027216                          ENDTST
     027216                                                                         L10031:
     027216  104401                                                                 TRAP    C$ETST
```

```
5608                                    .SBTTL  TEST 2: RESET TEST
5609                                    ;******************************************************************************
5610                                    ;                       TEST 2 - RESET TEST.
5611                                    ; THIS TEST CHECKS THAT THE DEVICE REGISTERS ARE CORRECTLY SET OR RESET
5612                                    ; AFTER A BUS RESET. IN THE MOD REGISTER ONLY THE LED BIT  IS TESTED .
5613                                    ;******************************************************************************
5614 027220                                    BGNTST
     027220                                                                                    T2::
5615 027220  004737  011714                    CALL    SELECT                  ;CALL SELECT ROUTINE
5616 027224  000417                            .WORD   417                     ;GIVE TEST PARAMETER
5617 027226  027562                            TSHD2                           ;GIVE TEST HEADER ADDRESS
5618 027230  103552                            BCS     EXQV2                   ;IF CARRY IS SET, EXIT TEST
5619 027232  005037  004144                    CLR     ITRCNT                  ;CLEAR ITERATION COUNTER
5620 027236  005001                    ITRAC2: CLR     R1                      ;CLEAR TEMPORARY STORE
5621 027240  113701  004132                    MOVB    CONMSK,R1               ;GET MODULE TYPE
5622 027244  032701  000020                    BIT     #20,R1                  ;DON'T TEST SPECIAL MODULES
5623 027250  004737  012146                    CALL    INSERT                  ;SKIP BRANCH IF "SFI" IS SET
5624 027254  001404                            BEQ     10$                     ;BRANCH IF NO SPEC. MODULE
5625 027256                                    ERRSOFT 200,E200,EERG           ;ERROR HANDLER
     027256  104457                                                                            TRAP    C$ERSOFT
     027260  000310                                                                            .WORD   200
     027262  027605                                                                            .WORD   E200
     027264  007724                                                                            .WORD   EERG
5626 027266  012702  177777            10$:    MOV     #-1,R2                  ;MODULE IDENTIFICATION
5627 027272  005202                    20$:    INC     R2                      ;...
5628 027274  006201                            ASR     R1                      ;...
5629 027276  103375                            BCC     20$                     ;...
5630 027300  006302                            ASL     R2                      ;MULTYPLY BY 10 TO GET TABLE
5631 027302  006302                            ASL     R2                      ;OFFSET
5632 027304  006302                            ASL     R2                      ;...
5633 027306  005003                            CLR     R3                      ;START WITH DAT REGISTER
5634 027310                                    BGNSEG
     027310  104404                                                                            TRAP    C$BSEG
5635 027312                                    BRESET                          ;DO A BUS RESET
     027312  104433                                                                            TRAP    C$RESET
5636 027314  032777  000100  154356            BIT     #100,@MOD               ;IS LED BIT CLEARED ?
5637 027322  004737  012146                    CALL    INSERT                  ;SKIP BRANCH IF "SFI" IS SET
5638 027326  001404                            BEQ     30$                     ;BRANCH IF YES
5639 027330                                    ERRSOFT 201,E201,EERG           ;ERROR HANDLER
     027330  104457                                                                            TRAP    C$ERSOFT
     027332  000311                                                                            .WORD   201
     027334  027703                                                                            .WORD   E201
     027336  007724                                                                            .WORD   EERG
5640 027340                            30$:    CKLOOP                          ;
     027340  104406                                                                            TRAP    C$CLP1
5641 027342  052777  000100  154330            BIS     #100,@MOD               ;SWITCH ON THE MODULE LED
5642 027350  032777  000100  154322            BIT     #100,@MOD               ;IS LED BIT NOW SET ?
5643 027356  004737  012146                    CALL    INSERT                  ;SKIP BRANCH IF "SFI" IS SET
5644 027362  001004                            BNE     40$                     ;BRANCH IF YES
5645 027364                                    ERRSOFT 202,E202,EERG           ;ERROR HANDLER
     027364  104457                                                                            TRAP    C$ERSOFT
     027366  000312                                                                            .WORD   202
     027370  027770                                                                            .WORD   E202
     027372  007724                                                                            .WORD   EERG
5646 027374                            40$:    ENDSEG                          ;
     027374                                                                 10000$:
     027374  104405                                                                            TRAP    C$ESEG
```

TEST 2: RESET TEST

```
5647 027376  013705  003702                MOV     DAT,R5          ;GET FIRST REGISTER ADDRESS
5648 027402  062702  000002                ADD     #2,R2           ;POINT TABLE OFFSET TO DAT CONT.
5649 027406                                BGNSEG
     027406  104404                                                 TRAP    C$BSEG
5650 027410                                BRESET                  ;DO A BUS RESET
     027410  104433                                                 TRAP    C$RESET
5651 027412  052777  000100  154260        BIS     #100,@MOD       ;SWITCH ON THE MODULE LED
5652 027420  016237  030102  004062  50$:  MOV     RSAV(R2),GOOD   ;GET FIRST COMPARE CONTENTS FROM TABLE
5653 027426  011537  004064               MOV     @R5,BAD         ;GET FIRST REGISTER CONTENTS
5654 027432  005703                       TST     R3              ;IS THIS THE DAT REGISTER?
5655 027434  001006                       BNE     60$             ;IF NO, BRANCH
5656 027436  032737  000005  004132       BIT     #5,CONMSK       ;IS THIS AN INPUT MODULE?
5657 027444  001402                       BEQ     60$             ;IF NO, BRANCH
5658 027446  005037  004064               CLR     BAD             ;IF YES, CLEAR DAT CONTENTS
5659 027452  042737  000040  004064  60$:  BIC     #40,BAD         ;MASK OUT OPL BIT FOR ANA. OUTPUT
5660 027460  023737  004062  004064       CMP     GOOD,BAD        ;CMP TABLE CONT.WITH REG. CONT.
5661 027466  004737  012146               CALL    INSERT          ;SKIP BRANCH IF "SFI" IS SET
5662 027472  001404                       BEQ     70$             ;
5663 027474                                ERRSOFT 203,E203,EERB   ;ERROR HANDLER
     027474  104457                                                 TRAP    C$ERSOFT
     027476  000313                                                 .WORD   203
     027500  030035                                                 .WORD   E203
     027502  007664                                                 .WORD   EERB
5664 027504                        70$:    CKLOOP                  ;
     027504  104406                                                 TRAP    C$CLP1
5665 027506  005203                       INC     R3              ;COUNTER FOR NEXT REGISTER
5666 027510  022703  000003               CMP     #3,R3           ;3 REGISTERS TESTED ?
5667 027514  001405                       BEQ     80$             ;BRANCH IF YES
5668 027516  062702  000002               ADD     #2,R2           ;LOAD NEXT TABLE ADDR.
5669 027522  062705  000002               ADD     #2,R5           ;LOAD NEXT REGISTER ADDR.
5670 027526  000734                       BR      50$             ;
5671 027530                        80$:    ENDSEG                  ;
     027530                                                                 10001$:
     027530  104405                                                         TRAP    C$ESEG
5672 027532  005737  002242               TST     QVP             ;IS QUICK VERIFY PASS SELECTED?
5673 027536  001007                       BNE     EXQV2           ;IF YES EXIT TEST
5674 027540  005237  004144               INC     ITRCNT          ;ITERATION COUNTER + 1
5675 027544  023737  004146  004144       CMP     ITRDEF,ITRCNT   ;DEFAULT ITERATION EXECUTED
5676 027552  001401                       BEQ     EXQV2           ;IF YES EXIT TEST
5677 027554  000630                       BR      ITRAC2          ;IF NO, TEST ITERATION
5678 027556                        EXQV2:  EXIT    TST
     027556  104432                                                         TRAP    C$EXIT
     027560  000362                                                         .WORD   L10033-.
5679                                       .NLIST  BEX
5680 027562     045     123     062  TSHD2:: .ASCIZ  /%S2%ARESET TEST.%N/
5681 027605     123     120     105  E200:   .ASCIZ  /SPECIAL MODULE FOUND -  CAN'T BE TESTED WITH THIS DIAGNOSTIC /
5682 027703     114     105     104  E201:   .ASCIZ  /LED BIT IN MOD REGISTER NOT CLEARED AFTER BUS RESET /
5683 027770     114     105     104  E202:   .ASCIZ  /LED BIT IN MOD REGISTER CAN'T BE SET/
5684 030035     122     105     107  E203:   .ASCIZ  /REGISTER INCORRECT AFTER BUS RESET /
5685                                       .EVEN
5686
5687 030102  000000  000000  000000  RSAV:   .WORD   0,0,0,0         ;MASKS FOR DIGITAL INPUT
5688 030112  000000  000000  000000          .WORD   0,0,0,0         ;MASKS FOR DIGITAL OUTPUT
5689 030122  000000  000000  100000          .WORD   0,0,100000,0    ;MASKS FOR ANALOGUE INPUT
5690 030132  000000  000000  100200          .WORD   0,0,100200,0    ;MASKS FOR ANALOGUE OUTPUT
5691                                       .LIST   BEX
5692                                       .EVEN
```

TEST 2: RESET TEST

```
   5693 030142                          ENDTST
        030142                                      L10033:
        030142  104401                                       TRAP    C$ETST
```

TEST 3: REGISTER R/W BIT TEST.

```
                                .SBTTL  TEST 3: REGISTER R/W BIT TEST.
                                ;*************************************************************************
                                ;               TEST 3 - REGISTER R/W BIT TEST.
                                ;
                                ;THIS TEST CHECKS THAT THE READ/WRITE BITS OF EACH REGISTER CAN ALL BE
                                ;SET, ALL CLEARED AND INDIVIDUALLY SET.
                                ;*************************************************************************
                                        BGNTST
                                                                                        T3::
030144  004737  011714                  CALL    SELECT                  ;CALL SELECT ROUTINE
030150  000417                          .WORD   417                     ;TEST SELECT MASK
030152  030626                          TSHD3                           ;TEST HEADER ADDRESS
030154  103002                          BCC     1$                      ;IF CARRY IS SET, DON'T BRANCH
030156                                  EXIT    TST                     ;EXIT TEST IF CARRY IS SET
030156  104432                                                                  TRAP    C$EXIT
030160  001144                                                                  .WORD   L10034-.
030162  005037  004144          1$:     CLR     ITRCNT                  ;CLEAR ITERATION COUNTER
030166  113701  004132                  MOVB    CONMSK,R1               ;GET MODULE TYPE
030172  032701  000020                  BIT     #20,R1                  ;TEST ONLY ANAL.+ DIGITAL MODULES
030176  004737  012146                  CALL    INSERT                  ;SKIP BRANCH IF "SFI" IS SET
030202  001404                          BEQ     ITRAC3                  ;...
030204                                  ERRSOFT 300,E300,EERG           ;ERROR HANDLER
030204  104457                                                                  TRAP    C$ERSOFT
030206  000454                                                                  .WORD   300
030210  030652                                                                  .WORD   E300
030212  007724                                                                  .WORD   EERG
030214                          ITRAC3: SETPRI  #PRI07                  ;DISABLE INTERRUPTS
030214  012700  000340                                                          MOV     #PRI07,R0
030220  104441                                                                  TRAP    C$SPRI
030222  005001                          CLR     R1                      ;CLEAR TEMPORARY STORE
030224  113701  004132                  MOVB    CONMSK,R1               ;GET MODULE TYPE
030230  012702  177777                  MOV     #-1,R2                  ;
030234  005202                  10$:    INC     R2                      ;MODULE IDENTIFICATION
030236  006201                          ASR     R1                      ;...
030240  103375                          BCC     10$                     ;...
030242  006302                          ASL     R2                      ;MULTYPLY BY 8. TO GET TABLE
030244  006302                          ASL     R2                      ;OFFSET
030246  006302                          ASL     R2                      ;
030250  005003                          CLR     R3                      ;START WITH MOD REGISTER
030252  013737  003700  010760          MOV     MOD,REGADD              ;LOAD FIRST REGISTER ADDRESS
030260  012737  000455  007200  20$:     MOV     #301.,ERRNBR            ;LOAD FIRST ERROR NUMBER
030266  016237  031264  010754          MOV     RWMAK(R2),MASK          ;GET R/W MASK FORM TABLE
030274  004737  010440                  CALL    REGTS1                  ;CALL REGISTER TEST
030300  005203                          INC     R3                      ;COUNTER FOR NEXT REGISTER
030302  022703  000004                  CMP     #4,R3                   ;4 REGISTERS TESTED ?
030306  001406                          BEQ     30$                     ;BRANCH IF YES
030310  062702  000002                  ADD     #2,R2                   ;LOAD NEXT TABLE ADDR.
030314  062737  000002  010760          ADD     #2,REGADD               ;NEXT REGISTER ADDRESS
030322  000756                          BR      20$                     ;TEST AGAIN WITH NEW PARAMETER
                                ;
                                ;THE FOLLOWING CODE IS FOR TESTING THE RT1 BIT IN A DIGITAL INPUT MODULE.
                                ;
030324                          30$:    BGNSEG
030324  104404                                                                  TRAP    C$BSEG
030326  113701  004132                  MOVB    CONMSK,R1               ;GET MODULE TYPE
030332  032701  000001                  BIT     #1,R1                   ;IS MODULE A DIGITAL INPUT?
030336  001515                          BEQ     70$                     ;BRANCH IF NO
```

TEST 3: REGISTER R/W BIT TEST.

```
5742 030340  052777  000001  153332          BIS     #1,@MOD                 ;SET RTO BIT IN DIGITAL INPUT
5743 030346  042777  000002  153324          BIC     #2,@MOD                 ;CLEAR RT1 BIT
5744 030354  017737  153320  004064          MOV     @MOD,BAD                ;GET MOD REGISTER CONTENTS
5745 030362  122737  000101  004064          CMPB    #101,BAD                ;RT1 BIT CLEARED + RTO BIT SET ?
5746 030370  004737  012146                  CALL    INSERT                  ;SKIP BRANCH IF "SFI" IS SET
5747 030374  001414                          BEQ     40$                     ;BRANCH IF YES
5748 030376  013705  003700                  MOV     MOD,R5                  ;SET UP DATA FOR ERROR MESSAGES
5749 030402  012737  000101  004062          MOV     #101,GOOD               ;SET UP DATA FOR ERROR MESSAGES
5750 030410  042737  177600  004064          BIC     #177600,BAD             ;MASK OUT UNUSED BITS
5751 030416                                  ERRSOFT 304,E304,EERB           ;ERROR HANDLER
     030416  104457                                                          TRAP    C$ERSOFT
     030420  000460                                                          .WORD   304
     030422  030747                                                          .WORD   E304
     030424  007664                                                          .WORD   EERB
5752 030426                          40$:    CKLOOP                          ;
     030426  104406                                                          TRAP    C$CLP1
5753 030430  042777  000001  153242          BIC     #1,@MOD                 ;CLEAR RTO BIT
5754 030436  017737  153236  004064          MOV     @MOD,BAD                ;GET REGISTER CONTENTS
5755 030444  122737  000102  004064          CMPB    #102,BAD                ;IS RT1 BIT SET ?
5756 030452  004737  012146                  CALL    INSERT                  ;SKIP BRANCH IF "SFI" IS SET
5757 030456  001414                          BEQ     60$                     ;BRANCH IF YES
5758 030460  013705  003700                  MOV     MOD,R5                  ;SET UP DATA FOR ERROR MESSAGES
5759 030464  012737  000102  004062          MOV     #102,GOOD               ;SET UP DATA FOR ERROR MESSAGES
5760 030472  042737  177600  004064          BIC     #177600,BAD             ;MASK OUT UNUSED BITS
5761 030500                                  ERRSOFT 305,E305,EERB           ;ERROR HANDLER
     030500  104457                                                          TRAP    C$ERSOFT
     030502  000461                                                          .WORD   305
     030504  031037                                                          .WORD   E305
     030506  007664                                                          .WORD   EERB
5762 030510                          60$:    CKLOOP                          ;
     030510  104406                                                          TRAP    C$CLP1
5763 030512  052777  000001  153160          BIS     #1,@MOD                 ;SET RTO BIT
5764 030520  117737  153154  004064          MOVB    @MOD,BAD                ;GET MOD REG. CONTENTS
5765 030526  122737  000103  004064          CMPB    #103,BAD                ;IS RTO AND RT1 BIT SET
5766 030534  004737  012146                  CALL    INSERT                  ;SKIP BRANCH IF "SFI" IS SET
5767 030540  001414                          BEQ     70$                     ;BRANCH IF YES
5768 030542  013705  003700                  MOV     MOD,R5                  ;SET UP DATA FOR ERROR MESSAGES
5769 030546  012737  000103  004062          MOV     #103,GOOD               ;SET UP DATA FOR ERROR MESSAGES
5770 030554  142737  177600  004064          BICB    #177600,BAD             ;MASK OUT UNUSED BITS
5771 030562                                  ERRSOFT 306,E306,EERB           ;ERROR HANDLER
     030562  104457                                                          TRAP    C$ERSOFT
     030564  000462                                                          .WORD   306
     030566  031150                                                          .WORD   E306
     030570  007664                                                          .WORD   EERB
5772 030572                          70$:    ENDSEG
     030572                                                          10000$:
     030572  104405                                                          TRAP    C$ESEG
5773 030574  005737  002242                  TST     QVP                     ;IS QUICK VERIFY PASS SELECTED?
5774 030600  001010                          BNE     EXQV3                   ;IF YES, EXIT TEST
5775 030602  005237  004144                  INC     ITRCNT                  ;ITERATION COUNTER + 1
5776 030606  023737  004146  004144          CMP     ITRDEF,ITRCNT           ;DEFAULT ITERATION EXECUTED
5777 030614  001402                          BEQ     EXQV3                   ;IF YES, EXIT TEST
5778 030616  000137  030214                  JMP     ITRAC3                  ;IF NO, TEST ITERATION
5779 030622                          EXQV3:  EXIT TST
     030622  104432                                                          TRAP    C$EXIT
     030624  000500                                                          .WORD   L10034-.
5780
```

TEST 3: REGISTER R/W BIT TEST.

```
5781                                                    .NLIST  BEX
5782 030626      045     123     062    TSHD3::         .ASCIZ  /*S2*AR-W BIT TEST*N/
5783 030652      123     120     105    E300:           .ASCIZ  /SPECIAL MODULE FOUND - CAN'T BE TESTED WITH THIS DIAGNOSTIC /
5784 030747      115     117     104    E304:           .ASCIZ  /MOD REGISTER CONTENTS OF DIGITAL INPUT MODULE INCORRECT/
5785 031037      115     117     104    E305:           .ASCII  /MOD REGISTER CONTENTS OF DIGITAL INPUT MODULE INCORRECT/
5786 031126      012     015     122                    .ASCIZ  <12><15>/RT1 BIT NOT SET/
5787 031150      115     117     104    E306:           .ASCII  /MOD REGISTER CONTENTS OF DIGITAL INPUT MODULE INCORRECT/
5788 031237      012     015     122                    .ASCIZ  <12><15>/RT0 + RT1 NOT SET/
5789                                                    .LIST   BEX
5790                                                    .EVEN
5791 031264  000011  000000  070000    RWMAK:          .WORD   11,0,70000,0            ;R/W MASKS FOR DIGITAL INPUT
     031272  000000
5792 031274  000000  177777  000000                    .WORD   0,177777,0,0            ;R/W MASKS FOR DIGITAL OUTPUT
     031302  000000
5793 031304  000000  000000  077136                    .WORD   0,0,77136,0             ;R/W MASKS FOR ANALOGUE INPUT
     031312  000000
5794 031314  000000  000000  001420                    .WORD   0,0,1420,0              ;R/W MASKS FOR ANALOGUE OUTPUT
     031322  000000
5795                                                    .EVEN
5796 031324                                            ENDTST
     031324                                                                  L10034:
     031324  104401                                                          TRAP    C$ETST
5797
5798 031326                                            ENDMOD
5799
```

TEST 3: REGISTER R/W BIT TEST.

```
                                        .TITLE HARDWARE TESTS
                                               BGNMOD
                                        .SBTTL  TEST 4: INTERNAL INTERRUPT LOGIC TEST - DIGITAL INPUT.
                                        ;*************************************************************************
                                        ;               TEST 4 - INTERNAL INTERRUPT LOGIC TEST - DIGITAL INPUT.
                                        ;
                                        ;THIS TEST CHECKS THAT THE INTERNAL INTERRUPT LOGIC IS ABLE TO CAUSE AN
                                        ;INTERRUPT USING THE VECTOR AND PRIORITY LEVEL SELECTED IN THE START UP
                                        ;QUESTIONS. THE INTERRUPT IS GENERATED BY SETTING THE INTERRUPT ENABLE
                                        ;AND THEN INTERRUPT TEST BITS. AFTER INTERRUPT, THE CSA CONTENTS
                                        ;ARE ALSO CHECKED.
                                        ;*************************************************************************
                                               BGNTST  4
                                                                                        T4::
031326  004737  011714                        CALL    SELECT                  ;JUMP TO SELECT ROUTINE
031332  000401                               .WORD   401                     ;GIVE TEST PARAMETER
031334  031760                               TSHD4                           ;GIVE TEST HEADER
031336  103002                               BCC     1$                      ;BRANCH IF CARRY IS CLEARED
031340                                       EXIT    TST                     ;EXIT TEST IF CARRY WAS SET
031340  104432                                                                       TRAP    C$EXIT
031342  001050                                                                       .WORD   L10035 .
031344  005037  004144                1$:    CLR     ITRCNT                  ;CLEAR ITERATION COUNTER
031350                                 ITRAC4: BGNSEG
031350  104404                                                                       TRAP    C$BSEG
031352  005037  004150                       CLR     INTFLA                  ;CLEAR INTERRUPT FLAG
031356  005077  152322                       CLR     @CSA                    ;CLEAR CONTOL STATUS REGISTER
031362                                       SETVEC  VEC,@INTSR,@PRIO7       ;SET VECTOR AND SERVICE ROUTINE
031362  012746  000340                                                               MOV     @PRIO7,-(SP)
031366  012746  017276                                                               MOV     @INTSR,-(SP)
031372  013746  003710                                                               MOV     VEC,-(SP)
031376  012746  000003                                                               MOV     #3,(SP)
031402  104437                                                                       TRAP    C$SVEC
031404  062706  000010                                                               ADD     #10,SP
031410                                       SETPRI  @PRIO7                  ;DISABLE INTERRUPT AT THIS POINT
031410  012700  000340                                                               MOV     @PRIO7,R0
031414  104441                                                                       TRAP    C$SPRI
031416  012777  040000  152260               MOV     #40000,@CSA             ;;;SET IE BIT IN CSA
031424  052777  000400  152252               BIS     #400,@CSA               ;;;SET TST IR BIT IN CSA REGISTER
031432  012701  000340                       MOV     @PRIO7,R1               ;;;LOAD R1 WITH PRIORITY NUMBER
031436  004737  011522                10$:    CALL    WT25                    ;;;WAIT 20 US
031442  005737  004150                       TST     INTFLA                  ;INTERRUPT OCCURRED ?
031446  001015                               BNE     20$                     ;BRANCH IF YES
031450  162701  000040                       SUB     #40,R1                  ;DECREMENT PRIORITY
031454                                       SETPRI  R1                      ;SET PRIORITY
031454  010100                                                                       MOV     R1,R0
031456  104441                                                                       TRAP    C$SPRI
031460  020127  000100                       CMP     R1,@PRIO2               ;IS THE PRIORITY OVER 2?
031464  004737  012146                       CALL    INSERT                  ;SKIP BRANCH IF SFI FLAG SET
031470  001362                               BNE     10$                     ;IF YES, BRANCH
031472                                       ERRSOFT 401,E401,EER3           ;ERROR HANDLER
031472  104457                                                                       TRAP    C$ERSOFT
031474  000621                                                                       .WORD   401
031476  032040                                                                       .WORD   E401
031500  007442                                                                       .WORD   EER3
031502                                 20$:    CKLOOP                          ;BRANCH TO BGNSEG IF LOOP IS SET
031502  104406                                                                       TRAP    C$CLP1
031504                                       SETPRI  @PRIO7                  ;DISABLE INTERRUPT AT THIS POINT
```

TEST 4: INTERNAL INTERRUPT LOGIC TEST - DIGITAL INPUT.

```
                031504  012700  000340                                                          MOV     #PRIO7,R0
                031510  104441                                                                  TRAP    C$SPRI
5885            031512  062701  000040          ADD     #40,R1          ;CORRECT PRI. FOR CMP (+INC BY 1)
5886            031516  020137  003712          CMP     R1,PRIO         ;CHECK INTERRUPT PRIORITY
5887            031522  004737  012146          CALL    INSERT          ;SKIP BRANCH IF SFI FLAG SET
5888            031526  001430                  BEQ     30$             ;BRANCH IF PRIORITY WAS CORRECT
5889                    000005                  .REPT   5               ;SET UP DATA FOR ERROR MESSAGES
5890                                            ASR     R1              ;...
5891                                            .ENDR                   ;...
5892            031542  010137  004064          MOV     R1,BAD          ;SET UP DATA FOR ERROR MESSAGE
5893            031546  013737  003712  004062  MOV     PRIO,GOOD       ;...
5894                    000005                  .REPT   5               ;...
5895                                            ASR     GOOD            ;...
5896                                            .ENDR                   ;...
5897            031600                          ERRSOFT 402,E402,EER1   ;ERROR HANDLER
                031600  104457                                                                  TRAP    C$ERSOFT
                031602  000622                                                                  .WORD   402
                031604  032122                                                                  .WORD   E402
                031606  007342                                                                  .WORD   EER1
5898            031610                  30$:    CKLOOP                  ;BRANCH TO BGNSEG IF LOE IS SET
                031610  104406                                                                  TRAP    C$CLP1
5899            031612  017737  152066  004064  MOV     @CSA,BAD        ;GET CSA CONTENTS
5900            031620  022737  140000  004064  CMP     #140000,BAD     ;IE AND IR SHOULD BE SET
5901            031626  004737  012146          CALL    INSERT          ;SKIP BRANCH IF SFI FLAG SET
5902            031632  001407                  BEQ     40$             ;BRANCH IF YES
5903            031634  012737  140000  004062  MOV     #140000,GOOD    ;SET UP DATA FOR ERROR MESSAGES
5904            031642                          ERRSOFT 403,E403,EER1   ;ERROR HANDLER
                031642  104457                                                                  TRAP    C$ERSOFT
                031644  000623                                                                  .WORD   403
                031646  032211                                                                  .WORD   E403
                031650  007342                                                                  .WORD   EER1
5905            031652                  40$:    CKLOOP                  ;BRANCH TO BGNSEG IF LOE IS SET
                031652  104406                                                                  TRAP    C$CLP1
5906            031654  052777  100000  152022  BIS     #100000,@CSA    ;CLEAR  IR 15 BIT IN CSA
5907            031662  017737  152016  004064  MOV     @CSA,BAD        ;GET CSA CONTENTS
5908            031670  022737  040000  004064  CMP     #40000,BAD      ;IS IR15 BIT CLEARED
5909            031676  004737  012146          CALL    INSERT          ;SKIP BRANCH IF SFI FLAG SET
5910            031702  001407                  BEQ     50$             ;BRANCH IF YES
5911            031704  012737  040000  004062  MOV     #40000,GOOD     ;SET UP DATA FOR ERROR MESSAGES
5912            031712                          ERRSOFT 404,E404,EER1   ;ERROR HANDLER
                031712  104457                                                                  TRAP    C$ERSOFT
                031714  000624                                                                  .WORD   404
                031716  032310                                                                  .WORD   E404
                031720  007342                                                                  .WORD   EER1
5913            031722                  50$:    ENDSEG
                031722                                                                  10000$:
                031722  104405                                                                  TRAP    C$ESEG
5914            031724  005737  002242          TST     QVP             ;IS QUICK VERIFY PASS SELECTED?
5915            031730  001007                  BNE     EXQV4           ;IF YES, EXIT TEST
5916            031732  005237  004144          INC     ITRCNT          ;ITERATION COUNTER + 1
5917            031736  023737  004146  004144  CMP     ITRDEF,ITRCNT   ;DEFAULT ITERATION EXECUTED
5918            031744  001401                  BEQ     EXQV4           ;IF YES, EXIT TEST
5919            031746  000600                  BR      ITRAC4          ;IF NO, TEST ITERATION
5920            031750  005077  151730  EXQV4:  CLR     @CSA            ;CLEAR CSA REGISTER
5921            031754                  EXIT    TST                     ;EXIT TETS
                031754  104432                                                                  TRAP    C$EXIT
                031756  000434                                                                  .WORD   L10035-.
```

TEST 4: INTERNAL INTERRUPT LOGIC TEST - DIGITAL INPUT.

```
                                        .NLIST  BEX
032412                                  ENDTST
032412                                                          L10035:
032412  104401                                                          TRAP    C$ETST
```

TEST 5: INTERNAL LOGIC TEST - ANALOGUE INPUT.

```
                                        .SBTTL  TEST 5: INTERNAL LOGIC TEST - ANALOGUE INPUT.
                                        ;*************************************************************************
                                        ;               TEST 5 - INTERNAL LOGIC TEST - ANALOGUE INPUT.
                                        ;
                                        ;THIS TEST PERFORMS A PSEUDO CONVERSION ON EACH CHANNEL THAT IS FOUND, BY
                                        ;SETTING THE A/D START BIT AND THEN  POLLING THE 'DONE' BIT TO CHECK THAT
                                        ;THE CONVERSION HAS BEEN COMPLETED WITHIN THE ALLOWED TIMEOUT PERIOD (AT
                                        ;LEAST 10MS).
                                        ;BEFORE A/D START IS SET, A CHECK IS MADE THAT THE DONE BIT IS CLEARED.
                                        ;THE ERROR CONDITIONS ARE ALSO CHECKED, BUT NO CHECK IS MADE ON THE RESULTING
                                        ;INPUTS OR ON THE GAIN SETTING.
                                        ;*************************************************************************
032414                                  BGNTST
032414                                                                                  T5::
032414  004737  011714                 CALL    SELECT                  ;CALL SELECT ROUTINE
032420  000404                          .WORD   404                     ;GIVE TEST PARAMETER (BASIC,AIP)
032422  033204                          TSHD5                           ;GIVE TEST HEADER ADDRESS
032424  103002                          BCC     1$                      ;BRANCH IF CARRY IS CLEARED
032426                                  EXIT    TST                     ;EXIT TEST IF CARRY WAS SET
032426  104432                                                                  TRAP    C$EXIT
032430  001242                                                                  .WORD   L10036-.
032432  005037  004144          1$:     CLR     ITRCNT                  ;CLEAR ITERATION COUNTER
032436  005003                  ITRAC5: CLR     R3                      ;CLEAR MAXIMUM CHANNEL COUNTER
032440  005004                          CLR     R4                      ;GET FIRST CHANNEL
032442                          10$:    BGNSEG
032442  104404                                                                  TRAP    C$BSEG
032444  005777  151232                  TST     @DAT                    ;READ DAT TO CLEAR DONE+ERR IN CSA
032450  005077  151230                  CLR     @CSA                    ;CLEAR CONTROL STATUS REGISTER
032454  050477  151224                  BIS     R4,@CSA                 ;LOAD CHANNEL NUMBER
032460  017737  151220  004064          MOV     @CSA,BAD                ;GET CSA CONTENTS
032466  012737  100000  004062          MOV     #100000,GOOD            ;SET UP GOOD DATA
032474  050437  004062                  BIS     R4,GOOD                 ;SAVE CHANNEL NUMBER IN GOOD
032500  023737  004062  004064          CMP     GOOD,BAD                ;IS CHANNEL AVAILABLE AND DONE CLEARED
032506  004737  012146                  CALL    INSERT                  ;SKIP BRANCH IF SFI FLAG SET
032512  001404                          BEQ     20$                     ;BRANCH IF YES
032514                                  ERRSOFT 501,E501,EER4           ;ERROR HANDLER
032514  104457                                                                  TRAP    C$ERSOFT
032516  000765                                                                  .WORD   501
032520  033261                                                                  .WORD   E501
032522  007474                                                                  .WORD   EER4
032524                          20$:    CKLOOP                          ;BRANCH BACK TO BGNSEG
032524  104406                                                                  TRAP    C$CLP1
032526  052777  000001  151150          BIS     #1,@CSA                 ;START A CONVERSION
032534  012701  000024                  MOV     #20.,R1                 ;SET UP TIME OUT COUNTER
032540  004737  011514          30$:    CALL    WT500                   ;WAIT 500 US
032544  017737  151134  004064          MOV     @CSA,BAD                ;GET CSA CONTENTS
032552  032737  000200  004064          BIT     #200,BAD                ;POLL THE DONE BIT
032560  001015                          BNE     40$                     ;BRANCH IF DONE BIT WAS SET
032562  005301                          DEC     R1                      ;DECREMENT TIMEOUT COUNTER
032564  004737  012146                  CALL    INSERT                  ;SKIP BRANCH IF SFI FLAG SET
032570  001363                          BNE     30$                     ;BRANCH IF 4 MS NOT REACHED
032572  012737  100200  004062          MOV     #100200,GOOD            ;SET UP DATA FOR ERROR MESSAGES
032600  050437  004062                  BIS     R4,GOOD                 ;LOAD CHANNEL NUMBER INTO GOOD
032604                                  ERRSOFT 502,E502,EER4           ;ERROR HANDLER
032604  104457                                                                  TRAP    C$ERSOFT
032606  000766                                                                  .WORD   502
032610  033345                                                                  .WORD   E502
```

TEST 5: INTERNAL LOGIC TEST - ANALOGUE INPUT.

```
                032612  007474                                                          .WORD   EER4
5978            032614                          40$:    CKLOOP                  ;BRANCH TO BGNSEG
                032614  104406                                                          TRAP    C$CLP1
5979            032616  052777  000001  151060          BIS     #1,@CSA         ;SET A/D START BIT TO GET AN ERR
5980            032624  017737  151054  004064          MOV     @CSA,BAD        ;GET CSA CONTENTS
5981            032632  012737  100240  004062          MOV     #100240,GOOD    ;SET UP GOOD DATA FOR COMPARISON
5982            032640  050437  004062                  BIS     R4,GOOD         ;...
5983            032644  023737  004062  004064          CMP     GOOD,BAD        ;ERROR BIT SHOULD NOW BE SET
5984            032652  004737  012146                  CALL    INSERT          ;SKIP BRANCH IF SFI FLAG SET
5985            032656  001404                          BEQ     50$             ;BRANCH IF YES
5986            032660                                  ERRSOFT 503,E503,EER4   ;ERROR HANDLER
                032660  104457                                                          TRAP    C$ERSOFT
                032662  000767                                                          .WORD   503
                032664  033427                                                          .WORD   E503
                032666  007474                                                          .WORD   EER4
5987            032670                          50$:    ENDSEG                                  10000$:
                032670                                                                          TRAP    C$ESEG
                032670  104405
5988            032672                                  BGNSEG                          TRAP    C$BSEG
                032672  104404
5989            032674  017737  151002  004064          MOV     @DAT,BAD        ;CLEAR DONE + ERR BY READING DAT REG.
5990            032702  017737  150776  004064          MOV     @CSA,BAD        ;GET CSA CONTENTS
5991            032710  012737  100000  004062          MOV     #100000,GOOD    ;SET UP GOOD DATA FOR COMPARISON
5992            032716  050437  004062                  BIS     R4,GOOD         ;...
5993            032722  023737  004062  004064          CMP     GOOD,BAD        ;DONE + ERR BIT SHOULD NOW BE CLEARED
5994            032730  004737  012146                  CALL    INSERT          ;SKIP BRANCH IF SFI FLAG SET
5995            032734  001404                          BEQ     60$             ;BRANCH IF YES
5996            032736                                  ERRSOFT 504,E504,EER4   ;ERROR HANDLER
                032736  104457                                                          TRAP    C$ERSOFT
                032740  000770                                                          .WORD   504
                032742  033517                                                          .WORD   E504
                032744  007474                                                          .WORD   EER4
5997            032746                          60$:    CKLOOP                  ;BRANCH TO BGNSEG IF LOE IS SET
                032746  104406                                                          TRAP    C$CLP1
5998            032750  052777  000001  150726          BIS     #1,@CSA         ;SET A/D START BIT IN CSA
5999            032756  052777  000001  150720          BIS     #1,@CSA         ;SET A/D START A SECOND TIME
6000            032764  017737  150714  004064          MOV     @CSA,BAD        ;GET CSA CONTENTS
6001            032772  012737  100040  004062          MOV     #100040,GOOD    ;SET UP GOOD DATA FOR COMPARISON
6002            033000  050437  004062                  BIS     R4,GOOD         ;...
6003            033004  023737  004062  004064          CMP     GOOD,BAD        ;ERROR BIT SHOULD BE SET
6004            033012  004737  012146                  CALL    INSERT          ;SKIP BRANCH IF SFI FLAG SET
6005            033016  001404                          BEQ     70$             ;BRANCH IF YES
6006            033020                                  ERRSOFT 505,E505,EER4   ;ERROR HANDLER
                033020  104457                                                          TRAP    C$ERSOFT
                033022  000771                                                          .WORD   505
                033024  033604                                                          .WORD   E505
                033026  007474                                                          .WORD   EER4
6007            033030                          70$:    CKLOOP                  ;BRANCH BACK TO BGNSEG (LOE SET)
                033030  104406                                                          TRAP    C$CLP1
6008            033032                                  ENDSEG                                  10001$:
                033032                                                                          TRAP    C$ESEG
                033032  104405
6009            033034  017737  150642  004064          MOV     @DAT,BAD        ;CLEAR ERROR BIT IN CSA
6010            033042  005203                          INC     R3              ;MARK CHANNEL NUMBER
6011            033044  022703  000017                  CMP     #15.,R3         ;16 CHANNELS TESTED ?
6012            033050  002027                          BGE     90$             ;BRANCH IF NOT
6013            033052  017737  150626  004064          MOV     @CSA,BAD        ;GET CSA CONTENTS
```

SEQ 0150

TEST 5: INTERNAL LOGIC TEST - ANALOGUE INPUT.

```
6014 033060  042737  100377  004064          BIC     #100377,BAD             ;MASK OUT UNUSED BITS
6015 033066  023727  004064  077400          CMP     BAD,#77400              ;HAVE WE REACHED LAST CHA. IN LAST BANK
6016 033074  103026                          BHIS    110$                    ;EXIT IF YES
6017 033076  062704  000400                  ADD     #400,R4                 ;INCREMENT CHANNEL NUMBER
6018 033102  005077  150576          80$:    CLR     @CSA                    ;CLEAR OLD CHANNEL NUMBER
6019 033106  050477  150572                  BIS     R4,@CSA                 ;LOAD NEW CHANNEL NUMBER
6020 033112  032777  100000  150564          BIT     #100000,@CSA            ;IS THE LOADED CHANNEL AVAILABLE ?
6021 033120  001407                          BEQ     100$                    ;BRANCH IF NOT
6022 033122  005003                          CLR     R3                      ;POINT TO FIRST CHANNEL IN BANK
6023 033124  000137  032442                  JMP     10$                     ;IF YES GO TO TEST CHANNEL
6024 033130  062704  000400          90$:    ADD     #400,R4                 ;GET NEXT CHANNEL
6025 033134  000137  032442                  JMP     10$                     ;REPEAT WITH NEXT CHANNEL
6026 033140  062704  010000          100$:   ADD     #10000,R4               ;POINT TO NEXT CHANNEL BANK
6027 033144  020427  070000                  CMP     R4,#70000               ;HAVE WE REACHED THE LAST CHA.
6028 033150  101754                          BLOS    80$                     ;BRANCH IF NOT
6029 033152  005737  002242          110$:   TST     QVP                     ;IS QUICK VERIFY PASS SELECTED?
6030 033156  001010                          BNE     EXQV5                   ;IF YES, EXIT TEST
6031 033160  005237  004144                  INC     ITRCNT                  ;ITERATION COUNTER + 1
6032 033164  023737  004146  004144          CMP     ITRDEF,ITRCNT           ;DEFAULT ITERATION EXECUTED
6033 033172  001402                          BEQ     EXQV5                   ;IF YES, EXIT TEST
6034 033174  000137  032436                  JMP     ITRAC5                  ;IF NO, TEST ITERATION
6035 033200                          EXQV5:  EXIT    TST                     ;EXIT TEST
     033200  104432                                                                  TRAP    C$EXIT
     033202  000470                                                                  .WORD   L10036-.
6036
6037                                         .NLIST  BEX
6038 033204      045     123     062  TSHD5:: .ASCIZ  /<S2><A>INTERNAL LOGIC TEST - ANALOGUE INPUT.<N>/
6039 033261      103     123     101  E501:   .ASCIZ  /CSA CONTENTS INCORRECT AFTER READ DAT AND CLEAR CSA/
6040 033345      104     117     116  E502:   .ASCIZ  /DONE BIT IN CSA NOT SET (TIMEOUT) AFTER A\D START/
6041 033427      105     122     122  E503:   .ASCIZ  \ERR BIT IN CSA NOT SET AFTER A/D START WHEN DONE IS SET\
6042 033517      105     122     122  E504:   .ASCIZ  /ERR, DONE BIT IN CSA NOT CLEARED AFTER READ DAT REG./
6043 033604      105     122     122  E505:   .ASCIZ  \ERR BIT IN CSA NOT SET AFTER LOADING A/D START TWICE\
6044                                         .LIST   BEX
6045                                         .EVEN
6046 033672                                  ENDTST
     033672                                                                  L10036:
     033672  104401                                                                  TRAP    C$ETST
```

TEST 6: INTERNAL INTERRUPT LOGIC TEST - ANALOGUE INPUT.

```
                                .SBTTL  TEST 6: INTERNAL INTERRUPT LOGIC TEST - ANALOGUE INPUT.
                                ;*************************************************************************
                                ;       TEST 6 - INTERNAL INTERRUPT LOGIC TEST - ANALOGUE INPUT.
                                ;
                                ;THIS TEST CHECKS THAT THE INTERNAL INTERRUPT LOGIC IS ABLE TO CAUSE A
                                ;DONE AND AN ERROR INTERRUPT USING THE VECTOR AND PRIORITY LEVEL SELECTED
                                ;IN THE START UP QUESTIONS.
                                ;THE DONE INTERRUPT IS GENERATED BY SETTING THE INTERRUPT ENABLE
                                ;BIT AND THE A/D START BIT.
                                ;THE ERROR INTERRUPT IS GENERATED BY SETTING THE A/D START BIT TWICE.
                                ;A TIME OUT IS GENERATED IF THE INTERRUPT HAS NOT OCCURED WITHIN THE
                                ;ALLOWED TIMEOUT PERIOD.
                                ;*************************************************************************
033674                                  BGNTST
033674                                                                  T6::
033674  004737  011714                CALL    SELECT                  ;CALL SELECT ROUTINE
033700  000404                        .WORD   404                     ;GIVE TEST PARAMETER (BASIC+AIP)
033702  034524                        TSHD6                           ;GIVE TEST HEADER ADDRESS
033704  103002                        BCC     1$                      ;BRANCH IF CARRY IS CLEARED
033706                                EXIT    TST                     ;EXIT TEST IF CARRY WAS SET
033706  104432                                                                  TRAP    C$EXIT
033710  001242                                                                  .WORD   L10037-.
033712  005037  004144          1$:   CLR     ITRCNT                  ;CLEAR ITERATION COUNTER
033716                                SETVEC  VEC,#INTSR,#PRIO7       ;SET DONE VECTOR AND SERVICE ROUTINE
033716  012746  000340                                                          MOV     #PRIO7,-(SP)
033722  012746  017276                                                          MOV     #INTSR,-(SP)
033726  013746  003710                                                          MOV     VEC,-(SP)
033732  012746  000003                                                          MOV     #3,-(SP)
033736  104437                                                                  TRAP    C$SVEC
033740  062706  000010                                                          ADD     #10,SP
033744  013702  003710                        MOV     VEC,R2          ;GET DONE VECTOR
033750  062702  000004                        ADD     #4,R2           ;CREATE ERROR VECTOR (VEC+4)
033754                                        SETVEC  R2,#INTSR2,#PRIO7       ;SET ERROR VEC. AND SERVICE ROUTINE
033754  012746  000340                                                          MOV     #PRIO7,-(SP)
033760  012746  017306                                                          MOV     #INTSR2,-(SP)
033764  010246                                                                  MOV     R2,-(SP)
033766  012746  000003                                                          MOV     #3,-(SP)
033772  104437                                                                  TRAP    C$SVEC
033774  062706  000010                                                          ADD     #10,SP
034000                          ITRAC6: BGNSEG
034000  104404                                                                  TRAP    C$BSEG
034002                                  SETPRI  #PRIO7                  ;DISABLE INTERRUPT AT THIS POINT
034002  012700  000340                                                          MOV     #PRIO7,R0
034006  104441                                                                  TRAP    C$SPRI
034010  005037  004150                        CLR     INTFLA          ;CLEAR INTERRUPT FLAG
034014  005037  004152                        CLR     INTFL2          ;CLEAR ERROR INTERRUPT FLAG
034020  005777  147656                        TST     @DAT            ;READ DAT TO CLEAR ERR+DONE IN CSA
034024  005077  147654                        CLR     @CSA            ;CLEAR CONTOL STATUS REGISTER
034030  012701  000340                        MOV     #PRIO7,R1       ;;;LOAD R1 WITH PRIORITY NUMBER
034034  012777  000100  147642              MOV     #100,@CSA       ;;;SET INTERRUPT ENABLE BIT
034042  052777  000001  147634              BIS     #1,@CSA         ;;;START THE CONVERSION
034050  012703  000036                        MOV     #30.,R3         ;;;SET UP TIME OUT COUNTER
034054  004737  011514          10$:  CALL    WT500                   ;;;WAIT 500 US
034060  032777  000200  147616              BIT     #200,@CSA       ;;;POLL THE DONE BIT
034066  001010                        BNE     20$                     ;;;BRANCH IF DONE BIT WAS SET
034070  005303                        DEC     R3                      ;;;DECREMENT TIMEOUT COUNTER
034072  004737  012146                        CALL    INSERT          ;;;SKIP BRANCH IF SPI FLAG SET
```

TEST 6: INTERNAL INTERRUPT LOGIC TEST - ANALOGUE INPUT.

```
6087 034076  001366                        BNE     10$                 ;;;BRANCH IF 4 MS NOT REACHED
6088 034100                                ERRSOFT 601,E601,EERG       ;;;ERROR HANDLER
     034100  104457                                                             TRAP    C$ERSOFT
     034102  001131                                                             .WORD   601
     034104  034605                                                             .WORD   E601
     034106  007724                                                             .WORD   EERG
6089 034110                        20$:    CKLOOP                      ;;;BRANCH TO BGNSEG
     034110  104406                                                             TRAP    C$CLP1
6090 034112  005737  004150                TST     INTFLA              ;DONE INTERRUPT OCCURRED ?
6091 034116  001015                        BNE     30$                 ;BRANCH IF YES
6092 034120  162701  000040                SUB     #40,R1              ;DECREMENT PRIORITY
6093 034124                                SETPRI  R1                  ;SET PRIORITY
     034124  010100                                                             MOV     R1,R0
     034126  104441                                                             TRAP    C$SPRI
6094 034130  020127  000100                CMP     R1,#PRIO2           ;IS THE PRIORITY OVER 2?
6095 034134  004737  012146                CALL    INSERT              ;SKIP BRANCH IF SFI FLAG SET
6096 034140  001363                        BNE     20$                 ;IF YES, BRANCH
6097 034142                                ERRSOFT 602,E602,EERG       ;ERROR HANDLER
     034142  104457                                                             TRAP    C$ERSOFT
     034144  001132                                                             .WORD   602
     034146  034670                                                             .WORD   E602
     034150  007724                                                             .WORD   EERG
6098 034152                        30$:    CKLOOP                      ;BRANCH TO BGNSEG IF LOE IS SET
     034152  104406                                                             TRAP    C$CLP1
6099 034154  062701  000040                ADD     #40,R1              ;CORRECT PRI.FOR CMP
6100 034160  020137  003712                CMP     R1,PRIO             ;CHECK INTERRUPT PRIORITY
6101 034164  004737  012146                CALL    INSERT              ;SKIP BRANCH IF SFI FLAG SET
6102 034170  001430                        BEQ     40$                 ;BRANCH IF PRIORITY WAS CORRECT
6103         000005                        .REPT   5                   ;SET UP DATA FOR ERROR MESSGAES
6104                                       ASR     R1                  ;...
6105                                       .ENDR                       ;...
6106 034204  010137  004064                MOV     R1,BAD              ;SET UP DATA FOR ERROR MESSAGE
6107 034210  013737  003712  004062        MOV     PRIO,GOOD           ;...
6108         000005                        .REPT   5                   ;...
6109                                       ASR     GOOD                ;...
6110                                       .ENDR                       ;...
6111 034242                                ERRSOFT 603,E603,EER1       ;ERROR HANDLER
     034242  104457                                                             TRAP    C$ERSOFT
     034244  001133                                                             .WORD   603
     034246  034751                                                             .WORD   E603
     034250  007342                                                             .WORD   EER1
6112 034252                        40$:    CKLOOP                      ;BRANCH TO BGNSEG IF LOE IS SET
     034252  104406                                                             TRAP    C$CLP1
6113 034254  017737  147424  004064        MOV     @CSA,BAD            ;GET CSA CONTENTS
6114 034262  022737  100300  004064        CMP     #100300,BAD         ;CHAVAI + IE + DONE SHOULD BE SET
6115 034270  004737  012146                CALL    INSERT              ;SKIP BRANCH IF SFI FLAG SET
6116 034274  001407                        BEQ     50$                 ;BRANCH IF YES
6117 034276  012737  100300  004062        MOV     #100300,GOOD        ;SET UP DATA FOR ERROR MESSAGES
6118 034304                                ERRSOFT 604,E604,EER1       ;ERROR HANDLER
     034304  104457                                                             TRAP    C$ERSOFT
     034306  001134                                                             .WORD   604
     034310  035002                                                             .WORD   E604
     034312  007342                                                             .WORD   EER1
6119 034314                        50$:    ENDSEG                      ;
     034314                                                                10000$:
     034314  104405                                                             TRAP    C$ESEG
6120
```

TEST 6: INTERNAL INTERRUPT LOGIC TEST - ANALOGUE INPUT.

```
6121                                    ;NOW WE TEST THE ERROR INTERRUPT
6122
6123 034316                                     BGNSEG
     034316  104404                                                      TRAP    C$BSEG
6124 034320  005777  147356                     TST     @DAT           ;READ DAT TO CLEAR ERR+DONE IN CSA
6125 034324  005737  004152                     TST     INTFL2         ;ERROR INTERRUPT OCCURRED ?
6126 034330  004737  012146                     CALL    INSERT         ;SKIP BRANCH IF SFI FLAG SET
6127 034334  001404                             BEQ     60$            ;BRANCH IF NO
6128 034336                                     ERRSOFT 605,E605,EERG  ;ERROR HANDLER
     034336  104457                                                      TRAP    C$ERSOFT
     034340  001135                                                      .WORD   605
     034342  035052                                                      .WORD   E605
     034344  007724                                                      .WORD   EERG
6129 034346                             60$:    CKLOOP                 ;
     034346  104406                                                      TRAP    C$CLP1
6130 034350  013703  000036                     MOV     30.,R3         ;SET TIMEOUT COUNTER
6131 034354  052777  000001  147322             BIS     #1,@CSA        ;START A CONVERSION (SET A/D BIT)
6132 034362  004737  011514             70$:    CALL    WT500          ;WAIT 500 US
6133 034366  032777  000200  147310             BIT     #200,@CSA      ;POLL THE DONE BIT
6134 034374  001010                             BNE     80$            ;BRANCH IF DONE BIT WAS SET
6135 034376  005303                             DEC     R3             ;DECREMENT TIMEOUT COUNTER
6136 034400  004737  012146                     CALL    INSERT         ;SKIP BRANCH IF SFI FLAG SET
6137 034404  001366                             BNE     70$            ;BRANCH IF 4 MS NOT REACHED
6138 034406                                     ERRSOFT 606,E601,EERG  ;ERROR HANDLER
     034406  104457                                                      TRAP    C$ERSOFT
     034410  001136                                                      .WORD   606
     034412  034605                                                      .WORD   E601
     034414  007724                                                      .WORD   EERG
6139 034416                             80$:    CKLOOP                 ;
     034416  104406                                                      TRAP    C$CLP1
6140 034420  052777  000001  147256             BIS     #1,@CSA        ;SET A/D START A SECOND TIME
6141 034426  004737  011522                     CALL    WT25           ;WAIT 25 US FOR INTERRUPT
6142 034432  005737  004152                     TST     INTFL2         ;ERROR INTERRUPT OCCURRED ?
6143 034436  004737  012146                     CALL    INSERT         ;SKIP BRANCH IF SFI FLAG SET
6144 034442  001004                             BNE     90$            ;BRANCH IF YES
6145 034444                                     ERRSOFT 607,E606,EERG  ;ERROR HANDLER
     034444  104457                                                      TRAP    C$ERSOFT
     034446  001137                                                      .WORD   607
     034450  035102                                                      .WORD   E606
     034452  007724                                                      .WORD   EERG
6146 034454                             90$:    CKLOOP                 ;
     034454  104406                                                      TRAP    C$CLP1
6147 034456  005777  147220                     TST     @DAT           ;READ DAT TO CLEAR ERR+DONE IN CSA
6148 034462                                     ENDSEG
     034462                                                          10001$:
     034462  104405                                                      TRAP    C$ESEG
6149 034464                                     SETPRI  #PRIO7         ;DISABLE INTERRUPTS
     034464  012700  000340                                             MOV     #PRIO7,R0
     034470  104441                                                      TRAP    C$SPRI
6150 034472  005737  002242                     TST     QVP            ;IS QUICK VERIFY PASS SELECTED?
6151 034476  001010                             BNE     EXQV6          ;IF YES, EXIT TEST
6152 034500  005237  004144                     INC     ITRCNT         ;ITERATION COUNTER + 1
6153 034504  023737  004146  004144             CMP     ITRDEF,ITRCNT  ;DEFAULT ITERATION EXECUTED
6154 034512  001402                             BEQ     EXQV6          ;IF YES, EXIT TEST
6155 034514  000137  034000                     JMP     ITRAC6         ;IF NO, TEST ITERATION
6156 034520                             EXQV6:  EXIT    TST            ;
     034520  104432                                                      TRAP    C$EXIT
```

TEST 6: INTERNAL INTERRUPT LOGIC TEST - ANALOGUE INPUT.

```
      034522  000430                                                        .WORD   L10037-.
6157
6158                                          .NLIST  BEX
6159 034524     045     123     062  TSHD6:: .ASCIZ  /*S2*AINTERNAL INTERRUPT TEST - ANALOGUE INPUT.*N/
6160 034605     124     111     115  E601:   .ASCIZ  \TIME OUT - DONE BIT IN CSA NOT SET AFTER A/D START\
6161 034670     116     117     040  E602:   .ASCIZ  \NO INTERRUPT AFTER SETTING EL + A/D START IN CSA\
6162 034751     120     122     111  E603:   .ASCIZ  /PRIORITY LEVEL INCORRECT/
6163 035002     103     123     101  E604:   .ASCIZ  /CSA CONTENTS INCORRECT AFTER CONVERSION/
6164 035052     105     122     122  E605:   .ASCIZ  /ERROR INTERRUPT OCCURED/
6165 035102     116     117     040  E606:   .ASCIZ  \NO ERROR INTERRUPT AFTER TWO A/D STARTS\
6166                                          .LIST   BEX
6167                                          .EVEN
6168 035152                                  ENDTST
     035152                                                        L10037:
     035152  104401                                                        TRAP    C$ETST
```

TEST 7: INTERNAL LOGIC TEST - ANALOGUE OUTPUT.

```
                                        .SBTTL  TEST 7: INTERNAL LOGIC TEST - ANALOGUE OUTPUT.
                                        ;*************************************************************************
                                        ;               TEST 7 - INTERNAL LOGIC TEST - ANALOGUE OUTPUT.
                                        ;
                                        ;THIS TEST PERFORMS A CONVERSION ON EACH AVAILABLE CHANNEL, LOADING THE
                                        ;DAT REGISTER AND CHECKING THAT THE CONVERSIONS ARE COMPLETED WITHIN THE
                                        ;ALLOWED TIMEOUT PERIOD ( READING THE READY BIT AFTER 150 US).
                                        ;*************************************************************************
035154                                          BGNTST
035154                                                                                  T7::
035154  004737  011714                        CALL    SELECT                  ;CALL SELECT ROUTINE
035160  000410                                .WORD   410                     ;GIVE TEST PARAMETER (BASIC+AUP)
035162  035424                                TSHD7                           ;GIVE TEST HEADER ADDRESS
035164  103515                                BCS     EXQV7                   ;IF CARRY IS SET, EXIT TEST
035166  005037  004144                        CLR     ITRCNT                  ;CLEAR ITERATION COUNTER
035172  005002                        ITRAC7: CLR     R2                      ;LOAD R2 WITH FIRST CHAN. NUMBER
035174  012704  012525                        MOV     #12525,R4               ;SET UP DATA FOR DATA REGISTER
035200                                  10$:    BGNSEG
035200  104404                                                                  TRAP    C$BSEG
035202  042777  003400  146474                BIC     #3400,@CSA              ;CLEAR CHANNEL BITS
035210  050277  146470                        BIS     R2,@CSA                 ;LOAD CHANNEL NUMBER
035214  017737  146464  004064                MOV     @CSA,BAD                ;GET CSA CONTENTS
035222  012737  100200  004062                MOV     #100200,GOOD            ;LOAD GOOD DATA FOR COMPARISON
035230  050237  004062                        BIS     R2,GOOD                 ;...
035234  042737  000040  004064                BIC     #40,BAD                 ;MASK OUT OPL BIT
035242  023737  004062  004064                CMP     GOOD,BAD                ;CHAVAI,READY SHOULD BE SET
035250  004737  012146                        CALL    INSERT                  ;SKIP BRANCH IF SFI FLAG SET
035254  001404                                BEQ     20$                     ;BRANCH IF YES
035256                                        ERRSOFT 701,E701,EER1           ;ERROR HANDLER
035256  104457                                                                  TRAP    C$ERSOFT
035260  001275                                                                  .WORD   701
035262  035502                                                                  .WORD   E701
035264  007342                                                                  .WORD   EER1
035266                                  20$:    ENDSEG                          ;BRANCH TO BGNSEG IF LOE IS SET
035266                                                                                  10000$:
035266  104405                                                                  TRAP    C$ESEG
035270  006104                                ROL     R4                      ;CHANGE DATA FOR LOAD DAT REGISTER
035272                                        BGNSEG
035272  104404                                                                  TRAP    C$BSEG
035274  010477  146402                        MOV     R4,@DAT                 ;LOAD DATA REGISTER
035300  012703  000006                        MOV     #6,R3                   ;LOAD WAIT COUNTER
035304  004737  011522                  30$:  CALL    WT25                    ;WAIT 25 US
035310  005303                                DEC     R3                      ;DECREMENT COUNTER
035312  001374                                BNE     30$                     ;BRANCH IF NOT ZERO
035314  017737  146364  004064                MOV     @CSA,BAD                ;GET CSA CONTENTS
035322  042737  000040  004064                BIC     #40,BAD                 ;MASK OUT OPL BIT
035330  023737  004062  004064                CMP     GOOD,BAD                ;COMPARE GOOD AND BAD
035336  004737  012146                        CALL    INSERT                  ;SKIP BRANCH IF SFI FLAG SET
035342  001404                                BEQ     40$                     ;BRANCH IF YES
035344                                        ERRSOFT 702,E702,EER1           ;ERROR HANDLER
035344  104457                                                                  TRAP    C$ERSOFT
035346  001276                                                                  .WORD   702
035350  035606                                                                  .WORD   E702
035352  007342                                                                  .WORD   EER1
035354                                  40$:    ENDSEG                          ;BRANCH TO BGNSEG IF LOE IS SET
035354                                                                                  10001$:
035354  104405                                                                  TRAP    C$ESEG
```

TEST 7: INTERNAL LOGIC TEST - ANALOGUE OUTPUT.

```
6212 035356  000302                          SWAB    R2                      ;SWAB HIGH AND LOW BYTE
6213 035360  120227  000003                  CMPB    R2,#3                   ;ALL 4 CHANNELS EXECUTED?
6214 035364  001403                          BEQ     60$                     ;BRANCH IF YES
6215 035366  005202                          INC     R2                      ;NEXT CHANNEL NUMBER
6216 035370  000302                          SWAB    R2                      ;SWAB LOW AND HIGH BYTE
6217 035372  000702                          BR      10$                     ;PERFORM A CONV. WITH NEXT CHAN.
6218 035374  005737  002242          60$:    TST     QVP                     ;IS QUICK VERIFY PASS SELECTED?
6219 035400  001007                          BNE     EXQV7                   ;IF YES EXIT TEST
6220 035402  005237  004144                  INC     ITRCNT                  ;ITERATION COUNTER + 1
6221 035406  023737  004146  004144          CMP     ITRDEF,ITRCNT           ;DEFAULT ITERATION EXECUTED
6222 035414  001401                          BEQ     EXQV7                   ;IF YES, EXIT TEST
6223 035416  000665                          BR      ITRAC7                  ;IF NO, TEST ITERATION
6224 035420                          EXQV7:  EXIT    TST                     ;
     035420  104432                                                                  TRAP    C$EXIT
     035422  000274                                                                  .WORD   L10040-.
6225                                         .NLIST  BEX
6226 035424     045     123     062  TSHD7:: .ASCIZ  /#S2#AINTERNAL LOGIC TEST - ANALOGUE OUTPUT.#N/
6227 035502     103     123     101  E701:   .ASCII  /CSA CONTENTS INCORRECT AFTER LOADING NEW CHANNEL /<12><15>
6228 035565     050     111     107          .ASCIZ  /(IGNORE OPL BIT)/
6229 035606     103     123     101  E702:   .ASCII  /CSA CONTENTS INCORRECT AFTER LOADING DAT REG./<12><15>
6230 035665     122     105     101          .ASCIZ  /READY TIMEOUT WAS 150US/
6231                                         .LIST   BEX
6232                                         .EVEN
6233 035716                                  ENDTST
     035716                                                                  L10040:
     035716  104401                                                                  TRAP    C$ETST
6234
6240
6241
6253
```

TEST 7: INTERNAL LOGIC TEST - ANALOGUE OUTPUT.

```
6261 035720                                        ENDMOD
6262
```

TEST 8: INTERNAL LOGIC TEST - ANALOGUE OUTPUT.

```
                                        .TITLE HARDWARE TESTS
                                               BGNMOD

                                        .SBTTL  TEST 8: DIGITAL INPUT LOOPBACK TEST WITH SELECTABLE DATA PATTERN PAIR.
                                        ;*************************************************************************
                                        ;       TEST 8 - DIGITAL INPUT LOOPBACK WITH SELECTABLE DATA PATTERN PAIR.
                                        ;
                                        ;       DATA TRANSFERS ARE MADE BETWEEN THE MODULE UNDER TEST (IN THIS
                                        ;       TEST A DIGITAL INPUT) AND THE MODULE SPECIFIED AS THE "OTHER" IN
                                        ;       THE HARDWARE QUESTIONS (IN THIS TEST A DIGITAL OUTPUT). IF LOW
                                        ;       LEVEL IS NOT SELECTED, ONE HUNDRED CYCLES ARE PERFORMED USING
                                        ;       THE DATA PAIR AND DEBOUNCE PERIOD SPECIFIED IN THE SOFTWARE
                                        ;       AND HARDWARE QUESTIONS. A DEBOUNCE PERIOD OF 10 MILLISECONDS IS
                                        ;       THEN USED TO CHECK THAT THE DAT REGISTER DOES NOT CHANGE IN THE
                                        ;       FIRST 2.5 MILLISECONDS.
                                        ;
                                        ;       IF LOW LEVEL IS SELECTED, ONLY 4 CYCLES ARE PERFORMED AND THE
                                        ;       DEBOUNCE FUNCTION IS NOT CHECKED.
                                        ;
                                        ;       BY DEFAULT, THE DATA PAIR IS ALL ZEROS AND ALL ONES, BUT ANY
                                        ;       PATTERN PAIR CAN BE SELECTED. IF THE TWO PATTERNS ARE IDENTICAL,
                                        ;       A FIXED OUTPUT WILL RESULT.
                                        ;*************************************************************************
035720                                          BGNTST 8.
035720                                                                                  T8::
035720  004737  011714                         CALL    SELECT                  ;CALL SELECT ROUTINE
035724  002001                                 .WORD   2001                    ;GIVE TEST PARAMETER
035726  036570                                 TSH08                           ;GIVE TEST HEADER ADDRESS
035730  103002                                 BCC     1$                      ;IF CARRY IS CLEARED BRANCH
035732                                         EXIT    TST                     ;IF CARRY IS SET, EXIT TEST
035732  104432                                                                          TRAP    C$EXIT
035734  001140                                                                          .WORD   L10041-.
035736  005037  004144          1$:            CLR     ITRCNT                  ;CLEAR ITERATION COUNTER
035742  013737  004154  036566  ITRA8:         MOV     CYCLE,SAV8              ;LOAD CYCLE COUNTER
035750  005002                 10$:            CLR     R2                      ;FLAG FOR PATTERN CHOICE
035752  005737  003716                         TST     LOWLVL                  ;IS LOW LEVEL SELEC. IN P TABLE?
035756  001402                                 BEQ     20$                     ;BRANCH IF NO
035760  000137  036360                         JMP     LLPA8                   ;JUMP TO LOW LEVEL PART
035764  013705  003720          20$:           MOV     DBOUNC,R5               ;GET DEBOUNCE FROM P TABLE
035770  005205                                 INC     R5                      ;CREATE DEBOUNCE VALUE FOR MOD
035772  042705  177774                         BIC     #177774,R5              ;ONLY BITS 1 AND 2 ARE USED
035776  022737  000003  003720                 CMP     #3,DBOUNC               ;ALL DEBOUNCE PERIODS SELECTED ?
036004  001002                                 BNE     30$                     ;BRANCH IF NO
036006  012705  000001                         MOV     #1,R5                   ;GET FIRST DEBOUNCE
036012  110577  145662          30$:           MOVB    R5,@MOD                 ;LOAD INPUT DEBOUNCE INTO MOD REGISTER
036016  052777  000100  145654                 BIS     #100,@MOD               ;SET MODULE LED BIT AGAIN
036024  116503  004172                         MOVB    DBTA8(R5),R3            ;GET DEBOUNCE WAIT VALUE FROM TABLE
036030  013701  002236          40$:           MOV     PAT1,R1                 ;GET FIRST PATTERN FROM P TABLE
036034                 50$:    BGNSEG
036034  104404                                                                          TRAP    C$BSEG
036036  010304                                 MOV     R3,R4                   ;LOAD WAIT COUNTER
036040  012737  001441  007200                 MOV     #801.,ERRNBR            ;ERROR NUMBER FOR WRITE SUBROU.
036046  004737  016122                         CALL    WRITE                   ;CALL WRITE ROUTINE
036052  103002                                 BCC     60$                     ;BRANCH IF NO ADDR. ERROR FOUND
036054                                         EXIT    TST                     ;EXIT TEST IF ADDRESSING ERROR
036054  104432                                                                          TRAP    C$EXIT
036056  001016                                                                          .WORD   L10041-.
```

TEST 8: DIGITAL INPUT LOOPBACK TEST WITH SELECTABLE DATA PATTE

```
6362 036060  063704  004166          60$:    ADD     OUTDE1,R4       ;ADD OPTO OUTPUT DEBOUNCE
6363 036064  032777  000001  145630          BIT     #1,@OTHMOD      ;IS DEBOUNCE OF OUTPUT 500 US ?
6364 036072  001002                          BNE     70$             ;BRANCH IF YES
6365 036074  063704  004170                  ADD     OUTDE2,R4       ;IF NO ADD RLEAY DEBOUNCE
6366 036100  004737  011514          70$:    JSR     PC,WT500        ;WAIT 500 US
6367 036104  005304                          DEC     R4              ;DECREMENT DEBOUNCE WAIT COUNTER
6368 036106  001374                          BNE     70$             ;BRANCH IF COUNTER IS NOT ZERO
6369 036110  017737  145566  004064          MOV     @DAT,BAD        ;READ DIGITAL INPUT PATTERN
6370 036116  020137  004064                  CMP     R1,BAD          ;CMP READ AND LOADED DATA
6371 036122  004737  012146                  CALL    INSERT          ;SKIP BRANCH IF 'SFI' IS SET
6372 036126  001406                          BEQ     80$             ;BRANCH IF EQUAL
6373 036130  010137  004062                  MOV     R1,GOOD         ;GET GOOD PATTERN
6374 036134                                  ERRSOFT 802,E802,EER2   ;ERROR HANDLER
     036134  104457                                                          TRAP    C$ERSOFT
     036136  001442                                                          .WORD   802
     036140  036665                                                          .WORD   E802
     036142  007400                                                          .WORD   EER2
6375 036144                          80$:    ENDSEG                                  10000$:
     036144                                                                          TRAP    C$ESEG
     036144  104405
6376 036146  005702                          TST     R2              ;IS THE 2ND PATTERN USED
6377 036150  001004                          BNE     90$             ;BRANCH IF YES
6378 036152  005202                          INC     R2              ;INC FLAG TO SHOW 2ND PATTERN
6379 036154  013701  002240                  MOV     PAT2,R1         ;GET SECOND PATTERN FROM P TABLE
6380 036160  000725                          BR      50$             ;BRANCH TO OUTPUT LOOP
6381 036162  022737  000003  003720  90$:    CMP     #3,DBOUNC       ;ALL DEBOUNCE SELECTED?
6382 036170  001004                          BNE     100$            ;BRANCH IF NO
6383 036172  005205                          INC     R5              ;POINT TO NEXT DEBOUNCE VALUE
6384 036174  022705  000004                  CMP     #4,R5           ;ALL DEBOUNCE PERIODS EXECUTED
6385 036200  001304                          BNE     30$             ;BRANCH IF NO
6386 036202  005337  036566          100$:   DEC     SAV8            ;DECREMENT CYCLE COUNTER
6387 036206  001260                          BNE     10$             ;BRANCH IF NO ZERO
6388
6389                                        ;NOW WE WILL TEST THAT THE DEBOUNCE TIME IS NOT FINISHED TOO FAST
6390
6391 036210                          PSUE8:  BGNSEG                                  TRAP    C$BSEG
     036210  104404
6392 036212  005001                          CLR     R1              ;GET VALUE FOR WRITE ROUTINE
6393 036214  012704  000062                  MOV     #50.,R4         ;WAIT COUNTER FOR CLEAR DAT REG.
6394 036220  012737  001443  007200          MOV     #803.,ERRNBR    ;LOAD ERROR NUMBER
6395 036226  004737  016122                  JSR     PC,WRITE        ;CLEAR OUTPUT DAT REGISTER
6396 036232  103002                          BCC     10$             ;BRANCH IF NO ADDR. ERROR FOUND
6397 036234                                  EXIT    TST             ;EXIT TEST IF ADDRESSING ERROR
     036234  104432                                                          TRAP    C$EXIT
     036236  000636                                                          .WORD   L10041-.
6398 036240  004737  011514          10$:    JSR     PC,WT500        ;...
6399 036244  005304                          DEC     R4              ;...
6400 036246  001374                          BNE     10$             ;...
6401 036250  052777  000003  145422          BIS     #3,@#OD         ;LOAD INPUT DEBOUNCE OF 10 MS
6402 036256  012701  177777                  MOV     #177777,R1      ;LOAD VALUE FOR OUTPUT DAT REG.
6403 036262  012704  000004                  MOV     #4,R4           ;LOAD (2MS) WAIT COUNTER
6404 036266  012737  001444  007200          MOV     #804.,ERRNBR    ;LOAD ERROR NUMBER
6405 036274  004737  016122                  JSR     PC,WRITE        ;SEND DATA
6406 036300  103002                          BCC     20$             ;BRANCH IF NO ADDR. ERROR FOUND
6407 036302                                  EXIT    TST             ;EXIT TEST IF ADDRESSING ERROR
     036302  104432                                                          TRAP    C$EXIT
     036304  000570                                                          .WORD   L10041-.
```

SEQ 0160

TEST 8: DIGITAL INPUT LOOPBACK TEST WITH SELECTABLE DATA PATTE

```
6408 036306  004737  011514          20$:    JSR     PC,WT500            ;WAIT 500 US
6409 036312  005304                          DEC     R4                  ;...
6410 036314  001374                          BNE     20$                 ;BRANCH IF NOT FINISHED
6411 036316  017737  145360  004064          MOV     @DAT,BAD            ;READ INPUT DATA REG.
6412 036324  020137  004064                  CMP     R1,BAD              ;DATA SHOULD NOT BE CHANGED
6413 036330  004737  012146                  CALL    INSERT              ;SKIP BRANCH IF 'SFI' IS SET
6414 036334  001006                          BNE     30$                 ;BRANCH IF OK
6415 036336  005037  004062                  CLR     GOOD                ;SET UP DATA FOR ERROR HANDLER
6416 036342                                  ERRSOFT 805,E803,EER2       ;ERROR HANDLER
     036342  104457                                                              TRAP    C$ERSOFT
     036344  001445                                                              .WORD   805
     036346  036764                                                              .WORD   E803
     036350  007400                                                              .WORD   EER2
6417 036352                          30$:    ENDSEG                      ;
     036352                                                                 10001$:
     036352  104405                                                              TRAP    C$ESEG
6418 036354  000137  036534                  JMP     @VR8                ;SKIP LOW LEVEL PART
6419
6420                                 ;THE FOLLOWING CODE WILL TEST THE LOW LEVEL (IF SELECTED) OF THE INPUT MODULE
6421
6422 036360  013737  004156  036566  LLPA8:  MOV     CYCLLS,SAV8         ;LOAD LOW LEVEL CYCLE COUNTER
6423 036366  052777  000002  145304          BIS     #2,@MOD             ;LOAD 5MS INPUT DEBOUNCE
6424 036374  042777  000001  145276          BIC     #1,@MOD             ;...
6425 036402  052777  000010  145270          BIS     #10,@MOD            ;SWITCH INPUT MODULE TO LLS
6426 036410  005002                  10$:    CLR     R2                  ;FLAG FOR PATTERN MARKING
6427 036412  013701  002236                  MOV     PAT1,R1             ;GET FIRST PATTERN
6428 036416  013704  004162          20$:    MOV     LLWC,R4             ;GET LOW LEVEL DEBOUNCE TIME
6429 036422  012737  001446  007200          MOV     #806.,ERRNBR        ;LOAD ERROR NUMBER
6430 036430                                  BGNSEG
     036430  104404                                                              TRAP    C$BSEG
6431 036432  004737  016122                  CALL    WRITE               ;CALL WRITE ROUTINE
6432 036436  103002                          BCC     30$                 ;BRANCH IF NO ADDR. ERROR FOUND
6433 036440                                  EXIT    TST                 ;EXIT TEST IF ADDRESSING ERROR
     036440  104432                                                              TRAP    C$EXIT
     036442  000432                                                              .WORD   L10041-.
6434 036444  004737  011514          30$:    JSR     PC,WT500            ;WAIT 500 US
6435 036450  005304                          DEC     R4                  ;DECREMENT WAIT COUNTER
6436 036452  001374                          BNE     30$                 ;BRANCH IF COUNTER IS NOT ZERO
6437 036454  017737  145222  004064          MOV     @DAT,BAD            ;READ DIGITAL INPUT PATTERN
6438 036462  020137  004064                  CMP     R1,BAD              ;CMP READ AND LOADED DATA
6439 036466  004737  012146                  CALL    INSERT              ;SKIP BRANCH IF 'SFI' IS SET
6440 036472  001406                          BEQ     40$                 ;BRANCH IF EQUAL
6441 036474  010137  004062                  MOV     R1,GOOD             ;GET GOOD PATTERN
6442 036500                                  ERRSOFT 807,E802,EER2       ;ERROR HANDLER
     036500  104457                                                              TRAP    C$ERSOFT
     036502  001447                                                              .WORD   807
     036504  036665                                                              .WORD   E802
     036506  007400                                                              .WORD   EER2
6443 036510                          40$:    ENDSEG
     036510                                                                 10002$:
     036510  104405                                                              TRAP    C$ESEG
6444 036512  005702                          TST     R2                  ;WAS THE 2ND PATTERN USED?
6445 036514  001004                          BNE     50$                 ;BRANCH IF YES
6446 036516  005202                          INC     R2                  ;INC FLAG TO SHOW 2ND PATTERN
6447 036520  013701  002240                  MOV     PAT2,R1             ;GET SECOND PATTERN FROM P TABLE
6448 036524  000734                          BR      20$                 ;BRANCH TO OUTPUT LOOP
6449 036526  005337  036566          50$:    DEC     SAV8                ;IS CYCLE COUNTER OVER?
```

TEST 8: DIGITAL INPUT LOOPBACK TEST WITH SELECTABLE DATA PATTE

```
 6450 036532  001326                        BNE     10$                     ;BRANCH IF NO
 6451 036534  005737  002242          QVR8:  TST     QVP                     ;IS QUICK VERIFY PASS SELECTED?
 6452 036540  001010                        BNE     EXQV8                   ;IF YES, EXIT TEST
 6453 036542  005237  004144                INC     ITRCNT                  ;ITERATION COUNTER + 1
 6454 036546  023737  004146  004144        CMP     ITRDEF,ITRCNT           ;DEFAULT ITERATION EXECUTED
 6455 036554  001402                        BEQ     EXQV8                   ;IF YES, EXIT TEST
 6456 036556  000137  035742                JMP     ITRA8                   ;IF NO, TEST ITERATION
 6457 036562                        EXQV8:  EXIT    TST                     ;EXIT TEST
      036562  104432                                                                TRAP    C$EXIT
      036564  000310                                                                .WORD   L10041-.
 6458
 6459
 6460 036566  000000                SAV8:   .WORD                           ;
 6461
 6462
 6463                                        .NLIST  BEX
 6464 036570     045     123     062  TSHD8:: .ASCIZ  /#S2#ADIGITAL INPUT LOOPBACK TEST - PATTERN PAIR SELECTABLE#N/
 6465 036665     114     117     120  E802:   .ASCIZ /LOPPED DATA IN DATA REGISTER OF DIGITAL INPUT MODULE INCORRECT/
 6466 036764     104     105     102  E803:   .ASCII  /DEBOUNCE FUNCTION ERROR/<12><15>
 6467 037015     104     101     124          .ASCIZ  /DATA ACCEPTED BEFORE LOADED DEBOUNCE FINISHED/
 6468                                        .LIST   BEX
 6469                                        .EVEN
 6470
 6471 037074                                ENDTST
      037074                                                             L10041:
      037074  104401                                                          TRAP    C$ETST
```

```
                                        .SBTTL  TEST 9: DIGITAL OUTPUT LOOPBACK TEST WITH SELECTABLE DATA PATTERN PAIR.
                                        ;*****************************************************************************
                                        ;       TEST 9 - DIGITAL OUTPUT LOOPBACK TEST - SELECTABLE DATA PATTERN PAIR.
                                        ;
                                        ;DATA TRANSFERS ARE MADE BETWEEN THE MODULE UNDER TEST (IN THIS TEST A
                                        ;DIGITAL OUTPUT) AND THE MODULE SPECIFIED AS THE 'OTHER' IN THE HARDWARE
                                        ;QUESTIONS (IN THIS TEST A DIGITAL INPUT). SEVERAL CYCLES
                                        ;ARE PERFORMED USING THE DATA PAIR FROM THE SW P-TABLE AND A DEBOUNCE
                                        ;PERIOD FOUND IN THE MOD REGISTER OF THE DIGITAL OUTPUT MODULE .
                                        ;FOR THE INPUT MODULE THE DEBOUNCE OF (500US) IS USED.
                                        ;BY DEFAULT, THE DATA PAIR IS ALL ZEROS AND ALL ONES,
                                        ;BUT ANY PATTERN PAIR CAN BE SELECTED. IF THE TWO PATTERNS ARE IDENTICAL,
                                        ;A FIXED OUTPUT WILL RESULT.
                                        ;IF A RELAY OUTPUT MODULE IS USED, A CHECK IS ALSO MADE THAT THE
                                        ;DAT REGISTER OF THE DIGITAL INPUT MODULE WILL NOT BE CHANGED
                                        ;TOO FAST AFTER LOADING THE OUTPUT DATA REGISTER.
                                        ;*****************************************************************************
 6490 037076                                    BGNTS1
      037076                                                                                    T9::
 6491 037076  004737  011714                    CALL    SELECT                  ;CALL SELECT ROUTINE
 6492 037102  002002                            .WORD   2002                    ;GIVE TEST PARAMETER
 6493 037104  037616                            TSHD9                           ;GIVE TEST HEADER ADDRESS
 6494 037106  103002                            BCC     1$                      ;IF CARRY IS CLEARED, BRANCH
 6495 037110                                    EXIT    TST                     ;IF CARRY IS SET, EXIT TEST
      037110  104432                                                                            TRAP    C$EXIT
      037112  001102                                                                           .WORD   L10042-.
 6496 037114  005037  004144            1$:     CLR     ITRCNT                  ;CLEAR ITERATION COUNTER
 6497 037120  013705  004154            ITRA9:  MOV     CYCLE,R5                ;LOAD CYCLE COUNTER
 6498 037124  005002                    10$:    CLR     R2                      ;FLAG FOR PATTERN CHOICE
 6499 037126  012737  001605  007200            MOV     #901.,ERRNBR            ;LOAD ERROR NUMBER
 6500 037134  004737  016326                    CALL    READ                    ;TEST OTHER MODULE ADDRESS
 6501 037140  103002                            BCC     20$                     ;BRANCH IF NO ADDR. ERROR FOUND
 6502 037142                                    EXIT    TST                     ;EXIT TEST IF ADDRESSING ERROR
      037142  104432                                                                            TRAP    C$EXIT
      037144  001050                                                                           .WORD   L10042-.
 6503 037146  052777  000001  144546    20$:    BIS     #1,@OTHMOD              ;LOAD 500 US INPUT DEBOUNCE
 6504 037154  142777  000002  144540            BICB    #2,@OTHMOD              ;...
 6505 037162  012703  000001                    MOV     #1,R3                   ;LOAD INPUT DEBOUNCE COUNTER
 6506 037166  032777  000001  144504            BIT     #1,@MOD                 ;FIND DEBOUNCE OF OUTPUT MODULE
 6507 037174  001003                            BNE     30$                     ;BRANCH IF RTO IS SET (500 US)
 6508 037176  063703  004170                    ADD     OUTDE2,R3               ;ADD RELAY OUTPUT MODULE DEB
 6509 037202  000402                            BR      40$                     ;BRANCH OVER NEXT COMMAND
 6510 037204  063703  004166            30$:    ADD     OUTDE1,R3               ;ADD OPTP OUTPUT  DEB.
 6511 037210  013701  002236            40$:    MOV     PAT1,R1                 ;GET FIRST PATTERN
 6512 037214  010304                    50$:    MOV     R3,R4                   ;SAVE WAIT COUNTER VALUE
 6513 037216  010177  144460                    MOV     R1,@DAT                 ;LOAD OUTPUT DATA REGISTER
 6514 037222  004737  011514            60$:    JSR     PC,WT500                ;WAIT 500 US
 6515 037226  005304                            DEC     R4                      ;DECREMENT WAIT COUNTER
 6516 037230  001374                            BNE     60$                     ;BRANCH IF COUNTER IS NOT ZERO
 6517 037232  017737  144444  004064            MOV     @DAT,BAD                ;READ LOADED DATA BACK
 6518 037240  020137  004064                    CMP     R1,BAD                  ;ARE THE LOADED DATA STILL THERE?
 6519 037244  004737  012146                    CALL    INSERT                  ;SKIP BRANCH IF 'SET' IS SET
 6520 037250  001406                            BEQ     70$                     ;BRANCH IF YES
 6521 037252  010137  004062                    MOV     R1,GOOD                 ;SET UP DATA FOR ERROR REPORT
 6522 037256                                    ERRSOFT 902,E902,ERR            ;ERROR HANDLER
      037256  104457                                                                            TRAP    C$ERSOFT
      037260  001606                                                                           .WORD   902
```

TEST 9: DIGITAL OUTPUT LOOPBACK TEST WITH SELECTABLE DATA PATT

```
        037262  037714                                                          .WORD   E902
        037264  007400                                                          .WORD   EER2
  6523  037266  012737  001607  007200  70$:    MOV     #903.,ERRNBR           ;LOAD ERROR NUMBER
  6524  037274  004737  016326                  CALL    READ                   ;READ DATA REG. OF INPUT MODULE
  6525  037300  103002                          BCC     80$                    ;BRANCH IF NO ADDR. ERROR FOUND
  6526  037302                                  EXIT    TST                    ;EXIT TEST IF ADDRESSING ERROR
        037302  104432                                                          TRAP    C$EXIT
        037304  000710                                                          .WORD   L10042-.
  6527  037306  020137  004064          80$:    CMP     R1,BAD                 ;CMP READ AND LOADED DATA
  6528  037312  004737  012146                  CALL    INSERT                 ;SKIP BRANCH IF 'SFI' IS SET
  6529  037316  001406                          BEQ     90$                    ;BRANCH IF EQUAL
  6530  037320  010137  004062                  MOV     R1,GOOD                ;GET GOOD PATTERN
  6531  037324                                  ERRSOFT 904,E903,EER2          ;ERROR HANDLER
        037324  104457                                                          TRAP    C$ERSOFT
        037326  001610                                                          .WORD   904
        037330  040017                                                          .WORD   E903
        037332  007400                                                          .WORD   EER2
  6532  037334  005702          90$:    TST     R2                             ;IS THE 2ND PATTERN USED?
  6533  037336  001004                  BNE     100$                           ;BRANCH IF YES
  6534  037340  005202                  INC     R2                             ;INC FLAG TO SHOW 2ND PATTERN
  6535  037342  013701  002240          MOV     PAT2,R1                        ;GET SECOND PATTERN FROM P TABLE
  6536  037346  000722                  BR      50$                            ;BRANCH TO OUTPUT LOOP
  6537  037350  005305          100$:   DEC     R5                             ;ALL CYCLES PERFORMED?
  6538  037352  001264                  BNE     10$                            ;BRANCH IF NO
  6539
  6540                                  ;NOW WE WILL TEST THAT THE OUTPUT DEBOUNCE TIME IS NOT FINISHED TOO FAST
  6541                                  ;ONLY IF WE HAVE A RELAY OUTPUT (5 MS DEBOUNCE).
  6542
  6543  037354                          BGNSEG
        037354  104404                                                          TRAP    C$BSEG
  6544  037356  032777  000001  144314          BIT     #1,@MOD                ;IS THE DEBOUNCE OF OUTPUT 500 US
  6545  037364  001076                  BNE     170$                           ;SKIP THE FOLLOWING PART IF YES
  6546  037366  012777  177777  144306          MOV     #177777,@DAT           ;LOAD OUTPUT MODULE DAT REGISTER
  6547  037374  010304                  MOV     R3,R4                          ;GET IN AND OUTPUT DEBOUNCE
  6548  037376  004737  011514  110$:   JSR     PC,WT500                       ;INPUT DAT REGISTER WILL ALSO
  6549  037402  005304                  DEC     R4                             ;BE LOADED
  6550  037404  001374                  BNE     110$                           ;...
  6551  037406  005077  144270                  CLR     @DAT                   ;CLEAR OUTPUT DATA REGISTER
  6552  037412  012704  000002                  MOV     #2,R4                  ;LOAD WAIT COUNTER
  6553  037416  004737  011522  120$:   JSR     PC,WT25                        ;WAIT 25 US
  6554  037422  005304                  DEC     R4                             ;...
  6555  037424  001374                  BNE     120$                           ;BRANCH IF NOT FINISHED
  6556  037426  012737  001611  007200          MOV     #905.,ERRNBR           ;ERROR NUMBER FOR READ ROUT.
  6557  037434  004737  016326                  CALL    READ                   ;READ LOOPED DATA
  6558  037440  103002                          BCC     130$                   ;BRANCH IF NO ADDR. ERROR FOUND
  6559  037442                                  EXIT    TST                    ;EXIT TEST IF ADDRESSING ERROR
        037442  104432                                                          TRAP    C$EXIT
        037444  000550                                                          .WORD   L10042-.
  6560  037446  022737  177777  004064  130$:   CMP     #177777,BAD            ;DATA REG OF INPUT SHOULD NOT CHANGE
  6561  037454  004737  012146                  CALL    INSERT                 ;SKIP BRANCH IF 'SFI' IS SET
  6562  037460  001407                          BEQ     140$                   ;BRANCH IF YES
  6563  037462  012737  177777  004062          MOV     #177777,GOOD           ;SET UP DATA FOR ERROR HANDLER
  6564  037470                                  ERRSOFT 906,E904,EER2          ;ERROR HANDLER
        037470  104457                                                          TRAP    C$ERSOFT
        037472  001612                                                          .WORD   906
        037474  040074                                                          .WORD   E904
        037476  007400                                                          .WORD   EER2
```

TEST 9: DIGITAL OUTPUT LOOPBACK TEST WITH SELECTABLE DATA PATT

```
6565 037500                          140$:   CKLOOP                          ;
     037500  104406                                                                  TRAP    C$CLP1
6566 037502  010304                          MOV     R3,R4                   ;LOAD WAIT COUNTER
6567 037504  004737  011514          150$:   JSR     PC,WT500                ;WAIT FOR 500 US
6568 037510  005304                          DEC     R4                      ;...
6569 037512  001374                          BNE     150$                    ;BRANCH IF NOT FINISHED
6570 037514  012737  001613  007200        MOV     #907.,ERRNBR            ;LOAD ERROR NUMBER
6571 037522  004737  016326                CALL    READ                    ;READ DATA REG. OF INPUT MODULE
6572 037526  103002                        BCC     160$                    ;BRANCH IF NO ADDR. ERROR FOUND
6573 037530                                EXIT    TST                     ;EXIT TEST IF ADDRESSING ERROR
     037530  104432                                                                  TRAP    C$EXIT
     037532  000462                                                                  .WORD   L10042-.
6574 037534  005737  004064          160$:   TST     BAD                     ;OUTPUT DATA SHOULD BE EQUAL
6575 037540  004737  012146                CALL    INSERT                  ;SKIP BRANCH IF 'SFI' IS SET
6576 037544  001406                        BEQ     170$                    ;BRANCH IF EQUAL (ZERO)
6577 037546  005037  004062                CLR     GOOD                    ;GET GOOD PATTERN
6578 037552                                ERRSOFT 908,E903,EER2           ;ERROR HANDLER
     037552  104457                                                                  TRAP    C$ERSOFT
     037554  001614                                                                  .WORD   908
     037556  040017                                                                  .WORD   E903
     037560  007400                                                                  .WORD   EER2
6579 037562                          170$:   ENDSEG                                  10000$:
     037562                                                                       TRAP    C$ESEG
     037562  104405
6580 037564  005737  002242                TST     QVP                     ;IS QUICK VERIFY PASS SELECTED?
6581 037570  001010                        BNE     EXQV9                   ;IF YES, EXIT TEST
6582 037572  005237  004144                INC     ITRCNT                  ;ITERATION COUNTER + 1
6583 037576  023737  004146  004144        CMP     ITRDEF,ITRCNT           ;DEFAULT ITERATION EXECUTED
6584 037604  001402                        BEQ     EXQV9                   ;IF YES, EXIT TEST
6585 037606  000137  037120                JMP     ITRA9                   ;IF NO, TEST ITERATION
6586 037612                          EXQV9:  EXIT    TST                     ;EXIT TEST
     037612  104432                                                                  TRAP    C$EXIT
     037614  000400                                                                  .WORD   L10042-.
6587
6588
6589                                       .NLIST  BEX
6590 037616     045     123     062  TSHD9:: .ASCIZ  /*S2*ADIGITAL OUTPUT LOOPBACK TEST - PATTERN PAIR SELECTABLE*N/
6591 037714     104     101     124  E902:   .ASCII  /DATA REGISTER OF DIGITAL OUTPUT MODULE INCORRECT /<12><15>
6592 037777     101     106     124          .ASCIZ  /AFTER READ BACK/
6593 040017     122     105     103  E903:   .ASCIZ  /RECEIVED DATA INCORRECT - CHECK OUTPUT LOGIC/
6594 040074     104     105     102  E904:   .ASCII  /DEBOUNCE TIME INCORRECT/<12><15>
6595 040125     104     101     124          .ASCIZ  /DATA ACCEPTED TOO FAST (LOADED DEBOUNCE NOT FINISHED)/
6596                                       .LIST   BEX
6597                                       .EVEN
6598
6599 040214                                ENDTST
     040214                                                                       L10042:
     040214  104401                                                                  TRAP    C$ETST
```

```
6601                                    .SBTTL  TEST 10:DIGITAL INPUT LOOPBACK TEST - RANDOM PATTERN
6602                                    ;*****************************************************************************
6603                                    ;       TEST 10 - DIGITAL LOOPBACK TEST WITH RANDOM PATTERN AND RANDOM OR
6604                                    ;                 SELECTABLE DEBOUNCE PERIOD.
6605                                    ;
6606                                    ;       THIS TEST CHECKS THE DATA TRANSFER BETWEEN INPUT AND OUTPUT
6607                                    ;       MODULES. THE OUTPUT MODULE IS THAT SPECIFIED AS THE "OTHER" IN
6608                                    ;       THE HARDWARE QUESTIONS. SEVERAL CYCLES ARE PERFORMED USING DATA
6609                                    ;       GENERATED BY A RANDOM PATTERN GENERATOR WITHIN THE PROGRAM.
6610                                    ;
6611                                    ;       IF LOW LEVEL TESTING WAS NOT SELECTED IN THE HARDWARE QUESTIONS,
6612                                    ;       THE SELECTED DEBOUNCE PERIOD IS USED. IF "ALL" WAS SPECIFIED,
6613                                    ;       THE PERIOD IS SELECTED AT RANDOM FROM THE 3 ALLOWED VALUES.
6614                                    ;*****************************************************************************
6615 040216                            BGNTST
      040216                                                                    T10::
6616 040216  004737  011714                    CALL    SELECT                  ;CALL SELECT ROUTINE
6617 040222  002001                            .WORD   2001                    ;GIVE TEST PARAMETER
6618 040224  040676                            TSHD10                          ;GIVE TEST HEADER ADDRESS
6619 040226  103002                            BCC     1$                      ;IF CARRY IS CLEARED, BRANCH
6620 040230                                    EXIT    TST                     ;IF CARRY IS SET, EXIT TEST
      040230  104432                                                                    TRAP    C$EXIT
      040232  000642                                                                    .WORD   L10043-.
6621 040234  005037  004144            1$:     CLR     ITRCNT                  ;CLEAR ITERATION COUNTER
6622 040240  013702  004160            ITRA10: MOV     CYCRAD,R2               ;LOAD CYCLE COUNTER
6623 040244  005737  003716                    TST     LOWLVL                  ;IS LOW LEVEL SELEC. IN P-TABLE?
6624 040250  001402                            BEQ     10$                     ;BRANCH IF NO
6625 040252  000137  040504                    JMP     LLPA10                  ;JUMP TO LOW LEVEL PART
6626 040256  013705  003720            10$:    MOV     DBOUNC,R5               ;GET DEBOUNCE FROM P TABLE
6627 040262  005205                            INC     R5                      ;CREATE DEBOUNCE VALUE FOR MOD
6628 040264  042705  177774                    BIC     #177774,R5              ;WE ONLY USE BITS 1 AND 2
6629 040270  022737  000003  003720            CMP     #3,DBOUNC               ;ALL DEBOUNCE PERIODS SELECTED ?
6630 040276  001002                            BNE     30$                     ;BRANCH IF NO
6631 040300  012705  000001            20$:    MOV     #1,R5                   ;GET FIRST DEBOUNCE
6632 040304  110577  143370            30$:    MOVB    R5,@MOD                 ;LOAD DEBOUNCE INTO MOD REGISTER
6633 040310  052777  000100  143362            BIS     #100,@MOD               ;SWITCH ON THE MODULE LED AGAIN
6634 040316  116503  004172                    MOVB    DBTAB(R5),R3            ;GET WAIT VALUE FROM TABLE
6635 040322                            40$:    BGNSEG
      040322  104404                                                                   TRAP    C$BSEG
6636 040324  013701  016574                    MOV     RB,R1                   ;GET FIRST RANDOM PATTERN
6637 040330  010304                    50$:    MOV     R3,R4                   ;SAVE WAIT COUNTER VALUE
6638 040332  012737  001751  007200            MOV     #1001.,ERRNBR           ;LOAD ERROR NUMBER FOR SUBROU.
6639 040340  004737  016122                    JSR     PC,WRITE                ;CALL WRITE ROUTINE
6640 040344  103002                            BCC     60$                     ;BRANCH IF NO ADDR. ERROR FOUND
6641 040346                                    EXIT    TST                     ;EXIT TEST IF ADDRESSING ERROR
      040346  104432                                                                    TRAP    C$EXIT
      040350  000524                                                                    .WORD   L10043-.
6642 040352  063704  004166            60$:    ADD     OUTDEL,R4               ;ADD OPTO OUTPUT DEBOUNCE
6643 040356  032777  000001  143336            BIT     #1,@OTHMOD              ;IS DEBOUNCE OF OUTPUT 500 US ?
6644 040364  001002                            BNE     70$                     ;BRANCH IF YES
6645 040366  063704  004170                    ADD     OUTDEP,R4               ;IF NO ADD RELAY DEBOUNCE
6646 040372  004737  011514            70$:    JSR     PC,WT500                ;WAIT 500 US
6647 040376  005304                            DEC     R4                      ;DECREMENT WAIT COUNTER
6648 040400  001374                            BNE     70$                     ;BRANCH IF COUNTER IS NOT ZERO
6649 040402  017737  143274  004064            MOV     @DAT,BAD                ;READ DIGITAL INPUT PATTERN
6650 040410  020137  004064                    CMP     R1,BAD                  ;CMP READ AND LOADED DATA
6651 040414  004737  012146                    CALL    INSERT                  ;SKIP BRANCH IF 'SEL' IS SET
```

TEST 10:DIGITAL INPUT LOOPBACK TEST - RANDOM PATTERN

```
   6652 040420  001406                    BEQ     80$                     ;BRANCH IF EQUAL
   6653 040422  010137  004062            MOV     R1,GOOD                 ;GET GOOD PATTERN
   6654 040426                            ERRSOFT 1002,E1002,EER2         ;ERROR HANDLER
        040426  104457                                                            TRAP    C$ERSOFT
        040430  001752                                                            .WORD   1002
        040432  040762                                                            .WORD   E1002
        040434  007400                                                            .WORD   EER2
   6655 040436                    80$:    ENDSEG
        040436                                                          10000$:
        040436  104405                                                           TRAP    C$ESEG
   6656 040440  004737  016534            CALL    RANDOM                  ;GENERATE NEXT PATTERN
   6657 040444  022737  000003  003720    CMP     #3,DBOUNC               ;ALL DEBOUNCE REQUESTED ?
   6658 040452  001010                    BNE     90$                     ;BRANCH IF NO
   6659 040454  005205                    INC     R5                      ;NEXT DEBOUNCE
   6660 040456  022705  000004            CMP     #4,R5                   ;ALL DEBOUNCE PERIODS EXECUTED?
   6661 040462  001310                    BNE     30$                     ;BRANCH IF NO
   6662 040464  005302                    DEC     R2                      ;ALL CYCLES PERFORMED ?
   6663 040466  001304                    BNE     20$                     ;BRANCH IF NO
   6664 040470  000137  040644            JMP     QVR10                   ;SKIP LOW LEVEL PART
   6665 040474  005302            90$:    DEC     R2                      ;ALL CYCLES PERFORMED ?
   6666 040476  001311                    BNE     40$                     ;BRANCH IF NO
   6667 040500  000137  040644            JMP     QVR10                   ;SKIP LOW LEVEL PART
   6668
   6669                            ;THIS PART WILL TEST THAT THE LOW LEVEL SELECT WILL WORK WITH RANDOM
   6670                            ;PATTERN. THE DEBOUNCE OF THE DIGITAL INPUT MODULE IS FIXED AT 5 MS
   6671
   6672 040504  052777  000002  143166 LLPA10: BIS     #2,@MOD                 ;LOAD A DEBOUNCE OF 5 MS
   6673 040512  042777  000001  143160        BIC     #1,@MOD                 ;CLEAR DEBOUNCE OF 5 US
   6674 040520  052777  000010  143152        BIS     #10,@MOD                ;SWITCH INPUT MODULE TO LLS
   6675 040526  013702  004156            MOV     CYCLLS,R2               ;LOAD CYCLE COUNTER
   6676 040532                            BGNSEG
        040532  104404                                                           TRAP    C$BSEG
   6677 040534  013701  016574            10$:    MOV     RB,R1           ;LOAD DATA
   6678 040540  013704  004162            MOV     LLWC,R4                 ;LOAD LLS WAIT COUNTER
   6679 040544  012737  001753  007200    MOV     #1003.,ERRNBR           ;LOAD ERROR NUMBER
   6680 040552  004737  016122            JSR     PC,WRITE                ;SEND DATA AND ADD OUTPUT DEBOU.
   6681 040556  103002                    BCC     20$                     ;BRANCH IF NO ADDR. ERROR FOUND
   6682 040560                            EXIT    TST                     ;EXIT TEST IF ADDRESSING ERROR
        040560  104432                                                           TRAP    C$EXIT
        040562  000312                                                           .WORD   L10043
   6683 040564  004737  011514            20$:    JSR     PC,WT500        ;WAIT 500 US
   6684 040570  005304                    DEC     R4                      ;...
   6685 040572  001374                    BNE     20$                     ;BRANCH IF NOT FINISHED
   6686 040574  017737  143102  004064    MOV     @DAT,BAD                ;READ INPUT DATA
   6687 040602  020137  004064            CMP     R1,BAD                  ;DATA SHOULD NOT BE CHANGED
   6688 040606  004737  012146            CALL    INSERT                  ;SKIP BRANCH IF 'SET' IS SET
   6689 040612  001406                    BEQ     30$                     ;BRANCH IF OK
   6690 040614  010137  004062            MOV     R1,GOOD                 ;SET UP DATA FOR ERROR HANDLER
   6691 040620                            ERRSOFT 1004,E1002,EER2         ;ERROR HANDLER
        040620  104457                                                            TRAP    C$ERSOFT
        040622  001754                                                            .WORD   1004
        040624  040762                                                            .WORD   E1002
        040626  007400                                                            .WORD   EER2
   6692 040630                    30$:    CKLOOP                          ;
        040630  104406                                                           TRAP    C$CLP1
   6693 040632  004737  016534            CALL    RANDOM                  ;CREATE NEXT PATTERN
   6694 040636  005302                    DEC     R2                      ;IS CYCLE COUNTER OVER?
```

TEST 10:DIGITAL INPUT LOOPBACK TEST - RANDOM PATTERN

```
 6695 040640  001335                        BNE     10$                     ;BRANCH IF NO
 6696 040642                                ENDSEG
      040642                                                                 10001$:
      040642  104405                                                                 TRAP    C$ESEG
 6697 040644  005737  002242          QVR10:  TST     QVP                     ;IS QUICK VERIFY PASS SELECTED?
 6698 040650  001010                        BNE     EXQV10                  ;IF YES, EXIT TEST
 6699 040652  005237  004144                INC     ITRCNT                  ;ITERATION COUNTER + 1
 6700 040656  023737  004146  004144        CMP     ITRDEF,ITRCNT           ;DEFAULT ITERATION EXECUTED
 6701 040664  001402                        BEQ     EXQV10                  ;IF YES, EXIT TEST
 6702 040666  000137  040240                JMP     ITRA10                  ;IF NO, TEST ITERATION
 6703 040672                        EXQV10: EXIT    TST                     ;EXIT TEST
      040672  104430                                                                 TRAP    C$EXIT
      040674  000200                                                                 .WORD   L10043-.
 6704
 6705
 6706                                       .NLIST  BEX
 6707 040676     045     123     062  TSHD10::.ASCIZ  /%S2%ADIGITAL INPUT LOOPBACK TEST - RANDOM PATTERN%N/
 6708 040762     104     111     107  E1002:  .ASCII  /DIGITAL INPUT DATA REGISTER INCORRECT /<12><15>
 6709 041032     114     117     101          .ASCIZ  /LOADED AND READ DATA NOT THE SAME/
 6710                                       .LIST   BEX
 6711                                       .EVEN
 6712
 6713 041074                                ENDTST
      041074                                                                 L10043:
      041074  104401                                                                 TRAP    C$ETST
```

TEST 11:DIGITAL OUTPUT LOOPBACK TEST - RANDOM PATTERN

```
                                .SBTTL  TEST 11:DIGITAL OUTPUT LOOPBACK TEST - RANDOM PATTERN
                                ;*************************************************************************
                                ;       TEST 11 - DIGITAL OUTPUT LOOPBACK TEST WITH RANDOM PATTERN
                                ;
                                ;THIS TEST CHECKS THE DATA OUTPUT LINES OF DIGITAL OUTPUT MODULES
                                ;BY READING THE OUTPUT DATA WITH AN INPUT MODULE. THE INPUT MODULE IS THAT
                                ;SPECIFIED AS THE 'OTHER' IN THE HARDWARE QUESTIONS. 500 CYCLES ARE
                                ;PERFORMED USING DATA GENERATED BY A RANDOM PATTERN GENERATOR WITHIN THE
                                ;PROGRAM. THE TIMEOUT PERIOD IS BASED ON THE DEBOUNCE PERIOD FOUND IN THE
                                ;MOD REGISTER OF THE DIGITAL OUTPUT MODULE.
                                ;THE DIGITAL INPUT MODULE IS ALWAYS LOADED WITH A DEBOUNCE OF 500 US.
                                ;*************************************************************************
041076                                  BGNTST
041076                                                                          T11::
041076  004737  011714                 CALL    SELECT                  ;CALL SELECT ROUTINE
041102  002002                         .WORD   2002                    ;GIVE TEST PARAMETER
041104  041400                         TSHD11                          ;GIVE TEST HEADER ADDRESS
041106  103002                         BCC     1$                      ;IF CARRY IS CLEARED, BRANCH
041110                                 EXIT    TST                     ;IF CARRY IS SET, EXIT TEST
041110  104432                                                                  TRAP    C$EXIT
041112  000560                                                                  .WORD   L10044-.
041114  005037  004144         1$:     CLR     ITRCNT                  ;CLEAR ITERATION COUNTER
041120  013702  004160         ITRA11: MOV     CYCRAD,R2               ;LOAD CYCLE COUNTER
041124  012737  002115  007200         MOV     #1101.,ERRNBR           ;LOAD ERROR NUMBER
041132  004737  016326                 CALL    READ                    ;TEST OTHER MODULE ADDRESS (INPUT)
041136  103002                         BCC     10$                     ;BRANCH IF NO ADDR. ERROR FOR ID
041140                                 EXIT    TST                     ;EXIT TEST IF ADDRESSING ERROR
041140  104432                                                                  TRAP    C$EXIT
041142  000530                                                                  .WORD   L10044-.
041144  152777  000001  142550 10$:     BISB    #1,@OTHMOD              ;SET 500 US DEBOUNCE IN INPUT
041152  042777  000002  142542         BIC     #2,@OTHMOD              ;CLEAR 5 MS DEBOUNCE IN INPUT MOD
041160  012703  000001                 MOV     #1,R3                   ;LOAD WAIT COUNTER WITH INPUT DEB.
041164  032777  000001  142506         BIT     #1,@MOD                 ;FIND DEBOUNCE OF OUTPUT MODULE
041172  001003                         BNE     20$                     ;BRANCH IF RTO IS SET (500 US)
041174  063703  004170                 ADD     OUTDE2,R3               ;ADD RELAY OUTPUT MODULE DEB.
041200  000402                         BR      30$                     ;
041202  063703  004166         20$:    ADD     OUTDE1,R3               ;ADD DEBOUNCE OF OPTO OUTPUT MODULE
041206  013701  016574         30$:    MOV     RB,R1                   ;GET FIRST RANDOM PATTERN
041212                                 BGNSEG
041212  104404                                                                  TRAP    C$BSEG
041214  010304                 40$:    MOV     R3,R4                   ;SAVE WAIT COUNTER VALUE
041216  010177  142460                 MOV     R1,@DAT                 ;LOAD OUTPUT DATA REGISTER
041222  004737  011514         50$:    JSR     PC,WT500                ;WAIT 500 US
041226  005304                         DEC     R4                      ;DECREMENT WAIT COUNTER
041230  001374                         BNE     50$                     ;BRANCH IF COUNTER IS NOT ZERO
041232  017737  142444  004064         MOV     @DAT,BAD                ;READ LOADED DATA BACK
041240  020137  004064                 CMP     R1,BAD                  ;LOADED DATA STILL THERE?
041244  004737  012146                 CALL    INSERT                  ;SKIP BRANCH IF 'SET' IS SET
041250  001406                         BEQ     60$                     ;BRANCH IF YES
041252  010137  004062                 MOV     R1,GOOD                 ;SET UP DATA FOR ERROR REPORT
041256                                 ERRSOFT 1102,E1102,EER2         ;ERROR HANDLER
041256  104457                                                                  TRAP    C$ERSOFT
041260  002116                                                                  .WORD   1102.
041262  041465                                                                  .WORD   E1102
041264  007400                                                                  .WORD   EER2
041266                         60$:    CKLOOP                          ;
041266  104406                                                                  TRAP    C$CLP1
```

TEST 11:DIGITAL OUTPUT LOOPBACK TEST - RANDOM PATTERN

```
 6761 041270  012737  002117  007200          MOV     #1103.,ERRNBR           ;LOAD ERROR NUMBER
 6762 041276  004737  016326                  CALL    READ                    ;READ D/O LINES WITH DI MODULE
 6763 041302  103002                          BCC     70$                     ;BRANCH IF NO ADDR. ERROR FOUND
 6764 041304                                  EXIT    TST                     ;EXIT TEST IF ADDRESSING ERROR
      041304  104432                                                                  TRAP    C$EXIT
      041306  000364                                                                  .WORD   L10044-.
 6765 041310  020137  004064          70$:    CMP     R1,BAD                  ;CMP READ AND LOADED DATA
 6766 041314  004737  012146                  CALL    INSERT                  ;SKIP BRANCH IF 'SFI' IS SET
 6767 041320  001406                          BEQ     80$                     ;BRANCH IF EQUAL
 6768 041322  010137  004062                  MOV     R1,GOOD                 ;GET GOOD PATTERN
 6769 041326                                  ERRSOFT 1104,E1103,EER2         ;ERROR HANDLER
      041326  104457                                                                  TRAP    C$ERSOFT
      041330  002120                                                                  .WORD   1104
      041332  041603                                                                  .WORD   E1103
      041334  007400                                                                  .WORD   EER2
 6770 041336                          80$:    ENDSEG                                      10000$:
      041336                                                                          TRAP    C$ESEG
      041336  104405
 6771 041340  004737  016534                  CALL    RANDOM                  ;GENERATE NEXT PATTERN
 6772 041344  005302                          DEC     R2                      ;ALL CYCLES PERFORMED ?
 6773 041346  001317                          BNE     30$                     ;BRANCH IF NO
 6774 041350  005737  002242                  TST     QVP                     ;IS QUICK VERIFY PASS SELECTED?
 6775 041354  001007                          BNE     EXQV11                  ;IF YES, EXIT TEST
 6776 041356  005237  004144                  INC     ITRCNT                  ;ITERATION COUNTER + 1
 6777 041362  023737  004146  004144          CMP     ITRDEF,ITRCNT           ;DEFAULT ITERATION EXECUTED
 6778 041370  001401                          BEQ     EXQV11                  ;IF YES, EXIT TEST
 6779 041372  000652                          BR      ITRA11                  ;IF NO, TEST ITERATION
 6780 041374                          EXQV11: EXIT    TST                     ;EXIT TEST
      041374  104432                                                                  TRAP    C$EXIT
      041376  000274                                                                  .WORD   L10044-.
 6781
 6782                                         .NLIST  BEX
 6783 041400      045     123     062  TSHD11::.ASCIZ  /*S2*ADIGITAL OUTPUT LOOPBACK TEST   RANDOM PATTERN*N/
 6784 041465      104     101     124  E1102:  .ASCII  /DATA REGISTER OF DIGITAL OUTPUT MODULE INCORRECT /<12><15>
 6785 041550      104     101     124          .ASCIZ  /DATA CHANGED AFTER LOADING/
 6786 041603      114     117     101  E1103:  .ASCIZ  /LOADED AND READ DATA NOT THE SAME - CHECK OUTPUT LOGIC/
 6787                                         .LIST   BEX
 6788                                         .EVEN
 6789
 6790 041672                                  ENDTST
      041672                                                                  L10044:
      041672  104401                                                                  TRAP    C$ETST
```

TEST 12: DIGITAL INPUT LOOPBACK TEST SLIDING PATTERN

```
6792                                    .SBTTL  TEST 12: DIGITAL INPUT LOOPBACK TEST - SLIDING PATTERN
6793                                    ;*****************************************************************************
6794                                    ;       TEST 12 - DIGITAL INPUT LOOPBACK TEST WITH SLIDING PATTERN
6795                                    ;
6796                                    ;THIS TEST TRANSFERS SLIDING ONES AND THEN SLIDING ZEROS BETWEEN
6797                                    ;OUTPUT MODULE AND INPUT MODULES.  THE OUTPUT MODULE THAT SPECIFIED
6798                                    ;AS THE 'OTHER' IN THE HARDWARE QUESTIONS.
6799                                    ;THE TRANSFERS ARE PERFORMED USING THE LEVEL SELECT AND THE DEBOUNCE
6800                                    ;PERIOD SPECIFIED IN THE HARDWARE QUESTIONS.
6801                                    ;*****************************************************************************
6802 041674                            BGNTST
      041674                                                                          T12::
6803 041674  004737  011714            CALL    SELECT                  ;CALL SELECT ROUTINE
6804 041700  002001                    .WORD   2001                    ;GIVE TEST PARAMETER
6805 041702  042572                    TSHD12                          ;GIVE TEST HEADER ADDRESS
6806 041704  103002                    BCC     1$                      ;IF CARRY IS CLEARED, BRANCH
6807 041706                            EXIT    TST                     ;IF CARRY IS SET, EXIT TEST
      041706  104432                                                                  TRAP    C$EXIT
      041710  001064                                                                  .WORD   L10045-.
6808 041712  005037  004144            1$:     CLR     ITRCNT          ;CLEAR ITERATION COUNTER
6809 041716  013702  004156            ITRA12: MOV     CYCLES,R2       ;LOAD CYCLE COUNTER
6810 041722  005737  003716                    TST     LOWLVL          ;IS LOW LEVEL SELEC. IN P-TABLE
6811 041726  001402                            BEQ     10$             ;BRANCH IF NO
6812 041730  000137  042270                    JMP     LLPA12          ;JUMP TO LOW LEVEL PART
6813 041734  013705  003720            10$:    MOV     DBOUNC,R5       ;GET DEBOUNCE FROM P TABLE
6814 041740  005205                            INC     R5              ;CREATE DEBOUNCE VALUE FOR MOD
6815 041742  042705  177774                    BIC     #177774,R5      ;WE ONLY USE BITS 1 AND 2
6816 041746  022737  000003  003720            CMP     #3,DBOUNC       ;ALL DEBOUNCE PERIODS SELECTED ?
6817 041754  001002                            BNE     30$             ;BRANCH IF NO
6818 041756  012705  000001            20$:    MOV     #1,R5           ;GET FIRST DEBOUNCE
6819 041762  110577  141712            30$:    MOVB    R5,@MOD         ;LOAD DEBOUNCE INTO MOD REGISTER
6820 041766  052777  000100  141704            BIS     #100,@MOD       ;SWITCH ON THE MODULE LED
6821 041774  012701  000001                    MOV     #1,R1           ;GET MASK FOR SLIDING ONES
6822 042000                            40$:    BGNSEG
      042000  104404                                                                  TRAP    C$BSEG
6823 042002  116503  004172                    MOVB    DBTAB(R5),R3    ;GET WAIT VALUE FROM TABLE
6824 042006  012737  002261  007200            MOV     #1201.,ERRNBR   ;LOAD ERROR NUMBER
6825 042014  004737  016122                    JSR     PC,WRITE        ;CALL WRITE ROUTINE
6826 042020  103002                            BCC     50$             ;BRANCH IF NO ADDR. ERROR FOUND
6827 042022                            EXIT    TST                     ;EXIT TEST IF ADDRESSING ERROR
      042022  104432                                                                  TRAP    C$EXIT
      042024  000750                                                                  .WORD   L10045-.
6828 042026  063703  004166            50$:    ADD     OUTDE1,R3       ;ADD OPTO OUTPUT DEBOUNCE
6829 042032  032777  000001  141662            BIT     #1,@OTHMOD      ;IS DEBOUNCE OF OUTPUT 500 US ?
6830 042040  001002                            BNE     60$             ;BRANCH IF YES
6831 042042  063703  004170                    ADD     OUTDE2,R3       ;IF NO, ADD RELAY DEBOUNCE
6832 042046  010304                    60$:    MOV     R3,R4           ;SAVE WAIT COUNTER VALUE
6833 042050  004737  011514            70$:    JSR     PC,WT500        ;WAIT 500 US
6834 042054  005304                            DEC     R4              ;DECREMENT WAIT COUNTER
6835 042056  001374                            BNE     70$             ;BRANCH IF COUNTER IS NOT ZERO
6836 042060  017737  141616  004064            MOV     @DAT,BAD        ;READ DIGITAL INPUT PATTERN
6837 042066  020137  004064                    CMP     R1,BAD          ;CMP READ AND LOADED DATA
6838 042072  004737  012146                    CALL    INVERT          ;SKIP BRANCH IF 'SKIP' IS SET
6839 042076  001406                            BEQ     80$             ;BRANCH IF EQUAL
6840 042100  010137  004062                    MOV     R1,GOOD         ;GET GOOD PATTERN
6841 042104                            ERRSOFT 1202,E1202,EEPA         ;ERROR HANDLER
      042104  104457                                                                  TRAP    C$ERSOFT
```

TEST 12: DIGITAL INPUT LOOPBACK TEST SLIDING PATTERN

```
                042106  002262                                                          .WORD   1202
                042110  042660                                                          .WORD   E1202
                042112  007400                                                          .WORD   EER2
        6842    042114                          80$:    ENDSEG                  ;
                042114                                                                  10000$:
                042114  104405                                                          TRAP    C$ESEG
        6843    042116  006301                          ASL     R1              ;NEXT SLIDING ONES DATA
        6844    042120  103327                          BCC     40$             ;BRANCH TILL ALL HAVE BEEN ONES
        6845
        6846                                    ;THE FOLLOWING CODE IS FOR SENDING SLIDING ZEROS
        6847
        6848    042122  012701  177776                  MOV     #177776,R1      ;LOAD MASK FOR SLIDING ZEROS
        6849    042126                          90$:    BGNSEG                                  ;
                042126  104404                                                          TRAP    C$BSEG
        6850    042130  010304                          MOV     R3,R4           ;SAVE WAIT COUNTER VALUE
        6851    042132  012737  002263  007200          MOV     #1203.,ERRNBR   ;LOAD ERROR NUMBER
        6852    042140  004737  016122                  JSR     PC,WRITE        ;CALL WRITE ROUTINE
        6853    042144  103002                          BCC     100$            ;BRANCH IF NO ADDR. ERROR FOUND
        6854    042146                          EXIT    TST                     ;EXIT TEST IF ADDRESSING ERROR
                042146  104432                                                          TRAP    C$EXIT
                042150  000624                                                          .WORD   L10045 .
        6855    042152  004737  011514          100$:   JSR     PC,WT500        ;WAIT 500 US
        6856    042156  005304                          DEC     R4              ;DECREMENT WAIT COUNTER
        6857    042160  001374                          BNE     100$            ;BRANCH IF COUNTER IS NOT ZERO
        6858    042162  017737  141514  004064          MOV     @DAT,BAD        ;READ DIGITAL INPUT PATTERN
        6859    042170  020137  004064                  CMP     R1,BAD          ;CMP READ AND LOADED DATA
        6860    042174  004737  012146                  CALL    INSERT          ;SKIP BRANCH IF 'SFLT' IS SET
        6861    042200  001406                          BEQ     110$            ;BRANCH IF EQUAL
        6862    042202  010137  004062                  MOV     R1,GOOD         ;GET GOOD PATTERN
        6863    042206                                  ERRSOFT 1204,E1202,EER2 ;ERROR HANDLER
                042206  104457                                                                  TRAP    C$ERSOFT
                042210  002264                                                                  .WORD   1204
                042212  042660                                                                  .WORD   E1202
                042214  007400                                                                  .WORD   EER2
        6864    042216                          110$:   ENDSEG                                  ;
                042216                                                                  10001$:
                042216  104405                                                                  TRAP    C$ESEG
        6865    042220  006301                          ASL     R1              ;NEXT SLIDING ZEROS DATA
        6866    042222  103002                          BCC     120$            ;BRANCH IF ALL DATA LINES WERE ZEROS
        6867    042224  005501                          ADC     R1              ;ADD THE CARRY AND REPEAT
        6868    042226  000737                          BR      90$             ;WITH NEW DATA
        6869    042230  022737  000003  003720  120$:   CMP     #3,DBOUNC       ;ALL DEBOUNCE SELECTED?
        6870    042236  001010                          BNE     130$            ;BRANCH IF NO
        6871    042240  005205                          INC     R5              ;NEXT DEBOUNCE
        6872    042242  022705  000004                  CMP     #4,R5           ;ALL DEBOUNCE PERIODS EXECUTED
        6873    042246  001245                          BNE     50$             ;BRANCH IF NO
        6874    042250  005302                          DEC     R2              ;ALL CYCLES PERFORMED ?
        6875    042252  001241                          BNE     40$             ;BRANCH IF NO
        6876    042254  000137  042540                  JMP     QVR1.0          ;SKIP LOW LEVEL PART
        6877    042260  005302                  130$:   DEC     R2              ;ALL CYCLES PERFORMED ?
        6878    042262  001246                          BNE     40$             ;BRANCH IF NO
        6879    042264  000137  042540                  JMP     QVR1.0          ;JUMP TO QUICK VERIFY ROUTINE
        6880
        6881                                    ;THIS PART WILL TEST THAT THE LOW LEVEL SELECT WILL WORK WITH SLIDING
        6882                                    ;PATTERNS.  THE DEBOUNCE OF THE DIGITAL INPUT MODULE WILL FIX 5 MS
        6883                                    ;BUT THE WAIT LOOP FOR 1MS WILL BE 10 MS.
        6884
```

TEST 12: DIGITAL INPUT LOOPBACK TEST SLIDING PATTERN

```
6885
6886 042270  052777  000002  141402  LLPA12: BIS     #2,@MOD          ;LOAD AN INPUT DEBOUNCE OF 5 MS
6887 042276  042777  000001  141374          BIC     #1,@MOD          ;...
6888 042304  052777  000010  141366          BIS     #10,@MOD         ;SWITCH INPUT MODULE TO LLS
6889 042312  013702  004156                  MOV     CYCLLS,R2        ;LOAD CYCLE COUNTER
6890 042316  013703  004162          10$:    MOV     LLWC,R3          ;LOAD LLS WAIT COUNTER
6891 042322  012701  000001                  MOV     #1,R1            ;LOAD MASK OF SLIDING DATA
6892 042326                                  BGNSEG
     042326  104404                                                   TRAP    C$BSEG
6893 042330  012737  002265  007200  20$:    MOV     #1205.,ERRNBR    ;LOAD ERROR NUMBER FOR SUBR.
6894 042336  004737  016122                  JSR     PC,WRITE         ;SEND DATA FORM OUTPUT TO INPUT
6895 042342  103002                          BCC     30$              ;BRANCH IF NO ADDR. ERROR FOUND
6896 042344                                  EXIT    TST              ;EXIT TEST IF ADDRESSING ERROR
     042344  104432                                                   TRAP    C$EXIT
     042346  000426                                                   .WORD   L10045-.
6897 042350  010304                  30$:    MOV     R3,R4            ;SAVE LLS WAIT COUNTER (30 MS)
6898 042352  004737  011514          40$:    JSR     PC,WT500         ;WAIT FOR 500 US
6899 042356  005304                          DEC     R4               ;...
6900 042360  001374                          BNE     40$              ;BRANCH IF NOT FINISHED
6901 042362  017737  141314  004064          MOV     @DAT,BAD         ;READ DATA
6902 042370  020137  004064                  CMP     R1,BAD           ;DATA SHOULD NOT BE CHANGED
6903 042374  004737  012146                  CALL    INSERT           ;SKIP BRANCH IF 'SFI' IS SET
6904 042400  001406                          BEQ     50$              ;BRANCH IF OK
6905 042402  010137  004062                  MOV     R1,GOOD          ;SET UP DATA FOR ERROR HANDLER
6906 042406                                  ERRSOFT 1206,E1202,ERR2  ;ERROR HANDLER
     042406  104457                                                   TRAP    C$ERSOFT
     042410  002266                                                   .WORD   1206
     042412  042660                                                   .WORD   E1202
     042414  007400                                                   .WORD   ERR2
6907 042416                  50$:    CKLOOP                           ;
     042416  104406                                                   TRAP    C$CLP1
6908 042420  006301                          ASL     R1               ;NEXT SLIDING ONES DATA
6909 042422  103342                          BCC     20$              ;BRANCH IF CARRY IS CLEARED
6910 042424                                  ENDSEG
     042424                                                       10002$:
     042424  104405                                                   TRAP    C$ESEG
6911 042426  012701  177776                  MOV     #177776,R1       ;LOAD MASK FOR SLIDING ZEROS
6912 042432                          60$:    BGNSEG
     042432  104404                                                   TRAP    C$BSEG
6913 042434  010304                          MOV     R3,R4            ;SAVE WAIT COUNTER VALUE
6914 042436  012737  002267  007200          MOV     #1207.,ERRNBR    ;LOAD ERROR NUMBER
6915 042444  004737  016122                  JSR     PC,WRITE         ;CALL WRITE ROUTINE
6916 042450  103002                          BCC     70$              ;BRANCH IF NO ADDR. ERROR FOUND
6917 042452                                  EXIT    TST              ;EXIT TEST IF ADDRESSING ERROR
     042452  104432                                                   TRAP    C$EXIT
     042454  000320                                                   .WORD   L10045-.
6918 042456  004737  011514          70$:    JSR     PC,WT500         ;WAIT 500 US
6919 042462  005304                          DEC     R4               ;DECREMENT WAIT COUNTER
6920 042464  001374                          BNE     70$              ;BRANCH IF COUNTER IS NOT ZERO
6921 042466  017737  141210  004064          MOV     @DAT,BAD         ;READ DIGITAL INPUT PATTERN
6922 042474  020137  004064                  CMP     R1,BAD           ;CMP READ AND LOADED DATA
6923 042500  004737  012146                  CALL    INSERT           ;SKIP BRANCH IF 'SFI' IS SET
6924 042504  001406                          BEQ     80$              ;BRANCH IF EQUAL
6925 042506  010137  004062                  MOV     R1,GOOD          ;GET GOOD PATTERN
6926 042512                                  ERRSOFT 1208,E1202,ERR2  ;ERROR HANDLER
     042512  104457                                                   TRAP    C$ERSOFT
     042514  002270                                                   .WORD   1208
```

TEST 12: DIGITAL INPUT LOOPBACK TEST - SLIDING PATTERN

```
        042516  042660                                                                  .WORD   E1202
        042520  007400                                                                  .WORD   EER2
   6927 042522                          80$:    ENDSEG
        042522                                                                  10003$:
        042522  104405                                                                  TRAP    C$ESEG
   6928 042524  000301                          ASL     R1              ;NEXT SLIDING ZERO DATA
   6929 042526  103002                          BCC     90$             ;BRANCH IF ALL ZEROS WHERE DONE
   6930 042530  005501                          ADC     R1              ;ADD THE CARRY
   6931 042532  000737                          BR      60$             ;AND REPEAT
   6932 042534  005302                  90$:    DEC     R2              ;ALL CYCLES PERFORMED ?
   6933 042536  001267                          BNE     10$             ;BRANCH IF NO
   6934 042540  005737  002242          QVR12:  TST     QVP             ;IS QUICK VERIFY PASS SELECTED?
   6935 042544  001010                          BNE     EXQV12          ;IF YES EXIT TEST
   6936 042546  005237  004144                  INC     ITRCNT          ;ITERATION COUNTER + 1
   6937 042552  023737  004146  004144          CMP     ITRDEF,ITRCNT   ;DEFAULT ITERATION EXECUTED
   6938 042560  001402                          BEQ     EXQV12          ;IF YES, EXIT TEST
   6939 042562  000137  041716                  JMP     ITRA12          ;IF NO, TEST ITERATION
   6940 042566                  EXQV12: EXIT    TST                     ;EXIT TEST
        042566  104432                                                                  TRAP    C$EXIT
        042570  000204                                                                  .WORD   L10045-.
   6941
   6942
   6943                                  .NLIST  BEX
   6944 042572     045     123     062  TSHD12::.ASCIZ  /<S2>ADIGITAL INPUT LOOPBACK TEST - SLIDING  PATTERN<N>/
   6945 042660     104     101     124  E1202:  .ASCII  /DATA REGISTER OF INPUT MODULE INCORRECT /<12><15>
   6946 042732     114     117     101          .ASCIZ  /LOADED AND READ DATA NOT THE SAME/
   6947                                  .LIST   BEX
   6948                                  .EVEN
   6949
   6950 042774                          ENDTST
        042774                                                          L10045:
        042774  104401                                                          TRAP    C$ETST
```

TEST 13:DIGITAL OUTPUT LOOPBACK TEST - SLIDING PATTERN

```
                                        .SBTTL  TEST 13:DIGITAL OUTPUT LOOPBACK TEST - SLIDING PATTERN
                                        ;*****************************************************************************
                                        ;       TEST 13 - DIGITAL OUTPUT LOOPBACK TEST WITH SLIDING PATTERN
                                        ;
                                        ;THIS TEST CHECKS THE DATA OUTPUT LINES OF DIGITAL OUTPUT MODULES
                                        ;BY READING THE OUTPUT DATA WITH AN INPUT MODULE. THE INPUT MODULE IS
                                        ;THAT SPECIFIED AS THE 'OTHER' IN THE HARDWARE QUESTIONS. SEVERAL CYCLES ARE
                                        ;PERFORMED USING SLIDING ONES AND THEN SLIDING ZEROS.
                                        ;THE TIMEOUT IS DEPENDENT ON THE DEBOUNCE PERIOD SPECIFIED BY RT BITS
                                        ;IN THE MOD REGISTER OF THE DIGITAL OUTPUT MODULE.
                                        ;THE DIGITAL INPUT MODULE IS ALWAYS LOADED WITH A DEBOUNCE PRIOD OF 5 US.
                                        ;*****************************************************************************
042776                                          BGNTST
042776                                                                          T13::
042776  004737  011714                        CALL    SELECT          ;CALL SELECT ROUTINE
043002  002002                                .WORD   2002            ;GIVE TEST PARAMETER
043004  043450                                TSHD13                  ;GIVE TEST HEADER ADDRESS
043006  103002                                BCC     1$              ;IF CARRY IS CLEARED, BRANCH
043010                                          EXIT    TST             ;IF CARRY IS SET, EXIT TEST
043010  104432                                                                  TRAP    C$EXIT
043012  000666                                                                  .WORD   L10046-.
043014  005037  004144          1$:     CLR     ITRCNT          ;CLEAR ITERATION COUNTER
043020  013702  004156          ITRA13: MOV     CYCLLS,R2       ;LOAD CYCLE COUNTER
043024  012737  002425  007200          MOV     #1301.,ERRNBR   ;LOAD ERROR NUMBER
043032  004737  016326                  CALL    READ            ;TEST  OTHER MODULE ADDRESS
043036  103002                          BCC     10$             ;BRANCH IF NO ADDR. ERROR FOUND
043040                                  EXIT    TST             ;EXIT TEST IF ADDRESSING ERROR
043040  104432                                                                  TRAP    C$EXIT
043042  000636                                                                  .WORD   L10046-.
043044  152777  000001  140650  10$:     BISB    #1,@OTHMOD      ;LOAD 5 US DEBOUNCE IN INPUT MOD
043052  042777  000002  140642          BIC     #2,@OTHMOD      ;...
043060  012703  000001                  MOV     #1,R3           ;LOAD WAIT COUNTER WITH INPUT DEB.
043064  032777  000001  140606          BIT     #1,@MOD         ;FIND DEBOUNCE OF OUTPUT MODULE
043072  001003                          BNE     20$             ;BRANCH IF RTO IS SET (500 US)
043074  063703  004170                  ADD     OUTDE2,R3       ;ADD RELAY OUTPUT MODULE DEB.
043100  000402                          BR      30$             ;BRANCH OVER NEXT COMMAND
043102  063703  004166          20$:    ADD     OUTDE1,R3       ;ADD OPTO OUTPUT DEB.
043106  012701  000001          30$:    MOV     #1,R1           ;GET SLIDING ONES' MASK
043112                          40$:    BGNSEG
043112  104404                                                                  TRAP    C$BSEG
043114  010304                          MOV     R3,R4           ;SAVE WAIT COUNTER VALUE
043116  010177  140560                  MOV     R1,@DAT         ;LOAD OUTPUT DATA REGISTER
043122  004737  011514          50$:    JSR     PC,WT500        ;WAIT 500 US
043126  005304                          DEC     R4              ;DECREMENT WAIT COUNTER
043130  001374                          BNE     50$             ;BRANCH IF COUNTER IS NOT ZERO
043132  017737  140544  004064          MOV     @DAT,BAD        ;READ LOADED DATA BACK
043140  020137  004064                  CMP     R1,BAD          ;LOADED DATA STILL THERE?
043144  004737  012146                  CALL    INSERT          ;SKIP BRANCH IF 'SFI' IS SET
043150  001406                          BEQ     60$             ;BRANCH IF YES
043152  010137  004062                  MOV     R1,GOOD         ;SET UP DATA FOR ERROR REPORT
043156                                  ERRSOFT 1302,E1302,ERR2 ;ERROR HANDLER
043156  104457                                                                  TRAP    C$ERSOFT
043160  002426                                                                  .WORD   1302
043162  043536                                                                  .WORD   E1302
043164  007400                                                                  .WORD   ERR2
043166                          60$:    CKLOOP                  ;
043166  104406                                                                  TRAP    C$CLP1
```

TEST 13:DIGITAL OUTPUT LOOPBACK TEST - SLIDING PATTERN

```
 6998 043170  012737  002427  007200          MOV     #1303.,ERRNBR           ;LOAD ERROR NUMBER
 6999 043176  004737  016326                  CALL    READ                    ;READ D/O LINES WITH DI MODULE
 7000 043202  103002                          BCC     70$                     ;BRANCH IF NO ADDR. ERROR FOUND
 7001 043204                                  EXIT    TST                     ;EXIT TEST IF ADDRESSING ERROR
      043204  104432                                                                  TRAP    C$EXIT
      043206  000472                                                                  .WORD   L10046-.
 7002 043210  020137  004064          70$:    CMP     R1,BAD                  ;CMP READ AND LOADED DATA
 7003 043214  004737  012146                  CALL    INSERT                  ;SKIP BRANCH IF 'SFI' IS SET
 7004 043220  001406                          BEQ     80$                     ;BRANCH IF EQUAL
 7005 043222  010137  004062                  MOV     R1,GOOD                 ;GET GOOD PATTERN
 7006 043226                                  ERRSOFT 1304,E1303,EER2         ;ERROR HANDLER
      043226  104457                                                                  TRAP    C$ERSOFT
      043230  002430                                                                  .WORD   1304
      043232  043622                                                                  .WORD   E1303
      043234  007400                                                                  .WORD   EER2
 7007 043236                          80$:    ENDSEG                                                  10000$:
      043236                                                                          TRAP    C$ESEG
      043236  104405
 7008 043240  006301                          ASL     R1                      ;NEXT SLIDING ONES DATA
 7009 043242  103323                          BCC     40$                     ;BRANCH IF CARRY IS CLEARED
 7010
 7011                                 ;THE FOLLOWING CODE IS FOR SLIDING ZERO
 7012
 7013 043244  012701  177776                  MOV     #177776,R1              ;LOAD MASK FOR SLIDING ZEROS
 7014 043250                          90$:    BGNSEG                                                  TRAP    C$BSEG
      043250  104404
 7015 043252  010304                          MOV     R3,R4                   ;SAVE WAIT COUNTER VALUE
 7016 043254  010177  140422                  MOV     R1,@DAT                 ;LOAD OUTPUT DATA REGISTER
 7017 043260  004737  011514          100$:   JSR     PC,WT500                ;WAIT 500 US
 7018 043264  005304                          DEC     R4                      ;DECREMENT WAIT COUNTER
 7019 043266  001374                          BNE     100$                    ;BRANCH IF COUNTER IS NOT ZERO
 7020 043270  017737  140406  004064          MOV     @DAT,BAD                ;READ DIGITAL INPUT PATTERN
 7021 043276  020137  004064                  CMP     R1,BAD                  ;CMP READ AND LOADED DATA
 7022 043302  004737  012146                  CALL    INSERT                  ;SKIP BRANCH IF 'SFI' IS SET
 7023 043306  001406                          BEQ     110$                    ;BRANCH IF EQUAL
 7024 043310  010137  004062                  MOV     R1,GOOD                 ;GET GOOD PATTERN
 7025 043314                                  ERRSOFT 1305,E1302,EER2         ;ERROR HANDLER
      043314  104457                                                                  TRAP    C$ERSOFT
      043316  002431                                                                  .WORD   1305
      043320  043536                                                                  .WORD   E1302
      043322  007400                                                                  .WORD   EER2
 7026 043324                          110$:   CKLOOP                                  ;
      043324  104406                                                                  TRAP    C$CLP1
 7027 043326  012737  002432  007200          MOV     #1306.,ERRNBR           ;LOAD ERROR NUMBER
 7028 043334  004737  016326                  CALL    READ                    ;READ D/O LINES WITH DI MODULE
 7029 043340  103002                          BCC     120$                    ;BRANCH IF NO ADDR. ERROR FOUND
 7030 043342                                  EXIT    TST                     ;EXIT TEST IF ADDRESSING ERROR
      043342  104432                                                                  TRAP    C$EXIT
      043344  000334                                                                  .WORD   L10046-.
 7031 043346  020137  004064          120$:   CMP     R1,BAD                  ;CMP READ AND LOADED DATA
 7032 043352  004737  012146                  CALL    INSERT                  ;SKIP BRANCH IF 'SFI' IS SET
 7033 043356  001406                          BEQ     130$                    ;BRANCH IF EQUAL
 7034 043360  010137  004062                  MOV     R1,GOOD                 ;GET GOOD PATTERN
 7035 043364                                  ERRSOFT 1307,E1303,EER2         ;ERROR HANDLER
      043364  104457                                                                  TRAP    C$ERSOFT
      043366  002433                                                                  .WORD   1307
      043370  043622                                                                  .WORD   E1303
```

TEST 13:DIGITAL OUTPUT LOOPBACK TEST - SLIDING PATTERN

```
      043372  007400                                                                  .WORD   EER2
 7036 043374                          130$:   ENDSEG
      043374                                                                  10001$:
      043374  104405                                                          TRAP    C$ESEG
 7037 043376  006301                          ASL     R1              ;NEXT SLIDING ZEROS DATA
 7038 043400  103002                          BCC     140$            ;BRANCH IF ALL LINES WHERE ZERO
 7039 043402  005501                          ADC     R1              ;ADD THE CARRY TO R1
 7040 043404  000721                          BR      90$             ;AND REPEAT
 7041 043406  005302                  140$:   DEC     R2              ;ALL CYCLES PERFORMED ?
 7042 043410  001402                          BEQ     150$            ;BRANCH IF YES
 7043 043412  000137  043106                  JMP     30$             ;IF NO, DO NEXT CYCLE
 7044 043416  005737  002242          150$:   TST     QVP             ;IS QUICK VERIFY PASS SELECTED?
 7045 043422  001010                          BNE     EXQV13          ;IF YES EXIT TEST
 7046 043424  005237  004144                  INC     ITRCNT          ;ITERATION COUNTER + 1
 7047 043430  023737  004146  004144          CMP     ITRDEF,ITRCNT   ;DEFAULT ITERATION EXECUTED
 7048 043436  001402                          BEQ     EXQV13          ;IF YES, EXIT TEST
 7049 043440  000137  043020                  JMP     ITRA13          ;IF NO, TEST ITERATION
 7050 043444                          EXQV13: EXIT    TST             ;EXIT TEST
      043444  104432                                                          TRAP    C$EXIT
      043446  000232                                                          .WORD   L10046-.
 7051
 7052                                         .NLIST  BEX
 7053 043450     045     123     062  TSHD13::.ASCIZ  /%S2%ADIGITAL OUTPUT LOOPBACK TEST   SLIDING PATTERN%N/
 7054 043536     104     101     124  E1302:  .ASCIZ  /DATA REGISTER OF OUTPUT MODULE INCORRECT AFTER LOAD/
 7055 043622     122     105     103  E1303:  .ASCIZ  /RECEIVED DATA INCORRECT - CHECK OUTPUT LINES/
 7056                                         .LIST   BEX
 7057                                         .EVEN
 7058
 7059 043700                                  ENDTST
      043700                                                                  L10046:
      043700  104401                                                          TRAP    C$ETST
```

TEST 14: DIGITAL INPUT LOOPBACK TEST - INPUT MODULE INTERRUPT

```
                                .SBTTL  TEST 14: DIGITAL INPUT LOOPBACK TEST   INPUT MODULE INTERRUPT LINE.
                                ;*****************************************************************************
                                ;       TEST 14 - DIGITAL LOOPBACK TEST - INPUT MODULE INTERRUPT LINE.
                                ;
                                ;THIS CHECKS THAT THE CSA INTERRUPT BIT OF THE INPUT MODULE CAN BE SET
                                ;TO CAUSE AN INTERRUPT BY THE LEADING OR TRAILING EDGES OF THE MODULE
                                ;DATA LINE 15. THE DEBOUNCE PERIOD FOR THE DIGITAL INPUT MODULE
                                ;IS DEPENDENT ON THE OUTPUT MODULE THAT YOU SELECT AS THE 'OTHER' IN THE
                                ;HARDWARE QUESTIONS. IT IS ALSO CHECKED THAT BIT 15 REMAINS HIGH AFTER THE
                                ;LINE HAS REVERTED BACK TO ITS INITIAL STATE. ALL SIGNALS ARE PROVIDED BY
                                ;LINES FROM THE OUTPUT MODULE.
                                ;ALSO THE BITS 0-14 ARE SWITCHED ON AND OFF FOUR TIMES AND THEN A CHECK IS
                                ;MADE THAT BIT 15 IS NOT AFFECTED.
                                ;ALL OF THE FUNCTIONAL TESTS ABOVE ARE ALSO CARRIED OUT IF LOW LEVEL
                                ;TESTING IS SELECTED.
                                ;*****************************************************************************
043702                                  BGNTST
043702                                                                          T14::
043702  004737  011714                 CALL    SELECT                  ;CALL SELECT ROUTINE
043706  002001                          .WORD   2001                    ;GIVE TEST PARAMETER
043710  045612                          TSHD14                          ;GIVE TEST HEADER ADDRESS
043712  103002                          BCC     1$                      ;IF CARRY IS SET, EXIT TEST
043714                                  EXIT    TST                     ;EXIT TEST
043714  104432                                                                  TRAP    C$EXIT
043716  002464                                                                  .WORD   L10047-.
043720  005037  004144          1$:     CLR     ITRCNT                  ;CLEAR ITERATION COUNTER
043724                          ITRA14: SETVEC  VEC,#INTSR,#PRIO7       ;SET VECTOR AND SERVICE ROUTINE
043724  012746  000340                                                          MOV     #PRIO7,-(SP)
043730  012746  017276                                                          MOV     #INTSR,-(SP)
043734  013746  005710                                                          MOV     VEC,-(SP)
043740  012746  000003                                                          MOV     #3,-(SP)
043744  104437                                                                  TRAP    C$SVEC
043746  062706  000010                                                          ADD     #10,SP
043752                                  SETPRI  #PRIO7                  ;DISABLE INTERRUPT
043752  012700  000340                                                          MOV     #PRIO7,R0
043756  104441                                                                  TRAP    C$SPRI
043760  005037  004150                  CLR     INTFLA                  ;CLEAR INTERRUPT FLAG
043764  012737  002571  007200          MOV     #1401.,ERRNBR           ;LOAD ERROR NUMBER
043772  004737  016122                  JSR     PC,WRITE                ;TEST SELECTED OUTPUT ADDR.
043776  103002                          BCC     10$                     ;BRANCH IF NO ADDR. ERROR FOUND
044000                                  EXIT    TST                     ;EXIT TEST IF ADDRESSING ERROR
044000  104432                                                                  TRAP    C$EXIT
044002  002400                                                                  .WORD   L10047-.
044004  005737  003716          10$:    TST     LOWLVL                  ;IS LOW LEVEL SELEC. IN P-TABLE
044010  001402                          BEQ     20$                     ;BRANCH IF NO
044012  000137  044704                  JMP     LEPA14                  ;JUMP TO LOW LEVEL PART
044016  112777  000001  137654  20$:    MOVB    #1,@MOD                 ;LOAD 500US AS INPUT DEBOUNCE
044024  012703  000003                  MOV     #3,R3                   ;LOAD DEBOUNCE WAIT COUNTER WITH 1,5MS
044030  032777  000001  137664          BIT     #1,@OTHMOD              ;IS DEBOUNCE OF OUTPUT MOD 500 US?
044036  001007                          BNE     30$                     ;BRANCH IF 500 US DEBOUNCE IS FOUND
044040  112777  000002  137630          MOVB    #2,@MOD                 ;IF NO, LOAD 5 MS AS INPUT DEBOUNCE
044046  012703  000024                  MOV     #20.,R3                 ;LOAD DEBOUNCE WAIT COUNTER WITH 10MS
044052  062703  000010                  ADD     #8.,R3                  ;ADD 4 MS DEBOUNCE TOLLERANCE
044056  052777  000100  137614  30$:    BIS     #100,@MOD               ; SWITCH ON THE MODULE LED AGAIN
044064                                  BGNSEG
044064  104404                                                                  TRAP    C$BSEG
044066  005001                          CLR     R1                      ;DATA FOR WRITE ROUTINE
```

TEST 14: DIGITAL INPUT LOOPBACK TEST - INPUT MODULE INTERRUPT

```
7104 044070  010304                    40$:   MOV     R3,R4                ;SAVE WAIT COUNTER
7105 044072  004737  016122                   JSR     PC,WRITE             ;SEND DATA
7106 044076  103002                           BCC     50$                  ;BRANCH IF NO ADDR. ERROR FOUND
7107 044100                                   EXIT    TST                  ;EXIT TEST IF ADDRESSING ERROR
     044100  104432                                                                TRAP    C$EXIT
     044102  002300                                                                .WORD   L10047-.
7108 044104  004737  011514            50$:   JSR     PC,WT500             ;WAIT 500 US
7109 044110  005304                           DEC     R4                   ;...
7110 044112  001374                           BNE     50$                  ;BRANCH IF NOT FINISHED
7111 044114  017737  137562  004064          MOV     @DAT,BAD             ;GET DATA REGISTER CONTENTS
7112 044122  005737  004064                   TST     BAD                  ;IS DATA REG. OF INPUT MODULE ZERO
7113 044126  004737  012146                   CALL    INSERT               ;SKIP BRANCH IF 'SET' IS SET
7114 044132  001406                           BEQ     60$                  ;BRANCH IF YES
7115 044134  005037  004062                   CLR     GOOD                 ;SET UP DATA FOR ERROR HANDLER
7116 044140                                   ERRSOFT 1402,E1402,EER2      ;ERROR HANDLER
     044140  104457                                                                TRAP    C$ERSOFT
     044142  002572                                                                .WORD   1402
     044144  045703                                                                .WORD   E1402
     044146  007400                                                                .WORD   EER2
7117 044150                            60$:   CKLOOP                       ;
     044150  104406                                                                TRAP    C$CLP1
7118 044152                                   SETPRI  #PRI00               ;ENABLE INTERRUPTS
     044152  012700  000000                                                        MOV     #PRI00,R0
     044156  104441                                                                TRAP    C$SPRI
7119 044160  012701  100000                   MOV     #100000,R1           ;DATA (BIT 15 SET) FOR WRITE ROUTINE
7120 044164  012777  060000  137512          MOV     #60000,@CSA          ;ENABLE INT. + LEADING EDGE
7121 044172  010304                           MOV     R3,R4                ;RELOAD WAIT COUNTER
7122 044174  004737  016122                   JSR     PC,WRITE             ;SEND DATA
7123 044200  103002                           BCC     70$                  ;BRANCH IF NO ADDR. ERROR FOUND
7124 044202                                   EXIT    TST                  ;EXIT TEST IF ADDRESSING ERROR
     044202  104432                                                                TRAP    C$EXIT
     044204  002176                                                                .WORD   L10047-.
7125 044206  004737  011514            70$:   JSR     PC,WT500             ;WAIT 500 US
7126 044212  005304                           DEC     R4                   ;...
7127 044214  001374                           BNE     70$                  ;BRANCH IF NOT FINISHED
7128 044216  005737  004150                   TST     INTFLA               ;WAS THERE AN INTERRUPT ON LEAD.
7129 044222  004737  012146                   CALL    INSERT               ;SKIP BRANCH IF 'SET' IS SET
7130 044226  001004                           BNE     80$                  ;BRANCH IF YES
7131 044230                                   ERRSOFT 1403,E1403,EER3      ;ERROR HANDLER
     044230  104457                                                                TRAP    C$ERSOFT
     044232  002573                                                                .WORD   1403
     044234  045764                                                                .WORD   E1403
     044236  007442                                                                .WORD   EER3
7132 044240                            80$:   CKLOOP                       ;
     044240  104406                                                                TRAP    C$CLP1
7133 044242  017737  137436  004064          MOV     @CSA,BAD             ;GET CSA CONTENTS
7134 044250  022737  160000  004064          CMP     #160000,BAD          ;IS IR,IE AND ELE SET
7135 044256  004737  012146                   CALL    INSERT               ;SKIP BRANCH IF 'SET' IS SET
7136 044262  001407                           BEQ     90$                  ;BRANCH IF YES
7137 044264  012737  160000  004062          MOV     #160000,GOOD         ;SET UP DATA FOR ERROR HANDLER
7138 044272                                   ERRSOFT 1404,E1404,EER1      ;ERROR HANDLER
     044272  104457                                                                TRAP    C$ERSOFT
     044274  002574                                                                .WORD   1404
     044276  046034                                                                .WORD   E1404
     044300  007342                                                                .WORD   EER1
7139 044302                            90$:   ENDSEG
     044302                                                                100000$:
```

TEST 14: DIGITAL INPUT LOOPBACK TEST - INPUT MODULE INTERRUPT

```
      044302  104405                                                                  TRAP    C$ESEG
7140
7141                                ;NOW WE TEST THAT WE GET AN INTERRUPT ON THE TRAILING EDGE OF BIT 15
7142
7143 044304                         BGNSEG
      044304  104404                                                                  TRAP    C$BSEG
7144 044306  012701  077777         MOV     #77777,R1           ;DATA (BIT 15 CLEAR) FOR WRITE ROUTINE
7145 044312  012777  050000  137364 MOV     #50000,@CSA         ;ENABLE INT. + TRAILING EDGE
7146 044320  052777  100000  137356 BIS     #100000,@CSA        ;CLEAR IR BIT IN CSA
7147 044326  017737  137352  004064 MOV     @CSA,BAD            ;GET CSA CONTENTS
7148 044334  022737  050000  004064 CMP     #50000,BAD          ;IS IR CLEARED AND EI+LTE SET?
7149 044342  004737  012146         CALL    INSERT              ;SKIP BRANCH IF 'SFI' IS SET
7150 044346  001407                 BEQ     100$                ;BRANCH IF YES
7151 044350  012737  050000  004062 MOV     #50000,GOOD         ;SET UP DATA FOR ERROR HANDLER
7152 044356                         ERRSOFT 1405,E1405,EER1     ;ERROR HANDLER
      044356  104457                                                                  TRAP    C$ERSOFT
      044360  002575                                                                  .WORD   1405
      044362  046103                                                                  .WORD   E1405
      044364  007342                                                                  .WORD   EER1
7153 044366                  100$:  CKLOOP                      ;
      044366  104406                                                                  TRAP    C$CLP1
7154 044370  005037  004150         CLR     INTFLA              ;CLEAR INTERRUPT FLAG
7155 044374  010304                 MOV     R3,R4               ;RELOAD WAIT COUNTER
7156 044376  004737  016122         JSR     PC,WRITE            ;SEND DATA
7157 044402  103002                 BCC     110$                ;BRANCH IF NO ADDR. ERROR FOUND
7158 044404                         EXIT    TST                 ;EXIT TEST IF ADDRESSING ERROR
      044404  104432                                                                  TRAP    C$EXIT
      044406  001774                                                                  .WORD   L10047-.
7159 044410  004737  011514  110$:  JSR     PC,WT500            ;WAIT 500 US
7160 044414  005304                 DEC     R4                  ;...
7161 044416  001374                 BNE     110$                ;BRANCH IF NOT FINISHED
7162 044420  005737  004150         TST     INTFLA              ;WAS THERE AN INTERRUPT ON TRAIL.?
7163 044424  004737  012146         CALL    INSERT              ;SKIP BRANCH IF 'SFI' IS SET
7164 044430  001004                 BNE     120$                ;BRANCH IF YES
7165 044432                         ERRSOFT 1406,E1406,EER3     ;ERROR HANDLER
      044432  104457                                                                  TRAP    C$ERSOFT
      044434  002576                                                                  .WORD   1406
      044436  046163                                                                  .WORD   E1406
      044440  007442                                                                  .WORD   EER3
7166 044442                  120$:  CKLOOP
      044442  104406                                                                  TRAP    C$CLP1
7167 044444  017737  137234  004064 MOV     @CSA,BAD            ;GET CSA CONTENTS
7168 044452  022737  150000  004064 CMP     #150000,BAD         ;IS IR,IE AND LTE SET
7169 044460  004737  012146         CALL    INSERT              ;SKIP BRANCH IF 'SFI' IS SET
7170 044464  001407                 BEQ     130$                ;BRANCH IF YES
7171 044466  012737  150000  004062 MOV     #150000,GOOD        ;SET UP DATA FOR ERROR HANDLER
7172 044474                         ERRSOFT 1407,E1404,EER1     ;ERROR HANDLER
      044474  104457                                                                  TRAP    C$ERSOFT
      044476  002577                                                                  .WORD   1407
      044500  046034                                                                  .WORD   E1404
      044502  007342                                                                  .WORD   EER1
7173 044504                  130$:  ENDSEG
      044504                                                                10001$:
      044504  104405                                                                  TRAP    C$ESEG
7174
7175                                ;WE NOW SWITCH BITS 0 14 ON AND OFF FOUR TIMES
7176                                ;AND TEST THAT WE GET NO INTERRUPT
```

TEST 14: DIGITAL INPUT LOOPBACK TEST - INPUT MODULE INTERRUPT

```
7177
7178 044506  012705  000004                MOV     #4,R5           ;LOAD FOUR TIMES LOOP COUNTER
7179 044512  012777  070000  137164        MOV     #70000,@CSA     ;SET IE,ETE AND ELE IN CSA
7180 044520  052777  100000  137156        BIS     #100000,@CSA    ;CLEAR IR BIR IN CSA
7181 044526                                BGNSEG
     044526  104404                                                TRAP    C$BSEG
7182 044530  005001                 140$:  CLR     R1              ;DATA FOR WRITE ROUTINE
7183 044532  005037  004150          150$:  CLR     INTFLA          ;CLEAR INTERRUPT FLAG
7184 044536  010304                        MOV     R3,R4           ;RELOAD WAIT COUNTER
7185 044540  004737  016122                JSR     PC,WRITE        ;SEND DATA AND ADD OUTPUT DEBOU.
7186 044544  103002                        BCC     160$            ;BRANCH IF NO ADDR. ERROR FOUND
7187 044546                                EXIT    TST             ;EXIT TEST IF ADDRESSING ERROR
     044546  104432                                                TRAP    C$EXIT
     044550  001632                                                .WORD   L10047-.
7188 044552  004737  011514          160$:  JSR     PC,WT500        ;WAIT 500 US
7189 044556  005304                        DEC     R4              ;...
7190 044560  001374                        BNE     160$            ;BRANCH IF NOT FINISHED
7191 044562  005737  004150                TST     INTFLA          ;NO INTERRUPT SHOULD BE SHOWN
7192 044566  004737  012146                CALL    INSERT          ;SKIP BRANCH IF 'SEI' IS SET
7193 044572  001404                        BEQ     170$            ;BRANCH IF NO INTERRUPT OCCURRED
7194 044574                                ERRSOFT 1408,E1408,EER3 ;ERROR HANDLER
     044574  104457                                                TRAP    C$ERSOFT
     044576  002600                                                .WORD   1408
     044600  046234                                                .WORD   E1408
     044602  007442                                                .WORD   EER3
7195 044604                          170$:  CKLOOP
     044604  104406                                                TRAP    C$CLP1
7196 044606  017737  137072  004064        MOV     @CSA,BAD        ;GET CSA CONTENTS
7197 044614  022737  070000  004064        CMP     #70000,BAD      ;IS TR,IE AND ETE SET
7198 044622  004737  012146                CALL    INSERT          ;SKIP BRANCH IF 'SEI' IS SET
7199 044626  001407                        BEQ     180$            ;BRANCH IF YES
7200 044630  012737  070000  004062        MOV     #70000,GOOD     ;SET UP DATA FOR ERROR HANDLER
7201 044636                                ERRSOFT 1409,E1409,EER1 ;ERROR HANDLER
     044636  104457                                                TRAP    C$ERSOFT
     044640  002601                                                .WORD   1409
     044642  046315                                                .WORD   E1409
     044644  007342                                                .WORD   EER1
7202 044646                          180$:  CKLOOP                  ;
     044646  104406                                                TRAP    C$CLP1
7203 044650  005705                        TST     R5              ;HAVE WE DONE THIS ROUTINE 4 TIMES?
7204 044652  001006                        BNE     190$            ;BRANCH IF YES
7205 044654  005305                        DEC     R5              ;DECREMENT FOUR TIMES LOOP COUNTER
7206 044656  005701                        TST     R1              ;USED DATA ALL ONES?
7207 044660  001723                        BEQ     140$            ;BRANCH IF YES
7208 044662  012701  077777                MOV     #77777,R1       ;IF NO, LOAD ONES DATA WRITE ROUTINE
7209 044666  000721                        BR      150$            ;BRANCH BACK TO WRITE ROUTINE
7210 044670                          190$:  SETPRI  #PRI07          ;DISABLE INTERRUPTS
     044670  012700  000340                                        MOV     #PRI07,R0
     044674  104441                                                TRAP    C$SPRI
7211 044676                                ENDSEG
     044676                                                  1000?$:
     044676  104405                                                TRAP    C$ESEG
7212 044700  000137  045560                JMP     QVR14           ;JUMP TO QUICK VERIFY ROUTINE
7213
7214
7215                                ;IF LOW LEVEL WAS REQUESTED IN THE SOFTWARE P TABLE, THE FOLLOWING
7216                                ;CODE WILL BE EXECUTED. WE WILL TEST THE SAME AS ABOVE BUT WITH LOW LEVEL
```

TEST 14: DIGITAL INPUT LOOPBACK TEST - INPUT MODULE INTERRUPT

```
7217                                        ;DEBOUNCE VALUE. THE INPUT MODULE DEBOUNCE WILL BE SELECTED AS 5 MS.
7218
7219
7220 044704  052777  000002  136766  LLPA14: BIS     #2,@MOD             ;LOAD AN INPUT DEBOUNCE OF 5 MS
7221 044712  042777  000001  136760          BIC     #1,@MOD             ;...
7222 044720  052777  000010  136752          BIS     #10,@MOD            ;SWITCH INPUT MODULE TO LLS
7223 044726  013702  004156                  MOV     CYCLLS,R2           ;LOAD CYCLE COUNTER
7224 044732  013703  004162                  MOV     LLWC,R3             ;LOAD LLS WAIT COUNTER
7225 044736                                  BGNSEG
     044736  104404                                                      TRAP    C$BSEG
7226 044740  005001                  10$:    CLR     R1                  ;DATA FOR WRITE ROUTINE
7227 044742  010304                          MOV     R3,R4               ;SAVE WAIT COUNTER
7228 044744  012737  002602  007200          MOV     #1410.,ERRNBR       ;LOAD ERROR NUMBER FOR WRITE ROUT.
7229 044752  004737  016122                  JSR     PC,WRITE            ;SEND DATA
7230 044756  103002                          BCC     20$                 ;BRANCH IF NO ADDR. ERROR FOUND
7231 044760                                  EXIT    TST                 ;EXIT TEST IF ADDRESSING ERROR
     044760  104432                                                      TRAP    C$EXIT
     044762  001420                                                      .WORD   L10047-.
7232 044764  004737  011514          20$:    JSR     PC,WT500            ;WAIT 500 US
7233 044770  005304                          DEC     R4                  ;...
7234 044772  001374                          BNE     20$                 ;BRANCH IF NOT FINISHED
7235 044774  017737  135702  004064          MOV     @DAT,BAD            ;GET DATA REGISTER CONTENTS
7236 045002  005737  004064                  TST     BAD                 ;IS DATA REG. OF INPUT MODULE ZERO?
7237 045006  004737  012146                  CALL    INSERT              ;SKIP BRANCH IF 'SFI' IS SET
7238 045012  001406                          BEQ     30$                 ;BRANCH IF YES
7239 045014  005037  004062                  CLR     GOOD                ;SET UP DATA FOR ERROR HANDLER
7240 045020                                  ERRSOFT 1411,E1402,EER2     ;ERROR HANDLER
     045020  104457                                                      TRAP    C$ERSOFT
     045022  002603                                                      .WORD   1411
     045024  045703                                                      .WORD   E1402
     045026  007400                                                      .WORD   EER2
7241 045030                          30$:    CKLOOP                      ;
     045030  104406                                                      TRAP    C$CLP1
7242 045032                                  SETPRI  #PRI00              ;ENABLE INTERRUPTS
     045032  012700  000000                                              MOV     #PRI00,R0
     045036  104441                                                      TRAP    C$SPRI
7243 045040  012701  100000                  MOV     #100000,R1          ;DATA (BIT 15 SET) FOR WRITE ROUTINE
7244 045044  012777  060000  136632          MOV     #60000,@CSA         ;ENABLE INT. + LEADING EDGE
7245 045052  010304                          MOV     R3,R4               ;RELOAD WAIT COUNTER
7246 045054  004737  016122                  JSR     PC,WRITE            ;SEND DATA
7247 045060  103002                          BCC     40$                 ;BRANCH IF NO ADDR. ERROR FOUND
7248 045062                                  EXIT    TST                 ;EXIT TEST IF ADDRESSING ERROR
     045062  104432                                                      TRAP    C$EXIT
     045064  001316                                                      .WORD   L10047-.
7249 045066  004737  011514          40$:    JSR     PC,WT500            ;WAIT 500 US
7250 045072  005304                          DEC     R4                  ;...
7251 045074  001374                          BNE     40$                 ;BRANCH IF NOT FINISHED
7252 045076  005737  004150                  TST     INTFLA              ;WAS THERE AN INTERRUPT?
7253 045102  004737  012146                  CALL    INSERT              ;SKIP BRANCH IF 'SFI' IS SET
7254 045106  001004                          BNE     50$                 ;BRANCH IF YES
7255 045110                                  ERRSOFT 1412,E1403,EER3     ;ERROR HANDLER
     045110  104457                                                      TRAP    C$ERSOFT
     045112  002604                                                      .WORD   1412
     045114  045764                                                      .WORD   E1403
     045116  007442                                                      .WORD   EER3
7256 045120                          50$:    CKLOOP
     045120  104406                                                      TRAP    C$CLP1
```

TEST 14: DIGITAL INPUT LOOPBACK TEST INPUT MODULE INTERRUPT

```
7257 045122  017737  136556  004064          MOV     @CSA,BAD                ;GET CSA CONTENTS
7258 045130  022737  160000  004064          CMP     #160000,BAD             ;IS IR,IE AND ELE SET
7259 045136  004737  012146                  CALL    INSERT                  ;SKIP BRANCH IF 'SFI' IS SET
7260 045142  001407                          BEQ     60$                     ;BRANCH IF YES
7261 045144  012737  160000  004062          MOV     #160000,GOOD            ;SET UP DATA FOR ERROR HANDLER
7262 045152                                  ERRSOFT 1413,E1404,EER1         ;ERROR HANDLER
     045152  104457                                                                  TRAP    C$ERSOFT
     045154  002605                                                                  .WORD   1413
     045156  046034                                                                  .WORD   E1404
     045160  007342                                                                  .WORD   EER1
7263 045162                          60$:    ENDSEG
     045162                                                                  10003$:
     045162  104405                                                                  TRAP    C$ESEG
7264
7265                                 ;WE NOW TEST THAT WE GET AN INTERRUPT ON THE TRAILING EDGE OF BIT 15
7266
7267 045164                                  BGNSEG
     045164  104404                                                                  TRAP    C$BSEG
7268 045166  012701  077777                  MOV     #77777,R1               ;DATA (BIT 15 CLEAR) FOR WRITE ROUTINE
7269 045172  012777  050000  136504          MOV     #50000,@CSA             ;ENABLE INT. + TRAILING EDGE
7270 045200  052777  100000  136476          BIS     #100000,@CSA            ;CLEAR IR BIT IN CSA
7271 045206  017737  136472  004064          MOV     @CSA,BAD                ;GET CSA CONTENTS
7272 045214  022737  050000  004064          CMP     #50000,BAD              ;IS IR CLEARED AND EI-ETE SET
7273 045222  004737  012146                  CALL    INSERT                  ;SKIP BRANCH IF 'SFI' IS SET
7274 045226  001407                          BEQ     70$                     ;BRANCH IF YES
7275 045230  012737  050000  004062          MOV     #50000,GOOD             ;SET UP DATA FOR ERROR HANDLER
7276 045236                                  ERRSOFT 1414,E1405,EER1         ;ERROR HANDLER
     045236  104457                                                                  TRAP    C$ERSOFT
     045240  002606                                                                  .WORD   1414
     045242  046103                                                                  .WORD   E1405
     045244  007342                                                                  .WORD   EER1
7277 045246                          70$:    CKLOOP                          ;
     045246  104406                                                                  TRAP    C$CLP1
7278 045250  005037  004150                  CLR     INTFLA                  ;CLEAR INTERRUPT FLAG
7279 045254  010304                          MOV     R3,R4                   ;RELOAD WAIT COUNTER
7280 045256  004737  016122                  JSR     PC,WRITE                ;SEND DATA
7281 045262  103002                          BCC     80$                     ;BRANCH IF NO ADDR. ERROR FOUND
7282 045264                                  EXIT    TST                     ;EXIT TEST IF ADDRESSING ERROR
     045264  104432                                                                  TRAP    C$EXIT
     045266  001114                                                                  .WORD   L10047-.
7283 045270  004737  011514          80$:    JSR     PC,WT500                ;WAIT 500 US
7284 045274  005304                          DEC     R4                      ;...
7285 045276  001374                          BNE     80$                     ;BRANCH IF NOT FINISHED
7286 045300  005737  004150                  TST     INTFLA                  ;WAS THERE AN INTERRUPT ON TRAIL?
7287 045304  004737  012146                  CALL    INSERT                  ;SKIP BRANCH IF 'SFI' IS SET
7288 045310  001004                          BNE     90$                     ;BRANCH IF YES
7289 045312                                  ERRSOFT 1415,E1406,EER3         ;ERROR HANDLER
     045312  104457                                                                  TRAP    C$ERSOFT
     045314  002607                                                                  .WORD   1415
     045316  046163                                                                  .WORD   E1406
     045320  007442                                                                  .WORD   EER3
7290 045322                          90$:    CKLOOP
     045322  104406                                                                  TRAP    C$CLP1
7291 045324  017737  136354  004064          MOV     @CSA,BAD                ;GET CSA CONTENTS
7292 045332  022737  150000  004064          CMP     #150000,BAD             ;IS IR,IE AND ELE SET
7293 045340  004737  012146                  CALL    INSERT                  ;SKIP BRANCH IF 'SFI' IS SET
7294 045344  001407                          BEQ     100$                    ;BRANCH IF YES
```

TEST 14: DIGITAL INPUT LOOPBACK TEST INPUT MODULE INTERRUPT

```
7295 045346  012737  150000  004062          MOV     #150000,GOOD            ;SET UP DATA FOR ERROR HANDLER
7296 045354                                  ERRSOFT 1416,E1404,EER1         ;ERROR HANDLER
     045354  104457                                                          TRAP    C$ERSOFT
     045356  002610                                                          .WORD   1416
     045360  046034                                                          .WORD   E1404
     045362  007342                                                          .WORD   EER1
7297 045364                          100$:   ENDSEG                                  10004$:
     045364                                                                  TRAP    C$ESEG
     045364  104405
7298
7299                                 ;WE NOW SWITCH BITS 0-14 ON AND OFF FOUR TIMES AND TEST THAT WE
7300                                 ;GET NO INTERRUPT
7301
7302 045366  012705  000004                  MOV     #4,R5                   ;LOAD FOUR TIMES LOOP COUNTER
7303 045372  012777  070000  136304          MOV     #70000,@CSA             ;SET IE,ETE AND ELE IN CSA
7304 045400  052777  100000  136276          BIS     #100000,@CSA            ;CLEAR IR BIT IN CSA
7305 045406                                  BGNSEG
     045406  104404                                                          TRAP    C$BSEG
7306 045410  005001                  110$:   CLR     R1                      ;DATA FOR WRITE ROUTINE
7307 045412  005037  004150          120$:   CLR     INTFLA                  ;CLEAR INTERRUPT FLAG
7308 045416  010304                          MOV     R3,R4                   ;RELOAD WAIT COUNTER
7309 045420  004737  016122                  JSR     PC,WRITE                ;SEND DATA AND ADD OUTPUT DEBOU.
7310 045424  103002                          BCC     130$                    ;BRANCH IF NO ADDR. ERROR FOUND
7311 045426                                  EXIT    TST                     ;EXIT TEST IF ADDRESSING ERROR
     045426  104432                                                          TRAP    C$EXIT
     045430  000752                                                          .WORD   L10042-.
7312 045432  004737  011514          130$:   JSR     PC,WT500                ;WAIT 500 US
7313 045436  005304                          DEC     R4                      ;...
7314 045440  001374                          BNE     130$                    ;BRANCH IF NOT FINISHED
7315 045442  005737  004150                  TST     INTFLA                  ;WAS THERE AN INTERRUPT?
7316 045446  004737  012146                  CALL    INSERT                  ;SKIP BRANCH IF 'SEIP' IS SET
7317 045452  001404                          BEQ     140$                    ;BRANCH IF YES
7318 045454                                  ERRSOFT 1417,E1408,EER3         ;ERROR HANDLER
     045454  104457                                                          TRAP    C$ERSOFT
     045456  002611                                                          .WORD   1417
     045460  046234                                                          .WORD   E1408
     045462  007442                                                          .WORD   EER3
7319 045464                          140$:   CKLOOP                                  10005$:
     045464  104406                                                          TRAP    C$CLP1
7320 045466  017737  136212  004064          MOV     @CSA,BAD                ;GET CSA CONTENTS
7321 045474  022737  070000  004064          CMP     #70000,BAD              ;IS IR,IE AND ETE SET
7322 045502  004737  012146                  CALL    INSERT                  ;SKIP BRANCH IF 'SEIP' IS SET
7323 045506  001407                          BEQ     150$                    ;BRANCH IF YES
7324 045510  012737  070000  004062          MOV     #70000,GOOD             ;SET UP DATA FOR ERROR HANDLER
7325 045516                                  ERRSOFT 1418,E1409,EER1         ;ERROR HANDLER
     045516  104457                                                          TRAP    C$ERSOFT
     045520  002612                                                          .WORD   1418
     045522  046315                                                          .WORD   E1409
     045524  007342                                                          .WORD   EER1
7326 045526                          150$:   CKLOOP                                  10006$:
     045526  104406                                                          TRAP    C$CLP1
7327 045530  005705                          TST     R5                      ;HAVE WE DONE THIS ROUTINE 4 TIMES?
7328 045532  001006                          BNE     160$                    ;BRANCH IF YES
7329 045534  005305                          DEC     R5                      ;DECREMENT FOUR TIMES LOOP COUNTER
7330 045536  005701                          TST     R1                      ;USED DATA ALL ONES?
7331 045540  001743                          BEQ     110$                    ;BRANCH IF YES
7332 045542  012701  077777                  MOV     #77777,R1               ;IF NO, LOAD ONES DATA WRITE ROUTINE
```

TEST 14: DIGITAL INPUT LOOPBACK TEST INPUT MODULE INTERRUPT

```
7333 045546  000721                    BR      1$0$                ;BRANCH BACK TO WRITE ROUTINE
7334 045550                     160$:   SETPRI  #PRIO7              ;DISABLE INTERRUPTS
     045550  012700  000340                                                MOV     #PRIO7,R0
     045554  104441                                                        TRAP    C$SPRI
7335 045556                             ENDSEG
     045556                                                     10005$:
     045556  104405                                                        TRAP    C$ESEG
7336 045560  005737  002242        QVR14:  TST     QVP                 ;IS QUICK VERIFY PASS SELECTED?
7337 045564  001010                        BNE     EXQV14              ;IF YES, EXIT TEST
7338 045566  005237  004144                INC     ITRCNT              ;ITERATION COUNTER + 1
7339 045572  023737  004146  004144        CMP     ITRDEF,ITRCNT       ;DEFAULT ITERATION EXECUTED
7340 045600  001402                        BEQ     EXQV14              ;IF YES, EXIT TEST
7341 045602  000137  043724                JMP     ITRA14              ;IF NO, TEST ITERATION
7342 045606                     EXQV14: EXIT TST                        ;EXIT TEST
     045606  104432                                                        TRAP    C$EXIT
     045610  000572                                                        .WORD   L10047-.
7343
7344
7345                                    .NLIST  BEX
7346 045612  045  125  062  124  TSHD14::.ASCIZ  /*S2*ADIGITAL INPUT LOOPBACK TEST  INTERRUPT LINE TEST*N/
7347 045703  104  101  124  040  E1402:  .ASCIZ  /DATA REGISTER CONTENTS OF INPUT MODULE INCORRECT/
7348 045764  116  117  040  040  E1403:  .ASCIZ  /NO INTERRUPT ON LEADING EDGE OF LINE 15/
7349 046034  103  123  101  040  E1404:  .ASCIZ  /CSA REGISTER INCORRECT AFTER INTERRUPT/
7350 046103  103  123  101  040  E1405:  .ASCIZ  /CSA REGISTER NOT LOADABLE WITH THE CORRECT DATA/
7351 046165  116  117  040  040  E1406:  .ASCIZ  /NO INTERRUPT ON TRAILING EDGE OF LINE 15/
7352 046234  111  116  124  040  E1408:  .ASCIZ  /INTERRUPT OCCURRED WHEN SWITCHING DATA BITS 0-14/
7353 046315  103  123  101  040  E1409:  .ASCIZ  /CSA REGISTER CHANGED AFTER SWITCHING DATA BITS 0-14/
7354                                    .LIST   BEX
7355                                    .EVEN
7356
7357 046402                             ENDTST
     046402                                                     L10047:
     046402  104401                                                        TRAP    C$ETST
7358
7370
7371                                    .EVEN
7372
```

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TEST 14: DIGITAL INPUT LOOPBACK TEST INPUT MODULE INTERRUPT

7340 046404
7341
ENDMOD

DIS

3E0 0145

TEST 14: DIGITAL INPUT LOOPBACK TEST - INPUT MODULE INTERRUPT

```
                                        .TITLE HARDWARE TESTS


                                                BGNMOD
                                        .SBTTL  TEST 15: ANALOGUE INPUT TEST   FIELD AND MANUFACTURING TEST.
                                        ;*************************************************************************
                                        ;       TEST 15 - ANALOGUE INPUT TEST.
                                        ;
                                        ;AT FIRST THE USER IS TOLD THAT THE TEST WILL ONLY RUN CORRECTLY IF THE
                                        ;MODULE HAS BEEN CALIBRATED CORRECTLY.
                                        ;THEN HE IS ASKED HOW MANY MUXBOARDS ARE CONNECTED THE THE CONTROLLER.
                                        ;THEN HE IS ASKED TO CONNECT A CALIBRATED VOLTAGE SOURCE ON THE EVEN
                                        ;INPUTS TO THE MODULE VIA THE ANALOGUE INPUT TEST CONNECTOR.
                                        ;PROMPTED BY THE PROGRAM, THE USER THEN
                                        ;SETS UP A SERIES OF VOLTAGES, TYPING 'CARRIAGE RETURN' AFTER EACH SO
                                        ;THAT THE PROGRAM CAN CHECK THE D/A CONVERSIONS.
                                        ;THE CONVERSION FOR 48.828 MV ARE PERFORMED ON ALL GAINS, OTHER
                                        ;CONVERSIONS ARE PERFORMED ONLY IN GAIN 1.
                                        ;IF "N" TO THE SW QUESTION "RUN MANUFACTURING TEST" WAS ANSWERED THE FOLLOWING
                                        ;TOLLERANCE MAY BE USED , FOR GAIN 1,2,5 IS 2 LSB, FOR GAIN 10 IS 4 LSB,
                                        ;FOR GAIN 20 IS 6, FOR GAIN 50 IS 7 LSB, FOR GAIN 100 IS 12 LSB AND FOR
                                        ;GAIN 200 IS 20 LSB.
                                        ;IF "Y" WAS ANSWERED THEN THE TOLLERANCE WILL BE , FOR GIAN 1,2,5 IS 2 LSB
                                        ;FOR GAIN 10 IS 3 LSB, FOR GIAN 20 IS 5 LSB, FOR GAIN 50 IS 5 LSB, FOR GAIN
                                        ;100 IS 10 LSB AND FOR GAIN 200 IS 15 LSB. IF A MUX BOARD IS CONNECTED WE WILL
                                        ;ADD 2 LSB MORE FOR GAINS OVER 10.
                                        ;NEXT THE USER IS PROMTED TO CONNECT THE VOLTAGE SOURCE TO THE ODD INPUTS
                                        ;AND DO THE SAME AS FOR THE EVEN LINES ABOVE.
                                        ;THE VALUES USED DEPEND ON WHETHER THE MODULE IS
                                        ;SET UP FOR UNIPOLAR OR BIPOLAR INPUT
                                        ;
                                        ;FINALLY, THE EXTERNAL TRIGGER FUNCTION IS TESTED BY SWITCHING THE
                                        ;ENABLE EXTERNAL TRIGGER ON AND OFF TO DO THE EXTERNAL START (LET IS LOOPED
                                        ;BACK TO THE EXTERNAL TRIGGER INPUT VIA THE ANALOGUE INPUT TEST CONNECTOR).
                                        ;THE EXTERNAL TRIGGER FUNCTION IS TESTED UNDER INTERRUPT.
                                        ;
                                        ;IF THE "OAM" FLAG IS SET, THIS TEST IS NOT CARRIED OUT.
                                        ;TO RUN THIS TEST SUCCESSFULLY, THE DEVICE HAS TO BE CALIBRATED CORRECTLY.
                                        ;*************************************************************************
                                                BGNTST  15.
046404                                                                                  T15::
046404  004737  011714                        CALL    SELECT                  ;CALL SELECT ROUTINE
046410  005004                                .WORD   5004                    ;GIVE TEST PARAMETER
046412  051006                                T5HD15                          ;GIVE TEST HEADER ADDRESS
046414  103002                                BCC     1$                      ;IF CARRY IS SET, EXIT TEST
046416                                        EXIT    TST                     ;EXIT TEST
046416  104432                                                                        TRAP    C$EXIT
046420  004066                                                                        .WORD   C100$0
046422                                  1$:   MANUAL                          ;IS MANUAL INTERVENTION ALLOWED?
046422  104450                                                                        TRAP    C$MANI
046424                                        BCOMPLETE 10$                   ;IF YES, BRANCH (OAM FLAG NOT SET)
046424  103416                                                                        BCS     10$
046426                                        RDFLAGS R0                      ;READ OPERATOR FLAGS INTO R0
046426  104421                                                                        TRAP    C$RDFLA
046430  032700  001000                        BIT     #PNT,R0                 ;PRINT MESSAGES ?
046434  001410                                BEQ     5$                      ;IF NO, EXIT
046436                                        PRINTF  #TM15                   ;IF YES PRINT TEST DISABLED
```

TEST 15: ANALOGUE INPUT TEST FIELD AND MANUFACTURING TEST.

```
                046436  012746  051100                                                  MOV     #TM15,-(SP)
                046442  012746  000001                                                  MOV     #1,-(SP)
                046446  010600                                                          MOV     SP,R0
                046450  104417                                                          TRAP    C$PNTF
                046452  062706  000004                                                  ADD     #4,SP
   7481         046456                          3$:     EXIT    TST                    ;EXIT TEST
                046456  104436                                                          TRAP    C$EXIT
                046460  004026                                                          .WORD   L10050-.
   7482         046462                          10$:    PRINTF  #PME153                ;TELL WITCH TEST FOR CALIBRATION
                046462  012746  052337                                                  MOV     #PME153,-(SP)
                046466  012746  000001                                                  MOV     #1,-(SP)
                046472  010600                                                          MOV     SP,R0
                046474  104417                                                          TRAP    C$PNTF
                046476  062706  000004                                                  ADD     #4,SP
   7483         046502                                  PRINTF  #PME154                ;...
                046502  012746  052430                                                  MOV     #PME154,-(SP)
                046506  012746  000001                                                  MOV     #1,-(SP)
                046512  010600                                                          MOV     SP,R0
                046514  104417                                                          TRAP    C$PNTF
                046516  062706  000004                                                  ADD     #4,SP
   7484         046522                          20$:    PRINTF  #WME151                ;PRINT TEST CONNECTOR CONNECTION
                046522  012746  051202                                                  MOV     #WME151,-(SP)
                046526  012746  000001                                                  MOV     #1,-(SP)
                046532  010600                                                          MOV     SP,R0
                046534  104417                                                          TRAP    C$PNTF
                046536  062706  000004                                                  ADD     #4,SP
   7485         046542                                  PRINTF  #WME152                ;PRINT TEST CONNECTOR CONNECTION
                046542  012746  051304                                                  MOV     #WME152,-(SP)
                046546  012746  000001                                                  MOV     #1,-(SP)
                046552  010600                                                          MOV     SP,R0
                046554  104417                                                          TRAP    C$PNTF
                046556  062706  000004                                                  ADD     #4,SP
   7486         046562  004737  016576                  CALL    FLASH                  ;CALL FLASHING LED ROUTINE
   7487         046566  005737  017000                  TST     FLSANS                 ;WAS THE ANSWER NO ?
   7488         046572  001753                          BEQ     20$                    ;IF YES, BRANCH
   7489         046574  005001                  ITRA15: CLR     R1                     ;CLEAR TEMPORARY STORE
   7490         046576  005037  050664                  CLR     BIPOL                  ;CLEAR BIPOLAR FLAG
   7491         046602  032777  000020  135070          BIT     #20,@MOD               ;IS UNIPOLAR RANGE SELECTED?
   7492         046610  001414                          BEQ     30$                    ;BRANCH IF YES
   7493         046612                                  PRINTF  #PME152                ;PRINT BIPOLAR MESSAGES
                046612  012746  052265                                                  MOV     #PME152,-(SP)
                046616  012746  000001                                                  MOV     #1,-(SP)
                046622  010600                                                          MOV     SP,R0
                046624  104417                                                          TRAP    C$PNTF
                046626  062706  000004                                                  ADD     #4,SP
   7494         046632  012737  000001  050664          MOV     #1,BIPOL               ;AND SET BIPOLAR FLAG
   7495         046640  000410                          BR      30$                    ;SKIP UNIPOLAR PRINTOUT
   7496         046642                          20$:    PRINTF  #PME151                ;PRINT UNIPOLAR MESSAGES
                046642  012746  052212                                                  MOV     #PME151,-(SP)
                046646  012746  000001                                                  MOV     #1,-(SP)
                046652  010600                                                          MOV     SP,R0
                046654  104417                                                          TRAP    C$PNTF
                046656  062706  000004                                                  ADD     #4,SP
   7497         046662  005777  155014          30$:    TST     @DAT                   ;READ DAT TO CLR DONE+ERR BIT IN CSR
   7498         046666  005037  050666                  CLR     MUXC                   ;CLEAR MUX BOARD COUNTER
   7499         046672                                  GMANID  MES151,ANS151,0, 1,0,',NO  ;HOW MANY MUX BOARDS ARE THERE
                046672  104443                                                          TRAP    C$GMAN
```

TEST 15: ANALOGUE INPUT TEST - FIELD AND MANUFACTURING TEST.

```
                046674  000406                                                          BR      10000$
                046676  050656                                                          .WORD   ANS151
                046700  000042                                                          .WORD   T$CODE
                046702  051340                                                          .WORD   MES151
                046704  177777                                                          .WORD   -1
                046706  C00000                                                          .WORD   T$LOLIM
                046710  000007                                                          .WORD   T$HILIM
                046712                                                              10000$:
7500 046712     012737  050726  050674          MOV     #FILTOL,TOLOF           ;GET FIELD TOLLERANCE TABLE
7501 046720     005737  002232                  TST     MANTST                  ;ARE MANUFACTURING TESTS REQUIRED ?
7502 046724     001411                          BEQ     PS151                   ;BRANCH IF NOT
7503 046726     012737  050746  050674          MOV     #MAFTOL,TOLOF           ;GET MANUFACTURING TOLLERANCE TABLE
7504 046734     005737  050656                  TST     ANS151                  ;ARE THERE SOME MUX BOARDS CONNECTED
7505 046740     001403                          BEQ     PS151                   ;BRANCH IF NOT
7506 046742     012737  050766  050674          MOV     #MUXTOL,TOLOF           ;GET MUX TOLLERANCE TABLE
7507 046750     012703  000014          PS151:  MOV     #14,R3                  ;POINT R3 TO BIPOLAR TABLE (VOLVA+14)
7508 046754     012737  000024  050670          MOV     #24,VOLTE               ;LOAD BIPOLAR VOLTAGE TABLE END ADDRESS
7509 046762     005737  050664                  TST     BIPOL                   ;IS BIPOLAR SELECTED ?
7510 046766     001004                          BNE     10$                     ;BRANCH IF YES
7511 046770     005003                          CLR     R3                      ;POINT R3 TO UNIPOLAR TABLE (VOLVA)
7512 046772     012737  000010  050670          MOV     #10,VOLTE               ;LOAD UNIP. VOLTAGE TABLE END ADDR.
7513 047000     005737  050666          10$:    TST     MUXC                    ;ARE WE TESTING A MUX BOARED ?
7514 047004     001001                          BNE     20$                     ;BRANCH IF YES
7515 047006     005004                          CLR     R4                      ;BEGIN WITH CHANNEL ZERO
7516 047010     042704  007400          20$:    BIC     #7400,R4                ;BEGIN WITH FIRST CHANNEL IN BANK
7517 047014     005037  050662                  CLR     ANS153                  ;CLEAR ODD/EVEN FLAG
7518 047020                                     PRINTF  #MES152                 ;PRINT VOLT SOURCE ADJUSTMENT
     047020     012746  051415                                                          MOV     #MES152,-(SP)
     047024     012746  000001                                                          MOV     #1,-(SP)
     047030     010600                                                                  MOV     SP,R0
     047032     104417                                                                  TRAP    C$PNTF
     047034     062706  000004                                                          ADD     #4,SP
7519 047040     016301  050676                  MOV     VOLVA(R3),R1            ;LOAD DECOUT INPUT (R1)
7520 047044     016302  050700                  MOV     VOLVA+2(R3),R2          ;...
7521 047050     004737  015764                  CALL    DECOUT                  ;PRINT DECIMAL NUMBER
7522 047054                                     PRINTF  #OUT15                  ;PRINT VOLT
     047054     012746  051455                                                          MOV     #OUT15,-(SP)
     047060     012746  000001                                                          MOV     #1,-(SP)
     047064     010600                                                                  MOV     SP,R0
     047066     104417                                                                  TRAP    C$PNTF
     047070     062706  000004                                                          ADD     #4,SP
7523 047074                             30$:    GMANIL  MES153,ANS152,-1,YES    ;AND SOURCE CONNECTION
     047074     104443                                                                  TRAP    C$GMAN
     047076     000404                                                                  BR      10001$
     047100     050660                                                                  .WORD   ANS152
     047102     000130                                                                  .WORD   T$CODE
     047104     051474                                                                  .WORD   MES153
     047106     177777                                                                  .WORD   -1
     047110                                                                      10001$:
7524 047110     005737  050660                  TST     ANS152                  ;TEST ANSWER OF SOURCE CONNECTION
7525 047114     001767                          BEQ     30$                     ;GO ON IF ANSWER WAS YES
7526 047116     005037  004154                  CLR     MODE                    ;LOAD ADCON INPUT (UNIPOLAR)
7527 047122     005737  050664                  TST     BIPOL                   ;IS BIPOLAR SELECTED ?
7528 047126     001403                          BEQ     50$                     ;BRANCH IF YES
7529 047130     012737  000001  004154          MOV     #1,MODE                 ;LOAD ADCON INPUT (BIPOLAR)
7530 047136     022763  000060  050676  50$:    CMP     #48.,VOLVA(R3)          ;IS THE USED VOLTAGE 48,828 MV
7531 047144     001016                          BNE     40$                     ;BRANCH IF NOT
```

SEQ 0189

TEST 15: ANALOGUE INPUT TEST - FIELD AND MANUFACTURING TEST.

```
                                                                                                                    ;WAIT LOOP NECESSARY FOR
7533 047152                                                 PRINTF  @PME155                                         ;PRINT WORKING MESSAGES
     047152 012746 052467                                                                                                       MOV     @PME155,-(SP)
     047156 012746 000001                                                                                                       MOV     #1,-(SP)
     047162 010600                                                                                                              MOV     SP,R0
     047164 104417                                                                                                              TRAP    C$PNTF
     047166 062706 000004                                                                                                       ADD     #4,SP
7534 047172 004737 011506                          41$:     CALL    WT25M                                                   ;LOADING NEXT VOLTAGE INTO
7535 047176 005302                                          DEC     R2                                                      ;CAPACITOR
7536 047200 001374                                          BNE     41$                                                     ;BRANCH IF 30 SEC. NOT OVER
7537 047202 005005                                 40$:     CLR     R5                                                      ;LOAD ZERO INTO GAIN POINTER
7538 047204 010537 004136                          60$:     MOV     R5,GAIN                                                 ;LOAD ADCON INPUT (GAIN)
7539 047210                                                 BGNSEG
     047210 104404                                                                                                              TRAP    C$BSEG
7540 047212 042777 077536 134464                           BIC     #77536,@CSA                                             ;CLEAR ALL R/W BITS IN CSA
7541 047220 006305                                          ASL     R5                                                      ;CORRECT BIT POSITION FOR CSA
7542 047222 050577 134456                                   BIS     R5,@CSA                                                 ;LOAD GAIN INTO CSA
7543 047226 012737 100000 004062                           MOV     #100000,GOOD                                            ;SET UP GOOD DATA
7544 047234 050537 004062                                  BIS     R5,GOOD                                                 ;ADD GAIN TO GOOD
7545 047240 006205                                         ASR     R5                                                      ;CHANGE BACK BIT POSITION
7546 047242 050477 134436                                  BIS     R4,@CSA                                                 ;LOAD CHANNEL NUMBER
7547 047246 017737 134432 004064                           MOV     @CSA,BAD                                                ;GET CSA CONTENTS
7548 047254 050437 004062                                  BIS     R4,GOOD                                                 ;ADD CHA. NUMBER TO GOOD
7549 047260 023737 004062 004064                           CMP     GOOD,BAD                                                ;IS CSA CONTENTS CORRECT ?
7550 047266 004737 012146                                  CALL    INSERT                                                  ;SKIP BRANCH IF "SFI" IS SET
7551 047272 001404                                         BEQ     70$                                                     ;BRANCH IF YES
7552 047274                                                ERRSOFT 1501,E1501,EER4                                         ;ERROR HANDLER
     047274 104457                                                                                                              TRAP    C$ERSOFT
     047276 002735                                                                                                              .WORD   1501
     047300 051726                                                                                                              .WORD   E1501
     047302 007474                                                                                                              .WORD   EER4
7553 047304                                        70$:     CKLOOP                                                  ;
     047304 104406                                                                                                              TRAP    C$CLP1
7554 047306 052777 000001 154570                           BIS     #1,@CSA                                                 ;START THE CONVERSION
7555 047314 005002                                         CLR     R2                                                      ;SET UP TIMEOUT COUNTER
7556 047316 017737 134362 004064           80$:     MOV     @CSA,BAD                                                ;GET CSA CONTENTS
7557 047324 032737 000200 004064                           BIT     #200,BAD                                                ;CONVERSION OVER (DONE SET)?
7558 047332 001013                                         BNE     90$                                                     ;BRANCH IF YES
7559 047334 005302                                         DEC     R2                                                      ;DECREMENT TIMEOUT COUNTER
7560 047336 004737 012146                                  CALL    INSERT                                                  ;SKIP BRANCH IF "SFI" IS SET
7561 047342 001365                                         BNE     80$                                                     ;BRANCH IF NOT ZERO
7562 047344 052737 000200 004062                           BIS     #200,GOOD                                               ;SET DONE IN GOOD
7563 047352                                                ERRSOFT 1502,E1502,EER4                                         ;ERROR HANDLER
     047352 104457                                                                                                              TRAP    C$ERSOFT
     047354 002736                                                                                                              .WORD   1502
     047356 051755                                                                                                              .WORD   E1502
     047360 007474                                                                                                              .WORD   EER4
7564 047362                                        90$:     CKLOOP                                                  ;
     047362 104406                                                                                                              TRAP    C$CLP1
7565
7566                                               ;***
7567
7568 047364 012702 000012                                  MOV     #10.,R2                                                 ;REPEAT DATA DEALY FOR
7569 047370 004737 011514                          100$:    CALL    WT500                                                   ;SAME CHANNEL
7570 047374 005302                                         DEC     R2                                                      ;5 MS OVER
7571 047376 001374                                         BNE     100$                                                    ;BRANCH IF NOT
7572 047400 017737 134276 004064                           MOV     @DAT,BAD                                                ;GET CONVERSION VALUE
```

TEST 15: ANALOGUE INPUT TEST - FIELD AND MANUFACTURING TEST.

```
7573 047406  016301  050676                  MOV     VOLVA(R3),R1        ;GET EXPECTED VOLTAGE VALUE
7574 047412  016302  050700                  MOV     VOLVA+2(R3),R2      ;GET EXPECTED MILLIVOLT VALUE
7575 047416  004737  014730                  CALL    ADCON               ;ANALOGUE TO DIGITAL CONVERSION
7576 047422  010137  004062                  MOV     R1,GOOD             ;GET GOOD VALUE FROM ADCON ROUTINE
7577 047426  013702  050674                  MOV     TOLOF,R2            ;LOAD TOLLERANCE POINTER
7578 047432  022763  000060  050676          CMP     #48.,VOLVA(R3)      ;IS THE USED VOLTAGE 48,828 MV
7579 047440  001007                          BNE     120$                ;BRANCH IF NOT
7580 047442  010500                          MOV     R5,R0               ;GET GAIN
7581 047444  005700                          TST     R0                  ;IS GIAN 1 USED ?
7582 047446  001404                          BEQ     120$                ;BRANCH IF YES
7583 047450  062702  000002          110$:   ADD     #2,R2               ;POINT TO NEXT TOLLERANCE VALUE
7584 047454  005300                          DEC     R0                  ;LOOK TO NEXT GAIN
7585 047456  001374                          BNE     110$                ;BRANCH IF GAIN NOT USED
7586
7587 047460  011237  050672          120$:   MOV     (R2),TOLRA          ;LOAD TOLLERANS
7588 047464  063737  050672  004062          ADD     TOLRA,GOOD          ;ADD TOLLERANS TO EXPECTED VALUE
7589 047472  023737  004064  004062          CMP     BAD,GOOD            ;FOUND VALUE OUTSIDE POS. TOLLERANS ?
7590 047500  101016                          BHI     130$                ;BRANCH IF YES TO ERROR
7591 047502  163737  050672  004062          SUB     TOLRA,GOOD          ;SUBRACT ADDED TOLLERANS
7592 047510  163737  050672  004062          SUB     TOLRA,GOOD          ;SUB TOLLERANS FROM EXPECTED VALUE
7593 047516  023737  004064  004062          CMP     BAD,GOOD            ;FOUND VALUE INSIDE NEG  TOLLERANS ?
7594 047524  002013                          BGE     150$                ;BRANCH IF YES
7595 047526  063737  050672  004062          ADD     TOLRA,GOOD          ;CORRECT GOOD TO ORIGINAL VALUE
7596 047534  000403                          BR      140$                ;
7597 047536  163737  050672  004062  130$:   SUB     TOLRA,GOOD          ;FORM EXPECTED VALUE
7598 047544                          140$:   ERRSOFT 1503,E1503,EER5     ;ERROR HANDLER
     047544  104457                                                                  TRAP    C$ERSOFT
     047546  002737                                                                  .WORD   1503
     047550  052030                                                                  .WORD   E1503
     047552  007540                                                                  .WORD   EER5
7599 047554                          150$:   ENDSEG                                 10002$:
     047554  104405                                                                  TRAP    C$ESEG
7600
7601                                 ;---
7602
7603 047556  022763  000060  050676          CMP     #48.,VOLVA(R3)      ;IS THE USED VOLTAGE 48,828 MV
7604 047564  001006                          BNE     160$                ;BRANCH IF NOT
7605 047566  005205                          INC     R5                  ;INCREMENT GAIN
7606 047570  022705  000010                  CMP     #10,R5              ;ALL GAINS TESTED?
7607 047574  001402                          BEQ     160$                ;BRANCH IF YES
7608 047576  000137  047204                  JMP     60$                 ;JUMP IF NOT
7609
7610                                 ;NOW WE TEST THAT THE NEIGHBORING CHANNEL IS ZERO FOR UNIPOLAR RANGE
7611                                 ;OR HALF SCALE FOR BIPOLAR RANGE
7612
7613 047602  010400                  160$:   MOV     R4,R0               ;GET R4 CONTENTS (CHANNEL)
7614 047604  042700  170377                  BIC     #170377,R0          ;CLEAR UNNEEDED BITS
7615 047610  022700  007400                  CMP     #7400,R0            ;ALL CHANNEL TESTED ?
7616 047614  001545                          BEQ     230$                ;BRANCH IF YES
7617 047616  000304                          SWAB    R4                  ;SWAB HIGH BYTE INTO LOW BYTE
7618 047620  005204                          INC     R4                  ;INCREMENT CHANNEL NUMBER
7619 047622  000304                          SWAB    R4                  ;SWAB LOW BYTE INTO HIGH BYTE
7620 047624                                  BGNSEG
     047624  104404                                                                  TRAP    C$BSEG
7621 047626  042777  077536  134050          BIC     #77536,@CSA         ;CLEAR R/W BITS IN CSA
7622 047634  005005                          CLR     R5                  ;LOAD GAIN 1
```

TEST 15: ANALOGUE INPUT TEST - FIELD AND MANUFACTURING TEST.

```
7623 047636  042777  000016  134040          BIC     #16,@CSA        ;LOAD GAIN 1
7624 047644  013702  050674                  MOV     TOLOF,R2        ;LOAD TABLE POINTER
7625 047650  011237  050672                  MOV     (R2),TOLRA      ;LOAD TOLLERANCE FOR GAIN 1
7626 047654  012737  100000  004062          MOV     #100000,GOOD    ;SET UP GOOD CONTENTS
7627 047662  050477  134016                  BIS     R4,@CSA         ;LOAD NEIGHBORING CHANNEL
7628 047666  017737  134012  004064          MOV     @CSA,BAD        ;GET CSA CONTENTS
7629 047674  060437  004062                  ADD     R4,GOOD         ;ADD CHA. NUMBER TO GOOD
7630 047700  023737  004062  004064          CMP     GOOD,BAD        ;IS CHANNEL AVAILABLE ?
7631 047706  004737  012146                  CALL    INSERT          ;SKIP BRANCH IF "SFS" IS SET
7632 047712  001404                          BEQ     170$            ;BRANCH IF YES
7633 047714                                  ERRSOFT 1504,E1501,EER4 ;ERROR HANDLER
     047714  104457                                                          TRAP    C$ERSOFT
     047716  002740                                                          .WORD   1504
     047720  051726                                                          .WORD   E1501
     047722  007474                                                          .WORD   EER4
7634 047724                          170$:   CKLOOP                  ;
     047724  104406                                                          TRAP    C$CLP1
7635 047726  052777  000001  133750          BIS     #1,@CSA         ;START THE CONVERSION
7636 047734  005002                          CLR     R2              ;SET UP TIMEOUT COUNTER
7637 047736  032777  000200  133740  180$:   BIT     #200,@CSA       ;CONVERSION OVER ?
7638 047744  001006                          BNE     190$            ;BRANCH IF YES
7639 047746  005302                          DEC     R2              ;DECREMENT TIMEOUT COUNTER
7640 047750  001372                          BNE     180$            ;BRANCH IF NOT ZERO
7641 047752                                  ERRSOFT 1505,E1502,EER3 ;ERROR HANDLER
     047752  104457                                                          TRAP    C$ERSOFT
     047754  002741                                                          .WORD   1505
     047756  051755                                                          .WORD   E1502
     047760  007442                                                          .WORD   EER3
7642 047762                          190$:   CKLOOP                  ;
     047762  104406                                                          TRAP    C$CLP1
7643 047764  017737  133712  004064          MOV     @DAT,BAD        ;GET CONVERSION VALUE
7644 047772  005001                          CLR     R1              ;ADCON INPUT SHOULD BE ZERO
7645 047774  005002                          CLR     R2              ;ADCON INPUT SHOULD BE ZERO
7646 047776  004737  014730                  CALL    ADCON           ;ANALOGUE TO DIGITAL CONVERSION
7647 050002  010137  004062                  MOV     R1,GOOD         ;GET GOOD VALUE FROM ADCON ROUTINE
7648 050006  063737  050672  004062          ADD     TOLRA,GOOD      ;ADD TOLLERANS TO EXPECTED VALUE
7649 050014  023737  004064  004062          CMP     BAD,GOOD        ;FOUND VALUE OUTSIDE POS. TOLLERANS ?
7650 050022  101020                          BHI     200$            ;BRANCH IF YES TO ERROR
7651 050024  163737  050672  004062          SUB     TOLRA,GOOD      ;SUBRACT ADDED TOLLERANS
7652 050032  163737  050672  004062          SUB     TOLRA,GOOD      ;SUB TOLLERANS FROM EXPECTED VALUE
7653 050040  023737  004064  004062          CMP     BAD,GOOD        ;FOUND VALUE INSIDE NEG. TOLLERANS ?
7654 050046  004737  012146                  CALL    INSERT          ;SKIP BRANCH IF "SFS" IS SET
7655 050052  002015                          BGE     220$            ;BRANCH IF YES
7656 050054  063737  050672  004062          ADD     TOLRA,GOOD      ;CORRECT GOOD TO ORIGINAL VALUE
7657 050062  000403                          BR      210$            ;
7658 050064  163737  050672  004062  200$:   SUB     TOLRA,GOOD      ;CORRECT GOOD TO ORIGINAL VALUE
7659 050072                          210$:   ERRSOFT 1506,E1503,EER4 ;ERROR HANDLER
     050072  104457                                                          TRAP    C$ERSOFT
     050074  002742                                                          .WORD   1506
     050076  052030                                                          .WORD   E1503
     050100  007474                                                          .WORD   EER4
7660 050102                          220$:   ENDSEG                  ;
     050102                                                      10003$:
     050102  104405                                                          TRAP    C$ESEG
7661
7662                                 ;
7663
```

TEST 15: ANALOGUE INPUT TEST - FIELD AND MANUFACTURING TEST.

```
7664 050104  010400                        MOV     R4,R0           ;GET R4 CONTENTS (CHANNEL)
7665 050106  042700  170377                BIC     #170377,R0      ;CLEAR UNNEEDED BITS
7666 050112  022700  007400                CMP     #7400,R0        ;ALL CHANNELS TESTED ?
7667 050116  001404                        BEQ     230$            ;BRANCH IF YES
7668 050120  062704  000400                ADD     #400,R4         ;INCREMENT CHANNEL NUMBER
7669 050124  000137  047202                JMP     40$             ;BRANCH IF NOT
7670 050130  023703  050670        230$:   CMP     VOLTE,R3        ;ALL VOLTAGES REQUESTED ?
7671 050134  001414                        BEQ     240$            ;BRANCH IF YES
7672 050136  062703  000004                ADD     #4,R3           ;IF NO, POINT TO NEXT VALUE
7673 050142  005737  050666                TST     MUXC            ;ARE WE TESTING MUX BOARDS ?
7674 050146  001402                        BEQ     233$            ;BRANCH IF NOT
7675 050150  062703  000004                ADD     #4,R3           ;IF YES SKIP HALF SCALE TESTING
7676 050154  005737  050662        233$:   TST     ANS153          ;ARE WE TESTING ODD CHANNELS
7677 050160  001016                        BNE     250$            ;BRANCH IF YES
7678 050162  000137  047000                JMP     10$             ;AND REPEAT THE TEST WITH FIRST CHA.
7679 050166  005737  050662        240$:   TST     ANS153          ;WAS ODD AND EVEN CHA. TESTED ?
7680 050172  001056                        BNE     270$            ;BRANCH IF YES
7681
7682                                ;NOW WE DO CONVERSION WITH VOLTAGE SOURCE ON ODD CHANNELS
7683
7684 050174  012737  000001  050662        MOV     #1,ANS153       ;SET ODD/EVEN FLAG
7685 050202  012703  000014                MOV     #14,R3          ;POINT R3 TO BIPOLAR TABLE (VOLVA+14)
7686 050206  005737  050664                TST     BIPOL           ;IS BIPOLAR SELECTED ?
7687 050212  001001                        BNE     250$            ;BRANCH IF YES
7688 050214  005003                        CLR     R3              ;POINT R3 TO UNIPOLAR TABLE (VOLVA)
7689 050216  042704  007400        250$:   BIC     #7400,R4        ;CLEAR BITS FOR CHANNEL 0-15
7690 050222  052704  000400                BIS     #400,R4         ;LOAD FIRST ODD CHANNEL
7691 050226                                PRINTF  #MES152         ;PRINT VOLT SOURCE ADJUSTMENT
     050226  012746  051415                                                  MOV     #MES152,-(SP)
     050232  012746  000001                                                  MOV     #1, (SP)
     050236  010600                                                          MOV     SP,R0
     050240  104417                                                          TRAP    C$PNTF
     050242  062706  000004                                                  ADD     #4,SP
7692 050246  016301  050676                MOV     VOLVA(R3),R1    ;LOAD DECOUT INPUT (R1)
7693 050252  016302  050700                MOV     VOLVA+2(R3),R2  ;...
7694 050256  004737  015764                CALL    DECOUT          ;PRINT DECIMAL NUMBER
7695 050262                                PRINTF  #OUT15          ;PRINT VOLT
     050262  012746  051455                                                  MOV     #OUT15,-(SP)
     050266  012746  000001                                                  MOV     #1, (SP)
     050272  010600                                                          MOV     SP,R0
     050274  104417                                                          TRAP    C$PNTF
     050276  062706  000004                                                  ADD     #4,SP
7696 050302                        260$:   GMANIL  MES154,ANS152,-1,YES    ;CONNECT VOLT SOURCE TO J3 (ODD)
     050302  104443                                                          TRAP    C$GMAN
     050304  000404                                                          BR      10004$
     050306  050660                                                          .WORD   ANS152
     050310  000150                                                          .WORD   I$CODE
     050312  051571                                                          .WORD   MES154
     050314  177777                                                          .WORD   -1
     050316                                                          10004$:
7697 050316  005737  050660                TST     ANS152          ;TEST ANSWER
7698 050322  001367                        BEQ     260$            ;ASK AGAIN IF ANSWER IS NO
7699 050324  000137  047136                JMP     50$             ;REPEAT TEST WITH ODD CHANNELS
7700
7701                                ;
7702
7703 050330  005737  050666        270$:   TST     MUXC            ;ARE WE TESTING THE CONTROLLER ?
```

TEST 15: ANALOGUE INPUT TEST - FIELD AND MANUFACTURING TEST.

```
 7704 050334  001427                          BEQ     EXTRI                   ;BRANCH IF YES TO EXT.TRIGGER PART
 7705 050336  023737  050656  050666  MUXPAR: CMP     ANS151,MUXC             ;ALL BOARDS TESTED ?
 7706 050344  001542                          BEQ     EXQV15                  ;IF YES, EXIT TEST
 7707 050346  062704  000400                  ADD     #400,R4                 ;POINT TO NEXT BANK
 7708 050352  042777  077536  133324          BIC     #77536,@CSA             ;CLEAR CSA REGISTER
 7709 050360  050477  133320                  BIS     R4,@CSA                 ;LOAD CHANNEL IN CSA
 7710 050364                                  GMANIL  MES155,ANS152,-1,YES    ;PUT TEST CONNECTOR TO NEXT BANK
      050364  104443                                                                      TRAP    C$GMAN
      050366  000404                                                                      BR      10005$
      050370  050660                                                                      .WORD   ANS152
      050372  000130                                                                      .WORD   T$CODE
      050374  051666                                                                      .WORD   MES155
      050376  177777                                                                      .WORD   -1
      050400                                                                      10005$:
 7711 050400  042704  007400                  BIC     #7400,R4                ;BEGIN TEST ITERATION WITH AN EVEN CHA.
 7712 050404  005237  050666                  INC     MUXC                    ;COUNT MUX BOARDS
 7713 050410  000137  046750                  JMP     PS151                   ;TEST ITERATION
 7714
 7715
 7716                                 ;THE FOLLOWING CODE IS USED FOR TEST EXTERNAL TRIGGER FUNCTION
 7717
 7718 050414                          EXTRI:  SETVEC  VEC,#INTSR,#PRIO7       ;SET VECTOR 1 AND SERVICE ROUTINE
      050414  012746  000340                                                              MOV     #PRIO7,-(SP)
      050420  012746  017276                                                              MOV     #INTSR,-(SP)
      050424  013746  003710                                                              MOV     VEC,-(SP)
      050430  012746  000003                                                              MOV     #3,-(SP)
      050434  104437                                                                      TRAP    C$SVEC
      050436  062706  000010                                                              ADD     #10,SP
 7719 050442                                  SETPRI  #PRIO7                  ;DISABLE INTERRUPTS
      050442  012700  000340                                                              MOV     #PRIO7,R0
      050446  104441                                                                      TRAP    C$SPRI
 7720 050450                                  BGNSEG
      050450  104404                                                                      TRAP    C$BSEG
 7721 050452  005037  004150                  CLR     INTFLA                  ;CLEAR INTERRUPT FLAG
 7722 050456  005005                  20$:    CLR     R5                      ;CLEAR GAIN POINTER
 7723 050460  042777  077536  133216          BIC     #77536,@CSA             ;CLEAR ALL R\W BITS IN CSA
 7724 050466  050477  133212                  BIS     R4,@CSA                 ;LOAD CHANNEL
 7725 050472                                  SETPRI  #PRI00                  ;ALLOW INTERRUPTS
      050472  012700  000000                                                              MOV     #PRI00,R0
      050476  104441                                                                      TRAP    C$SPRI
 7726 050500  052777  000120  133176          BIS     #120,@CSA               ;SET EET + IE IN CSA
 7727 050506  042777  000020  133170          BIC     #20,@CSA                ;DO EXTERNAL START (= CLR EET)
 7728 050514  005003                          CLR     R3                      ;CLEAR TIMEOUT COUNTER
 7729 050516  005737  004150          40$:    TST     INTFLA                  ;WAS THERE A DONE INTERRUPT?
 7730 050522  001010                          BNE     50$                     ;BRANCH IF YES
 7731 050524  005303                          DEC     R3                      ;DECREMENT TIMEOUT COUNTER
 7732 050526  004737  012146                  CALL    INSERT                  ;SKIP BRANCH IF 'SEI' IS SET
 7733 050532  001371                          BNE     40$                     ;BRANCH IF NOT ZERO
 7734 050534                                  ERRSOFT 1507,E1507,EERG         ;ERROR HANDLER
      050534  104457                                                                      TRAP    C$ERSOFT
      050536  002743                                                                      .WORD   1507
      050540  052063                                                                      .WORD   E1507
      050542  007724                                                                      .WORD   EERG
 7735 050544                          50$:    CKLOOP                          ;
      050544  104406                                                                      TRAP    C$CLP1
 7736 050546  017737  133132  004064          MOV     @CSA,BAD                ;GET CSA CONTENTS
 7737 050554  012737  100300  004062          MOV     #100300,GOOD            ;SET UP DATA FOR ERROR MESSAGES
```

TEST 15: ANALOGUE INPUT TEST - FIELD AND MANUFACTURING TEST.

```
7738 050562  050437  004062                 BIS     R4,GOOD             ;... (CHANNEL)
7739 050566  050537  004062                 BIS     R5,GOOD             ;... (GAIN )
7740 050572  023737  004062  004064         CMP     GOOD,BAD            ;IS CSA CONTENTS OK AFTER CONVERSION?
7741 050600  004737  012146                 CALL    INSERT              ;SKIP BRANCH IF 'SFI' IS SET
7742 050604  001404                         BEQ     60$                 ;BRANCH IF DONE IS CLEARED
7743 050606                                 ERRSOFT 1508,E1508,EER4     ;ERROR HANDLER
     050606  104457                                                             TRAP    C$ERSOFT
     050610  002744                                                             .WORD   1508
     050612  052134                                                             .WORD   E1508
     050614  007474                                                             .WORD   EER4
7744 050616                         60$:    CKLOOP
     050616  104406                                                             TRAP    C$CLP1
7745 050620  042777  000100  133056         BIC     #100,@CSA           ;CLEAR INTERRUPT ENABLE BIT
7746 050626  005037  004150                 CLR     INTFLA              ;CLEAR DONE INTERRUPT FLAG
7747 050632                                 SETPRI  #PRIO7              ;DISABLE INTERRUPTS
     050632  012700  000340                                                     MOV     #PRIO7,R0
     050636  104441                                                             TRAP    C$SPRI
7748 050640  005777  133036                 TST     @DAT                ;READ DAT TO CLR DONE+ERR IN CSA
7749 050644                                 ENDSEG
     050644                                                         10006$:
     050644  104405                                                             TRAP    C$ESEG
7750 050646  000137  050336                 JMP     MUXPAR              ;JUMP TO MUX PART
7751
7752 050652                         EXQV15: EXIT    TST
     050652  104432                                                             TRAP    C$EXIT
     050654  001632                                                             .WORD   L10050-.
7753
7754 050656  000000                 ANS151: .WORD   0                   ;SAVE LOCATION FOR MUX BOARD ANSWER
7755 050660  000001                 ANS152: .WORD   1                   ;SAVE LOCATION FOR SOURCE CONNECTION ANSWER
7756 050662  000000                 ANS153: .WORD   0                   ;LOCATION FOR ODD/EVEN FLAG
7757 050664  000000                 BIPOL:  .WORD   0                   ;BIPOLAR FLAG
7758 050666  000000                 MUXC:   .WORD   0                   ;MUX BOARD COUNTER
7759 050670  000000                 VOLTE:  .WORD   0                   ;SAVE LOCATION FOR VOLVA TABLE END ADDR.
7760 050672  000002                 TOLRA:  .WORD   2                   ;LOCATION TO STORE THE TOLLERANS VALUE
7761 050674  000000                 TOLOF:  .WORD   0                   ;STORE TO SAVE TABLE POINTER
7762
7763 050676  000060  001474         VOLVA:  .WORD   48.,828.            ;UNIPOLAR LSB VALUE
7764 050702  011610  000000                 .WORD   5000.,0             ;UNIPOLAR HALF SCALE VALUE
7765 050706  023413  000144                 .WORD   9995.,100.          ;UNIPOLAR FULL SCALE VALUE
7766
7767 050712  154365  177634                 .WORD   -9995.,-100.        ;BIPOLAR FULL NEG. VALUE
7768 050716  000060  001474                 .WORD   48.,828.            ;BIPOLAR ZERO SCALE VALUE
7769 050722  023413  000144                 .WORD   9995.,100.          ;BIPOLAR FULL POS. VALUE
7770
7771
7772                                 ;       TOLLERANCE TABLE
7773
7774                                 ;       GAIN    1 2 5 10 20 50 100 200
7775
7776 050726  000002  000002  000002 FILTOL: .WORD   2,2,2, 4, 6, 7,12., 20.      ;FIELD TABLE
     050734  000004  000006  000007
     050742  000014  000024
7777 050746  000002  000002  000002 MAFTOL: .WORD   2,2,2, 3, 3, 5,10., 15.      ;MANUFACTURING TABLE (NO MUX)
     050754  000003  000003  000005
     050762  000012  000017
7778 050766  000002  000002  000002 MUXTOL: .WORD   2,2,2, 3, 5, 6,12., 17.      ;MANUFACTURING TABLE (WITH MUX)
     050774  000003  000005  000006
```

TEST 15: ANALOGUE INPUT TEST - FIELD AND MANUFACTURING TEST.

```
        051002  000014  000021
 7779
 7780
 7781
 7782                                    .NLIST  BEX
 7783 051006      045     125     062    TSHD15::.ASCIZ  /%S2%AANALOGUE INPUT TEST - FIELD AND MANUFACTURING TEST%N/
 7784 051100      045     101     124    TM15: .ASCIZ /%ATEST DISABLED - NO MANUAL INTERVENTION ALLOWED (UAM FLAG SET)%N/
 7785
 7786 051202      045     1[illegible]    045    WME151: .ASCIZ/%N%AIS THE ANALOGUE INPUT TEST CONNECTOR PLUGGED INTO THE BOARD%N/
 7787 051304      045     101     127    WME152: .ASCIZ  /%AWITH THE FLASHING LED ?  /
 7788 051340      116     125     115    MES151: .ASCIZ  /NUMBER OF MUX BOARDS CONNECTED TO CONTROLLER/
 7789 051415      045     116     045    MES152: .ASCIZ  /%N%AADJUST VOLTAGE SOURCE TO   /
 7790 051455      045     101     040    OUT15:  .ASCIZ  /%A MILLIVOLT%N/
 7791 051474      101     116     104    MES153: .ASCIZ  /AND PUT IT TO J2 ON TEST CONNECTOR (CONNECT ALSO J3 WITH J4)/
 7792 051571      101     116     104    MES154: .ASCIZ  /AND PUT IT TO J3 ON TEST CONNECTOR (CONNECT ALSO J2 WITH J4)/
 7793 051666      120     125     124    MES155: .ASCIZ  /PUT TEST CONNECTOR TO NEXT BANK/
 7794
 7795 051726      103     123     101    E1501:  .ASCIZ  /CSA CONTENTS INCORRECT/
 7796 051755      124     111     115    E1502:  .ASCIZ  /TIMEOUT - DONE BIT NOT SET AFTER A\D START/
 7797 052030      103     117     116    E1503:  .ASCIZ  /CONVERSION VALUE INCORRECT/
 7798 052063      116     117     040    E1507:  .ASCIZ  /NO DONE INTERRUPT AFTER EXTERNAL TRIGGER/
 7799 052134      103     123     101    E1508:  .ASCIZ  /CSA CONTENTS INCORRECT AFTER EXTERNAL TRIGGER/
 7800 052212      045     116     045    PME151: .ASCIZ  /%N%AMODULE IS SWITCHED TO UNIPOLAR RANGE%N/
 7801 052265      045     116     045    PME152: .ASCIZ  /%N%AMODULE IS SWITCHED TO BIPOLAR RANGE%N/
 7802 052337      045     116     045    PME153: .ASCIZ  /%N%ATHIS TEST WILL ONLY RUN CORRECTLY IF THE MODULE IS%N/
 7803 052430      045     101     103    PME154: .ASCIZ  /%ACALIBRATED (USE TEST 24)%N%N/
 7804 052467      045     116     045    PME155: .ASCIZ  /%N%AWORKING%N/
 7805                                    .LIST   BEX
 7806                                    .EVEN
 7807 052506                             ENDTST
      052506                                                 L10050:
      052506  104401                                               TRAP    C$ETST
```

TEST 16: ANALOGUE OUTPUT TEST - FIELD AND MANUFACURING TEST

```
                        .SBTTL  TEST 16: ANALOGUE OUTPUT TEST   FIELD AND MANUFACURING TEST
                        ;*****************************************************************************
                        ;       TEST 16 - ANALOGUE OUTPUT TEST.
                        ;
                        ;       THE USER IS TOLD THAT THE TEST WILL ONLY
                        ;       RUN CORRECTLY IF THE MODULE HAS BEEN CALIBRATED.
                        ;
                        ;       NEXT, THE OPERATOR IS ASKED WHETHER THE MODULE IS VOLTAGE
                        ;       CALIBRATED OR CURRENT CALIBRATED. DEPENDING ON THE RESPONSE, THE
                        ;       PROGRAM PROMPTS WITH VOLTAGE OR CURRENT VALUES.
                        ;       IF CURRENT IS USED A CHECK IS MADE THAT ALL CHANNELS ARE SHOWN
                        ;       AS "OPEN LINE"IN THE CSA REGISTER.
                        ;       THIS ASSUMES THAT NOTHING IS CONNECTED TO THE CURRENT OUTPUTS.
                        ;       THE USER IS THEN ASKED TO CONNECT A DVM WITH THE CORRECT RANGE
                        ;       TO THE MODULE OUTPUT AT THE SPECIFIED CHANNEL. IF CURRENT WAS
                        ;       SELECTED, THE PROGRAM USES THE OFFSET BIT IN THE MOD REGISTER AND
                        ;       CHECKS THAT THE OPL BIT IN THE CSA REGISTER IS CLEAR.
                        ;
                        ;       THE OPERATOR THEN HAS TO CHECK SEVERAL VALUES TO ENSURE THAT THE
                        ;       READING OF THE DVM IS THE SAME AS THE OUTPUT VALUE. ALL
                        ;       VALUES HAVE BEEN CHECKED BY ASWERING THE QUESTION "IS VALUE ON
                        ;       DVM IN RANGE. THE PROCESS IS REPEATED FOR ALL
                        ;       CHANNELS.
                        ;
                        ;       IF "UAM" FLAG IS SET, THIS TEST WILL NOT BE CARRIED OUT.
                        ;
                        ;       N.B. THE DVM READINGS MAY DIFFER FROM THE PRINTED VALUES IF THE
                        ;            MODULE HAS BEEN RECALIBRATED BY THE CUSTOMER.
                        ;*****************************************************************************
7838 052510             BGNTST
                                                                        ITRA16::
7839 052510 004737 011714       CALL    SELECT          ;CALL SELECT ROUTINE
7840 052514 001010              .WORD   1010            ;GIVE TEST PARAMETER
7841 052516 054530              TSHD16                  ;GIVE TEST HEADER ADDRESS
7842 052520 103002              BCC     1$              ;IF CARRY IS SET, EXIT TEST
7843 052522             EXIT    TST                     ;EXIT TEST
     052522 104432                                                      TRAP    C$EXIT
     052524 004010                                                      .WORD   ^C100S1 .
7844 052526             1$:     MANUAL                  ;IS MANUAL INTERVENTION ALLOWED?
     052526 104456                                                      TRAP    C$MANI
7845 052530                     BCOMPLETE ITRA16        ;BRANCH IF YES (UAM FLAG NOT SET)
     052530 103416                                                      BCS     ITRA16
7846 052532                     RFLAGS  R0              ;READ OPERATOR FLAGS INTO R0
     052532 104421                                                      TRAP    C$RFLA
7847 052534 032700 001000       BIT     #PNT,R0         ;PRINT MESSAGES ?
7848 052540 001410              BEQ     3$              ;IF NO, EXIT
7849 052542             PRINTF  #TM16                   ;IF YES PRINT TEST DISABLED
     052542 012746 054623                                               MOV     #TM16,-(SP)
     052546 012746 000001                                               MOV     #1,-(SP)
     052552 010600                                                      MOV     SP,R0
     052554 104417                                                      TRAP    C$PRNT
     052556 062706 000004                                               ADD     #4,SP
7850 052562             3$:     EXIT    TST             ;EXIT TEST
     052562 104432                                                      TRAP    C$EXIT
     052564 004750                                                      .WORD   ^C100S1 .
7851 052566 005001      ITRA16: CLR     R1              ;CLEAR TEMPORARY STORE
7852 052570 005004              CLR     R4              ;GET FIRST CHANNEL NUMBER
```

TEST 16: ANALOGUE OUTPUT TEST - FIELD AND MANUFACURING TEST

```
                                        PRINTF  #PME166                 ;MARK FOR CALIBRATION WITH
                                                                                        MOV     #PME166,(SP)
                                                                                        MOV     #1,(SP)
                                                                                        MOV     SP,R0
                                                                                        TRAP    C$PNTF
                                                                                        ADD     #4,SP
                                        PRINTF  #PME167                 ;TEST 23
                                                                                        MOV     #PME167,-(SP)
                                                                                        MOV     #1,-(SP)
                                                                                        MOV     SP,R0
                                                                                        TRAP    C$PNTF
                                                                                        ADD     #4,SP
                                        GMANIL  MES164,ANS164,-1,NO     ;VOLTAGE OR CURRENT
                                                                                        TRAP    C$GMAN
                                                                                        BR      10000$
                                                                                        .WORD   ANS164
                                                                                        .WORD   T$CODE
                                                                                        .WORD   MES164
                                                                                        .WORD   1
                                                                                10000$:
                                        TST     ANS164                  ;IS CURRENT CALIBRATED?
                                        BNE     10$                     ;SKIP VOLTAGE ROUTINE IF YES
                                        JMP     VOLPA                   ;JUMP TO VOLTAGE ROUTINE
                                10$:    BGNSEG
                                                                                        TRAP    C$BSEG
                                        SWAB    R4                      ;CHANNEL NUMBER IN HIGH BYTE
                                        CLR     @CSA                    ;SET UP CSA
                                        BIS     R4,@CSA                 ;LOAD CHANNEL INTO CSA
                                        BIT     #10,@MOD                ;IS 4-20 MA RANGE SELECTED
                                        BNE     12$                     ;BRANCH IF YES
                                        MOV     #10,@DAT                ;LOAD DAT FOR OPL  CORRECTION
                                        MOV     REDTIM,R3               ;LOAD READY TIMEOUT COUNTER
                                13$:    BIT     #200,@CSA               ;IS READY BIT SET?
                                        BNE     12$                     ;BRANCH IF YES
                                        DEC     R3                      ;IS TIMEOUT OVER?
                                        BNE     13$                     ;BRANCH IF NOT ZERO
                                12$:    CALL    WT500                   ;WAIT 500 US
                                        MOV     @CSA,BAD                ;GET CSA CONTENTS
                                        BIT     #40,BAD                 ;IS OLP BIT SET
                                        CALL    INSERT                  ;SKIP BRANCH IF "SFI" IS SET
                                        BNE     20$                     ;BRANCH IF YES
                                        ERRSOFT 1601,E1601,EER6         ;ERROR HANDLER
                                                                                        TRAP    C$ERSOFT
                                                                                        .WORD   1601
                                                                                        .WORD   E1601
                                                                                        .WORD   EER6
                                20$:    ENDSEG
                                                                                10001$:
                                                                                        TRAP    C$ESEG
                                        SWAB    R4                      ;CHANNEL NUMBER IN LOW BYTE
                                        INC     R4                      ;CREATE NEXT CHANNEL NUMBER
                                        CMP     #4,R4                   ;ALL 4 CHANNELS DONE ?
                                        BNE     10$                     ;BRANCH IF NO

                                        MOV     @MOD,BAD                ;GET MOD REGISTER CONTENTS
                                        MOV     #3,MODE                 ;SET UP INPUT FOR DACON ROUTINE
                                        MOV     #36,TABOFF              ;POINT TO CURRENT OFFSET TABLE
```

TEST 16: ANALOGUE OUTPUT TEST FIELD AND MANUFACURING TEST

```
7886 053026 032737 000010 004064          BIT     #10,BAD                 ;IS AN OFFSET SELECETED?
7887 053034 001005                        BNE     30$                     ;BRANCH IF YES
7888 053036 005037 054524                 CLR     TABOFF                  ;CLEAR TABLE POINTER
7889 053042 012737 000002 004134          MOV     #2,MODE                 ;SET UP INPUT FOR DACON ROUTINE
7890 053050 005037 004136           30$:  CLR     GAIN                    ;...
7891 053054 005004                        CLR     R4                      ;CHANNEL COUNTER
7892 053056 012737 000003 054526    40$:  MOV     #3,,VALCNT              ;LOAD VALUE COUNTER
7893 053064                               PRINTF  @PME162,R4              ;PROMT FOR DVM CHAN. CONNECTION
     053064 010446                                                                MOV     R4,-(SP)
     053066 012746 055055                                                         MOV     @PME162,-(SP)
     053072 012746 000002                                                         MOV     #2,-(SP)
     053076 010600                                                                MOV     SP,R0
     053100 104417                                                                TRAP    C$PNTF
     053102 062706 000006                                                         ADD     #6,SP
7894 053106                               PRINTF  @PME165                 ;PROMT FOR DVM ADJUSTMENT
     053106 012746 055151                                                         MOV     @PME165,-(SP)
     053112 012746 000001                                                         MOV     #1,-(SP)
     053116 010600                                                                MOV     SP,R0
     053120 104417                                                                TRAP    C$PNTF
     053122 062706 000004                                                         ADD     #4,SP
7895 053126                               PRINTF  @PME16A                 ;
     053126 012746 055213                                                         MOV     @PME16A,-(SP)
     053132 012746 000001                                                         MOV     #1,-(SP)
     053136 010600                                                                MOV     SP,R0
     053140 104417                                                                TRAP    C$PNTF
     053142 062706 000004                                                         ADD     #4,SP
7896 053146                               GMANIL  MES162,ANS161,-1,YES    ;...
     053146 104443                                                                TRAP    C$GMAN
     053150 000404                                                                BR      1000$
     053152 054402                                                                .WORD   ANS161
     053154 000130                                                                .WORD   I$CODE
     053156 055305                                                                .WORD   MES162
     053160 177777                                                                .WORD   -1
     053162                                                          1000$:
7897 053162 000304                        SWAB    R4                      ;LOAD CHANNEL IN HIGH BYTE
7898 053164 010477 130514                 MOV     R4,@CSA                 ;LOAD CSA WITH CHANNEL NUMBER
7899 053170 013705 054524                 MOV     TABOFF,R5               ;POINT TO THE FIRST VALUE
7900 053174 016571 054430           50$:  MOV     CUROUT(R5),R1           ;GET OUTPUT VALUE FROM TABLE
7901 053200                               BGNSEG
     053200 104404                                                                TRAP    C$BSEG
7902 053202 032777 000010 130470          BIT     #10,@MOD                ;IS 4-20 MA RANGE SELECTED
7903 053210 001002                        BNE     60$                     ;BRANCH IF YES
7904 053212 005701                        TST     R1                      ;ARE WE USEING 0 MA
7905 053214 001415                        BEQ     70$                     ;SKIP OPL TESTING IF YES
7906 053216 017737 130462 004064    60$:  MOV     @CSA,BAD                ;GET CSA CONTENT
7907 053224 032737 000040 004064          BIT     #40,BAD                 ;IS OPL BIT CLEARED ?
7908 053232 004737 012146                 CALL    INSERT                  ;SKIP BRANCH IF "SET" IS SET
7909 053236 001404                        BEQ     70$                     ;BRANCH IF YES
7910 053240                               ERRSOFT 160,,E1602,EER3         ;ERROR HANDLER
     053240 104457                                                                TRAP    C$ERSOFT
     053242 003102                                                                .WORD   160,,
     053244 056154                                                                .WORD   E1602
     053246 007442                                                                .WORD   EER3
7911 053250                               CYCLOOP                 70$:
     053250 104406                                                                TRAP    C$CYCL
7912 053252 010177 130434                 MOV     R1,@DAT                 ;LOAD OUTPUT VALUE INTO DATA REG.
7913 053256 013703 004164                 MOV     REDTIM,R3               ;LOAD READY TIMEOUT COUNTER
```

TEST 16: ANALOGUE OUTPUT TEST FIELD AND MANUFACURING TEST

```
7914 053362 052777 000200 150414 80$:    BIT     #200,@CSA          ;IS READY BIT SET?
7915 053370 001010                       BNE     90$                ;BRANCH IF YES
7916 053372 005303                       DEC     R3                 ;IS TIMEOUT OVER?
7917 053374 004737 012146                CALL    INSERT             ;SKIP BRANCH IF "SF1" IS SET
7918 053400 001370                       BNE     80$                ;BRANCH IF NOT ZERO
7919 053402                              ERRSOFT 1603,E1603,EER3    ;ERROR HANDLER
     053402 104457                                                      TRAP    C$ERSOFT
     053404 003103                                                      .WORD   1603
     053406 056244                                                      .WORD   E1603
     053410 007442                                                      .WORD   EER3
7920 053412                         90$:    CKLOOP                  ;
     053412 104406                                                      TRAP    C$CLP1
7921 053414 017737 130364 004064         MOV     @CSA,BAD           ;GET CSA CONTENTS
7922 053422 012737 100200 004062         MOV     #100200,GOOD       ;LOAD GOOD DATA
7923 053430 050437 004062                BIS     R4,GOOD            ;LOAD CHANNEL NUMBER
7924 053434 042737 000040 004064         BIC     #40,BAD            ;MASK OUT OPL BIT
7925 053442 023737 004062 004064         CMP     GOOD,BAD           ;CSA CONTENTS CORRECT AFTER READY SET?
7926 053450 004737 012146                CALL    INSERT             ;SKIP BRANCH IF "SF1" IS SET
7927 053454 001404                       BEQ     100$               ;BRANCH IF YES
7928 053456                              ERRSOFT 1604,E1604,EER1    ;ERROR HANDLER
     053456 104457                                                      TRAP    C$ERSOFT
     053460 003104                                                      .WORD   1604
     053462 056542                                                      .WORD   E1604
     053464 007342                                                      .WORD   EER1
7929 053466                         100$:   ENDSEG
     053466                                                         10003$:
     053466 104405                                                      TRAP    C$ESEG
7930 053470                              PRINTF  #PME161            ;PRINT OPERATOR ACTION
     053470 012746 054725                                               MOV     #PME161,-(SP)
     053474 012746 000001                                               MOV     #1,-(SP)
     053500 010600                                                      MOV     SP,R0
     053502 104417                                                      TRAP    C$PNTF
     053504 062706 000004                                               ADD     #4,SP
7931 053510 004737 014512                CALL    DACON              ;CALL D/A CONVERSION ROUTINE
7932 053514 004737 015764                CALL    DECOUT             ;PRINT OUT THE RESULT ON CONSOLE
7933 053520                              PRINTF  #OUT1              ;PRINT 'MICROAMPS'
     053520 012746 056501                                               MOV     #OUT1,(SP)
     053524 012746 000001                                               MOV     #1,(SP)
     053530 010600                                                      MOV     SP,R0
     053532 104417                                                      TRAP    C$PNTF
     053534 062706 000004                                               ADD     #4,SP
7934 053540 010157 054402                MOV     R1,ANS161          ;GET R1 CONTENTS
7935 053544 010203                       MOV     R2,R3              ;GET R3 CONTENTS
7936 053546 062705 000002                ADD     #2,R5              ;POINT TO DIFFERENTS VALUE
7937 053552 016501 054430                MOV     CUROUT(R5),R1      ;AND GET IT
7938 053556 062705 000002                ADD     #2,R5              ;POINT TO DECIMAL DIFFERENTS VALUE
7939 053562 016502 054430                MOV     CUROUT(R5),R2      ;AND GET IT
7940 053566                              PRINTF  #PLMI              ;PRINT +/-
     053566 012746 056457                                               MOV     #PLMI,(SP)
     053572 012746 000001                                               MOV     #1,(SP)
     053576 010600                                                      MOV     SP,R0
     053600 104417                                                      TRAP    C$PNTF
     053602 062706 000004                                               ADD     #4,SP
7941 053606 004737 015764                CALL    DECOUT             ;PRINT DIFFERENTS VALUE
7942 053612                              PRINTF  #OUT1              ;PRINT 'MICROAMPS'
     053612 012746 056501                                               MOV     #OUT1,(SP)
     053616 012746 000001                                               MOV     #1,(SP)
```

TEST 16: ANALOGUE OUTPUT TEST - FIELD AND MANUFACURING TEST

```
                053522  010600                                                          MOV     SP,R0
                053524  104417                                                          TRAP    C$PNTF
                053526  062706  000004                                                  ADD     #4,SP
7943
7944 053532     006237  054402          ASR     ANS161                  ;DIVIDE BY TWO FOR VOLTAGE PRINTOUT
7945 053536     006003                  ROR     R3                      ;DIVIDE BY TWO FOR VOLTAGE PRINTOUT
7946 053540                             PRINTF  #PME164,ANS161,R3       ;PRINT VOLT ON 500 OHM RESISTOR
                053540  010346                                                          MOV     R3,-(SP)
                053542  013746  054402                                                  MOV     ANS161,-(SP)
                053546  012746  055603                                                  MOV     #PME164,(SP)
                053552  012746  000003                                                  MOV     #3,-(SP)
                053556  010600                                                          MOV     SP,R0
                053560  104417                                                          TRAP    C$PNTF
                053562  062706  000010                                                  ADD     #10,SP
7947 053566     062705  000002          ADD     #2,R5                   ;POINT TO INTEGER DIFFERENTS VALUE
7948 053572     016501  054430          MOV     CUROUT(R5),R1           ;AND GET IT
7949 053576     062705  000002          ADD     #2,R5                   ;POINT TO DECIMAL DIFFERENTS VALUE
7950 053602     016502  054430          MOV     CUROUT(R5),R2           ;AND GET IT
7951 053606                             PRINTF  #PLMI                   ;PRINT +/-
                053606  012746  056457                                                  MOV     #PLMI,-(SP)
                053612  012746  000001                                                  MOV     #1,-(SP)
                053616  010600                                                          MOV     SP,R0
                053620  104417                                                          TRAP    C$PNTF
                053622  062706  000004                                                  ADD     #4,SP
7952 053626     004737  015764          CALL    DECOUT                  ;PRINT DIFFERENTS VALUE
7953 053632                             PRINTF  #OUT2                   ;PRINT 'MILLIVOTS'
                053632  012746  056516                                                  MOV     #OUT2,-(SP)
                053636  012746  000001                                                  MOV     #1,-(SP)
                053642  010600                                                          MOV     SP,R0
                053644  104417                                                          TRAP    C$PNTF
                053646  062706  000004                                                  ADD     #4,SP
7954
7955 053652                             GMANIT  MES165,ANS161, 1,NO     ;IS VALUE ON DVM IN RANGE ?
                053652  104443                                                          TRAP    C$GMAN
                053654  000404                                                          BR      10004$
                053656  054402                                                          .WORD   ANS161
                053660  000120                                                          .WORD   I$CODE
                053662  055017                                                          .WORD   MES165
                053664  177777                                                          .WORD   -1
                053666                                                          10004$:
7956 053666     005737  054402          TST     ANS161                  ;TEST ANSWER
7957 053672     001004                  BNE     110$                    ;BRANCH IF YES
7958 053674                             ERRSOFT 1605,E1608,EERG         ;ERROR HANDLER
                053674  104457                                                          TRAP    C$ERSOFT
                053676  003105                                                          .WORD   1605
                053700  056371                                                          .WORD   E1608
                053702  007724                                                          .WORD   EERG
7959 053704     062705  000002  110$:   ADD     #2,R5                   ;POINT TO NEXT OUTPUT VALUE
7960 053710     005337  054526          DEC     VALCNT                  ;ALL VALUES USED
7961 053714     001402                  BEQ     120$                    ;BRANCH IF YES
7962 053716     000137  053174          JMP     50$                     ;IF NO, REPEATED WITH NEXT VALUE
7963 053722     000304  120$:   SWAB    R4                              ;CHANNEL NUMBER IN LOW BYTE
7964 053724     005204                  INC     R4                      ;CREATE NEXT CHANNEL NUMBER
7965 053726     022704  000004          CMP     #4,R4                   ;ALL 4 CHANNELS DONE ?
7966 053732     001002                  BNE     130$                    ;BRANCH IF NO
7967 053734     000137  054376          JMP     EXQV16                  ;SKIP VOLTAGE OUTPUT CHECK
7968 053740     000137  053056  130$:   JMP     40$                     ;
```

TEST 16: ANALOGUE OUTPUT TEST - FIELD AND MANUFACURING TEST

```
                                        ;++PART 2 WILL DO THE SAME WITH THE VOLTAGES OUTPUTS (EXEPT THE OPL TESTING)
                                        ;
053744  012737  000000  004134  VOLPA:  MOV     #0,MODE                 ;SET UP DACON ROUTINE INPUT
053752  005037  004136                  CLR     GAIN                    ;...
053756  005004                          CLR     R4                      ;START WITH CHANNEL 0
053760  012737  000003  054526  10$:    MOV     #3.,VALCNT              ;LOAD OUTPUT VALUE COUNTER
053766                          PRINTF  #PME163,R4              ;PROMT FOR DVM CHAN. CONNECTION
053766  010446                                                          MOV     R4, (SP)
053770  012746  055346                                                  MOV     #PME163,-(SP)
053774  012746  000002                                                  MOV     #2, (SP)
054000  010600                                                          MOV     SP,R0
054002  104417                                                          TRAP    C$PNTF
054004  062706  000006                                                  ADD     #6,SP
054010                          GMANIL  MES163,ANS161,-1,YES    ;PROMT FOR DVM ADJUST
054010  104443                                                          TRAP    C$GMAN
054012  000404                                                          BR      10005$
054014  054402                                                          .WORD   ANS161
054016  000130                                                          .WORD   I$CODE
054020  055441                                                          .WORD   MES163
054022  177777                                                          .WORD   -1
054024                                                          10005$:
054024  000304                  SWAB    R4                      ;LOAD CHANNEL IN HIGH BYTE
054026  010477  127652          MOV     R4,@CSA                 ;LOAD CHANNEL IN CSA
054032  005005                  CLR     R5                      ;POINT TO THE FIRST VALUE
054034  016501  054406          MOV     VOLOUT(R5),R1           ;GET OUTPUT VALUE FROM TABLE
054040                          BGNSEG
054040  104404                                                          TRAP    C$BSEG
054042  010177  127654          MOV     R1,@DAT                 ;LOAD OUTPUT DATA REGISTER
054046  013703  004164          MOV     REDTIM,R3               ;LOAD READY TIMEOUT COUNTER
054052  032777  000200  127624  40$:    BIT     #200,@CSA               ;IS READY BIT NOW SET?
054060  004737  012146          CALL    INSERT                  ;SKIP BRANCH IF "SEI" IS SET
054064  001006                  BNE     50$                     ;BRANCH IF YES
054066  005303                  DEC     R3                      ;DECREMENT READY TIMEOUT COUNT.
054070  001370                  BNE     40$                     ;BRANCH IF COUNTER IS NOT ZERO
                                ERRSOFT 1606,E1603,EER3         ;
054072  104457                                                          TRAP    C$ERSOFT
054074  003106                                                          .WORD   1606
054076  056244                                                          .WORD   E1603
054100  007442                                                          .WORD   EER3
                                        ;
054102                  50$:    CKLOOP                          ;
054102  104406                                                          TRAP    C$CLP1
054104  017737  127574  004064          MOV     @CSA,BAD                ;GET CSA CONTENTS
054112  012737  100200  004062          MOV     #100200,GOOD            ;LOAD GOOD DATA
054120  050437  004062                  BIS     R4,GOOD                 ;LOAD CHANNEL NUMBER
054124  042737  000040  004064          BIC     #40,BAD                 ;MASK OUT OPL BIT
054132  023737  004062  004064          CMP     GOOD,BAD                ;CSA CONTENTS CORRECT AFTER READY SET?
054140  004737  012146                  CALL    INSERT                  ;SKIP BRANCH IF "SEI" IS SET
054144  001404                  BEQ     30$                     ;BRANCH IF YES
                                ERRSOFT 1607,E1604,EER1         ;ERROR HANDLER
054146  104457                                                          TRAP    C$ERSOFT
054150  003127                                                          .WORD   1607
054152  056342                                                          .WORD   E1604
054154  007342                                                          .WORD   EER1
054156                  30$:    ENDSEG
                                                                10006$:
054156  104405                                                          TRAP    C$ESEG
```

TEST 16: ANALOGUE OUTPUT TEST FIELD AND MANUFACURING TEST

```
                                                PRINTF  #PME161                ;PRINT OPERATOR ACTION
                                                                                        MOV     #PME161,-(SP)
                                                                                        MOV     #1,-(SP)
                                                                                        MOV     SP,R0
                                                                                        TRAP    C$PNTF
                                                                                        ADD     #4,SP
8002 054200 004737 014512                       CALL    DACON                   ;CALL D/A CONVERSION ROUTINE
8003 054204 004737 015764                       CALL    DECOUT                  ;PRINT OUT THE RESULT
8004 054210                                     PRINTF  #OUT2                   ;PRINT 'MILLIVOLTS'
     054210 012746 056516                                                               MOV     #OUT2,-(SP)
     054214 012746 000001                                                               MOV     #1,-(SP)
     054220 010600                                                                      MOV     SP,R0
     054222 104417                                                                      TRAP    C$PNTF
     054224 062706 000004                                                               ADD     #4,SP
8005 054230 062705 000002                       ADD     #2,R5                   ;POINT TO INTEGER DIFFERENTS VALUE
8006 054234 016501 054406                       MOV     VOLOUT(R5),R1           ;AND GET IT
8007 054240 062705 000002                       ADD     #2,R5                   ;POINT TO DECIMAL DIFFERENTS VALUE
8008 054244 016502 054406                       MOV     VOLOUT(R5),R2           ;AND GET IT
8009 054250                                     PRINTF  #PLMI                   ;PRINT +/-
     054250 012746 056457                                                               MOV     #PLMI,-(SP)
     054254 012746 000001                                                               MOV     #1,-(SP)
     054260 010600                                                                      MOV     SP,R0
     054262 104417                                                                      TRAP    C$PNTF
     054264 062706 000004                                                               ADD     #4,SP
8010 054270 004737 015764                       CALL    DECOUT                  ;PRINT THE DIFFERENTS VALUE
8011 054274                                     PRINTF  #OUT2                   ;PRINT 'MILLIVOLTS'
     054274 012746 056516                                                               MOV     #OUT2,-(SP)
     054300 012746 000001                                                               MOV     #1,-(SP)
     054304 010600                                                                      MOV     SP,R0
     054306 104417                                                                      TRAP    C$PNTF
     054310 062706 000004                                                               ADD     #4,SP
8012 054314                                     GMANIL  MES165,ANS161, 1,NO     ;IS THE VALUE ON THE DVM IN RANGE
     054314 104443                                                                      TRAP    C$GMAN
     054316 000404                                                                      BR      10007$
     054320 054402                                                                      .WORD   ANS161
     054322 000120                                                                      .WORD   T$CODE
     054324 055017                                                                      .WORD   MES165
     054326 177777                                                                      .WORD   -1
     054330                                                                     10007$:
8013 054330 005737 054402                       TST     ANS161                  ;TEST ANSWER
8014 054334 001004                              BNE     60$                     ;BRANCH IF YES
8015 054336                                     ERRSOFT 1608,E1608,EERG         ;ERROR HANDLER
     054336 104457                                                                      TRAP    C$ERSOFT
     054340 003110                                                                      .WORD   1608
     054342 056371                                                                      .WORD   E1608
     054344 007724                                                                      .WORD   EERG
8016 054346 062705 000002               60$:    ADD     #2,R5                   ;POINT TO THE NEXT OUTPUT VALUE
8017 054352 005337 054526                       DEC     VALCNT                  ;ALL OUTPUT VALUES USED
8018 054356 001326                              BNE     20$                     ;BRANCH IF NO
8019 054360 000304                              SWAB    R4                      ;CHANNEL NUMBER IN LOW BYTE
8020 054362 005204                              INC     R4                      ;NEXT CHANNEL NUMBER
8021 054364 022704 000004                       CMP     #4,R4                   ;ALL 4 CHANNELS DONE
8022 054370 001402                              BEQ     EXQV16                  ;EXIT IF YES
8023 054372 000137 053760                       JMP     10$                     ;BRANCH IF NO
8024 054376                             EXQV16: EXIT    TST
     054376 104457                                                                      TRAP    C$ERSOFT
     054400 002134                                                                      .WORD   E10005 .
```

TEST 16: ANALOGUE OUTPUT TEST - FIELD AND MANUFACURING TEST

```
8025
8026 054402  000000                    ANS161: .WORD   0                       ;TEMPORART STORE
8027 054404  000000                    ANS164: .WORD   0                       ;STORE FOR VOLTAGE OR CURRENT ANSWER
8028
8029 054406  000000  000002  000620  VOLOUT: .WORD   0,2,400.                 ;OUTPUT VALUE + DIFFERENTS FROM THAT
8030 054414  004000  000002  000620          .WORD   4000,2,400.              ;... (= +/- 1LSB DIFFERENCE)
8031 054422  007777  000002  000620          .WORD   7777,2,400.              ;...
8032
8033 054430  000000  000011  001130  CUROUT: .WORD   0,9.,600.,4,600.         ;OUT VALUE+DIFFERENTS+500 OHM DIFF.
     054436  000004  001130
8034 054442  004000  000011  001130          .WORD   4000,9.,600.,4,600.      ;...(+/- 2LSB DIFFERENCE)
     054450  000004  001130
8035 054454  007777  000011  001130          .WORD   7777,9.,600.,4,600.      ;...
     054462  000004  001130
8036
8037 054466  000000  000010  000000          .WORD   0,8.,0,4,0               ;OFFSET OUT+DIFFER.+500 OHM DIFFER.
     054474  000004  000000
8038 054500  004000  000010  000000          .WORD   4000,8.,0,4,0            ;...(+ +/- 2LSB DIFFERENCE)
     054506  000004  000000
8039 054512  007777  000010  000000          .WORD   7777,8.,0,4,0            ;...
     054520  000004  000000
8040
8041 054524  000000                    TABOFF: .WORD   0                       ;CUROUT TABLE PIONTER
8042 054526  000000                    VALCNT: .WORD   0                       ;VALUE COUNTER
8043
8044                                            .NLIST  BEX
8045 054530      045      123      062  TSHD16:: .ASCIZ  /*SO*AANALOGUE OUTPUT TEST   FIELD AND MANUFACTURING TEST*N
8046 054623      045      101      124  TM16:   .ASCIZ  /*ATEST DISABLED - NO MANUAL INTERVENTION ALLOWED (UAM FLAG SET)*N/
8047
8048 054725      045      116      045  PME161: .ASCIZ  /*N*ACOMPARE THE PRINTED VALUE WITH THE VALUE ON THE DVM*N/
8049 055017      012      015      012  MES165:: .ASCIZ  <12><15><12><15>/IS VALUE ON DVM IN RANGE /
8050 055055      045      116      045  PME162: .ASCIZ  /*N*ACONNECT YOUR DVM TO THE CURRENT OUTPUT AT CHANNEL *02*N/
8051 055151      045      101      124  PME165: .ASCIZ  /*ATO MEASURE THE 20000 UA RANGE*N/
8052 055213      045      101      050  PME16A: .ASCIZ  /*A(OR THE 10000 MV RANGE IF YOU USE A 500 OHM RESISTOR)*N/
8053 055305      124      131      120  MES162: .ASCIZ  /TYPE CARRIAGE RETURN TO CONTINUE/
8054 055346      045      116      045  PME163: .ASCIZ  /*N*ACONNECT YOUR DVM TO THE VOLTAGES OUTPUT AT CHANNEL *02/
8055 055441      101      116      104  MES163: .ASCIZ  /AND ADJUST IT TO MEASURE THE 0   10000 MV RANGE/
8056 055521      101      122      105  MES164: .ASCIZ  /ARE THE ANALOGUE OUTPUTS FOR CURRENT CALIBRATED ?/
8057 055603      045      116      045  PME164: .ASCIZ  /*N*A-  *05*A,*23*A MILLIVOLTS ON 500 OHM RESISTER /
8058 055666      045      116      045  PME166: .ASCIZ  /*N*ATHIS TEST WILL ONLY RUN CORRECTLY IF THE MODULE IS*N/
8059 055757      045      101      103  PME167: .ASCIZ  /*ACALIBRATED (USE TEST 23)*N*N/
8060
8061 056016      117      120      114  E1601:  .ASCII  /OPL BIT IN CSA NOT SET/<12><15>
8062 056046      115      101      113          .ASCIZ  /MAKE SURE THAT NOTHING IS CONNECTED TO CURRENT OUTPUT/
8063 056134      117      120      114  E1602:  .ASCII  /OPL BIT IN CSA NOT CLEARED/<12><15>
8064 056170      111      123      040          .ASCIZ  /IS DVM CONNECTED TO THE ADDRESSED CHANNEL ?/
8065 056244      122      105      101  E1603:  .ASCIZ  /READY BIT IN CSA NOT SET AFTER LOADING DAT REGISTER (TIMEOUT)
8066 056342      103      123      101  E1604:  .ASCIZ  /CSA CONTENTS INCORRECT/
8067 056371      115      117      104  E1608:  .ASCIZ  /MODULE DEFECT OR INCORRECTLY CALIBRATED   TRY TEST 23
8068
8069 056457      045      101      040  PLMI:   .ASCIZ  \*A TOLERANCE +/-\
8070 056501      045      101      040  OUT1:   .ASCIZ  /*A MICROAMPS/
8071 056516      045      101      040  OUT2:   .ASCIZ  /*A MILLIVOLTS/
8072                                            LIST    BEX
8073                                            .EVEN
8074 056534                             ENDTST
     056534                                                        [100%1:
```

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TEST 16: ANALOGUE OUTPUT TEST - FIELD AND MANUFACURING TEST

056534 104401

TRAP C$ELIST

SEQ 0204

TEST 17: DIGITAL INPUT TEST - USING FIELD TEST CONNECTOR.

```
 8076                                   .SBTTL  TEST 17: DIGITAL INPUT TEST -  USING FIELD TEST CONNECTOR.
 8077                                   ;******************************************************************************
 8078                                   ;       TEST 17 - DIGITAL INPUT TEST.
 8079                                   ;
 8080                                   ;FIRST OF ALL, THE USER IS PROMPTED TO INSERT THE TEST CONNECTOR INTO THE
 8081                                   ;MODULE ON WHICH THE LED IS FLASHING. THEN A CHECK IS MADE THAT THE INPUT
 8082                                   ;DATA MATCHES THE ODD PATTERNS AVAILABLE FROM THE CONNECTOR. AFTER THIS,
 8083                                   ;THE USER IS ASKED TO SWITCH THE CONNECTOR TO THE EVEN POSITION AND THE
 8084                                   ;DATA IS CHECKED TO BE CORRECT. THE PROGRAM THEN PROMPTS THE USER TO MOVE
 8085                                   ;THE SWITCH "ON" AND "OFF" TWICE MORE. THIS CHECKS THAT THE CSA INTERRUPT
 8086                                   ;BIT IR15 CAN BE SET TO CAUSE AN INTERRUPT BY THE LEADING OR TRAILING
 8087                                   ;EDGES OF THE MODULE DATA LINE 15, AND THAT IR15 OF THE CSA REMAINS SET
 8088                                   ;AFTER THE DATA LINE 15 HAS REVERTED TO ITS ORIGINAL STATE.
 8089                                   ;
 8090                                   ;IF 'UAM' FLAG IS SET, THIS TEST WILL NOT BE CARRIED OUT.
 8091                                   ;
 8092                                   ;THIS TEST IS CARRIED OUT IN LOW LEVEL MODE.
 8093                                   ;******************************************************************************
 8094 056536                            BGNTST
      056536                                                                                  T17::
 8095 056536  004737  011714            CALL    SELECT                  ;CALL SELECT ROUTINE
 8096 056542  001001                    .WORD   1001                    ;GIVE TEST PARAMETER
 8097 056544  057454                    TSHD17                          ;GIVE TEST HEADER ADDRESS
 8098 056546  103002                    BCC     10$                     ;IF CARRY IS SET, EXIT TEST
 8099 056550                            EXIT    TST                     ;EXIT TEST
      056550  104430                                                                          TRAP    C$EXIT
      056552  002314                                                                          .WORD   L10052
 8100 056554                            10$:    MANUAL                  ;IS MANUAL INTERVENTION ALLOWED?
      056554  104450                                                                          TRAP    C$MANI
 8101 056556                            BCOMPLETE 20$                   ;IF YES, BRANCH (UAM FLAG NOT SET)
      056556  103416                                                                          BCS     20$
 8102 056560                            RFLAGS  R0                      ;READ OPERATOR FLAGS INTO R0
      056560  104421                                                                          TRAP    C$RFLA
 8103 056562  032700  001000            BIT     #PNT,R0                 ;PRINT MESSAGES ?
 8104 056566  001410                    BEQ     3$                      ;IF NO, EXIT
 8105 056570                            PRINTF  #TM17                   ;IF YES PRINT TEST DISABLED
      056570  012746  057544                                                                  MOV     #TM17,-(SP)
      056574  012746  000001                                                                  MOV     #1,-(SP)
      056600  010600                                                                          MOV     SP,R0
      056602  104417                                                                          TRAP    C$PNTF
      056604  062706  000004                                                                  ADD     #4,SP
 8106 056610                            3$:     EXIT    TST             ;IF NO, EXIT TEST
      056610  104430                                                                          TRAP    C$EXIT
      056612  002254                                                                          .WORD   L10052
 8107 056614  052777  000010  125056    20$:    BIS     #10,@MOD        ;SELECT LOW LEVEL RANGE
 8108 056622                            30$:    PRINTF  #WME171         ;ASK FOR TEST CONNECTOR
      056622  012746  057646                                                                  MOV     #WME171,-(SP)
      056626  012746  000001                                                                  MOV     #1,-(SP)
      056632  010600                                                                          MOV     SP,R0
      056634  104417                                                                          TRAP    C$PNTF
      056636  062706  000004                                                                  ADD     #4,SP
 8109 056642                            PRINTF  #WME172                 ;ASK FOR TEST CONNECTOR
      056642  012746  057747                                                                  MOV     #WME172,-(SP)
      056646  012746  000001                                                                  MOV     #1,-(SP)
      056652  010600                                                                          MOV     SP,R0
      056654  104417                                                                          TRAP    C$PNTF
      056656  062706  000004                                                                  ADD     #4,SP
```

TEST 17: DIGITAL INPUT TEST - USING FIELD TEST CONNECTOR.

```
 8110 056662  004737  016576                 CALL    FLASH                ;CALL FLASHING LED ROUTINE
 8111 056666  005737  017000                 TST     FLSANS               ;WAS THE ANSWER NO?
 8112 056672  001753                         BEQ     30$                  ;ASK AGAIN IF ANSWER WAS NO
 8113 056674  005037  004144                 CLR     ITRCNT               ;CLEAR ITERATION COUNTER
 8114 056700                                 SETVEC  VEC,#INTSR,#PRI07    ;SET UP VECTOR AND SERVICE ROUT.
      056700  012746  000340                                               MOV     #PRI07,-(SP)
      056704  012746  017276                                               MOV     #INTSR,-(SP)
      056710  013746  003710                                               MOV     VEC,-(SP)
      056714  012746  000003                                               MOV     #3,-(SP)
      056720  104437                                                       TRAP    C$SVEC
      056722  062706  000010                                               ADD     #10,SP
 8115 056726  005001                 ITRA17: CLR     R1                   ;CLEAR TEMPORARY STORE
 8116 056730                                 BGNSEG
      056730  104404                                                       TRAP    C$BSEG
 8117 056732  005037  004150                 CLR     INTFLA               ;CLEAR INTERRUPT FLAG
 8118 056736  017737  124740  004064         MOV     @DAT,BAD             ;READ INPUT
 8119 056744  022737  125252  004064         CMP     #125252,BAD          ;IS ODD PATTERN FOUND ?
 8120 056752  004737  012146                 CALL    INSERT               ;SKIP BRANCH IF "SFI" IS SET
 8121 056756  001407                         BEQ     10$                  ;IF YES BRANCH
 8122 056760  012737  125252  004062         MOV     #125252,GOOD         ;SET UP DATA FOR ERROR HANDLER
 8123 056766                                 ERRSOFT 1701,E1701,EER2      ;ERROR HANDLER
      056766  104457                                                       TRAP    C$ERSOFT
      056770  005245                                                       .WORD   1701
      056772  060356                                                       .WORD   E1701
      056774  007400                                                       .WORD   EER2
 8124 056776                         10$:    CKLOOP
      056776  104406                                                       TRAP    C$CLP1
 8125 057000                         20$:    GMANIL  MES171,ANS,-1,NO     ;PROMPT FOR EVEN PATTERN
      057000  104443                                                       TRAP    C$GMAN
      057002  000404                                                       BR      10001$
      057004  004142                                                       .WORD   ANS
      057006  000120                                                       .WORD   T$CODE
      057010  060035                                                       .WORD   MES171
      057012  177777                                                       .WORD   -1
      057014                                                       10001$:
 8126 057014  005737  004142                 TST     ANS                  ;CHECK THE ANSWER
 8127 057020  001767                         BEQ     20$                  ;IF ANSWER WAS NO, ASK AGAIN
 8128 057022  017737  124654  004064         MOV     @DAT,BAD             ;READ INPUT
 8129 057030  022737  052525  004064         CMP     #52525,BAD           ;EVEN PATTERN FOUND
 8130 057036  004737  012146                 CALL    INSERT               ;SKIP BRANCH IF "SFI" IS SET
 8131 057042  001407                         BEQ     30$                  ;IF YES, BRANCH
 8132 057044  012737  052525  004062         MOV     #52525,GOOD          ;SET UP DATA FOR ERROR HANDLER
 8133 057052                                 ERRSOFT 1702,E1702,EER2      ;ERROR HANDLER
      057052  104457                                                       TRAP    C$ERSOFT
      057054  003246                                                       .WORD   1702
      057056  060447                                                       .WORD   E1702
      057060  007400                                                       .WORD   EER2
 8134 057062                         30$:    CKLOOP                       ;
      057062  104406                                                       TRAP    C$CLP1
 8135 057064  012777  040000  124612         MOV     #40000,@CSA          ;SET IE IN CSA REGISTER
 8136 057072  052777  020000  124604         BIS     #20000,@CSA          ;SET FLE IN CSA REGISTER
 8137 057100                                 SETPRI  #PRI00               ;ENABLE INTERRUPT
      057100  012700  000000                                               MOV     #PRI00,R0
      057104  104441                                                       TRAP    C$SPRI
 8138 057106                         40$:    GMANIL  MES172,ANS,-1,NO     ;ASK ODD POSITION
      057106  104443                                                       TRAP    C$GMAN
      057110  000404                                                       BR      10002$
```

TEST 17: DIGITAL INPUT TEST - USING FIELD TEST CONNECTOR.

```
        057112  004142                                                          .WORD   ANS
        057114  000120                                                          .WORD   T$CODE
        057116  060136                                                          .WORD   MES172
        057120  177777                                                          .WORD   -1
        057122                                                              10002$:
  8139  057122  005737  004142                  TST     ANS                   ;CHECK THE ANSWER
  8140  057126  001767                          BEQ     40$                   ;IF ANSWER WAS NO, ASK AGAIN
  8141  057130  005737  004150                  TST     INTFLA                ;WAS THERE AN INTERRUPT AT LEAD.?
  8142  057134  004737  012146                  CALL    INSERT                ;SKIP BRANCH IF "SFI" IS SET
  8143  057140  001004                          BNE     50$                   ;BRANCH IF YES
  8144  057142                                  ERRSOFT 1703,E1703,EER3       ;ERROR HANDLER
        057142  104457                                                          TRAP    C$ERSOFT
        057144  003247                                                          .WORD   1703
        057146  060537                                                          .WORD   E1703
        057150  007442                                                          .WORD   EER3
  8145  057152                          50$:    CKLOOP                        
        057152  104406                                                          TRAP    C$CLP1
  8146  057154  017737  124524  004064          MOV     @CSA,BAD              ;GET CSRA CONTENTS
  8147  057162  022737  160000  004064          CMP     #160000,BAD           ;IS IR15,EI AND ELE15 IN CSRA SET
  8148  057170  004737  012146                  CALL    INSERT                ;SKIP BRANCH IF "SFI" IS SET
  8149  057174  001407                          BEQ     60$                   ;BRANCH IF YES
  8150  057176  012737  160000  004062          MOV     #160000,GOOD          ;SET UP DATA FOR ERROR HANDLER
  8151  057204                                  ERRSOFT 1704,E1704,EER2       ;ERROR HANDLER
        057204  104457                                                          TRAP    C$ERSOFT
        057206  003250                                                          .WORD   1704
        057210  060614                                                          .WORD   E1704
        057212  007400                                                          .WORD   EER2
  8152  057214                          60$:    ENDSEG                        
        057214                                                              10000$:
        057214  104405                                                          TRAP    C$ESEG
  8153  057216                                  BGNSEG                        
        057216  104404                                                          TRAP    C$BSEG
  8154  057220  012777  050000  124456          MOV     #50000,@CSA           ;LOAD EI AND ETE15 INTO CSRA
  8155  057226  052777  100000  124450          BIS     #100000,@CSA          ;CLEAR IR BIT IN CSA REGISTER
  8156  057234  005037  004150                  CLR     INTFLA                ;CLEAR INTERRUPT FLAG
  8157  057240                          70$:    GMANIL  MES173,ANS,-1,NO      ;ASK FOR EVEN MESSAGES
        057240  104443                                                          TRAP    C$GMAN
        057242  000404                                                          BR      10004$
        057244  004142                                                          .WORD   ANS
        057246  000120                                                          .WORD   T$CODE
        057250  060247                                                          .WORD   MES173
        057252  177777                                                          .WORD   -1
        057254                                                              10004$:
  8158  057254  005737  004142                  TST     ANS                   ;CHECK THE ANSWER
  8159  057260  001767                          BEQ     70$                   ;IF ANSWER WAS NO, ASK AGAIN
  8160  057262  005737  004150                  TST     INTFLA                ;WAS THERE AN INTERRUPT AT TRAI.?
  8161  057266  004737  012146                  CALL    INSERT                ;SKIP BRANCH IF "SFI" IS SET
  8162  057272  001004                          BNE     80$                   ;BRANCH IF YES
  8163  057274                                  ERRSOFT 1705,E1705,EER3       ;ERROR HANDLER
        057274  104457                                                          TRAP    C$ERSOFT
        057276  003251                                                          .WORD   1705
        057300  060714                                                          .WORD   E1705
        057302  007442                                                          .WORD   EER3
  8164  057304                          80$:    CKLOOP                        
        057304  104406                                                          TRAP    C$CLP1
  8165  057306  017737  124456  004064          MOV     @CSA,BAD              ;GET CSRA CONTENTS
  8166  057314  022737  150000  004064          CMP     #150000,BAD           ;IS IR15,EI AND ETE15 STILL SET
```

USER DOCUMENTATION

....B1 ....B2 ....B3 ....B4 ....B5 ....B6 ....B7 ....B8 ....B9 ....B10 ....B11 ....B12 ....B13 ....B14 ....B15 ....B16

....C1 ....C2 ....C3 ....C4 ....C5 ....C6 ....C7 ....C8 ....C9 ....C10 ....C11 ....C12 ....C13 ....C14 ....C15 ....C16

....D1 ....D2 ....D3 ....D4 ....D5 ....D6 ....D7 ....D8 ....D9 ....D10 ....D11 ....D12 ....D13 ....D14 ....D15 ....D16

....E1 ....E2 ....E3 ....E4 ....E5 ....E6 ....E7 ....E8 ....E9 ....E10 ....E11 ....E12 ....E13 ....E14 ....E15 ....E16

....F1 ....F2 ....F3 ....F4 ....F5 ....F6 ....F7 ....F8 ....F9 ....F10 ....F11 ....F12 ....F13 ....F14 ....F15 ....F16

....G1 ....G2 ....G3 ....G4 ....G5 ....G6 ....G7 ....G8 ....G9 ....G10 ....G11 ....G12 ....G13 ....G14 ....G15 ....G16

....H1 ....H2 ....H3 ....H4 ....H5 ....H6 ....H7 ....H8 ....H9 ....H10 ....H11 ....H12 ....H13 ....H14 ....H15 ....H16

....I1 ....I2 ....I3 ....I4 ....I5 ....I6 ....I7 ....I8 ....I9 ....I10 ....I11 ....I12 ....I13 ....I14 ....I15 ....I16

....J1 ....J2 ....J3 ....J4 ....J5 ....J6 ....J7 ....J8 ....J9 ....J10 ....J11 ....J12 ....J13 ....J14 ....J15 ....J16

....K1 ....K2 ....K3 ....K4 ....K5 ....K6 ....K7 ....K8 ....K9 ....K10 ....K11 ....K12 ....K13 ....K14 ....K15 ....K16

....L1 ....L2 ....L3 ....L4 ....L5 ....L6 ....L7 ....L8 ....L9 ....L10 ....L11 ....L12 ....L13 ....L14 ....L15 ....L16

....M1 ....M2 ....M3 ....M4 ....M5 ....M6 ....M7 ....M8 ....M9 ....M10 ....M11 ....M12 ....M13 ....M14 ....M15 ....M16

....N1 ....N2 ....N3 ....N4 ....N5 ....N6 ....N7 ....N8 ....N9 ....N10 ....N11 ....N12 ....N13 ....N14 ....N15

TEST 17: DIGITAL INPUT TEST - USING FIELD TEST CONNECTOR.

```
8167 057322  004737  012146                CALL    INSERT                  ;SKIP BRANCH IF "SFI" IS SET
8168 057326  001407                        BEQ     90$                     ;BRANCH IF YES
8169 057330  012737  150000  004062        MOV     #150000,GOOD            ;SET UP DATA FOR ERROR HANDLER
8170 057336                                ERRSOFT 1706,E1704,EER2         ;ERROR HANDLER
     057336  104457                                                        TRAP    C$ERSOFT
     057340  003252                                                        .WORD   1706
     057342  060614                                                        .WORD   E1704
     057344  007400                                                        .WORD   EER2
8171 057346                        90$:    CKLOOP
     057346  104406                                                        TRAP    C$CLP1
8172 057350                                GMANIL  MES172,ANS,-1,NO        ;ASK ODD POSITION
     057350  104443                                                        TRAP    C$GMAN
     057352  000404                                                        BR      10005$
     057354  004142                                                        .WORD   ANS
     057356  000120                                                        .WORD   T$CODE
     057360  060136                                                        .WORD   MES172
     057362  177777                                                        .WORD   -1
     057364                                                          10005$:
8173 057364  005737  004142                TST     ANS                     ;CHECK THE ANSWER
8174 057370  001764                        BEQ     90$                     ;IF ANSWER WAS NO, ASK AGAIN
8175 057372  017737  124306  004064        MOV     @CSA,BAD                ;GET CSRA CONTENTS
8176 057400  022737  150000  004064        CMP     #150000,BAD             ;IS IR15,EI AND ETE15 STILL SET
8177 057406  004737  012146                CALL    INSERT                  ;SKIP BRANCH IF "SFI" IS SET
8178 057412  001407                        BEQ     100$                    ;BRANCH IF YES
8179 057414  012737  150000  004062        MOV     #150000,GOOD            ;SET UP DATA FOR ERROR HANDLER
8180 057422                                ERRSOFT 1707,E1707,EER2         ;ERROR HANDLER
     057422  104457                                                        TRAP    C$ERSOFT
     057424  003253                                                        .WORD   1707
     057426  060722                                                        .WORD   E1707
     057430  007400                                                        .WORD   EER2
8181 057432                        100$:   ENDSEG
     057432                                                         10003$:
     057432  104405                                                        TRAP    C$ESEG
8182 057434                                SETPRI  #PRI07                  ;DISABLE INTERRUPTS
     057434  012700  000340                                                MOV     #PRI07,R0
     057440  104441                                                        TRAP    C$SPRI
8183 057442                                CLRVEC  VEC                     ;RESTORE INTERRUPT VECTOR
     057442  013700  003710                                                MOV     VEC,R0
     057446  104436                                                        TRAP    C$CVEC
8184 057450                        EXQV17: EXIT    TST
     057450  104432                                                        TRAP    C$EXIT
     057452  001414                                                        .WORD   L10052 .
8185                                       .NLIST  BEX
8186 057454      045      123      062  TSH017::.ASCIZ  <45><45>ADIGITAL INPUT TEST  USING FIELD TEST CONNECTOR.<N>
8187 057544      045      101      124  TM17:  .ASCIZ  <45>ATEST DISABLED  NO MANUAL INTERVENTION ALLOWED (OAM FLAG SET)<N>
8188
8189 057646      045      116      045  WME17A: .ASCIZ <N><45>AIS THE DIGITAL TEST CONNECTOR SWITCHED TO THE ODD POSITION<N>
8190 057747      045      101      101  WME17B: .ASCIZ  /<45>AAND PLUGGED INTO THE BOARD WITH THE FLASHING LED ?
8191 060055      115      117      126  ME171:  .ASCII  /MOVE THE SWITCH TO THE EVEN POSITION<12><15>
8192 060103      124      131      120          .ASCIZ  /TYPE Y AND THEN CR IF DONE
8193 060156      116      117      127  ME172:  .ASCII  /NOW MOVE THE SWITCH BACK TO THE ODD POSITION <12><15>
8194 060214      124      131      120          .ASCIZ  /TYPE Y AND THEN CR IF DONE
8195 060247      115      117      126  ME173:  .ASCII  /MOVE THE SWITCH TO THE EVEN POSITION AGAIN<12><15>
8196 060323      124      131      120          .ASCIZ  /TYPE Y AND THEN CR IF DONE
8197 060356      104      101      124  E1701:  .ASCIZ  /DATA REGISTER OF DIGITAL INPUT NOT LOADED WITH EVEN DATA
8198 060441      104      101      124  E1702:  .ASCIZ  /DATA REGISTER OF DIGITAL INPUT NOT LOADED WITH ODD DATA
8199 060537      116      117      040  E1703:  .ASCIZ  /NO INTERRUPT ON LEADING EDGE OF DATA LINE 15
```

TEST 17: DIGITAL INPUT TEST USING FIELD TEST CONNECTOR.

```
 8200 060614      103     123     101  E1704:  .ASCII  /CSA REGISTER OF DIGITAL INPUT MODULE INCORRECT/<12><15>
 8201 060674      101     106     124          .ASCII  /AFTER INTERRUPT/
 8202 060714      116     117     040  E1705:  .ASCII  /NO INTERRUPT ON TRAILING EDGE OF DATA LINE 15/
 8203 060772      103     123     101  E1707:  .ASCII  /CSA DATA BIT IR15 IS NOT CORRECT - CLEARED BY DATA LINE 15/
 8204                                          .LIST   BEX
 8205                                          .EVEN
 8206 061066                                   ENDTST
      061066                                                                  L10052:
      061066  104401                                                                    TRAP    C$ETST
```

TEST 18: DIGITAL OUTPUT TEST USING FIELD TEST CONNECTOR.

```
                                        .SBTTL  TEST 18: DIGITAL OUTPUT TEST  USING FIELD TEST CONNECTOR.
                                        ;*****************************************************************************
                                        ;       TEST 18  DIGITAL OUTPUT TEST.
                                        ;
                                        ;THE USER IS PROMPTED TO INSERT THE DIGITAL TEST CONNECTOR INTO THE MODULE
                                        ;ON WHICH THE LED IS FLASHING. THEN HE IS PROMPTED TO CHECK THAT A SLIDING
                                        ;ONES PATTERN APPEARS ON THE TEST CONNECTOR LEDS. AFTER 15 SECONDS THE PROGRAM
                                        ;PROMPTS THE USER TO LOOK FOR A SLIDING ZEROS PATTERN, WHICH IS OUTPUT FOR
                                        ;15 SECONDS BEFORE TERMINATING THE TEST. THIS CHECKS THAT ALL OUTPUT LINES
                                        ;CAN BE UNIQUELY SET AND CLEARED.
                                        ;
                                        ;IF THE 'QUAM' FLAG IS SET, THIS TEST WILL NOT BE CARRIED OUT.
                                        ;*****************************************************************************
                                                BGNTST
                                                                                        T18::
061070                                  CALL    SELECT          ;CALL SELECT ROUTINE
061074  001002                          .WORD   100.            ;GIVE TEST PARAMETER (FIELD/CO)
061076  061434                          T$HD18                  ;GIVE TEST HEADER
061100  103546                          BCS     EXQV18          ;IF CARRY IS SET, EXIT TEST
061102                                  MANUAL                  ;IS MANUAL INTERVENTION ALLOWED?
061102  104450                                                                  TRAP    C$MANI
061104                                  BCOMPLETE 10$           ;IF YES BRANCH (QUAM FLAG NOT SET)
061104  103416                                                                  BCS     10$
061106                                  RFLAGS  R0              ;READ OPERATOR FLAGS INTO R0
061106  104421                                                                  TRAP    C$RFLA
061110  032700  001000                  BIT     #PNT,R0         ;PRINT MESSAGES ?
061114  001410                          BEQ     3$              ;IF NO, EXIT
061116                                  PRINTF  #TM18           ;IF YES PRINT TEST DISABLED
061116  012746  061515                                                          MOV     #TM18,-(SP)
061122  012746  000001                                                          MOV     #1,-(SP)
061126  010600                                                                  MOV     SP,R0
061130  104417                                                                  TRAP    C$PNTF
061132  062706  000004                                                          ADD     #4,SP
061136                          3$:     EXIT    TST             ;EXIT TEST
061136  104432                                                                  TRAP    C$EXIT
061140  000762                                                                  .WORD   L10055-.
061142  005737  004130          10$:    TST     LOOPFLG         ;IS LOOP ON TEST FLAG SET ?
061146  001007                          BNE     50$             ;IF NO, BRANCH
061150  005337  004130                  DEC     LOOPFLG         ;IF YES, DECREMENT IT
061154                          20$:    PRINTF  #WME181         ;ASK FOR TEST CONNECTOR
061154  012746  061611                                                          MOV     #WME181,-(SP)
061160  012746  000001                                                          MOV     #1,-(SP)
061164  010600                                                                  MOV     SP,R0
061166  104417                                                                  TRAP    C$PNTF
061170  062706  000004                                                          ADD     #4,SP
061174                                  PRINTF  #WME184         ;...
061174  012746  061711                                                          MOV     #WME184,-(SP)
061200  012746  000001                                                          MOV     #1,-(SP)
061204  010600                                                                  MOV     SP,R0
061206  104417                                                                  TRAP    C$PNTF
061210  062706  000004                                                          ADD     #4,SP
061214  004737  016576                  CALL    FLASH           ;CALL FLASHING LED ROUTINE
061220  005737  017000                  TST     FLAG            ;IF THE ANSWER IS NO
061224  001757                          BEQ     20$             ;BRANCH BACK AND ASK AGAIN
061226  005037  004144          40$:    CLR     ITRCNT          ;CLEAR ITERRATION COUNTER
061232  005037  004132          ITRA18: CLR     SLIDE           ;CLEAR FLAG
061236                                  PRINTF  #WME185         ;PRINT SLIDING ONE MESSAGE
```

TEST 18: DIGITAL OUTPUT TEST USING FIELD TEST CONNECTOR.

```
                061236  012746  061744                                                          MOV     #WME182,-(SP)
                061242  012746  000001                                                          MOV     #1,-(SP)
                061246  010600                                                                  MOV     SP,R0
                061250  104414                                                                  TRAP    C$PNTB
                061252  062706  000004                                                          ADD     #4,SP
8244            061256  012704  000001          MOV     #1,R4           ;MASK FOR SLIDING ONES
8245            061262  012702  000120    10$:  MOV     #80.,R2         ;LOAD COUNTER WITH 5 CYLES
8246            061266  010477  122410    20$:  MOV     R4,@DAT         ;PUT DATA TO OUTPUT
8247            061272  012703  000012          MOV     #10.,R3         ;LOAD WAIT COUNTER
8248            061276  004737  011506    30$:  JSR     PC,WT25M        ;WAIT FOR 25 MS
8249            061302  005303                  DEC     R3              ;DECREMENT WAIT COUNTER
8250            061304  001374                  BNE     30$             ;IF NO, BRANCH
8251            061306  006104                  ROL     R4              ;NEXT DATA
8252            061310  005504                  ADC     R4              ;ADD CARRY IF SET
8253            061312                          BREAK                   ;OPERATER INTERR. ENB.
                061312  104420                                                                  TRAP    C$BRK
8254            061314  005702                  TST     R2              ;IS COUNTER ZERO ?
8255            061316  001402                  BEQ     40$             ;BRANCH IF YES
8256            061320  005302                  DEC     R2              ;DECREMENT COUNTER
8257            061322  000761                  BR      20$             ;OUTPUT SLIDING ONES
8258            061324  005737  061422  40$:    TST     SLZERO          ;TEST PATTERN FLAG
8259            061330  001016                  BNE     50$             ;IF SET, BRANCH
8260            061332  012737  000001  061422  MOV     #1,SLZERO       ;OTHERWISE SET IT
8261            061340                          PRINTB  #WME183         ;PRINT SLIDING ZERO MESSAGES
                061340  012746  062030                                                          MOV     #WME183,-(SP)
                061344  012746  000001                                                          MOV     #1,-(SP)
                061350  010600                                                                  MOV     SP,R0
                061352  104414                                                                  TRAP    C$PNTB
                061354  062706  000004                                                          ADD     #4,SP
8262            061360  012704  177776          MOV     #177776,R4      ;MASK FOR SLIDING ZEROS
8263            061364  000736                  BR      10$             ;GO TO SEND ROUTINE
8264            061366  005077  122310    50$:  CLR     @DAT            ;CLEAR DATA REGISTER (LED'S OFF)
8265            061372  005737  002240          TST     QVP             ;IS QUICK VERIFY PASS SELECTED?
8266            061376  001007                  BNE     EXQV18          ;IF YES, EXIT TEST
8267            061400  005237  004144          INC     ITRCNT          ;ITERATION COUNTER + 1
8268            061404  023737  004146  004144  CMP     ITRDEF,ITRCNT   ;DEFAULT ITERATION EXECUTED
8269            061412  001401                  BEQ     EXQV18          ;IF YES, EXIT TEST
8270            061414  000706                  BR      ITRA18          ;IF NO, TEST ITERATION
8271            061416                  EXQV18: EXIT    TST             ;EXIT TEST
                061416  104432                                                                  TRAP    C$EXIT
                061420  000502                                                                  .WORD   L10053-.
8272
8273            061422  000000          SLZERO: .WORD   0
8274
8275                                            .NLIST  BEX
8276            061424      045     103     062     TSH018::.ASCIZ  /%S/%%DIGITAL OUTPUT TEST - USING FIELD TEST CONNECTOR.%%N/
8277            061515      045     101     124     TM18:   .ASCIZ  /%ATEST DISABLED   NO MANUAL INTERVENTION ALLOWED (QUAM FLAG SET)%%N/
8278
8279            061617      045     116     045     WME181: .ASCIZ  /%%N%%ARE THE DIGITAL TEST CONNECTOR PLUGGED INTO THE BOARD%%N/
8280            061713      045     101     124     WME184: .ASCIZ  /%%AWITH THE FLASHING LED'S/
8281            061744      045     116     045     WME182: .ASCIZ  /%%N%%ACHECK FOR SLIDING ONES ON THE TEST CONNECTOR.%%N/
8282            062030      045     116     045     WME183: .ASCIZ  /%%N%%ANOW CHECK FOR SLIDING ZEROS ON THE TEST CONNECTOR.%%N/
8283                                            .LIST   BEX
8284                                            .EVEN
8285            062120                          ENDTST                                  L10053:
                062122  104401                                                                  TRAP    C$ETST
```

TEST 18: DIGITAL OUTPUT TEST - USING FIELD TEST CONNECTOR.

8,29,?

SEQ 0213

TEST 18: DIGITAL OUTPUT TEST - USING FIELD TEST CONNECTOR.

```
8500 06:1,24                                        ENDMOD
8500
```

TEST 18: DIGITAL OUTPUT TEST - USING FIELD TEST CONNECTOR.

```
                                        .TITLE HARDWARE TESTS
                                
                                        BGNMOD
                                SBTTL   TEST 19: DIGITAL INPUT TEST - SPECIFICALLY SELECTABLE
                                ;*****************************************************************************
                                ;       TEST 19 - DIGITAL INPUT TEST - SPECIFICALLY SELECTABLE
                                ;
                                ;       THIS TEST CONTINOUSLY READS THE INPUT LINES AND PRINTS THE DATA
                                ;       TO THE CONSOLE.
                                ;
                                ;       THE USER IS ASKED WHICH INPUT RANGE (LOW LEVEL OR NORMAL) AND IF
                                ;       NORMAL IS SELECTED, WHICH DEBOUNCE PERIOD TO USE. THEN THE INPUT
                                ;       LINES OF THE MODULE ARE CONTINUOUSLY READ AND, IF THE SUPERVISOR
                                ;       FLAG "INHIBIT ERROR REPORT" IS NOT SET, THE BIT PATTERN IS
                                ;       OUTPUT TO THE CONSOLE. BY USING DIFFERENT INPUT VOLTAGES, THIS
                                ;       TEST CAN BE USED TO CHECK THE SWITCHING LEVELS. THIS TEST IS A
                                ;       VISUAL TEST. AN ERROR REPORT IS ONLY MADE IF THE LLS AND RT BITS
                                ;       IN THE MOD REGISTER CAN'T CLEAR OR SET. THE INTERRUPT FUNCTION
                                ;       OF THE MODULE IS NOT TESTED. TO ABORT THE TEST, THE USER MUST
                                ;       TYPE "CNTL C".
                                ;
                                ;*****************************************************************************
8376 062124                             BGNTST  19.
     062124                                                                     T19::
8377 062124  004737  011714                CALL    SELECT                  ;CALL SELECT ROUTINE
8378 062130  010001                        .WORD   10001                   ;GIVE TEST PARAMETER (SPEC/D1)
8379 062132  062450                        T$HD19                          ;GIVE TEST HEADER
8380 062134  103002                        BCC     ITRA19                  ;IF CARRY IS SET, EXIT TEST
8381 062136                                EXIT    TST                     ;EXIT TEST
     062136  104432                                                                     TRAP    C$EXIT
     062140  001112                                                                     .WORD   L10054-.
8382 062142                        ITRA19: GMANIL  MMES1,ANS, 1,NO ;ASK FOR LEVEL
     062142  104443                                                                     TRAP    C$GMAN
     062144  000404                                                                     BR      10000$
     062146  004142                                                                     .WORD   ANS
     062150  000120                                                                     .WORD   T$CODE
     062152  063020                                                                     .WORD   MMES1
     062154  177777                                                                     .WORD   1
     062156                                                                     10000$:
8383 062156  005737  004142                TST     ANS                     ;IS LOW LEVEL SELECTED?
8384 062162  001003                        BNE     30$                     ;IF YES, DON'T ASK FOR DEBOUNCE
8385 062164  042777  000010  121506        BIC     #10,@MOD                ;CLEAR LOW LEVEL BIT IN MOD REG.
8386 062172  017737  121502  004064        MOV     @MOD,BAD                ;GET MOD REGISTER CONTENTS
8387 062200  032737  000010  004064        BIT     #10,BAD                 ;IS LOW LEVEL BIT IN MOD CLEARED?
8388 062206  004737  012146                CALL    INSERT                  ;SKIP BRANCH IF 'SEL' IS SET
8389 062212  001404                        BEQ     10$                     ;BRANCH IF YES
8390 062214                                ERRSOFT 1901,E1901,EERG         ;ERROR HANDLER
     062214  104457                                                                     TRAP    C$ERSOFT
     062216  001555                                                                     .WORD   1901
     062220  062536                                                                     .WORD   E1901
     062222  007724                                                                     .WORD   EERG
8391 062224                        10$:    CLR     SEL                     ;
     062224  104404                                                                     TRAP    C$CLSL
8392 062226                                GMANIO  MMES2,ANS1,0,-1,1,3,NO  ;ASK FOR DEBOUNCE PERIOD
     062226  104443                                                                     TRAP    C$GMAN
     062230  000404                                                                     BR      10001$
     062232  062446                                                                     .WORD   ANS1
```

TEST 19: DIGITAL INPUT TEST SPECIFICALLY SELECTABLE

```
        062254  000000                                                                          .WORD   T$CODE
        062256  063040                                                                          .WORD   MMES2
        062260  177777                                                                          .WORD   -1
        062262  000001                                                                          .WORD   T$LOLIM
        062264  000003                                                                          .WORD   T$HILIM
        062266                                                                        10001$:
8393 062266  053777  062446  177404          BIS     ANS1,@MOD       ;SET RESPONSE TIME IN MOD REG.
8394 062274  052737  000001  062446          BIT     #1,ANS1         ;IS ONLY RTO USED ?
8395 062302  001003                          BNE     20$             ;BRANCH IF NO
8396 062304  042777  000002  177406          BIC     #2,@MOD         ;IF YES, CLEAR RT1 BIT
8397 062312  117737  177402  040064  20$:    MOVB    @MOD,BAD        ;GET MOD REGISTER CONTENTS
8398 062320  123727  040064  062446          CMPB    BAD,ANS1        ;DEBOUNCE CORRECT LOADED
8399 062326  004767  012146                  CALL    INSERT          ;SKIP BRANCH IF 'SFI' IS SET
8400 062332  001455                          BEQ     40$             ;BRANCH IF YES
8401 062334  013737  062446  040062          MOV     ANS1,GOOD       ;SET UP DATA FOR ERROR HANDLER
8402 062342  052737  002000  040062          BIS     #2000,GOOD      ;...
8403 062350                                   ERRSOFT 1902,E1902,EER1 ;ERROR HANDLER
                                                                                                TRAP    C$ERSOFT
        062350  104457                                                                         .WORD   1902
        062352  003556                                                                         .WORD   E1902
        062354  062641                                                                         .WORD   EER1
        062356  007540
8404 062360  000422                           BR      40$             ;SKIP THE NEXT COMMAND LINE
8405 062362  052777  000010  121330  30$:    BIS     #10,@MOD        ;SET LOW LEVEL
8406 062370  004737  011506                  CALL    WT25M           ;WAIT 25 MS
8407 062374  017737  121320  040064          MOV     @MOD,BAD        ;GET MOD REGISTER CONTENTS
8408 062402  032737  000010  040064          BIT     #10,BAD         ;IS LOW LEVEL SELECTED
8409 062410  004767  012146                  CALL    INSERT          ;SKIP BRANCH IF 'SFI' IS SET
8410 062414  001004                          BNE     40$             ;BRANCH IF YES
8411 062416                                   ERRSOFT 1903,E1903,EERG ;ERROR HANDLER
                                                                                                TRAP    C$ERSOFT
        062416  104457                                                                         .WORD   1903
        062420  003557                                                                         .WORD   E1903
        062422  062720                                                                         .WORD   EERG
        062424  007724
8412 062426                                   CKLOOP                  ;
                                                                                                TRAP    C$CLP1
        062426  104406
8413 062430  017702  121266                  MOV     @DAT,R2         ;GET INPUT VALUE
8414 062434                                   PRINTB  #FORMAT,R2,R2   ;PRINT INPUT VALUE BIN. + OCTAL
                                                                                                MOV     R2,-(SP)
        062434  010246                                                                          MOV     R2,-(SP)
        062436  010246                                                                          MOV     #FORMAT,-(SP)
        062440  013746  063171                                                                  MOV     #3,-(SP)
        062444  013746  000003                                                                  MOV     SP,R0
        062450  010600                                                                          TRAP    C$PNTB
        062452  104414                                                                         ADD     #10,SP
        062454  062706  000010                                                          ;GO INTO THE PRINTOUT LOOP
8415 062460  000762                          BR      40$             ;EXIT TEST
8416 062462                                   EXQV19: EXIT    TST
                                                                                                TRAP    C$EXIT
        062462  104452                                                                         .WORD   C10054 .
        062464  000604
8417
8418 062466  000000                          ANS1:   .WORD   0
8419
8420                                          .NLIST  BEX
8421 062470  104  124  040  124  105  123  124  072  040  104  111  107  111  124  101  114  040  111  116  120  125  124  040  124  105  123  124  040  040  123  120  105  103  111  106  111  103  101  114  114  131  040  123  105  114  105  103  124  101  102  114  105  015  012  000  ;?DIGITAL INPUT TEST  SPECIFICALLY SELECTABLE<CR><LF><NUL>
8422 063055  114  117  127  040  114  105  126  105  114  040  102  111  124  040  111  116  040  115  117  104  040  122  105  107  111  123  124  105  122  040  117  106  040  104  111  107  111  124  101  114  040  111  116  120  125  124  040  103  117  125  114  104  040  116  117  124  040  102  105  040  123  105  114  105  103  124  105  104  000  ;?LOW LEVEL BIT IN MOD REGISTER OF DIGITAL INPUT COULD NOT BE SELECTED<NUL>
8423 063141  104  105  102  117  125  116  103  105  040  102  111  124  123  040  111  116  040  115  117  104  040  122  105  107  111  123  124  105  122  040  103  117  125  114  104  040  116  117  124  040  102  105  040  123  105  124  000  ;?DEBOUNCE BITS IN MOD REGISTER COULD NOT BE SET<NUL>
8424 063220  114  117  127  040  114  105  126  105  114  040  102  111  124  040  111  116  040  115  117  104  040  122  105  107  111  123  124  105  122  040  117  106  040  104  111  107  111  124  101  114  040  111  116  120  125  124  040  103  117  125  114  104  040  116  117  124  040  102  105  040  123  105  124  000  ;?LOW LEVEL BIT IN MOD REGISTER OF DIGITAL INPUT COULD NOT BE SET<NUL>
8425 063020  114  117  127  040  114  105  126  105  114  040  111  116  120  125  124  040  077  000  ;?LOW LEVEL INPUT ?<NUL>
```

SEQ 0216

TEST 14: DIGITAL INPUT TEST SPECIFICALLY SELECTABLE

```
 8426 063040      123      110      111  MMES2:  .ASCII  /WHICH DEBOUNCE PERIOD DO YOU WANT TO USE ? /<12><15>
 8427 063117      105      116      124          .ASCIZ  /ENTER 1 FOR 500US, 2 FOR 5MS, 3 FOR 10MS./
 8428 063171      045      116      045  FORMAT: .ASCIZ  /%N%AREAD INPUT VALUE = %B16%A  (OCTAL = %O6%A )/
 8429                                       .EVEN
 8430                                       BEX
 8431 063252                                ENDTST
      063252                                                          L10054:
      063252  104401                                                          TRAP    C$ETST
```

```
                                        .SBTTL  TEST 20: DIGITAL OUTPUT TEST - SPECIFICALLY SELECTABLE
                                        ;*****************************************************************************
                                        ;       TEST 20 - DIGITAL OUTPUT TEST - SPECIFICALLY SELECTABLE.
                                        ;
                                        ;       THE USER IS FIRST ASKED TO SELECT A PATTERN TYPE - SLIDING ONES,
                                        ;       SLIDING ZEROS, OR A PATTERN PAIR. IN THE LAST CASE, HE IS ALSO
                                        ;       ASKED TO ENTER THE DATA PAIR. THE PROGRAM THEN REQUESTS A TIME
                                        ;       INTERVAL IN MILLISECONDS (DEFAULT IS ZERO) TO WAIT BETWEEN EACH
                                        ;       PATTERN CHANGE. THE SELECTED PATTERN IS THEN OUTPUT TO THE USER
                                        ;       LINES OF THE MODULE.
                                        ;
                                        ;       AFTER LOADING THE OUTPUT, THE DATA REGISTER IS READ BACK AND AN
                                        ;       ERROR REPORTED IF THE LOADED DATA AND THE READ DATA ARE NOT THE
                                        ;       SAME. THIS IS THE ONLY ERROR REPORT IN THE TEST. ALL OTHER
                                        ;       CHECKING IS VISUAL.
                                        ;
                                        ;       TO ABORT THE TEST, "CNTL C" MUST BE TYPED.
                                        ;*****************************************************************************
                                                BGNTST
                                                                                        T20::
063254                                  CALL    SELECT                  ;CALL SELECT ROUTINE
063254  004467  011714                  .WORD   100$                    ;GIVE TEST PARAMETER (SPEC/DI)
063260  010000                          T$HD20                          ;GIVE TEST HEADER
063262  063746                          BCC     ITRA20                  ;IF CARRY IS SET EXIT TEST
063264  103000                          EXIT    TST                     ;EXIT TEST
063266                                                                          TRAP    C$EXIT
063270  001206                                                                  .WORD   L100SS
063272                          ITRA20: GMANID  MMES71,ANS2,0,-1,1,3,YES        ;GET MANUAL PARAMETER
063272  104443                                                                  TRAP    C$GMAN
063274  000406                                                                  BR      10000$
063276  063736                                                                  .WORD   ANS2
063300  000032                                                                  .WORD   T$CODE
063302  064104                                                                  .WORD   MMES71
063304  177777                                                                  .WORD   -1
063306  000001                                                                  .WORD   T$LOLIM
063310  000003                                                                  .WORD   T$HILIM
063312                                                                  10000$:
063312  022737  000003  063736          CMP     #3,ANS2                 ;IS IT A PATTERN PAIR?
063320  001410                          BEQ     10$                     ;BRANCH IF YES
063322  022737  000001  063736          CMP     #1,ANS2                 ;IS IT SLIDING ONES?
063330  001445                          BEQ     20$                     ;IF YES, BRANCH
063332  022737  000002  063736          CMP     #2,ANS2                 ;IS IT SLIDING ZEROS?
063340  001444                          BEQ     30$                     ;BRANCH IF YES
063342                          10$:    GMANID  MMES72,PIRPA,0, 1,0,177777,YES  ;GET FIRST PATTERN
063342  104443                                                                  TRAP    C$GMAN
063344  000406                                                                  BR      10001$
063346  063740                                                                  .WORD   PIRPA
063350  000032                                                                  .WORD   T$CODE
063352  064104                                                                  .WORD   MMES72
063354  177777                                                                  .WORD   -1
063356  000000                                                                  .WORD   T$LOLIM
063360  177777                                                                  .WORD   T$HILIM
063362                                                                  10001$:
063362                                  GMANID  MMES73,SECPA,0, 1,0,177777,YES  ;GET SECOND PATTERN
063362  104443                                                                  TRAP    C$GMAN
063364  000406                                                                  BR      10002$
063366  063742                                                                  .WORD   SECPA
```

TEST 20: DIGITAL OUTPUT TEST - SPECIFICALLY SELECTABLE

```
                                                                                .WORD   T$CODE
                                                                                .WORD   MMES73
                                                                                .WORD   -1
                                                                                .WORD   T$LOLIM
                                                                                .WORD   T$HILIM
                                                                        10002$:
8466 063402                             GMANID  MMES74,TIMIN,D,-1,1,5000,YES    ;GET TIME INTERVAL IN MS
                                                                                TRAP    C$GMAN
                                                                                BR      10003$
                                                                                .WORD   TIMIN
                                                                                .WORD   T$CODE
                                                                                .WORD   MMES74
                                                                                .WORD   -1
                                                                                .WORD   T$LOLIM
                                                                                .WORD   T$HILIM
                                                                        10003$:
8467 063422                             PRINTB  #WMES2                  ;PRINT MESSAGES
                                                                                MOV     #WMES2,-(SP)
                                                                                MOV     #1,(SP)
                                                                                MOV     SP,R0
                                                                                TRAP    C$PNTB
                                                                                ADD     #4,SP
8468 063442                             BR      80$                     ;SKIP SLIDING ONES+ZEROS
8469 063444                     20$:    MOV     #1,R4                   ;MASK FOR SLIDING ONES
8470 063450                             BR      40$                     ;BRANCH TO SEND ROUTINE
8471 063452                     30$:    MOV     #177776,R4              ;MASK FOR SLIDING ZEROS
8472
8473                                    ;SEND ROUTINE FOR SLIDING ONES AND ZEROS
8474
8475 063456                     40$:    GMANID  MMES74,TIMIN,D,-1,1,5000,YES    ;GET TIME INTERVAL IN MS
                                                                                TRAP    C$GMAN
                                                                                BR      10004$
                                                                                .WORD   TIMIN
                                                                                .WORD   T$CODE
                                                                                .WORD   MMES74
                                                                                .WORD   -1
                                                                                .WORD   T$LOLIM
                                                                                .WORD   T$HILIM
                                                                        10004$:
8476 063476                             PRINTB  #WMES1                  ;PRINT WORKING MESSAGE
                                                                                MOV     #WMES1,-(SP)
                                                                                MOV     #1,-(SP)
                                                                                MOV     SP,R0
                                                                                TRAP    C$PNTB
                                                                                ADD     #4,SP
8477 063516             50$:    MOV     TIMIN,R3                        ;LOAD TIME INTERVAL COUNTER
8478 063522                     BGNSEG
                                                                                TRAP    C$BSEG
8479 063524                     MOV     R4,@DAT                         ;PUT DATA TO OUTPUT
8480 063530             60$:    DEC     R3                              ;DEC TIME INTERVAL CON.
8481 063532                     JSR     PC,WT500                        ;WAIT 500 US
8482 063536                     JSR     PC,WT500                        ;WAIT 500 US
8483 063542                     TST     R3                              ;IS THE TIME OVER?
8484 063544                     BNE     60$                             ;IF NO, BRANCH
8485 063546                     MOV     @DAT,BAD        004064          ;READ THE DATA REG. BACK
8486 063554                     CMP     BAD,R4                          ;CMP READ - LOADED DATA
8487 063560     004737  012146  CALL    INSERT                  ;SKIP BRANCH IF 'SF1' IS SET
```

TEST 20: DIGITAL OUTPUT TEST - SPECIFICALLY SELECTABLE

```
8488 063564  001406                        BEQ     70$                 ;BRANCH IF EQUAL
8489 063566  010437  004062                MOV     R4,GOOD             ;SET UP DATA FOR ERRMES.
8490 063572                                ERRSOFT 2001,E2001,EER1     ;ERROR HANDLER
     063572  104457                                                        TRAP    C$ERSOFT
     063574  003721                                                        .WORD   2001
     063576  064034                                                        .WORD   E2001
     063600  007342                                                        .WORD   EER1
8491 063602                        70$:    ENDSEG
     063602                                                          10005$:
     063602  104405                                                        TRAP    C$ESEG
8492 063604  006104                        ROL     R4                  ;NEXT DATA
8493 063606  005504                        ADC     R4                  ;ADD CARRY IF SET
8494 063610                                BREAK                       ;OPERATER INTERR. ENB.
     063610  104422                                                        TRAP    C$BRK
8495 063612  000741                        BR      50$                 ;GO INTO OUTPUT LOOP
8496
8497                                       ;SEND ROUTINE FOR PATTERN PAIR
8498
8499 063614  013777  063740  120060  80$:  MOV     FIRPA,@DAT          ;FIRST PATTERN TO OUTPUT
8500 063622  013704  063740                MOV     FIRPA,R4            ;THIS IS FOR ERR HANDLER
8501 063626                                BREAK                       ;OPERATOR INTRR. ENB.
     063626  104422                                                        TRAP    C$BRK
8502 063630  005002                        CLR     R2                  ;FLAG FOR PATTERN CHOICE
8503 063632  013703  063744          90$:  MOV     TIMIN,R3            ;LOAD TIME INTERVAL COUNTER
8504 063636  005303                100$:  DEC     R3                  ;DEC TIME INTERVAL CON.
8505 063640  004737  011514                JSR     PC,WT500            ;WAIT 500 US
8506 063644  004737  011514                JSR     PC,WT500            ;WAIT 500 US
8507 063650  005703                        TST     R3                  ;IS THE TIME OVER?
8508 063652  001371                        BNE     100$                ;IF YES, SEND SECOND PAT.
8509 063654  017737  120020  004064        MOV     @DAT,BAD            ;READ THE DATA REG. BACK
8510 063662  023704  004064                CMP     BAD,R4              ;CMP READ + LOADED DATA
8511 063666  004737  012146                CALL    INSERT          ;SKIP BRANCH IF 'SFI' IS SET
8512 063672  001406                        BEQ     110$                ;BRANCH IF EQUAL
8513 063674  010437  004062                MOV     R4,GOOD             ;SET UP DATA FOR ERRMES.
8514 063700                                ERRSOFT 2002,E2001,EER1     ;ERROR HANDLER
     063700  104457                                                        TRAP    C$ERSOFT
     063702  003722                                                        .WORD   2002
     063704  064034                                                        .WORD   E2001
     063706  007342                                                        .WORD   EER1
8515 063710  005702                110$:  TST     R2                  ;IS R2 CLEARED?
8516 063712  001340                        BNE     80$                 ;BRANCH IF R2 = 1
8517 063714  005202                        INC     R2                  ;INCREMENT R2
8518 063716  013777  063742  117756        MOV     SECPA,@DAT          ;SECOND PATTERN TO OUTP.
8519 063724  013704  063742                MOV     SECPA,R4            ;THIS IS FOR ERR HANDLER
8520 063730  000740                        BR      90$                 ;GO INTO OUTPUT LOOP
8521 063732                        EXQV20: EXIT    TST             ;EXIT TEST
     063732  104452                                                        TRAP    C$EXIT
     063734  000542                                                        .WORD   L10055
8522 063736  000001                ANS:    .WORD   1
8523 063740  000000                FIRPA:  .WORD   0                   ;STORE FOR FIRST PATTERN
8524 063742  177777                SECPA:  .WORD   177777              ;STORE FOR SECOND PATTERN
8525 063744  001000                TIMIN:  .WORD   1000                ;STORE FOR TIME INTERVAL
8526                                       .NLIST  BEX
8527 063746       045       113       062  TSHD20: .ASCIZ  /%S,2%ADIGITAL OUTPUT TEST - SPECIFICALLY SELECTABLE.%N/
8528 064034       104       101       124  E2001:  .ASCIZ  /DATA REGISTER INCORRECT AFTER READ BACK/
8529 064104       105       116       124  MMES71: .ASCII  /ENTER PATTERN TYPE (1,2,3):/<12><15>
8530 064130       061       040       106          .ASCIZ  /1 FOR SLIDING ONES, 2 FOR ZEROS, 3 FOR PATTERN PAIR
```

TEST 20: DIGITAL OUTPUT TEST SPECIFICALLY SELECTABLE

```
8531 064214      106     111     122  MMES72: .ASCIZ  /FIRST PATTERN  /
8532 064254      123     105     103  MMES73: .ASCIZ  /SECOND PATTERN /
8533 064254      105     116     124  MMES74: .ASCIZ  /ENTER TIME INTERVAL (MS) BETWEEN EACH PATTERN CHANGE /
8534 064342      045     101     127  WMES1:  .ASCIZ  /*AWORKING,   OUTPUT DATA ARE SLIDING PATTERN/
8535 064421      045     101     127  WMES2:  .ASCIZ  /*AWORKING,   OUTPUT DATA ARE PATTERN PAIRS
8536                                   .LIST   BEX
8537                                   .EVEN
8538 064476                            ENDTST
     064476                                                                L10055:
     064476  104401                                                              TRAP    C$ETST
```

```
                                ;SBTTL  TEST 21: ANALOGUE INPUT (DYNAMIC ROUTINE)  SPECIFICALLY SELECTABLE
                                ;*****************************************************************************
                                ;       TEST 21 - ANALOGUE INPUT (DYNAMIC ROUTINE) - SPECIFICALLY
                                ;                 SELECTABLE.
                                ;
                                ;       THE USER IS ASKED WHICH CHANNELS ARE TO BE READ, WHICH GAIN AND
                                ;       WHICH TRIGGER (INTERNAL OR EXTERNAL) ARE TO BE USED . AFTER THIS
                                ;       HE IS TOLD WHICH RANGE (UNI OR BIPOLAR) THE MODULE IS SWITCHED
                                ;       TO.
                                ;
                                ;       CONVERSIONS ARE THEN MADE TWICE ON EACH SELECTED CHANNEL . THE
                                ;       VALUES READ ARE PRINTED OUT AS A DUMP AFTER ALL CONVERSIONS. THE
                                ;       DUMPED VALUES ARE OCTAL.
                                ;
                                ;       PRINTOUT CAN BE DISABLED USING THE SUPERVISOR FLAG "INHIBIT
                                ;       ERROR REPORTS".
                                ;
                                ;       TO ABORT THE TEST, "CNTL C" MUST BE TYPED.
                                ;*****************************************************************************
                                        BGNTST
                                                                                        T21::
                                        CALL    SELECT                  ;CALL SELECT ROUTINE
                                        .WORD   10004                   ;GIVE TEST PARAMETER (SPEC/DI)
                                        TSHD21                          ;GIVE TEST HEADER
                                        BCC     ITRC21                  ;IF CARRY IS SET, EXIT TEST
                                        EXIT    TST                     ;EXIT TEST
                                                                                        TRAP    C$EXIT
                                                                                        .WORD   L10056
                                ITRC21: GMANID  MES211,ANS211,0,77400,0,127.,,YES ;GET 1ST CHANNEL TO BE TESTED
                                                                                        TRAP    C$GMAN
                                                                                        BR      10000$
                                                                                        .WORD   ANS211
                                                                                        .WORD   T$CODE
                                                                                        .WORD   MES211
                                                                                        .WORD   77400
                                                                                        .WORD   T$LOLIM
                                                                                        .WORD   T$HILIM
                                                                                10000$:
                                        GMANID  MES212,ANS212,0,77400,0,127.,,YES ;GET LAST CHANNEL TO BE TESTED
                                                                                        TRAP    C$GMAN
                                                                                        BR      10001$
                                                                                        .WORD   ANS212
                                                                                        .WORD   T$CODE
                                                                                        .WORD   MES212
                                                                                        .WORD   77400
                                                                                        .WORD   T$LOLIM
                                                                                        .WORD   T$HILIM
                                                                                10001$:
                                        CMP     ANS212,ANS211           ;IS LAST CHA. GREATER THAN 1ST
                                        BGE     10$                     ;BRANCH IF YES
                                        PRINTF  @PME211                 ;PRINT OPERATOR MISTAKE
                                                                                        MOV     @PME211,(SP)
                                                                                        MOV     #1,-(SP)
                                                                                        MOV     SP,R0
                                                                                        TRAP    C$PMTF
                                                                                        ADD     #4,SP
                                        BR      ITRC21                  ;AND BRANCH BACK
```

TEST 21: ANALOGUE INPUT (DYNAMIC ROUTINE) SPECIFICALLY SELEC

```
 8571 064610                            10$:    GMANID  MES213,ANS213,0,16,0,7,YES     ;ASK FOR GAIN
      064610  104443                                                                      TRAP    C$GMAN
      064612  000406                                                                      BR      10002$
      064614  066334                                                                      .WORD   ANS213
      064616  000030                                                                      .WORD   T$CODE
      064620  067467                                                                      .WORD   MES213
      064622  000016                                                                      .WORD   16
      064624  000000                                                                      .WORD   T$LOLIM
      064626  000007                                                                      .WORD   T$HILIM
      064630                                                                        10002$:
 8572 064630  032777  000020  117042            BIT     #20,@MOD        ;IS BIPOLAR MODE SELECTED ?
 8573 064636  001011                            BNE     20$             ;BRANCH IF YES
 8574 064640                                    PRINTF  #PME213         ;PRINT UNIPOLAR MESSAGES
      064640  012746  067747                                                              MOV     #PME213,-(SP)
      064644  012746  000001                                                              MOV     #1,-(SP)
      064650  010600                                                                      MOV     SP,R0
      064652  104417                                                                      TRAP    C$PNTF
      064654  062706  000004                                                              ADD     #4,SP
 8575 064660  000410                            BR      30$             ;AND SKIP BIPOLAR MESSAGES
 8576 064662                            20$:    PRINTF  #PME214         ;PRINT BIPOLAR MESSAGES
      064662  012746  070022                                                              MOV     #PME214,-(SP)
      064666  012746  000001                                                              MOV     #1,-(SP)
      064672  010600                                                                      MOV     SP,R0
      064674  104417                                                                      TRAP    C$PNTF
      064676  062706  000004                                                              ADD     #4,SP
 8577 064702                            30$:    GMANIL  MES214,ANS214, 1,YES    ;ASK FOR TRIGGER
      064702  104443                                                                      TRAP    C$GMAN
      064704  000404                                                                      BR      10003$
      064706  066336                                                                      .WORD   ANS214
      064710  000130                                                                      .WORD   T$CODE
      064712  067550                                                                      .WORD   MES214
      064714  177777                                                                      .WORD   -1
      064716                                                                        10003$:
 8578 064716  042777  000016  116760            BIC     #16,@CSA        ;CLEAR GAIN BITS IN CSA
 8579 064724  053777  066334  116752            BIS     ANS213,@CSA     ;LOAD GAIN INTO CSA
 8580 064732  005001                    INTR:   CLR     R1              ;POINT TABLE POINT TO FIRST ADDRESS
 8581 064734  013704  066330                    MOV     ANS211,R4       ;GET FIRST CHANNEL
 8582 064740                            10$:    BGNSEG                                  TRAP    C$BSEG
      064740  104404
 8583 064742  005777  116734                    TST     @DAT            ;READ DAT TO CLEAR DONE+ERR IN CSA
 8584 064746  042777  177400  116730            BIC     #177400,@CSA    ;CLEAR HIGH BYTE OF CSA
 8585 064754  050477  116724                    BIS     R4,@CSA         ;LOAD CHANNEL INTO CSA
 8586 064760  017737  116720  004064            MOV     @CSA,BAD        ;GET CSA CONTENTS
 8587 064766  032737  100000  004064            BIT     #100000,BAD     ;IS THE LOADED CHANNEL AVAILABLE?
 8588 064774  004737  012146                    CALL    INSERT          ;SKIP BRANCH IF 'SET' IS SET
 8589 065000  001014                            BNE     20$             ;BRANCH IF YES
 8590 065002  012737  100000  004062            MOV     #100000,GOOD    ;SET UP DATA FOR ERROR MESSAGES
 8591 065010  050437  004062                    BIS     R4,GOOD         ;SET CHANNEL NUMBER
 8592 065014  053737  066334  004062            BIS     ANS213,GOOD     ;SET GAIN
 8593 065022                                    ERRSOFT 2101,E2101,ER4  ;ERROR HANDLER
      065022  104457                                                                      TRAP    C$ERSOFT
      065024  004065                                                                      .WORD   2101
      065026  070074                                                                      .WORD   E2101
      065030  007474                                                                      .WORD   ER4
 8594 065032                            20$:    CKLOOP                                  TRAP    C$CKL1
      065032  104406
 8595 065034  032777  000200  116642            BIT     #200,@CSA       ;IS INTERFACE READY FOR CONVERSION?
```

TEST 21: ANALOGUE INPUT (DYNAMIC ROUTINE) - SPECIFICALLY SELEC

```
8596 065042 004737 012146          CALL    INSERT          ;SKIP BRANCH IF 'SFI' IS SET
8597 065046 001404                 BEQ     30$             ;BRANCH IF  DONE IS CLEARED
8598 065050                        ERRSOFT 2102,E2102,EERG ;ERROR HANDLER
     065050 104457                                                 TRAP    C$ERSOFT
     065052 004066                                                  WORD   2102
     065054 070164                                                 .WORD   E2102
     065056 007724                                                 .WORD   EERG
8599 065060                  30$:  CKLOOP
     065060 104406                                                 TRAP    C$CLP1
8600 065062 005737 066336          TST     ANS214          ;IS EXTERNAL TRIGGER USED?
8601 065066 001175                 BNE     EXTR21          ;BRANCH IF YES TO EXTERNAL PART
8602 065070 005003                 CLR     R3              ;LOAD DONE TIMEOUT COUNTER
8603 065072 052777 000001 116604   BIS     #1,@CSA         ;START THE FIRST CONVERSION
8604 065100 032777 000200 116576 40$:  BIT  #200,@CSA       ;CONVERSION DONE (DONE SET )
8605 065106 001010                 BNE     50$             ;BRANCH IF YES
8606 065110 005303                 DEC     R3              ;DECREMENT READY WAIT COUNTER
8607 065112 004737 012146          CALL    INSERT          ;SKIP BRANCH IF 'SFI' IS SET
8608 065116 001370                 BNE     40$             ;BRANCH IF TIMEOUT COUNTER IS NOT ZERO
8609 065120                        ERRSOFT 2103,E2103,EERG ;ERROR HANDLER
     065120 104457                                                 TRAP    C$ERSOFT
     065122 004067                                                 .WORD   2103
     065124 070255                                                 .WORD   E2103
     065126 007724                                                 .WORD   EERG
8610 065130                  50$:  ENDSEG
     065130 104405                                                 TRAP    C$ESEG
8611 065132 017761 116544 066340   MOV     @DAT,DMPTAB(R1) ;READ DATA REGISTER AND SAVE IT
8612 065140 062701 000002          ADD     #2,R1           ;INCREMENT DUMP TABLE ADDRESS
8613 065144 032777 000200 116532   BIT     #200,@CSA       ;DONE CLEARED AFTER READ DAT REG.?
8614 065152 004737 012146          CALL    INSERT          ;SKIP BRANCH IF 'SFI' IS SET
8615 065156 001404                 BEQ     60$             ;BRANCH IF YES
8616 065160                        ERRSOFT 2104,E2104,EERG ;ERROR HANDLER
     065160 104457                                                 TRAP    C$ERSOFT
     065162 004070                                                 .WORD   2104
     065164 070346                                                 .WORD   E2104
     065166 007724                                                 .WORD   EERG
8617 065170 005003                 60$:  CLR     R3              ;LOAD DONE TIMEOUT COUNTER
8618 065172 052777 000001 116504   BIS     #1,@CSA         ;START SECOND CONVERSION
8619 065200 032777 000200 116476 70$:  BIT  #200,@CSA       ;CONVERSION DONE (DONE SET )
8620 065206 001010                 BNE     80$             ;BRANCH IF YES
8621 065210 005303                 DEC     R3              ;DECREMENT DONE TIMEOUT COUNTER
8622 065212 004737 012146          CALL    INSERT          ;SKIP BRANCH IF 'SFI' IS SET
8623 065216 001370                 BNE     70$             ;BRANCH IF TIMEOUT COUNTER IS NOT ZERO
8624 065220                        ERRSOFT 2105,E2103,EERG ;ERROR HANDLER
     065220 104457                                                 TRAP    C$ERSOFT
     065222 004071                                                 .WORD   2105
     065224 070255                                                 .WORD   E2105
     065226 007724                                                 .WORD   EERG
8625 065230 017761 116446 066340 80$:  MOV     @DAT,DMPTAB(R1) ;READ DATA REGISTER AND SAVE IT
8626 065236 062701 000002          ADD     #2,R1           ;INCREMENT DUMP TABLE ADDRESS
8627 065242 032777 000200 116434   BIT     #200,@CSA       ;DONE CLEARED AFTER READ DAT REG.?
8628 065250 004737 012146          CALL    INSERT          ;SKIP BRANCH IF 'SFI' IS SET
8629 065254 001404                 BEQ     90$             ;BRANCH IF YES
8630 065256                        ERRSOFT 2106,E2104,EERG ;ERROR HANDLER
     065256 104457                                                 TRAP    C$ERSOFT
     065260 004072                                                 .WORD   2106
     065262 070346                                                 .WORD   E2104
```

TEST 21: ANALOGUE INPUT (DYNAMIC ROUTINE) - SPECIFICALLY SELEC

```
                065264  007724                                                          .WORD   EERG
8631            065266  020437  066332  90$:    CMP     R4,ANS212               ;HAVE WE READ THE LAST CHANNEL ?
8632            065272  002017                   BGE     DMPR                    ;IF YES, BRANCH TO DUMP ROUTINE
8633            065274  062704  000400          ADD     #400,R4                 ;INCREMENT CHANNEL
8634            065300  022701  001000          CMP     #512.,R1                ;IS THE TOP ADDRESS OF TABLE REACHED?
8635            065304  004737  012146          CALL    INSERT                  ;SKIP BRANCH IF 'SFI' IS SET
8636            065310  001006                   BNE     100$                    ;BRANCH IF NO
8637            065312                           ERRSOFT 2107,E2107,EERG         ;ERROR HANDLER
                065312  104457                                                          TRAP    C$ERSOFT
                065314  004073                                                          .WORD   2107
                065316  070433                                                          .WORD   E2107
                065320  007724                                                          .WORD   EERG
8638            065322  000137  064516          100$:    JMP     ITRC21          ;
8639            065326  000137  064740                   JMP     10$             ;AND DO CONVERSION WITH NEXT CHA.
8640
8641                                             ;THE NEXT CODE WILL DUMP THE CONVERSION ON THE CONSOLE TERMINAL
8642
8643            065332                           DMPR:    RFLAGS  R0              ;READ SUPERVISOR FLAGS
                065332  104421                                                          TRAP    C$RFLA
8644            065334  032700  010000                   BIT     #IBE,R0         ;IS IBE FLAG SET?
8645            065340  001402                   BEQ     10$                     ;SKIP JUMP INSTRUCTION IF NO
8646            065342  000137  064732          JMP     INTR                    ;DISABLE DUMP PRINT OUT
8647            065346  162701  000002  10$:     SUB     #2,R1                   ;RESTORE LAST R1 INCREMENT
8648            065352  010102                   MOV     R1,R2                   ;SAVE DUMP TABLE END ADDRESS
8649            065354  005001                   CLR     R1                      ;POINT TO FIRST VALUE
8650            065356  013704  066330          MOV     ANS211,R4               ;SET UP R4 WITH FIRST CHANNEL NO.
8651            065362  000304                   SWAB    R4                      ;SWAB HIGH BYTE INTO LOW BYTE
8652            065364  005003                   CLR     R3                      ;CLEAR CHANNEL MARKER
8653            065366                   20$:    PRINTF  #PME212,DMPTAB(R1),R4   ;DUMP THE CONVERSION TABLE
                065366  010446                                                          MOV     R4,(SP)
                065370  016146  066340                                                  MOV     DMPTAB(R1),(SP)
                065374  012746  067665                                                  MOV     #PME212,(SP)
                065400  012746  000003                                                  MOV     #3,(SP)
                065404  010600                                                          MOV     SP,R0
                065406  104417                                                          TRAP    C$PNTF
                065410  062706  000010                                                  ADD     #10,SP
8654            065414  005203                   INC     R3                      ;INCREMENT CHANNEL MARKER
8655            065416  022703  000002          CMP     #2,R3                   ;IS CHANNEL NUMBER PRINTED TWICE ?
8656            065422  001002                   BNE     30$                     ;BRANCH IF NO
8657            065424  005204                   INC     R4                      ;IF YES, INCREMENT CHANNEL NUMBER
8658            065426  005003                   CLR     R3                      ;CLEAR CHANNEL MARKER
8659            065430  062701  000002  30$:     ADD     #2,R1                   ;INCREMENT TABLE ADDRESS
8660            065434  020201                   CMP     R2,R1                   ;ALL VALUES PRINTED ?
8661            065436  002353                   BGE     20$                     ;BRANCH IF NO
8662            065440  004737  011544          CALL    CRLF                    ;PRINT A CRLF BETWEEN EVERY DUMP
8663            065444  005737  066336          TST     ANS214                  ;IS EXTERNAL TRIGGER USED?
8664            065450  001002                   BNE     40$                     ;BRANCH IF YES
8665            065452  000137  064732          JMP     INTR                    ;REPEAT INTERNAL TEST
8666            065456  000137  065552  40$:     JMP     EXR                     ;REPEAT EXTERNAL TEST
8667
8668                                             ;THE FOLLOWING CODE IS USED IF EXTERNAL TRIGGER WAS REQUESTED
8669
8670            065462                   EXTR21: SETVEC  VEC,#INTSR,#PRIO7       ;SET VECTOR 1 AND SERVICE ROUTINE
                065462  012746  000340                                                  MOV     #PRIO7,-(SP)
                065466  012746  017776                                                  MOV     #INTSR,-(SP)
                065472  012746  000210                                                  MOV     VEC,-(SP)
                065476  012746  000003                                                  MOV     #3,-(SP)
```

TEST 21: ANALOGUE INPUT (DYNAMIC ROUTINE) SPECIFICALLY SELEC

```
                065502  104437                                                          TRAP    C$SVEC
                065504  062706  000010                                                  ADD     #10,SP
8671            065510  013702  003710          MOV     VEC,R2          ;GET VECTOR 1
8672            065514  062702  000004          ADD     #4,R2           ;CREATE ERR VECTOR (VECTOR 2)
8673            065520                          SETVEC  R2,#INTSR2,#PRI07       ;SET VECTOR 2 AND SERVICE ROUTINE
                065520  012746  000340                                                  MOV     #PRI07,-(SP)
                065524  012746  017306                                                  MOV     #INTSR2,-(SP)
                065530  010246                                                          MOV     R2,-(SP)
                065532  012746  000003                                                  MOV     #3,-(SP)
                065536  104437                                                          TRAP    C$SVEC
                065540  062706  000010                                                  ADD     #10,SP
8674            065544                          SETPRI  #PRI07          ;DISABLE INTERRUPTS
                065544  012700  000340                                                  MOV     #PRI07,R0
                065550  104441                                                          TRAP    C$SPRI
8675            065552  017737  116124  004064  EXR:    MOV     @DAT,BAD        ;READ DAT TO CLEAR DONE IN CSA
8676            065560  005037  004152          CLR     INTFLG          ;CLEAR ERR INTERRUPT FLAG
8677            065564  005001                  CLR     R1              ;POINT TABLE POINT TO FIRST ADDRESS
8678            065566  013704  066330          MOV     ANS211,R4       ;GET FIRST CHANNEL
8679            065572  042777  177536  116104  10$:    BIC     #177536,@CSA    ;CLEAR R/W BITS IN CSA
8680            065600  050477  116100          BIS     R4,@CSA         ;LOAD CHANNEL INTO CSA
8681            065604  053777  066334  116072  BIS     ANS213,@CSA     ;LOAD GAIN INTO CSA
8682            065612  017737  116066  004064  MOV     @CSA,BAD        ;GET CSA CONTENTS
8683            065620  012737  100000  004062  MOV     #100000,GOOD    ;SET UP DATA FOR ERROR MESSAGES
8684            065626  050437  004062          BIS     R4,GOOD         ;SET CHANNEL NUMBER
8685            065632  053737  066334  004062  BIS     ANS213,GOOD     ;SET GAIN
8686            065640  023737  004062  004064  CMP     GOOD,BAD        ;IS CSA CONTENTS CORRECT?
8687            065646  004737  012146          CALL    INSERT          ;SKIP BRANCH IF 'SFI' IS SET
8688            065652  001404                  BEQ     20$             ;BRANCH IF YES
8689            065654                          ERRSOFT 2108,E2108,EER4 ;ERROR HANDLER
                065654  104457                                                          TRAP    C$ERSOFT
                065656  004074                                                          .WORD   2108
                065660  070521                                                          .WORD   E2108
                065662  007474                                                          .WORD   EER4
8690            065664                  20$:    SETPRI  #PRI00          ;ALLOW INTERRUPTS
                065664  012700  000000                                                  MOV     #PRI00,R0
                065670  104441                                                          TRAP    C$SPRI
8691            065672  052777  000120  116004  BIS     #120,@CSA       ;SET EET + EI BITS IN CSA
8692            065700  005037  004150  30$:    CLR     INTFLG          ;CLEAR INTERRUPT FLAG
8693            065704  005003          CLR     R3              ;CLEAR TIMEOUT COUNTER
8694            065706  005737  004150  40$:    TST     INTFLG          ;WAS THERE A DONE INTERRUPT?
8695            065712  001010          BNE     50$             ;BRANCH IF YES
8696            065714  005303          DEC     R3              ;DECREMENT TIMEOUT COUNTER
8697            065716  004737  012146          CALL    INSERT          ;SKIP BRANCH IF 'SFI' IS SET
8698            065722  001371          BNE     40$             ;BRANCH IF NOT ZERO
8699            065724                          ERRSOFT 2109,E2109,EER6 ;ERROR HANDLER
                065724  104457                                                          TRAP    C$ERSOFT
                065726  004075                                                          .WORD   2109
                065730  070603                                                          .WORD   E2109
                065732  007724                                                          .WORD   EER6
8700            065734  005037  004150  50$:    CLR     INTFLG          ;CLEAR INTERRUPT FLAG
8701            065740  017737  116040  004064  MOV     @CSA,BAD        ;GET CSA CONTENTS
8702            065746  012737  100320  004062  MOV     #100320,GOOD    ;SET UP DATA FOR ERROR MESSAGES
8703            065754  050437  004062          BIS     R4,GOOD         ;SET CHANNEL NUMBER
8704            065760  053737  066334  004062  BIS     ANS213,GOOD     ;SET GAIN
8705            065766  023737  004062  004064  CMP     GOOD,BAD        ;IS CSA CONTENTS OK AFTER CONVERSION?
8706            065774  004737  012146          CALL    INSERT          ;SKIP BRANCH IF 'SFI' IS SET
8707            066000  001404                  BEQ     70$             ;BRANCH IF DONE IS CLEARED
```

```
8708 066002                                        ERRSOFT 2110,E2108,EER4      ;ERROR HANDLER
     066002  104457                                                              TRAP    C$ERSOFT
     066004  004076                                                              .WORD   2110
     066006  070521                                                              .WORD   E2108
     066010  007474                                                              .WORD   EER4
8709 066012  017761  115664  066340  70$:    MOV     @DAT,DMPTAB(R1)      ;SAVE DATA REGISTER CONTENTS
8710 066020  062701  000002                  ADD     #2,R1                ;INCREMENT DUMP TABLE ADDRESS
8711 066024  017737  115654  004064          MOV     @CSA,BAD             ;GET CSA CONTENTS
8712 066032  012737  100120  004062          MOV     #100120,GOOD         ;SET UP DATA FOR ERROR MESSAGES
8713 066040  050437  004062                  BIS     R4,GOOD              ;SET CHANNEL NUMBER
8714 066044  053737  066334  004062          BIS     ANS213,GOOD          ;SET GAIN
8715 066052  023737  004062  004064          CMP     GOOD,BAD             ;IS INTERFACE READY FOR CONVERSION?
8716 066060  004737  012146                  CALL    INSERT               ;SKIP BRANCH IF 'SFI' IS SET
8717 066064  001404                          BEQ     90$                  ;BRANCH IF DONE IS CLEARED
8718 066066                                        ERRSOFT 2112,E2108,EER4      ;ERROR HANDLER
     066066  104457                                                              TRAP    C$ERSOFT
     066070  004100                                                              .WORD   2112
     066072  070521                                                              .WORD   E2108
     066074  007474                                                              .WORD   EER4
8719 066076  005737  004152          90$:    TST     INTFL2               ;WAS THERE AN ERROR INTERRUPT?
8720 066102  004737  012146                  CALL    INSERT               ;SKIP BRANCH IF 'SFI' IS SET
8721 066106  001404                          BEQ     100$                 ;BRANCH IF NO
8722 066110                                        ERRSOFT 2113,E2110,EERG      ;ERROR HANDLER
     066110  104457                                                              TRAP    C$ERSOFT
     066112  004101                                                              .WORD   2113
     066114  070650                                                              .WORD   E2110
     066116  007724                                                              .WORD   EERG
8723 066120  005037  004150          100$:   CLR     INTFLA               ;CLEAR DONE INTERRUPT FLAG
8724 066124  005037  004152                  CLR     INTFL2               ;CLEAR ERROR INTERRUPT FLAG
8725 066130  005003                          CLR     R3                   ;SET UP WAIT COUNTER
8726 066132  005737  004150          170$:   TST     INTFLA               ;WAS THERE A DONE INTERRUPT?
8727 066136  001010                          BNE     180$                 ;BRANCH IF YES
8728 066140  005303                          DEC     R3                   ;DECREMENT TIMEOUT COUNTER
8729 066142  004737  012146                  CALL    INSERT               ;SKIP BRANCH IF 'SFI' IS SET
8730 066146  001371                          BNE     170$                 ;BRANCH IF NOT ZERO
8731 066150                                        ERRSOFT 2114,E2109,EERG      ;ERROR HANDLER
     066150  104457                                                              TRAP    C$ERSOFT
     066152  004102                                                              .WORD   2114
     066154  070603                                                              .WORD   E2109
     066156  007724                                                              .WORD   EERG
8732 066160  017761  115516  066340  180$:   MOV     @DAT,DMPTAB(R1)      ;SAVE DATA REGISTER CONTENTS
8733 066166  062701  000002                  ADD     #2,R1                ;INCREMENT DUMP TABLE ADDRESS
8734 066172  022701  001000                  CMP     #512.,R1             ;IS TOP ADDRESS OF TABLE REACHED?
8735 066176  001004                          BNE     120$                 ;BRANCH IF NO
8736 066200                                        ERRSOFT 2115,E2107,EERG      ;ERROR HANDLER
     066200  104457                                                              TRAP    C$ERSOFT
     066202  004103                                                              .WORD   2115
     066204  070433                                                              .WORD   E2107
     066206  007724                                                              .WORD   EERG
8737 066210  020437  066332          120$:   CMP     R4,ANS212            ;HAVE WE REACHED THE LAST CHANNEL?
8738 066214  002036                          BGE     130$                 ;IF YES, BRANCH TO DUMP ROUTINE
8739 066216  062704  000400                  ADD     #400,R4              ;INCREMENT CHANNEL NUMBER
8740 066222  042777  177400  115454          BIC     #177400,@CSA         ;CLEAR HIGH BYTE OF CSA
8741 066230  050477  115450                  BIS     R4,@CSA              ;LOAD CHANNEL INTO CSA
8742 066234  017737  115444  004064          MOV     @CSA,BAD             ;GET CSA CONTENTS
8743 066242  012737  100120  004062          MOV     #100120,GOOD         ;SET UP DATA FOR ERROR MESSAGES
8744 066250  050437  004062                  BIS     R4,GOOD              ;SET CHANNEL NUMBER
```

```
 8745 066254 053737 066334 004062          BIS     ANS213,GOOD             ;SET GAIN
 8746 066262 023737 004062 004064          CMP     GOOD,BAD                ;IS CSA CONTENTS CORRECT?
 8747 066270 004737 012146                 CALL    INSERT                  ;SKIP BRANCH IF 'SFI' IS SET
 8748 066274 001404                        BEQ     110$                    ;BRANCH IF YES
 8749 066276                               ERRSOFT 2116,E2108,EER4         ;ERROR HANDLER
      066276 104457                                                                TRAP    C$ERSOFT
      066300 004104                                                                .WORD   2116
      066302 070521                                                                .WORD   E2108
      066304 007474                                                                .WORD   EER4
 8750 066306 000137 065700          110$:   JMP     30$                     ;DO CONVERSION WITH NEXT CHANNEL
 8751 066312                        130$:   SETPRI  #PRI07                  ;DISABLE INTERRUPTS
      066312 012700 000340                                                         MOV     #PRI07,R0
      066316 104441                                                                TRAP    C$SPRI
 8752 066320 000137 065332                  JMP     DMPR                    ;JUMP TO DUMP ROUTINE
 8753
 8754 066324                        EXQV21: EXIT    TST                     ;EXIT TEST
      066324 104432                                                                TRAP    C$EXIT
      066326 002354                                                                .WORD   L10056-.
 8755
 8756 066330 000000                 ANS211: .WORD   0                       ;SAVE LOCATION FOR FIRST CHANNEL
 8757 066332 000000                 ANS212: .WORD   0                       ;SAVE LOCATION FOR LAST CHANNEL
 8758 066334 000000                 ANS213: .WORD   0                       ;SAVE LOCATION FOR THE GAIN
 8759 066336 000000                 ANS214: .WORD   0                       ;SAVE LOCATION FOR TRIGGER
 8760
 8761 066340                        DMPTAB: .BLKW   256.                    ;DUMP TABLE AREA
 8762
 8763                                       .NLIST  BEX
 8764 067340      045     123     062 TSHD21::.ASCIZ  /%S2%AANALOGUE INPUT (DYNAMIC ) - SPECIFICALLY SELECTABLE.%N/
 8765 067434      106     111     122 MES211: .ASCIZ  /FIRST CHANNEL/
 8766 067452      114     101     123 MES212: .ASCIZ  /LAST CHANNEL/
 8767 067467      107     101     111 MES213: .ASCIZ  /GAIN  (TYPE 0 - 7 = GAIN 1,2,5,10,20,50,100,200)/
 8768 067550      105     130     124 MES214: .ASCIZ  /EXTERNAL TRIGGER/
 8769
 8770 067571      045     101     114 PME211: .ASCIZ  /%ALAST CHANNEL HAS TO BE GREATER OR EQUAL TO THE 1ST ONE.%N/
 8771 067665      045     116     045 PME212: .ASCIZ  /%N%ACONVERSION VALUE (OCTAL):%06%9,   CHANNEL:%D3/
 8772 067747      045     116     045 PME213: .ASCIZ  /%N%AMODULE IS SWITCHED TO UNIPOLAR RANGE%N/
 8773 070022      045     116     045 PME214: .ASCIZ  /%N%AMODULE IS SWITCHED TO BIPOLAR RANGE%N/
 8774
 8775 070074      103     123     101 E2101:  .ASCIZ  /CSA CONTENTS INCORRECT   SELECTED CHANNEL NOT AVAILABLE/
 8776 070164      115     117     104 E2102:  .ASCIZ  /MODULE NOT READY FOR CONVERSION   DONE BIT IN CSA IS SET/
 8777 070255      104     117     116 E2103:  .ASCIZ  /DONE BIT IN CSA NOT SET (TIMEOUT) AFTER CONVERSION START/
 8778 070346      104     117     116 E2104:  .ASCIZ  /DONE BIT IN CSA NOT CLEARED AFTER READ DATA REGISTER/
 8779 070433      104     125     115 E2107:  .ASCIZ  /DUMP BUFFER FULL   MORE THEN 127 CHANNELS ADDRESSED ?/
 8780 070521      103     123     101 E2108:  .ASCIZ  /CSA CONTENTS INCORRECT - AFTER READ DATA REGISTER/
 8781 070603      124     111     115 E2109:  .ASCIZ  /TIMEOUT   NO DONE INTERRUPT OCCURRED/
 8782 070650      105     122     122 E2110:  .ASCIZ  /ERROR INTERRUPT OCCURRED/
 8783                                       .LIST   BEX
 8784                                       .EVEN
 8785 070702                               ENDTST
      070702                                                        L10056:
      070702 104401                                                        TRAP    C$ENDT
```

TEST 22: ANALOGUE OUTPUT (DYNAMIC TEST) - SPECIFICALLY SELECTA

```
                        .SBTTL  TEST 22: ANALOGUE OUTPUT (DYNAMIC TEST)  SPECIFICALLY SELECTABLE.
                        ;*****************************************************************************
                        ;       TEST 22 - ANALOGUE OUTPUT (DYNAMIC TEST) - SPECIFICALLY
                        ;                 SELECTABLE.
                        ;
                        ;THIS TEST GENERATES EITHER A PERMANENT LOADED STATIC VALUE, OR AN ENDLESS
                        ;SYMMETRICAL VOLTAGE RAMP.
                        ;
                        ;THE USER IS ASKED TO ENTER THE NUMBER OF THE FIRST AND LAST
                        ;CHANNEL WHICH HE WANTS TO USE. HE THEN SELECTS THE OUTPUT PATTERN TYPE
                        ;- SINGLE FIXED VALUE OR RAMP. FOR THE FIRST OF THESE, THE USER
                        ;TYPES THE DESIRED OUTPUT BINARY VALUE. FOR THE RAMP PATTERN, AN
                        ;ENDLESS SYMMETRICAL VOLTAGE RAMP IS GENERATED. IN THIS CASE, THE USER IS
                        ;ASKED TO ENTER A VALUE 'DELTA U'. THIS VALUE IS THE NUMBER OF BITS BY
                        ;WHICH THE PROGRAM CHANGES THE OUTPUT FOR EACH STEP OF THE RAMP, AND MUST
                        ;BE IN THE RANGE 1 TO 4096. THE USER MUST ALSO SELECT A TIME INTERVAL
                        ;'DELTA T' IN INCREMENT STEPS, WHICH WILL DETERMINE THE PERIOD BETWEEN EACH
                        ;VALUE CHANGE. IF ZERO IS TYPED, THE VALUE WILL BE VARIED AS FAST
                        ;AS THE HARDWARE ALLOWS IT.
                        ;
                        ;THE CONTROL STATUS REGISTER STATUS PRINTOUT CAN BE INHIBITED BY
                        ;SETTING THE 'IBE' FLAG.
                        ;*****************************************************************************
8810 070704                             BGNTST
     070704                                                                          T22::
8811 070704  004737  011714             CALL    SELECT                  ;CALL SELECT ROUTINE
8812 070710  010010                     .WORD   10010                   ;GIVE TEST PARAMETER (SPEC/DI)
8813 070712  071566                     TSHD22                          ;GIVE TEST HEADER
8814 070714  103002                     BCC     ITRC22                  ;IF CARRY IS CLEARED, EXIT TEST
8815 070716                             EXIT TST                        ;EXIT TEST
     070716  104432                                                                  TRAP    C$EXIT
     070720  001610                                                                  .WORD   L10057-.
8816 070722                         ITRC22: GMANID  MES221,ANS221,D,1400,0,7,YES    ;GET 1ST CHANNEL TO BE TESTED
     070722  104443                                                                  TRAP    C$GMAN
     070724  000406                                                                  BR      10000$
     070726  071552                                                                  .WORD   ANS221
     070730  000052                                                                  .WORD   T$CODE
     070732  071662                                                                  .WORD   MES221
     070734  001400                                                                  .WORD   1400
     070736  000000                                                                  .WORD   T$LOLIM
     070740  000007                                                                  .WORD   T$HILIM
     070742                                                                  10000$:
8817 070742                         10$:    GMANID  MES222,ANS222,D,1400,0,7,YES    ;GET LAST CHANNEL TO BE TESTED
     070742  104443                                                                  TRAP    C$GMAN
     070744  000406                                                                  BR      10001$
     070746  071554                                                                  .WORD   ANS222
     070750  000052                                                                  .WORD   T$CODE
     070752  071700                                                                  .WORD   MES222
     070754  001400                                                                  .WORD   1400
     070756  000000                                                                  .WORD   T$LOLIM
     070760  000007                                                                  .WORD   T$HILIM
     070762                                                                  10001$:
8818 070762  023737  071554  071552         CMP     ANS222,ANS221           ;LAST CHA. GREATER THAN 1ST?
8819 070770  002011                         BGE     20$                     ;BRANCH IF YES
8820 070772                                 PRINTF  #PME221                 ;PRINT OPERATOR MISTAKE
     070772  012746  071[6?                                                          MOV     #PME221,-(SP)
     070776  012746  000001                                                          MOV     #1,-(SP)
```

TEST 22: ANALOGUE OUTPUT (DYNAMIC TEST) - SPECIFICALLY SELECTA

```
                071002  010600                                                          MOV     SP,R0
                071004  104417                                                          TRAP    C$PNTF
                071006  062706  000004                                                  ADD     #4,SP
8821            071012  000743                  BR      ITRC22                  ;AND BRANCH BACK
8822            071014                  20$:    GMANID  MES223,ANS223,0,-1,1,2,YES      ;GET PATTERN TYPE
                071014  104443                                                          TRAP    C$GMAN
                071016  000406                                                          BR      10002$
                071020  071556                                                          .WORD   ANS223
                071022  000052                                                          .WORD   T$CODE
                071024  071715                                                          .WORD   MES223
                071026  177777                                                          .WORD   -1
                071030  000001                                                          .WORD   T$LOLIM
                071032  000002                                                          .WORD   T$HILIM
                071034                                                          10002$:
8823            071034  022737  000001  071556          CMP     #1,ANS223               ;IS STATIC VALUE USED ?
8824            071042  001431                  BEQ     40$                     ;BRANCH IF YES
8825            071044                  30$:    GMANID  MES224,ANS224,0,-1,1,4096.,YES  ;GET DELTA U
                071044  104443                                                          TRAP    C$GMAN
                071046  000406                                                          BR      10003$
                071050  071560                                                          .WORD   ANS224
                071052  000052                                                          .WORD   T$CODE
                071054  071767                                                          .WORD   MES224
                071056  177777                                                          .WORD   -1
                071060  000001                                                          .WORD   T$LOLIM
                071062  010000                                                          .WORD   T$HILIM
                071064                                                          10003$:
8826            071064                  GMANID  MES225,ANS225,0,-1,0,177777,YES ;GET DELTA T
                071064  104443                                                          TRAP    C$GMAN
                071066  000406                                                          BR      10004$
                071070  071562                                                          .WORD   ANS225
                071072  000052                                                          .WORD   T$CODE
                071074  072040                                                          .WORD   MES225
                071076  177777                                                          .WORD   -1
                071100  000000                                                          .WORD   T$LOLIM
                071102  177777                                                          .WORD   T$HILIM
                071104                                                          10004$:
8827            071104                  PRINTF  #PME223                 ;PRINT HOW TO CONTINUE
                071104  012746  072330                                                  MOV     #PME223,-(SP)
                071110  012746  000001                                                  MOV     #1,-(SP)
                071114  010600                                                          MOV     SP,R0
                071116  104417                                                          TRAP    C$PNTF
                071120  062706  000004                                                  ADD     #4,SP
8828            071124  000470                  BR      110$                    ;SKIP NEXT GMANID
8829
8830                            ;THE NEXT CODE FOR FIXED VALUE OUTPUT
8831
8832            071126                  40$:    GMANID  MES226,ANS226,0,-1,0,7777,YES   ;GET STATIC VALUE
                071126  104443                                                          TRAP    C$GMAN
                071130  000406                                                          BR      10005$
                071132  071563                                                          .WORD   ANS226
                071134  000052                                                          .WORD   T$CODE
                071136  072121                                                          .WORD   MES226
                071140  177777                                                          .WORD   -1
                071142  000000                                                          .WORD   T$LOLIM
                071144  007777                                                          .WORD   T$HILIM
                071146                                                          10005$:
8833            071146  005002                  CLR     R2                      ;CLEAR INHIBIT CSA PRINT.
```

TEST 22: ANALOGUE OUTPUT (DYNAMIC TEST) - SPECIFICALLY SELECTA

```
8834 071150  005037  071562                    CLR     ANS225                  ;SET DELTA T TO ZERO
8835 071154  004737  017066          50$:      CALL    CALRET                  ;READ OPERATOR KEYBOARD ACTION
8836 071160  103762                            BCS     40$                     ;BRANCH IF CR WAS TYPED TO NEXT VALUE
8837 071162  013704  071552                    MOV     ANS221,R4               ;SAVE CHANNEL
8838 071166  010477  112512          60$:      MOV     R4,@CSA                 ;LOAD CHANNEL
8839 071172  013703  004164                    MOV     REDTIM,R3               ;LOAD READY TIME OUT COUNTER
8840 071176  032777  000200  112500  70$:      BIT     #200,@CSA               ;READY SET
8841 071204  001010                            BNE     80$                     ;BRANCH IF YES
8842 071206  005303                            DEC     R3                      ;DECREMENT TIME OUT COUNTER
8843 071210  004737  012146                    CALL    INSERT                  ;SKIP BRANCH IF 'ESFI' IS SET
8844 071214  001370                            BNE     70$                     ;BRANCH IF COUNTER IS NOT ZERO
8845 071216                                    ERRSOFT 2201,E2201,EER3         ;ERROR HANDLER
     071216  104457                                                                    TRAP    C$ERSOFT
     071220  004231                                                                    .WORD   2201
     071222  072430                                                                    .WORD   E2201
     071224  007442                                                                    .WORD   EER3
8846 071226  005702                  80$:      TST     R2                      ;WAS CSA MESSAGES PRINTED ONCE?
8847 071230  001012                            BNE     90$                     ;SKIP PRINTOUT IF YES
8848 071232                                    PRINTB  #PME222,@CSA            ;PRINT CSA STATUS
     071232  017746  112446                                                           MOV     @CSA,-(SP)
     071236  012746  072260                                                           MOV     #PME222,-(SP)
     071242  012746  000002                                                           MOV     #2,-(SP)
     071246  010600                                                                   MOV     SP,R0
     071250  104414                                                                   TRAP    C$PNTB
     071252  062706  000006                                                           ADD     #6,SP
8849 071256  013777  071564  112416  90$:      MOV     ANS226,@DAT             ;LOAD DATA REG. WITH OPERATOR INPUT
8850 071264  020437  071554                    CMP     R4,ANS222               ;HAVE WE READ THE LAST CHANNEL ?
8851 071270  103003                            BHIS    100$                    ;BRANCH IF YES
8852 071272  062704  000400                    ADD     #400,R4                 ;INCREMENT CHANNEL
8853 071276  000733                            BR      60$                     ;GO INTO LOOP, EXIT WITH CNTL C
8854 071300  012702  000001          100$:     MOV     #1,R2                   ;SET INHIBIT CSA PRINTOUT FLAG
8855 071304  000723                            BR      50$                     ;BRANCH
8856
8857                                   ;THE FOLLOWING CODE CREATES A RAMP ON THE OUTPUT
8858
8859 071306  005002                  110$:     CLR     R2                      ;CLR DELTA U SAVE LOCATION
8860 071310  013704  071552                    MOV     ANS221,R4               ;GET FIRST CHANNEL
8861 071314  000412                            BR      130$                    ;
8862 071316  004737  017066          120$:     CALL    CALRET                  ;READ OPERATOR KEYBOARD ACTION
8863 071322  103650                            BCS     30$                     ;IF CR WAS TYPED, BRANCH
8864 071324  013704  071552                    MOV     ANS221,R4               ;GET FIRST CHANNEL NUMBER
8865 071330  063702  071560                    ADD     ANS224,R2               ;GET DELTA U
8866 071334  022702  007777                    CMP     #4095.,R2               ;FULL SCALE REACHED
8867 071340  103436                            BLO     180$                    ;IF YES, BRANCH TO NEGATIVE RAMP
8868 071342  013701  071562          130$:     MOV     ANS225,R1               ;LOAD DELTA T COUNTER
8869 071346  010477  112332                    MOV     R4,@CSA                 ;LOAD CHANNEL NUMBER
8870 071352  013703  004164                    MOV     REDTIM,R3               ;LOAD READY TIMEOUT COUNTER
8871 071356  032777  000200  112320  140$:     BIT     #200,@CSA               ;READY SET
8872 071364  001010                            BNE     150$                    ;BRANCH IF YES
8873 071366  005303                            DEC     R3                      ;DECREMENT TIMEOUT COUNTER
8874 071370  004737  012146                    CALL    INSERT                  ;SKIP BRANCH IF 'ESFI' IS SET
8875 071374  001370                            BNE     140$                    ;BRANCH IF COUNTER IS NOT ZERO
8876 071376                                    ERRSOFT 2202,E2201,EER3         ;ERROR HANDLER
     071376  104457                                                                    TRAP    C$ERSOFT
     071400  004231                                                                    .WORD   2201
     071402  072430                                                                    .WORD   E2201
     071404  007442                                                                    .WORD   EER3
```

TEST 22: ANALOGUE OUTPUT (DYNAMIC TEST) - SPECIFICALLY SELECTA

```
8877 071406  010277  112270          150$:   MOV     R2,@DAT                 ;LOAD DELTA U IN DATA REG.
8878 071412  005701                          TST     R1                      ;IS DELTA T ZERO ?
8879 071414  001402                          BEQ     170$                    ;BRANCH IF YES
8880 071416  005301                  160$:   DEC     R1                      ;IS DELTA T OVER ?
8881 071420  001376                          BNE     160$                    ;BRANCH IF NO
8882 071422  020437  071554          170$:   CMP     R4,ANS222               ;HAVE WE READ THE LAST CHANNEL ?
8883 071426  103333                          BHIS    120$                    ;IF YES, BRANCH TO FIRST CHANNEL
8884 071430  062704  000400                  ADD     #400,R4                 ;IF NO, INCREMENT CHANNEL
8885 071434  000742                          BR      130$                    ;AND DO NEXT ONE WITH SAME DELTA U
8886
8887                                 ;THE FOLLOWING CODE IS FOR NEGATIVE RAMP
8888
8889 071436  013704  071552          180$:   MOV     ANS221,R4               ;GET FIRST CHANNEL NUMBER
8890 071442  163702  071560                  SUB     ANS224,R2               ;DO NEGATIVE RAMP
8891 071446  005702                          TST     R2                      ;HAVE WE REACHED THE BOTTOM (ZERO)
8892 071450  001716                          BEQ     110$                    ;IF YES, BRANCH TO POSITIV RAMP
8893 071452  013701  071562          190$:   MOV     ANS225,R1               ;LOAD DELTA T
8894 071456  010477  112222                  MOV     R4,@CSA                 ;LOAD CHANNEL NUMBER
8895 071462  013703  004164                  MOV     REDTIM,R3               ;LOAD READY TIMEOUT COUNTER
8896 071466  032777  000200  112210  200$:   BIT     #200,@CSA               ;IS READY THERE ?
8897 071474  001010                          BNE     210$                    ;BRANCH IF YES
8898 071476  005303                          DEC     R3                      ;DECREMENT TIMEOUT COUNTER
8899 071500  004737  012146                  CALL    INSERT                  ;SKIP BRANCH IF 'SFI' IS SET
8900 071504  001370                          BNE     200$                    ;BRANCH IF COUNTER IS NOT ZERO
8901 071506                                  ERRSOFT 2203,E2201,EER3         ;ERROR HANDLER
     071506  104457                                                                  TRAP    C$ERSOFT
     071510  004233                                                                  .WORD   2203
     071512  072430                                                                  .WORD   E2201
     071514  007442                                                                  .WORD   EER3
8902 071516  010277  112160          210$:   MOV     R2,@DAT                 ;...
8903 071522  005701                          TST     R1                      ;IS DELTA T ZERO ?
8904 071524  001402                          BEQ     230$                    ;BRANCH IF YES
8905 071526  005301                  220$:   DEC     R1                      ;DECREMENT DELTA T COUNTER
8906 071530  001376                          BNE     220$                    ;UNTILL WE HAVE ZERO
8907 071532  020437  071554          230$:   CMP     R4,ANS222               ;HAVE WE READ THE LAST CHANNEL ?
8908 071536  103337                          BHIS    180$                    ;BRANCH IF YES
8909 071540  062704  000400                  ADD     #400,R4                 ;INCREMENT CHANNEL
8910 071544  000742                          BR      190$                    ;DO NEXT CHANNEL WITH SAME DELTA U
8911 071546                          EXQV22: EXIT    TST                     ;EXIT TEST
     071546  104432                                                                  TRAP    C$EXIT
     071550  000760                                                                  .WORD   L10057-.
8912
8913 071552  000000                  ANS221: .WORD   0                       ;SAVE LOCATION FOR FIRST CHANNEL
8914 071554  000000                  ANS222: .WORD   0                       ;SAVE LOCATION FOR SECOND CHANNEL
8915 071556  000002                  ANS223: .WORD   2                       ;SAVE LOCATION FOR PATTERN TYPE
8916 071560  000200                  ANS224: .WORD   128.                    ;SAVE LOCATION FOR DELTA U
8917 071562  000144                  ANS225: .WORD   100.                    ;SAVE LOCATION FOR DELTA T
8918 071564  004000                  ANS226: .WORD   4000                    ;SAVE LOCATIN FOR STATIC VALUE
8919
8920                                         .NLIST  BEX
8921 071566      045      123      062  TSHD22::.ASCIZ /%S2%AANALOGUE OUTPUT (DYNAMIC) - SPECIFICALLY SELECTABLE.%N
8922 071662      106      111      122  MES221: .ASCIZ /FIRST CHANNEL/
8923 071700      114      101      123  MES222: .ASCIZ /LAST CHANNEL/
8924 071715      120      101      124  MES223: .ASCIZ /PATTERN TYPE (1 = SINGLE FIXED, 2 = RAMP)/
8925 071767      116      125      115  MES224: .ASCIZ /NUMBER OF BINARY STEPS (DELTA U) (1-4096)/
8926 072040      124      111      115  MES225: .ASCIZ /TIME INTERVAL (INCREMENTS) BETWEEN DELTA U STEPS
8927 072121      105      116      124  MES226: .ASCIZ /ENTER FIXED VALUE (OCTAL 0-7777)/
```

TEST 22: ANALOGUE OUTPUT (DYNAMIC TEST) - SPECIFICALLY SELECTN

```
                                                                                                                    
 8928                                                                                                               
 8929 072162      045      101      114  PME221: .ASCIZ /%ALAST CHANNEL HAS TO BE GREATER OR EQUAL TO THE FIRST ONE.%N/
 8930 072260      045      116      045  PME222: .ASCIZ  /%N%AC)NTROL STATUS REGISTER STATUS :%06%N/
 8931 072332      045      116      045  PME223: .ASCIZ /%N%ATYPE CNTL C TO ABORT OR CR FOR NEXT DELTA T AND U VALUE%N/
 8932 072430      122      105      101  E2201:  .ASCIZ /READY BIT IN CSA NOT SET AFTER LOADING DATA REGISTER (TIMEOUT)/
 8933                                             .LIST   BEX
 8934                                             .EVEN
 8935 072530                                      ENDTST
      072530                                                                  L10057:
      072530  104401                                                                    TRAP    C$ETST
```

```
                                .SBTTL  TEST 23: ANALOGUE OUTPUT (CALIBRATION ROUTINE)
                                ;*************************************************************************
                                ;       TEST 23 - ANALOGUE OUTPUT (CALIBRATION ROUTINE) - SPECIFICALLY
                                ;                 SELECTABLE.
                                ;
                                ;       THIS TEST IS FOR CALIBRATION AND ALLOWS THE USER TO
                                ;       FOLLOW A CALIBRATION PROCEDURE OR TO DO A MANUAL CALIBRATION.
                                ;
                                ;       FIRST OF ALL, THE USER GETS SOME INFORMATION ABOUT THE
                                ;       CALIBRATION EQUIPMENT. HE IS THEN IS PROMPTED FOR THE CHANNEL
                                ;       AND THE OUTPUT TYPE (VOLTAGE OR CURRENT). IF CURRENT IS
                                ;       SELECTED, THE PROGRAM LOOKS AT THE COFS BIT IN THE CSA TO FIND
                                ;       OUT THE OFFSET CONFIGURATION. NOW THE OPERATOR CAN CHOOSE
                                ;       BETWEEN THE CALIBRATION PROCEDURE OR MANUAL VALUES; IF MANUAL IS
                                ;       USED, THE OPERATOR CAN TYPE IN A VALUE IN MILLIVOLTS OR
                                ;       MICROAMPS.
                                ;
                                ;       OTHERWISE HE IS PROMPTED TO CALIBRATE FIRST THE OFFSET AND THEN
                                ;       THE GAIN. THEN HE IS REQUIRED TO TEST THE HALF FULL SCALE. TO GO
                                ;       FROM ONE STEP TO THE NEXT, THE USER MUST TYPE CARRIAGE RETURN.
                                ;       ALL STEPS (OFFSET,GAIN AND HALF FULL SCALE) MUST BE REPEATED
                                ;       BEFORE GOING ON TO THE NEXT CHANNEL.
                                ;*************************************************************************
072532                          BGNTST
072532                                                          I23::
8961 072532 004737 011714       CALL    SELECT          ;CALL SELECT ROUTINE
8962 072536 010010              .WORD   10010           ;GIVE TEST PARAMETER (SPEC/AD)
8963 072540 075120              TSHD23                  ;GIVE TEST HEADER
8964 072542 103002              BCC     ITRC23          ;IF CARRY IS CLEARED, EXIT TEST
8965 072544                     EXIT TST                ;EXIT TEST
072544 104432                                                   TRAP    C$EXIT
072546 004340                                                   .WORD   L10060
8966 072550                     ITRC23: PRINTF  #PME23A ;PRINT CALIBRATION EQUIPMENT
072550 012746 075402                                            MOV     #PME23A,-(SP)
072554 012746 000001                                            MOV     #1,-(SP)
072560 010600                                                   MOV     SP,R0
072562 104417                                                   TRAP    C$PNTF
072564 062706 000004                                            ADD     #4,SP
8967 072570                             PRINTF  #PME23B ;PRINT CALIBRATION EQUIPMENT
072570 012746 075530                                            MOV     #PME23B,-(SP)
072574 012746 000001                                            MOV     #1,-(SP)
072600 010600                                                   MOV     SP,R0
072602 104417                                                   TRAP    C$PNTF
072604 062706 000004                                            ADD     #4,SP
8968 072610                             PRINTF  #PME23D ;PRINT CALIBRATION EQUIPMENT
072610 012746 075606                                            MOV     #PME23D,-(SP)
072614 012746 000001                                            MOV     #1,-(SP)
072620 010600                                                   MOV     SP,R0
072622 104417                                                   TRAP    C$PNTF
072624 062706 000004                                            ADD     #4,SP
8969 072630                             PRINTF  #PME23E ;PRINT CALIBRATION EQUIPMENT
072630 012746 075715                                            MOV     #PME23E,-(SP)
072634 012746 000001                                            MOV     #1,-(SP)
072640 010600                                                   MOV     SP,R0
072642 104417                                                   TRAP    C$PNTF
072644 062706 000004                                            ADD     #4,SP
8970 072650 005005              CHA23:  CLR     R5              ;CLEAR SECOND PASS COUNTER
```

TEST 23: ANALOGUE OUTPUT (CALIBRATION ROUTINE)

```
                                                GMANID  MES231,ANS231,0,3400,0,3,YES    ;WHICH CHANNEL SHOULD CALIBR.
 072652                                                                                         TRAP    C$GMAN
 072652  104443                                                                                 BR      10000$
 072654  000406                                                                                 .WORD   ANS231
 072656  074752                                                                                 .WORD   T$CODE
 072660  000052                                                                                 .WORD   MES231
 072662  075214                                                                                 .WORD   3400
 072664  003400                                                                                 .WORD   T$LOLIM
 072666  000000                                                                                 .WORD   T$HILIM
 072670  000003
 072672                                                                                 10000$:
8972 072672  042777  003400  111004          BIC     #3400,@CSA      ;CLEAR CHANNEL NUMBER
8973 072700  053777  074752  110776          BIS     ANS231,@CSA     ;LOAD CHANNEL NUMBER
8974 072706  013704  074752                  MOV     ANS231,R4       ;GET CHANNEL NUMBER
8975 072712  000304                          SWAB    R4              ;SWAB HIGH BYTE INTO LOW BYTE
8976 072714  032777  100000  110762          BIT     #100000,@CSA    ;IS THE CHANNEL AVAILABLE ?
8977 072722  001011                          BNE     10$             ;BRANCH IF YES
8978 072724                                  PRINTF  #PME233         ;PRINT CHA. NOT AVAILABLE
 072724  012746  076121                                                MOV     #PME233,-(SP)
 072730  012746  000001                                                MOV     #1,-(SP)
 072734  010600                                                        MOV     SP,R0
 072736  104417                                                        TRAP    C$PNTF
 072740  062706  000004                                                ADD     #4,SP
8979 072744  000741                          BR      CHA23           ;
8980 072746                          10$:    GMANID  MES232,ANS232,0, 1,0,1,YES      ;CURRENT OR VOLTAGE ?
 072746  104443                                                        TRAP    C$GMAN
 072750  000406                                                        BR      10001$
 072752  074754                                                        .WORD   ANS232
 072754  000032                                                        .WORD   T$CODE
 072756  075243                                                        .WORD   MES232
 072760  177777                                                        .WORD   1
 072762  000000                                                        .WORD   T$LOLIM
 072764  000001                                                        .WORD   T$HILIM
 072766                                                         10001$:
8981 072766                                  GMANII  MES233,ANS233, 1,YES            ;PROCEDURE OR MANUAL ?
 072766  104443                                                        TRAP    C$GMAN
 072770  000404                                                        BR      10002$
 072772  074756                                                        .WORD   ANS233
 072774  000130                                                        .WORD   T$CODE
 072776  075320                                                        .WORD   MES233
 073000  177777                                                        .WORD   1
 073002                                                         10002$:
8982 073002  005037  004134                  CLR     MODE            ;LOAD DACON INPUT (UNIPOLAR)
8983 073006  005737  074754                  TST     ANS233          ;IS VOLTAGE USED ?
8984 073012  001012                          BNE     20$             ;BRANCH IF YES
8985 073014  012737  000040  004134          MOV     #40,MODE        ;LOAD DACON INPUT (0 -10MA)
8986 073022  032777  000010  110650          BIT     #10,@MOD        ;READ OFFSET CONFIGURATION
8987 073030  001403                          BEQ     20$             ;BRANCH IF 0 MA OFFSET
8988 073032  012737  000003  004134          MOV     #3,MODE         ;LOAD DACON INPUT (4 -20MA)
8989 073040  005037  004136          20$:    CLR     GAIN            ;LOAD DACON INPUT (GAIN)
8990 073044  027737  000001  074756          CMP     #1,ANS233       ;IS MANUAL VALUE USED ?
8991 073052  001402                          BEQ     30$             ;BRANCH IF NO
8992 073054  000137  074544                  JMP     MAN23           ;IF YES JUMP TO MANUAL ROUT.
8993 073060  005002                  30$:    CLR     R2              ;CLEAR INHIBIT PRINT FLAG
8994 073062  013703  004144          40$:    MOV     REDTIM,R3       ;LOAD TIMEOUT COUNTER
8995 073066  032777  000200  110610  50$:    BIT     #200,@CSA       ;READY SET ?
8996 073074  001010                          BNE     60$             ;BRANCH IF YES
8997 073076  005303                          DEC     R3              ;DECREMENT TIMEOUT COUNTER
```

TEST 23: ANALOGUE OUTPUT (CALIBRATION ROUTINE)

```
                                                CALL    INSERT          ;SKIP BRANCH IF 'SET' IS SET
                                                BNE     50$             ;BRANCH IF NOT ZERO
                                                ERRSOFT 2301,E2301,EER3 ;ERROR HANDLER
                                                                                TRAP    C$ERSOFT
                                                                                .WORD   2301
                                                                                .WORD   E2301
                                                                                .WORD   EER3
                                        60$:    MOV     #1,@DAT         ;LOAD DATA REG.
                                                TST     R5              ;WAS THE OFFSET CALIB. MES. PRINTED
                                                BNE     90$             ;BRANCH IF YES
                                                MOV     #1,R1           ;SETUP R1 FOR PRINTOUT
                                                PRINTF  @PME235,R1,R4   ;PRINT CHANNEL NUMBER + DAT CONT.
                                                                                MOV     R4,-(SP)
                                                                                MOV     R1,-(SP)
                                                                                MOV     @PME235,-(SP)
                                                                                MOV     #3,-(SP)
                                                                                MOV     SP,R0
                                                                                TRAP    C$PNTF
                                                                                ADD     #10,SP
                                                MOV     MODE,R3         ;LOAD TABLE START ADDRESS (O/P=1)
                                                ASL     R3              ;
                                                ASL     R3              ;
                                                MOV     TAB23(R3),R1    ;LOAD R1 FOR DECOUT ROUTINE
                                                MOV     TAB23+2(R3),R2  ;LOAD R2 FOR DECOUT ROUTINE
                                                TST     ANS232          ;WAS VOLTAGE RANGE REQUESTED
                                                BNE     66$             ;BRANCH IF YES
                                                BIT     #10,@MOD        ;IS OFFSET BIT SET ?
                                                BNE     62$             ;BRANCH IF YES
                                                PRINTF  @PME231         ;PRINT 0 - 20 MA RANGE IS SELECTED
                                                                                MOV     @PME231,-(SP)
                                                                                MOV     #1,-(SP)
                                                                                MOV     SP,R0
                                                                                TRAP    C$PNTF
                                                                                ADD     #4,SP
                                                BR      66$             ;SKIP 4 - 20 MA PRINTOUT
                                        62$:    PRINTF  @PME232         ;PRINT 4 - 20 MA RANGE IS SELECTED
                                                                                MOV     @PME232,-(SP)
                                                                                MOV     #1,-(SP)
                                                                                MOV     SP,R0
                                                                                TRAP    C$PNTF
                                                                                ADD     #4,SP
                                        66$:    PRINTF  @PME234         ;PRINT OFFSET CALIBRATION
                                                                                MOV     @PME234,-(SP)
                                                                                MOV     #1,-(SP)
                                                                                MOV     SP,R0
                                                                                TRAP    C$PNTF
                                                                                ADD     #4,SP
                                                CALL    DECOUT          ;CALL DECIMAL OUT ROUTINE
                                                TST     ANS232          ;IS VOLTAGE USED ?
                                                BNE     70$             ;BRANCH IF YES
                                                PRINTF  @OUT231         ;PRINT 'MICROAMPS'
                                                                                MOV     @OUT231,-(SP)
                                                                                MOV     #1,-(SP)
                                                                                MOV     SP,R0
```

TEST 23: ANALOGUE OUTPUT (CALIBRATION ROUTINE)

```
        073326  104417                                                          TRAP    C$PNTF
        073330  062706  000004                                                  ADD     #4,SP
 9026 073334  006201                    ASR     R1              ;DIVIDE BY TWO FOR VOLTAGE VALUE
 9027 073336  006002                    ROR     R2              ;DIVIDE BY TWO ADD CARRY FOR VOLTAGE
 9028 073340                            PRINTF  #PME239,R1,R2   ;PRINT VOLTAGE ON 500 OHM RESISTOR
        073340  010246                                                          MOV     R2,-(SP)
        073342  010146                                                          MOV     R1,-(SP)
        073344  012746  076576                                                  MOV     #PME239,-(SP)
        073350  012746  000003                                                  MOV     #3,-(SP)
        073354  010600                                                          MOV     SP,R0
        073356  104417                                                          TRAP    C$PNTF
        073360  062706  000010                                                  ADD     #10,SP
 9029 073364  016301  074764            MOV     TAB23+4(R3),R1  ;GET VOLTAGE ON 500 OHM TOLLERANCE
 9030 073370  016302  074766            MOV     TAB23+6(R3),R2  ;...
 9031 073374                            PRINTF  #TOL1,R1,R2     ;AND PRINT IT
        073374  010246                                                          MOV     R2,-(SP)
        073376  010146                                                          MOV     R1,-(SP)
        073400  012746  076707                                                  MOV     #TOL1,-(SP)
        073404  012746  000003                                                  MOV     #3,-(SP)
        073410  010600                                                          MOV     SP,R0
        073412  104417                                                          TRAP    C$PNTF
        073414  062706  000010                                                  ADD     #10,SP
 9032 073420  000426                    BR      80$             ;AND SKIP MILLIVOLTS PRINTOUT
 9033 073422                    70$:    PRINTF  #OUT232         ;PRINT 'MILLIVOLTS'
        073422  012746  076762                                                  MOV     #OUT232,-(SP)
        073426  012746  000001                                                  MOV     #1,-(SP)
        073432  010600                                                          MOV     SP,R0
        073434  104417                                                          TRAP    C$PNTF
        073436  062706  000004                                                  ADD     #4,SP
 9034 073442  016301  074764            MOV     TAB23+4(R3),R1  ;GET VOLTAGE TOLLERANCE
 9035 073446  016302  074766            MOV     TAB23+6(R3),R2  ;...
 9036 073452                            PRINTF  #TOL1,R1,R2     ;AND PRINT IT
        073452  010246                                                          MOV     R2,-(SP)
        073454  010146                                                          MOV     R1,-(SP)
        073456  012746  076707                                                  MOV     #TOL1,-(SP)
        073462  012746  000003                                                  MOV     #3,-(SP)
        073466  010600                                                          MOV     SP,R0
        073470  104417                                                          TRAP    C$PNTF
        073472  062706  000010                                                  ADD     #10,SP
 9037 073476                    80$:    PRINTF  #PME236         ;PRINT HOW TO CONTINUE
        073476  012746  076352                                                  MOV     #PME236,-(SP)
        073502  012746  000001                                                  MOV     #1,-(SP)
        073506  010600                                                          MOV     SP,R0
        073510  104417                                                          TRAP    C$PNTF
        073512  062706  000004                                                  ADD     #4,SP
 9038 073516  012702  000001            MOV     #1,R2           ;SET INHIBIT OFFSET PRINTOUT
 9039 073522  004737  017066    90$:    CALL    CALRET          ;READ OPERATOR KEYBOARD ACTION
 9040 073526  103402                    BCS     95$             ;BRANCH IF CARRIGE RETURN TO NEXT
 9041 073530  000137  073062            JMP     40$             ;REPEAT IF NO CARRIGE RETURN FOUND
 9042
 9043 073534  005002            95$:    CLR     R2              ;
 9044 073536  013703  004164    100$:   MOV     READTIM,R3      ;LOAD READY TIMEOUT COUNTER
 9045 073542  032777  000200  110134  110$:   BIT     #200,@CSA       ;READ, SET
 9046 073550  001010                    BNE     120$            ;BRANCH IF YES
 9047 073552  005303                    DEC     R3              ;DECREMENT TIMEOUT COUNTER
 9048 073554  004737  012146            CALL    INSERT          ;SKIP BRANCH IF   SET IS SET
 9049 073560  001370                    BNE     110$            ;BRANCH IF COUNTER IS NOT ZERO
```

TEST 23: ANALOGUE OUTPUT (CALIBRATION ROUTINE)

```
                074010  062706  000010                                                  ADD     #10,SP
          9073  074014  000426                  BR      140$            ;AND SKIP MILLIVOLT PRINTOUT
          9074  074016                  130$:   PRINTF  #OUT232         ;PRINT 'MILLIVOLTS'
                074016  012746  076762                                                  MOV     #OUT232,-(SP)
                074022  012746  000001                                                  MOV     #1,(SP)
                074026  010600                                                          MOV     SP,R0
                074030  104417                                                          TRAP    C$PNTF
                074032  062706  000004                                                  ADD     #4,SP
          9075  074036  016301  075024          MOV     TAB23+44(R3),R1 ;GET VOLTAGE ON 500 OHM TOLLERANCE
          9076  074042  016302  075026          MOV     TAB23+46(R3),R2 ;...
          9077  074046                          PRINTF  #TOL1,R1,R2     ;AND PRINT IT
                074046  010246                                                          MOV     R2,-(SP)
                074050  010146                                                          MOV     R1,-(SP)
                074052  012746  076707                                                  MOV     #TOL1,-(SP)
                074056  012746  000003                                                  MOV     #3,-(SP)
                074062  010600                                                          MOV     SP,R0
                074064  104417                                                          TRAP    C$PNTF
                074066  062706  000010                                                  ADD     #10,SP
          9078  074072                  140$:   PRINTF  #PME236          ;PRINT HOW TO CONTINUE
                074072  012746  076352                                                  MOV     #PME236,-(SP)
                074076  012746  000001                                                  MOV     #1,(SP)
                074102  010600                                                          MOV     SP,R0
                074104  104417                                                          TRAP    C$PNTF
                074106  062706  000004                                                  ADD     #4,SP
          9079  074112  012702  000001          MOV     #1,R2           ;SET INHIBIT GAIN PRINTOUT
          9080  074116  004737  017066  150$:   CALL    CALRET          ;READ OPERATOR KEYBOARD ACTION
          9081  074122  103402                  BCS     155$            ;BRANCH IF CARRIAGE RETURN
          9082  074124  000137  073536          JMP     100$            ;REPEAT IF NO CARRIGE RETURN FOUD
          9083
          9084  074130  005002          155$:   CLR     R2              ;CLEAR INHIBIT HALF SCALE PRI. FLAG
          9085  074132  013703  004164  160$:   MOV     @EDTIM,R3       ;LOAD READY TIMEOUT COUNTER
          9086  074136  032777  000200  107540  170$:   BIT     #200,@CSA       ;READY SET
          9087  074144  001010                  BNE     180$            ;BRANCH IF YES
          9088  074146  005303                  DEC     R3              ;DECREMENT TIMEOUT COUNTER
          9089  074150  004737  012146          CALL    INSERT          ;SKIP BRANCH IF 'SEIP' IS SET
          9090  074154  001370                  BNE     170$            ;BRANCH IF NOT ZERO
          9091  074156                          ERRSOFT 2303,E2301,EER3 ;ERROR HANDLER
                074156  104457                                                                  TRAP    C$ERSOFT
                074160  004577                                                                  .WORD   2303
                074162  077021                                                                  .WORD   E2301
                074164  007442                                                                  .WORD   EER3
          9092  074166  012777  004000  107506  180$:   MOV     #4000,@DAT      ;LOAD DATA REG. (HALF SCALE)
          9093  074174  005702                  TST     R2              ;WAS THE GAIN CALIB. MES. PRINTED?
          9094  074176  001145                  BNE     210$            ;BRANCH IF YES
          9095  074200  012701  004000          MOV     #4000,R1        ;SETUP R1 FOR PRINTOUT
          9096  074204                          PRINTF  #PME235,R1,R4   ;PRINT DAT AND CHA. VALUE
                074204  010446                                                                  MOV     R4,-(SP)
                074206  010146                                                                  MOV     R1,-(SP)
                074210  012746  076275                                                          MOV     #PME235,-(SP)
                074214  012746  000003                                                          MOV     #3,-(SP)
                074220  010600                                                                  MOV     SP,R0
                074222  104417                                                                  TRAP    C$PNTF
                074224  062706  000010                                                          ADD     #10,SP
          9097  074230  013703  004134          MOV     MODE,R3         ;LOAD TABLE START POINT (O'P 4000)
          9098  074234  006303                  ASL     R3              ;BUILD EVEN ADDRESS
          9099  074236  006303                  ASL     R3              ;...
          9100  074240  006303                  ASL     R3              ;...
```

TEST 23: ANALOGUE OUTPUT (CALIBRATION ROUTINE)

```
9101 074242  016301  075060                MOV     TAB23+100(R3),R1        ;LOAD R1 FOR DECOUT ROUTINE
9102 074246  016302  075062                MOV     TAB23+102(R3),R2        ;LOAD R2 FOR DECOUT ROUTINE
9103 074252                                PRINTF  #PME238                 ;PRINT HALF SCALE CALIBRATION
     074252  012746  076507                                                        MOV     #PME238,-(SP)
     074256  012746  000001                                                        MOV     #1,-(SP)
     074262  010600                                                                MOV     SP,R0
     074264  104417                                                                TRAP    C$PNTF
     074266  062706  000004                                                        ADD     #4,SP
9104 074272  004737  015764                CALL    DECOUT                  ;CALL DECIMAL OUT ROUTINE
9105 074276  005737  074754                TST     ANS232                  ;IS VOLTAGE USED ?
9106 074302  001043                       BNE     190$                    ;BRANCH IF YES
9107 074304                                PRINTF  #OUT231                 ;PRINT 'MICROAMPS'
     074304  012746  077002                                                        MOV     #OUT231,-(SP)
     074310  012746  000001                                                        MOV     #1,-(SP)
     074314  010600                                                                MOV     SP,R0
     074316  104417                                                                TRAP    C$PNTF
     074320  062706  000004                                                        ADD     #4,SP
9108 074324  006201                       ASR     R1                      ;DIVIDE BY TWO FOR VOLTAGE VALUE
9109 074326  006002                       ROR     R2                      ;DIVIDE BY TWO ADD CARRY FOR VOLTAGE
9110 074330                                PRINTF  #PME239,R1,R2           ;PRINT VOLTAGE ON 500 OHM RESISTOR
     074330  010246                                                                MOV     R2,-(SP)
     074332  010146                                                                MOV     R1,-(SP)
     074334  012746  076576                                                        MOV     #PME239,-(SP)
     074340  012746  000003                                                        MOV     #3,-(SP)
     074344  010600                                                                MOV     SP,R0
     074346  104417                                                                TRAP    C$PNTF
     074350  062706  000010                                                        ADD     #10,SP
9111 074354  016301  075064                MOV     TAB23+104(R3),R1        ;GET VOLTAGE ON 500 OHM TOLLERANCE
9112 074360  016302  075066                MOV     TAB23+106(R3),R2        ;...
9113 074364                                PRINTF  #TOL1,R1,R2             ;AND PRINT IT
     074364  010246                                                                MOV     R2,-(SP)
     074366  010146                                                                MOV     R1,-(SP)
     074370  012746  076707                                                        MOV     #TOL1,-(SP)
     074374  012746  000003                                                        MOV     #3,-(SP)
     074400  010600                                                                MOV     SP,R0
     074402  104417                                                                TRAP    C$PNTF
     074404  062706  000010                                                        ADD     #10,SP
9114 074410  000426                       BR      200$                    ;AND SKIP MILLIVOLT PRINTOUT
9115 074412                        190$:  PRINTF  #OUT232                 ;PRINT 'MILLIVOLTS'
     074412  012746  075762                                                        MOV     #OUT232,-(SP)
     074416  012746  000001                                                        MOV     #1,-(SP)
     074422  010600                                                                MOV     SP,R0
     074424  104417                                                                TRAP    C$PNTF
     074426  062706  000004                                                        ADD     #4,SP
9116 074432  016301  075064                MOV     TAB23+104(R3),R1        ;GET VOLTAGE ON 500 OHM TOLLERANCE
9117 074436  016302  075066                MOV     TAB23+106(R3),R2        ;...
9118 074442                                PRINTF  #TOL1,R1,R2             ;AND PRINT IT
     074442  010246                                                                MOV     R2,-(SP)
     074444  010146                                                                MOV     R1,-(SP)
     074446  012746  076707                                                        MOV     #TOL1,-(SP)
     074452  012746  000003                                                        MOV     #3,-(SP)
     074456  010600                                                                MOV     SP,R0
     074460  104417                                                                TRAP    C$PNTF
     074462  062706  000010                                                        ADD     #10,SP
9119 074466                        200$:  PRINTF  #PME236                 ;PRINT HOW TO CONTINUE
     074466  012746  076452                                                        MOV     #PME236,-(SP)
     074472  012746  000001                                                        MOV     #1,-(SP)
```

TEST 23: ANALOGUE OUTPUT (CALIBRATION ROUTINE)

```
        074476  010600                                                  MOV     SP,R0
        074500  104417                                                  TRAP    C$PNTF
        074502  062706  000004                                          ADD     #4,SP
 9120   074506  012702  000001              MOV     #1,R2               ;SET INHIBIT PRNTOUT FLAG
 9121   074512  004737  017066      210$:   CALL    CALRET              ;READ OPERATOR KEYBOARD ACTION
 9122   074516  103402                      BCS     215$                ;IF CARRIGE RETURN NEXT STEP
 9123   074520  000137  074132              JMP     160$                ;BRANCH IF NO CARRIAGE RETURN
 9124   074524  005705              215$:   TST     R5                  ;WAS IT THE SECOND PASS ?
 9125   074526  001402                      BEQ     220$                ;IF NO BRANCH
 9126   074530  000137  072650              JMP     CHA23               ;IF YES JUMP TO CHANNEL PRINTOUT
 9127   074534  012705  000001      220$:   MOV     #1,R5               ;SET SECOND PASS INDICATOR
 9128   074540  000137  073060              JMP     30$                 ;DO THE SECOND PASS
 9129
 9130                              ;THE FOLLOWING PART IS USED IF THE OPERATOR WANTS MANUAL VALUES FOR
 9131                              ;CALIBRATION
 9132
 9133   074544  005737  074754      MAN23:  TST     ANS232              ;IS VOLTAGE USED ?
 9134   074550  001004                      BNE     10$                 ;BRANCH IF YES
 9135   074552  012737  077002  004140      MOV     #OUT231,PADD        ;LOAD 'MICROAMPS' INFORMATION
 9136   074560  000403                      BR      20$                 ;AND JUMP
 9137   074562  012737  076762  004140  10$:MOV     #OUT232,PADD        ;LOAD 'MILLIVOLTS' INFORMATION
 9138   074570                      20$:    PRINTF  #PRMST              ;PRINT ENTER MANUAL VALUE
        074570  012746  076655                                          MOV     #PRMST,-(SP)
        074574  012746  000001                                          MOV     #1,-(SP)
        074600  010600                                                  MOV     SP,R0
        074602  104417                                                  TRAP    C$PNTF
        074604  062706  000004                                          ADD     #4,SP
 9139   074610  004737  015204              CALL    DEC1N               ;REQUEST A DEC. NUM. FROM OPERATOR
 9140   074614  004737  014730              CALL    ADCON               ;CONVERT THE ANALOGUE VALUE TO DIGI.
 9141   074620  005002                      CLR     R2                  ;CLEAR INHIBIT MESSAGES FLAG
 9142   074622  013703  004164      30$:    MOV     REDTIM,R3           ;LOAD TIMEOUT COUNTER
 9143   074626  032777  000200  107050  40$:BIT     #200,@CSA           ;READY SET
 9144   074634  001010                      BNE     50$                 ;BRANCH IF YES
 9145   074636  005303                      DEC     R3                  ;DECREMENT TIMEOUT COUNTER
 9146   074640  004737  012146              CALL    INSERT              ;SKIP BRANCH IF 'SPIF' IS SET
 9147   074644  001370                      BNE     40$                 ;BRANCH IF COUNTER IS NOT ZERO
 9148   074646                              ERRSOFT 2304,E2301,EER3     ;ERROR HANDLER
        074646  104457                                                  TRAP    C$ERSOFT
        074650  004400                                                  .WORD   2304
        074652  077021                                                  .WORD   E2301
        074654  007442                                                  .WORD   EER3
 9149   074656  010177  107020      50$:    MOV     R1,@DAT             ;LOAD DIGITAL VALUE INTO DATA REGISTER
 9150   074662  004737  017066              CALL    CALRET              ;READ OPERATOR KEYBOARD ACTION
 9151   074666  103726                      BCS     MAN23               ;BRANCH IF 'CR' WAS TYPED
 9152   074670  005702                      TST     R2                  ;INHIBIT THE PRINT OUT ?
 9153   074672  001353                      BNE     30$                 ;BRANCH IF YES
 9154   074674                              PRINTF  #PME235,R1,R4       ;PRINT CHANNEL NUMBER + DAT CONT.
        074674  010446                                                  MOV     R4,-(SP)
        074676  010146                                                  MOV     R1,-(SP)
        074700  012746  076275                                          MOV     #PME235,-(SP)
        074704  012746  000003                                          MOV     #3,-(SP)
        074710  010600                                                  MOV     SP,R0
        074712  104417                                                  TRAP    C$PNTF
        074714  062706  000010                                          ADD     #10,SP
 9155   074720                      60$:    PRINTF  #PME236             ;PRINT HOW TO CONTINUE
        074720  012746  076456                                          MOV     #PME236,-(SP)
        074724  012746  000001                                          MOV     #1,-(SP)
```

TEST 23: ANALOGUE OUTPUT (CALIBRATION ROUTINE)

```
                074730  010600                                                  MOV     SP,R0
                074732  104417                                                  TRAP    C$PNTF
                074734  062706  000004                                          ADD     #4,SP
  9156          074740  012702  000001                  MOV     #1,R2           ;SET INHIBIT PRINT FLAG
  9157          074744  000726                          BR      30$             ;GO INTO LOOP
  9158          074746                          EXQV23: EXIT    TST             ;EXIT TEST
                074746  104432                                                  TRAP    C$EXIT
                074750  002136                                                  .WORD   L10060-.
  9159
  9160          074752  000000                  ANS231: .WORD   0               ;SAVE LOCATION FOR CHANNEL
  9161          074754  000000                  ANS232: .WORD   0               ;SAVE LOCATION FOR CURRENT OR VOLT
  9162          074756  000001                  ANS233: .WORD   1               ;SAVE LOCATION FOR OPERATOR VALUE
  9163
  9164
  9165
  9166          074760  000002  000671  000002  TAB23:  .WORD   2.,441.,2,400.  ;MODE 0  (LOADED VALUE INTO DAT = 1)
                074766  000620
  9167          074770  154365  000000  000002          .WORD   -9995.,000,2,400. ;MODE 1  (LOADED VALUE INTO DAT = 1)
                074776  000620
  9168          075000  000004  001563  000004          .WORD   4.,883.,4,800.  ;MODE 2  (LOADED VALUE INTO DAT = 1)
                075006  001440
  9169          075010  007643  000000  000004          .WORD   4003.,000,4,000 ;MODE 3  (LOADED VALUE INTO DAT = 1)
                075016  000000
  9170
  9171          075020  023415  000000  000002          .WORD   9997.,000,2,400. ;MODE 0  (LOADED VALUE INTO DAT = 7777)
                075026  000620
  9172          075030  023413  000000  000002          .WORD   9995.,000,2,400. ;MODE 1  (LOADED VALUE INTO DAT = 7777)
                075036  000620
  9173          075040  047033  000000  000004          .WORD   19995.,000.4,800. ;MODE 2  (LOADED VALUE INTO DAT = 7777)
                075046  001440
  9174          075050  047034  000000  000004          .WORD   19996.,000,4,000 ;MODE 3  (LOADED VALUE INTO DAT = 7777)
                075056  000000
  9175
  9176          075060  011610  000000  000002          .WORD   5000.,000,2,400. ;MODE 0  (LOADED VALUE INTO DAT = 4000)
                075066  000620
  9177          075070  000000  000000  000002          .WORD   000.,000,2,400. ;MODE 1  (LOADED VALUE INTO DAT = 4000)
                075076  000620
  9178          075100  023420  000000  000004          .WORD   10000.,000,4,800. ;MODE 2  (LOADED VALUE INTO DAT = 4000)
                075106  001440
  9179          075110  027340  000000  000004          .WORD   12000.,000,4,000 ;MODE 3  (LOADED VALUE INTO DAT = 4000)
                075116  000000
  9180
  9181
  9182                                                  .NLIST  BEX
  9183          075120      045     123     062  TSHD23::.ASCIZ  /%%%AANALOGUE OUTPUT (CALIBR.) - SPECIFICALLY SELECTABLE.%N/
  9184          075214      105     110     101  MES231: .ASCIZ  /CHANNEL TO CALIBRATE ?/
  9185          075243      105     101     114  MES232: .ASCIZ  /CALIBRATE FOR CURRENT (0) OR FOR VOLTAGE (1)/
  9186          075320      104     117     040  MES233: .ASCIZ  /DO YOU WANT TO FOLLOW THE CALIBRATION PROCEDURE ?/
  9187
  9188          075402      045     116     045  PME23A: .ASCII  /%N%ACALIBRATION EQUIPMENT%N/
  9189          075435      045     116     045          .ASCIZ  /%N%ADIGITAL VOLTMETER TO MEASURE THE VOLTAGE AND CURRENT%N
  9190          075530      045     101     117  PME23B: .ASCIZ  /%AOUTPUTS. THE DVM SHOULD HAVE AN ACCURACY OF 0.01 PERCENT.%N
  9191          075626      045     101     106  PME23D: .ASCIZ  /%AFOR CURRENT ADJUSTMENT ATTACH THE 500 OHM RESISTOR%N
  9192          075715      045     101     111  PME23E: .ASCIZ  /%AIN PARALLEL WITH THE DVM.%N/
  9193
  9194          076014      045     116     045  PME231: .ASCIZ  /%N%A0 - 20 MA RANGE IS SELECTED (CSR5 BIT CLEARED)%N
  9195          076040      045     116     045  PME232: .ASCIZ  /%N%A4 - 20 MA RANGE IS SELECTED (CSR5 BIT SET)%N
```

TEST 33: ANALOGUE OUTPUT (CALIBRATION ROUTINE)

```
9196 076121  045  101  103  PME233:  .ASCIZ  /%ACHANNEL NOT AVAILABLE, ENTER AVAILABLE CHANNEL %N/
9197 076205  045  116  045  PME234:  .ASCIZ  /%N%AADJUST THE OFFSET TRIMPOT UNTIL THE DVM INDICATES :/
9198 076275  045  116  045  PME235:  .ASCIZ /%N%ABIT PATTERN %O6%A OUTPUT TO CHANNEL :%D5/
9199 076352  045  116  045  PME236:  .ASCIZ  /%N%ATYPE CARRIAGE RETURN TO CONTINUE%N/
9200 076421  045  116  045  PME237:  .ASCIZ  /%N%AADJUST THE GAIN TRIMPOT UNTIL THE DVM INDICATES :/
9201 076507  045  116  045  PME238:  .ASCIZ  /%N%ANOW CHECK THE HALF SCALE THE DVM SHOULD INDICATE :/
9202 076576  045  101  075  PME239:  .ASCIZ  /%A= -%D5%A.%Z3%A MILLIVOLT ON 500 OHM RESISTOR/
9203 076655  045  116  045  PRMST:   .ASCIZ  /%N%AENTER MANUAL VALUE IN/
9204
9205 076707  045  101  040  TOL1:    .ASCIZ  \%A TOLERANCE +/- %D1%A.%D3%A MILLIVOLTS%N\
9206 076762  045  101  040  OUT232:  .ASCIZ  /%A MILLIVOLTS%N/
9207 077002  045  101  040  OUT231:  .ASCIZ  /%A MICROAMPS%N/
9208
9209 077021  122  105  101  E2301:   .ASCIZ  /READY BIT IN CSA NOT SET AFTER LOADING DATA REGISTER/
9210                                  .LIST   BEX
9211                                  .EVEN
9212 077106                           ENDTST
     077106                                                        I10060:
     077106  104401                                                       TRAP    C$FTST
```

TEST 24: ANALOGUE INPUT (CALIBRATION ROUTINE)

```
                077234  062706  000004                          ADD     #4,SP
9247            077240                          PRINTF  #PME24C         ;CALIBRATION INFORMATION FOR BIPOLAR
                077240  012746  100604                          MOV     #PME24C,-(SP)
                077244  012746  000001                          MOV     #1,-(SP)
                077250  010600                                  MOV     SP,R0
                077252  104417                                  TRAP    C$PNTF
                077254  062706  000004                          ADD     #4,SP
9248            077260                          PRINTF  #PME24D         ;CALIBRATION INFORMATION FOR BIPOLAR
                077260  012746  100675                          MOV     #PME24D,-(SP)
                077264  012746  000001                          MOV     #1,-(SP)
                077270  010600                                  MOV     SP,R0
                077272  104417                                  TRAP    C$PNTF
                077274  062706  000004                          ADD     #4,SP
9249            077300                          PRINTF  #PME24E         ;CALIBRATION INFORMATION FOR BIPOLAR
                077300  012746  100750                          MOV     #PME24E,-(SP)
                077304  012746  000001                          MOV     #1,-(SP)
                077310  010600                                  MOV     SP,R0
                077312  104417                                  TRAP    C$PNTF
                077314  062706  000004                          ADD     #4,SP
9250            077320  000460                          BR      20$             ;AND SKIP UNIPOLAR MESSAGE
9251
9252            077322                  10$:    PRINTF  #PME24A         ;CALIBRATION INFORMATION GENERAL
                077322  012746  100364                          MOV     #PME24A,-(SP)
                077326  012746  000001                          MOV     #1,-(SP)
                077332  010600                                  MOV     SP,R0
                077334  104417                                  TRAP    C$PNTF
                077336  062706  000004                          ADD     #4,SP
9253            077342                          PRINTF  #PME243         ;PRINT UNIPOLAR MESSAGES
                077342  012746  101604                          MOV     #PME243,-(SP)
                077346  012746  000001                          MOV     #1,-(SP)
                077352  010600                                  MOV     SP,R0
                077354  104417                                  TRAP    C$PNTF
                077356  062706  000004                          ADD     #4,SP
9254            077362                          PRINTF  #PME24F         ;CALIBRATION INFORMATION FOR UNIPOLAR
                077362  012746  101036                          MOV     #PME24F,-(SP)
                077366  012746  000001                          MOV     #1,-(SP)
                077372  010600                                  MOV     SP,R0
                077374  104417                                  TRAP    C$PNTF
                077376  062706  000004                          ADD     #4,SP
9255            077402                          PRINTF  #PME24G         ;CALIBRATION INFORMATION FOR UNIPOLAR
                077402  012746  101145                          MOV     #PME24G,-(SP)
                077406  012746  000001                          MOV     #1,-(SP)
                077412  010600                                  MOV     SP,R0
                077414  104417                                  TRAP    C$PNTF
                077416  062706  000004                          ADD     #4,SP
9256            077422                          PRINTF  #PME24H         ;CALIBRATION INFORMATION FOR UNIPOLAR
                077422  012746  101235                          MOV     #PME24H,-(SP)
                077426  012746  000001                          MOV     #1,-(SP)
                077432  010600                                  MOV     SP,R0
                077434  104417                                  TRAP    C$PNTF
                077436  062706  000004                          ADD     #4,SP
9257            077442                          PRINTF  #PME24I         ;CALIBRATION INFORMATION FOR UNIPOLAR
                077442  012746  101307                          MOV     #PME24I,-(SP)
                077446  012746  000001                          MOV     #1,-(SP)
                077452  010600                                  MOV     SP,R0
                077454  104417                                  TRAP    C$PNTF
                077456  062706  000004                          ADD     #4,SP
```

TEST 24: ANALOGUE INPUT (CALIBRATION ROUTINE)

```
 9258
 9259 077462  005037  004134          20$:    CLR     MODE                                    ;LOAD DACON INPUT (UNIPOLAR)
 9260 077466  032777  000020  104204          BIT     #20,@MOD                                ;IS UNIPOLAR RANGE SWITCHED
 9261 077474  001403                          BEQ     30$                                     ;BRANCH IF YES
 9262 077476  012737  000001  004134          MOV     #1,MODE                                 ;LOAD DACON INPUT (BIPOLAR)
 9263 077504                          30$:    GMANID  MES242,ANS242,D,77400,0,15.,YES         ;GET USED CHANNEL
      077504  104443                                                                                  TRAP    C$GMAN
      077506  000406                                                                                 BR      10001$
      077510  100074                                                                                 .WORD   ANS242
      077512  000052                                                                                 .WORD   T$CODE
      077514  100246                                                                                 .WORD   MES242
      077516  077400                                                                                 .WORD   77400
      077520  000000                                                                                 .WORD   T$LOLIM
      077522  000017                                                                                 .WORD   T$HILIM
      077524                                                                                   10001$:
 9264 077524  042777  077536  104152          BIC     #77536,@CSA                             ;CLEAR CSA R/W BITS
 9265 077532  053777  100074  104144          BIS     ANS242,@CSA                             ;LOAD CHANNEL NUMBER
 9266 077540  013704  100074                  MOV     ANS242,R4                               ;AND GET CHANNEL NUMBER
 9267 077544  032777  100000  104132          BIT     #100000,@CSA                            ;IS THE CHANNEL AVAILABLE
 9268 077552  001011                          BNE     40$                                     ;BRANCH IF YES
 9269 077554                                  PRINTF  @PME241                                 ;PRINT CHA. NOT AVAILABLE
      077554  012746  101375                                                                      MOV     #PME241,-(SP)
      077560  012746  000001                                                                      MOV     #1,-(SP)
      077564  010600                                                                             MOV     SP,R0
      077566  104417                                                                             TRAP    C$PNTF
      077570  062706  000004                                                                     ADD     #4,SP
 9270 077574  000743                          BR      30$                                     ;
 9271
 9272 077576                          40$:    GMANID  MES243,ANS243,0,16,0,7,YES              ;GET GAIN
      077576  104443                                                                                  TRAP    C$GMAN
      077600  000406                                                                                 BR      10002$
      077602  100076                                                                                 .WORD   ANS243
      077604  000032                                                                                 .WORD   T$CODE
      077606  100306                                                                                 .WORD   MES243
      077610  000016                                                                                 .WORD   16
      077612  000000                                                                                 .WORD   T$LOLIM
      077614  000007                                                                                 .WORD   T$HILIM
      077616                                                                                   10002$:
 9273 077616  053777  100076  104060          BIS     ANS243,@CSA                             ;LOAD GAIN INTO CSA
 9274 077624  006237  100076                  ASR     ANS243                                  ;CHANGE GAIN BIT POSITION
 9275 077630  013737  100076  004136          MOV     ANS243,GAIN                             ;LOAD DACON INPUT (GAIN)
 9276 077636  006337  100076                  ASL     ANS243                                  ;CHANGE BACK GAIN BIT POSI.
 9277
 9278 077642  005777  104034                  TST     @DAT                            ;READ DAT FOR CLR DONE+ERR BIT IN CSA
 9279 077648  017737  104032  004064  50$:    MOV     @CSA,BAD                        ;GET CSA CONTENTS
 9280 077654  032737  000200  004064          BIT     #200,BAD                        ;READY FOR CONVERSION (DONE CLEARED)
 9281 077662  004737  012146                  CALL    INSERT                          ;SKIP BRANCH IF 'SFI' IS SET
 9282 077666  001414                          BEQ     60$                             ;BRANCH IF YES
 9283 077670  012737  100000  004062          MOV     #100000,GOOD                    ;SET UP GOOD DATA
 9284 077676  013737  100076  004062          MOV     ANS243,GOOD                     ;SET UP GOOD DATA
 9285 077704  050437  004062                  BIS     R4,GOOD                         ;...
 9286 077710                                  ERRSOFT 2401,E2401,EER1                 ;ERROR HANDLER
      077710  104457                                                                             TRAP    C$ERSOFT
      077712  004541                                                                             .WORD   2401
      077714  101746                                                                             .WORD   E2401
      077716  004342                                                                             .WORD   EER1
 9287 077720  005003                  60$:    CLR     R3                              ;CLEAR DONE TIMEOUT COUNTER
```

TEST 24: ANALOGUE INPUT (CALIBRATION ROUTINE)

```
 9288 077722  052777  000001  103754          BIS     #1,@CSA          ;START A CONVERSION
 9289 077730  017737  103750  004064  70$:    MOV     @CSA,BAD         ;GET CSA CONTENTS
 9290 077736  032737  000200  004064          BIT     #200,BAD         ;CONVERSION DONE (DONE SET) ?
 9291 077744  001013                          BNE     80$              ;BRANCH IF YES
 9292 077746  005303                          DEC     R3               ;DECREMENT DONE WAIT COUNTER
 9293 077750  004737  012146                  CALL    INSERT           ;SKIP BRANCH IF 'SFI' IS SET
 9294 077754  001365                          BNE     70$              ;BRANCH IF NO TIMEOUT
 9295 077756  052737  000200  004062          BIS     #200,GOOD        ;SET UP GOOD DATA
 9296 077764                                  ERRSOFT 2402,E2402,EER1  ;ERROR HANDLER
      077764  104457                                                          TRAP    C$ERSOFT
      077766  004542                                                          .WORD   2402
      077770  102031                                                          .WORD   E2402
      077772  007342                                                          .WORD   EER1
 9297
 9298 077774  017737  103702  004062  80$:    MOV     @DAT,GOOD        ;GET DAT CONTENTS
 9299 100002  013701  004062                  MOV     GOOD,R1          ;LOAD DACON INPUT WITH DAT CONTENTS
 9300 100006  004737  014512                  CALL    DACON            ;DIGITAL TO ANALOGUE CONVERSION
 9301 100012                                  PRINTF  #PME244,GOOD     ;PRINT FOUND VALUES
      100012  013746  004062                                                  MOV     GOOD,-(SP)
      100016  012746  101661                                                  MOV     #PME244,-(SP)
      100022  012746  000002                                                  MOV     #2,-(SP)
      100026  010600                                                          MOV     SP,R0
      100030  104417                                                          TRAP    C$PNTF
      100032  062706  000006                                                  ADD     #6,SP
 9302 100036  004737  015764                  CALL    DECOUT           ;CALL DECIMAL OUT ROUTINE
 9303 100042                                  PRINTF  #OUT24           ;PRINT 'MILLIVOLTS'
      100042  012746  101731                                                  MOV     #OUT24,-(SP)
      100046  012746  000001                                                  MOV     #1,-(SP)
      100052  010600                                                          MOV     SP,R0
      100054  104417                                                          TRAP    C$PNTF
      100056  062706  000004                                                  ADD     #4,SP
 9304 100062  000137  077646                  JMP     50$              ;GO INTO LOOP
 9305 100066                                  EXIT    TST
      100066  104432                                                          TRAP    C$EXIT
      100070  002010                                                          .WORD   L10061-.
 9306
 9307 100072  000000          ANS241: .WORD   0                        ;LOCATION FOR HELP ANSWER
 9308 100074  000000          ANS242: .WORD   0                        ;SAVE LOCATION FOR CHANNEL NUMBER
 9309 100076  000000          ANS243: .WORD   0                        ;SAVE LOCATION FOR GAIN VALUE
 9310
 9311                                  .NLIST  BEX
 9312 100100     045     123     062  TSHD24::.ASCIZ  /%S2%AANALOGUE INPUT (CALIBR.) - SPECIFICALLY SELECTABLE.%N/
 9313 100173     104     117     040  MES241: .ASCIZ  /DO YOU NEED CALIBRATION HELP INFORMATION ?/
 9314 100246     125     123     105  MES242: .ASCIZ  /USED CHANNEL FOR VOLTAGE SOURCE/
 9315 100306     107     101     111  MES243: .ASCIZ  /GAIN (TYPE 0-7 = GIAN 1,2,5,10,20,50,100,200)/
 9316
 9317 100364     045     116     045  PME24A: .ASCII  /%N%ACALIBRATION INFORMATION%N/
 9318 100421     045     101     107          .ASCIZ  /%AGAIN 1 IS USED FOR FOLLOWING PROCEDURE%N/
 9319
 9320 100474     045     116     045  PME24B: .ASCII  /%N%N%AFOR BIPOLAR ADJUSTMENT%N%N/
 9321 100554     045     101     101          .ASCIZ  /%AADJUST VOLTAGE SOURCE TO  9.9951 V%N
 9322 100604     045     101     101  PME24C: .ASCIZ  /%AADJUST OFFSET TRIMPOT UNTIL 0001 ( 9.9951 V) APPEARS%N
 9323 100675     045     116     045  PME24D: .ASCIZ  /%N%N%AADJUST VOLTAGE SOURCE TO +9.9902 V%N
 9324 100750     045     101     101  PME24E: .ASCIZ  /%AADJUST GAIN TRIMPOT UNTIL  7776 (9.9902 V) APPEARS%N
 9325
 9326 101036     045     116     045  PME24F: .ASCII  /%N%N%AFOR UNIPOLAR ADJUSTMENT%N%N
 9327 101077     045     101     101          .ASCIZ  /%AADJUST VOLTAGE SOURCE TO 0.0024 V%N
```

TEST 24: ANALOGUE INPUT (CALIBRATION ROUTINE)

```
9328 101145      045      101      101  PME24G: .ASCIZ  /*AADJUST OFFSET TRIMPOT UNTIL 0001 (0.0024 V) APPEARS*N/
9329 101235      045      116      045  PME24H: .ASCIZ  /*N*N*AADJUST VOLTAGE SOURCE TO 9.9952 V*N/
9330 101307      045      101      101  PME241: .ASCIZ  /*AADJUST GAIN TRIMPOT UNTIL 7776 (9.9952 V) APPEARS*N/
9331
9332 101475      045      101      103  PME241: .ASCII  /*ACHANNEL NOT AVAILABLE, ENTER CORRECT CHANNEL OR *N/
9333 101461      045      101      106          .ASCIZ  /*AFIND THE MISTAKE WITH OTHER TESTS,*N/
9334 101530      045      116      045  PME242: .ASCIZ  /*N*AMODULE IS SWITCHED TO BIPOLAR RANGE*N*N/
9335 101604      045      116      045  PME243: .ASCIZ  /*N*AMODULE IS SWITCHED TO UNIPOLAR RANGE*N*N/
9336 101661      045      116      045  PME244: .ASCIZ  /*N*AOCTAL VALUE :*06*A, EQUIVALENT TO :/
9337
9338 101731      045      101      040  OUT24:  .ASCIZ  /*A MILLIVOLT/
9339
9340 101746      105      123      101  E2401:  .ASCIZ  /CSA CONTENTS INCORRECT AFTER READING DATA REGISTER/
9341 102031      124      111      115  E2402:  .ASCIZ  \TIMEOUT - DONE NOT SET AFTER A/D STARTS
9342                                    .LIST   BEX
9343                                    .EVEN
9344 102100                             ENDTST
     102100                                                          L10061:
     102100  104401                                                         TRAP    C$ETST
```

TEST 25: VISUAL LED TEST - SPECIFICALLY SELECTABLE.

```
                                        .SBTTL  TEST 25:  VISUAL LED TEST - SPECIFICALLY SELECTABLE.
                                        ;*****************************************************************************
                                        ;       TEST 25   VISUAL LED TEST - SPECIFICALLY SELECTABLE.
                                        ;
                                        ;       THIS TEST IS A VISUAL TEST. IT FLASHES THE LED ON AND OFF ON
                                        ;       EVERY MODULE IN THE SYSTEM THAT IS FOUND BY THE AUTOMATIC
                                        ;       CONFIGURATION ROUTINE OR SELECTED IN THE HARDWARE QUESTIONS.
                                        ;
                                        ;       MUX BOARDS ARE NOT INDEPENDENTLY ADDRESSABLE, SO THEIR LEDS ARE
                                        ;       NOT FLASHED.
                                        ;
                                        ;       THE TEST RUNS UNTIL "CNTL C" IS TYPED.
                                        ;*****************************************************************************

102102                                          BGNTST
                                                                                        T25::
102102  004737  011714                        CALL    SELECT                  ; CALL THE SELECT ROUTINE
102106  010377                                .WORD   10377                   ; SPECIFIC TEST, ALL DEVICES
102110  102236                                TSHD25                          ; TEST HEADER ADDRESS
102112  103002                                BCC     10$                     ; BRANCH IF THE TEST IS SELECTED
102114                                          EXIT    TST                     ; OTHERWISE, EXIT THE TEST
102114  104432                                                                          TRAP    C$EXIT
102116  000202                                                                          .WORD   L10062-.

102120  005001                          10$:    CLR     R1                      ; START BY SWITCHING LEDS ON
102122  062701  000100                  20$:    ADD     #100,R1                 ; IF BIT 6 IS CLEAR, SET IT
102126  042701  000200                          BIC     #200,R1                 ; IF IT IS SET, CLEAR IT

102132  005037  002074                          CLR     L$LUN                   ; START WITH UNIT 0
102136  013703  002074                  30$:    MOV     L$LUN,R3                ; FORM OFFSET FOR PARAMETER ADDRESS
102142  006303                                  ASL     R3                      ;
102144  016302  003774                          MOV     GPADD(R3),R2            ; GET PARAMETER ADDRESS IN R2
102150  001006                                  BNE     35$                     ; IF ADDRESS IS SET UP, BRANCH
102152                                          GPHARD  L$LUN,R2                ; ELSE, GET PARAM ADDRESS FROM DRV
102152  013700  002074                                                                  MOV     L$LUN,R0
102156  104442                                                                          TRAP    C$GPHRD
102160  010002                                                                          MOV     R0,R2
102162  010263  003774                          MOV     R2,GPADD(R3)            ; AND SAVE IT IN THE TABLE
102166  005712                          35$:    TST     (R2)                    ; MODE ADDRESS = 0 ?
102170  001002                                  BNE     40$                     ; IF NOT, BRANCH
102172  004737  012214                          JSR     PC,CONFIG               ; ELSE DO AUTO CONFIGURATION FOR THIS UNIT
102176  010172  000000                  40$:    MOV     R1,@(R2)                ; SWITCH THE LED OVER
102202  005237  002074                          INC     L$LUN                   ; GO TO NEXT UNIT
102206  023737  002074  002012                  CMP     L$LUN,L$UNITS           ; ALL CHANGED ?
102214  002750                                  BLT     30$                     ; IF NOT, SWITCH OVER THE NEXT

102216  012703  000024                          MOV     #20.,R3                 ; WAIT FOR 0.5 SECONDS
102222  004737  011506                  50$:    JSR     PC,WT25M                ; 25 MILLISECONDS WAIT ROUTINE
102226  005303                                  DEC     R3                      ; * 20 = 0.5 SECONDS
102230  001374                                  BNE     50$                     ; GO ON IF 0.5 SEC. ARE OVER
102232                                          BREAK                           ; ALLOW OPERATOR INPUT
102232  104422                                                                          TRAP    C$BRK
102234  000752                                  BR      20$                     ; DO IT ALL AGAIN

                                                .NLIST  BEX
102236  045  123  062  TSHD25::.ASCIZ  /%S2%AVISUAL LED TEST - SPECIFICALLY SELECTABLE.%N
```

TEST 25: VISUAL LED TEST SPECIFICALLY SELECTABLE.

```
                                        .LIST   BEX
                                        .EVEN
                                        ENDTST
                                L10062:
                                        TRAP    C$ETST
```

TEST 25: VISUAL LED TEST - SPECIFICALLY SELECTABLE.

```
9412
9413
9419
9436 102322                                    ENDMOD
9437
```

TEST 25: VISUAL LED TEST - SPECIFICALLY SELECTABLE.

```
                                        .TITLE CLOSE SECTION

                                                BGNMOD

                                        $PATCH::
                                                .BLKW   500

                                                .BLKB   400-<.&377>             ; SHIFT TO CORRECT FOR LSI BUG
                                                LASTAD

                                                                                        .EVEN
                                                                                        .WORD T$FREE
                                                                                        .WORD T$SIZE
```

```
9441
9450
9481
9482 102322
9483
9484 102322
9485 102322
9496
9493
9495 105522
9497 104000

     104000  104504
     104002  000240
     104004
9498 104004                             L$LAST::
                                                ENDMOD
```

TEST 25: VISUAL LED TEST - SPECIFICALLY SELECTABLE.

```
9500
9501
9502
9515
9516 104004                                BGNSETUP        16.
9517            000020                     .REPT   16.
9518                                       BGNPTAB
9519                                       .WORD   0,0,0,0,0,0,0,0
9520                                       ENDPTAB
9521                                       .ENDR
      104004  104034
      104006  000010
      104010
      104030
      104030  104060
      104032  000010
      104034
      104054
      104054  104104
      104056  000010
      104060
      104100
      104100  104130
      104102  000010
      104104
      104124
      104124  104154
      104126  000010
      104130
      104150
      104150  104200
      104152  000010
      104154
      104174
      104174  104224
      104176  000010
      104200
      104220
      104220  104250
      104222  000010
      104224
      104244
      104244  104274
      104246  000010
      104250
      104270  104320
      104272  000010
      104274
      104314
      104314  104344
      104316  000010
      104320
      104340
      104340  104370
      104342  000010
      104344
```

```
                .WORD   L10064
                .WORD   L10065-./2-1
L10063:
L10065:
                .WORD   L10066
                .WORD   L10067-./2-1
L10064:
L10067:
                .WORD   L10070
                .WORD   L10071-./2-1
L10066:
L10071:
                .WORD   L10072
                .WORD   L10073-./2-1
L10070:
L10073:
                .WORD   L10074
                .WORD   L10075-./2-1
L10072:
L10075:
                .WORD   L10076
                .WORD   L10077-./2-1
L10074:
L10077:
                .WORD   L10100
                .WORD   L10101-./2-1
L10076:
L10101:
                .WORD   L10102
                .WORD   L10103-./2-1
L10100:
L10103:
                .WORD   L10104
                .WORD   L10105-./2-1
L10102:
L10105:
                .WORD   L10106
                .WORD   L10107-./2-1
L10104:
L10107:
                .WORD   L10110
                .WORD   L10111-./2-1
L10106:
L10111:
                .WORD   L10112
                .WORD   L10113-./2-1
L10110:
```

TEST 25: VISUAL LED TEST - SPECIFICALLY SELECTABLE.

```
            104364
            104364  104414
            104366  000010
            104370
            104410
            104410  104440
            104412  000010
            104414
            104434
            104434  104464
            104436  000010
            104440
            104460
            104460  000000
            104462  000010
            104464
            104504
            104504                          ENDSETUP
            000001                  .END
```

```
L10113:
                .WORD   L10114
                .WORD   L10115-./2-1
L10112:
L10115:
                .WORD   L10116
                .WORD   L10117-./2-1
L10114:
L10117:
                .WORD   L10120
                .WORD   L10121-./2-1
L10116:
L10121:
                .WORD   0
                .WORD   L10123-./2-1
L10120:
L10123:
```

SYMBOL TABLE

```
ACFLG   023650
ADCON   014730 G
ADR     = 000020 G
AT      014470
ANS     004142 G
ANS1    062446
ANS151  050656
ANS152  050660
ANS153  050662
ANS161  054402
ANS164  054404
ANS2    063736
ANS211  066330
ANS212  066332
ANS213  066334
ANS214  066336
ANS221  071552
ANS222  071554
ANS223  071556
ANS224  071560
ANS225  071562
ANS226  071564
ANS231  074752
ANS232  074754
ANS233  074756
ANS241  100072
ANS242  100074
ANS243  100076
AQ      014501
ASK     017520
ASKADD  020234
ASSEMB  030010
BAD     006364 G
BADPOL  006664
BIT0    = 000001 G
BIT00   = 000001 G
BIT01   = 000002 G
BIT02   = 000004 G
BIT03   = 000010 G
BIT04   = 000020 G
BIT05   = 000040 G
BIT06   = 000100 G
BIT07   = 000200 G
BIT08   = 000400 G
BIT09   = 001000 G
BIT1    = 000002 G
BIT10   = 002000 G
BIT11   = 004000 G
BIT12   = 010000 G
BIT13   = 020000 G
BIT14   = 040000 G
BIT15   = 100000 G
BIT2    = 000004 G
BIT3    = 000010 G
BIT4    = 000020 G
BIT5    = 000040 G
BIT6    = 000100 G
BIT7    = 000200 G
BIT8    = 000400 G
BIT9    = 001000 G
BOE     = 000400 G
CALRET  017066 G
CARRFL  017172
CHAR    020454
CHA23   072650
CHKMAX  011342 G
CLINT   017316 G
CLKFLG  025074
CNT25   011540 G
CNT25M  011534 G
CNT500  011536 G
CON     020010
COND    003714 G
CONEX   013704
CONFIG  012214 G
CONMSK  004132 G
CONPRI  012600 G
CONT    022746
CO1     012520
CP1     013720
CP1A    013771
CP1B    014043
CP1C    014146
CP1D    014400
CP1DA   014415
CP11    014433
CP12    014437
CP2     014421
CP3     014233
CP4     014237
CP5     014251
CP6     014266
CP7     014274
CP8     014356
CP9     014367
CRLF    011542 G
CSA     003704 G
CSB     003706 G
CUROUT  054430
CYCLE   004154 G
CYCLLS  004156 G
CYCRAD  004160 G
C$AU    = 000052
C$AUTO  = 000061
C$BRK   = 000022
C$BSEG  = 000004
C$BSUB  = 000002
C$CEFG  = 000045
C$CLCK  = 000060
C$CLEA  = 000012
C$CLOS  = 000035
C$CLP1  = 000006
C$CVEC  = 000056
C$DCLN  = 000044
C$DDDU  = 000051
C$DRPT  = 000024
C$DU    = 000053
C$EDIT  = 000003
C$ERDF  = 000055
C$ERHR  = 000056
C$ERRO  = 000060
C$ERSF  = 000054
C$ERSO  = 000057
C$ESCA  = 000010
C$ESEG  = 000005
C$ESUB  = 000003
C$ETST  = 000001
C$EXIT  = 000032
C$GETB  = 000026
C$GETW  = 000027
C$GMAN  = 000043
C$GPHR  = 000042
C$GPLO  = 000030
C$GPRI  = 000040
C$INIT  = 000011
C$INLP  = 000020
C$MANI  = 000050
C$MEM   = 000031
C$MSG   = 000023
C$OPEN  = 000034
C$PNTB  = 000014
C$PNTF  = 000017
C$PNTS  = 000016
C$PNTX  = 000015
C$QIO   = 000377
C$RDBU  = 000007
C$REFG  = 000047
C$RESE  = 000033
C$REVI  = 000003
C$RFLA  = 000021
C$RPT   = 000025
C$SEFG  = 000046
C$SPRI  = 000041
C$SVEC  = 000037
C$TPRI  = 000013
DACON   014512 G
DAT     003702 G
DBOUNC  003720 G
DBTAB   004172 G
DECEX   016074
DECIN   015204 G
DECIN1  015615
DECIN2  015655
DECIN3  015734
DECOUT  015764 G
DECO1   016102
DECO2   016106
DECO3   016112
DEPTBL  002210 G
DI      014446
DIAGMC  = 000000
DMPR    065332
DMPTAB  066340
DO      014457
DROPD   026650
DROPED  004034 G
ECNT    003734 G
EERA    007634 G
EERB    007664 G
EERG    007724 G
EER1    007342 G
EER2    007400 G
EER3    007442 G
EER4    007474 G
EER5    007540 G
EER6    007602 G
EF.CON  = 000036 G
EF.NEW  = 000035 G
EF.PWR  = 000034 G
EF.RES  = 000037 G
EF.STA  = 000040 G
EMG1    007762
EMG2    010031
EMG3    010101
EMG4    010166
EMG5    010230
EMG6    010314
END     023644
ERRBLK  007204 G
ERRMSG  007202 G
ERRNBR  007200 G
ERRTYP  007176 G
EVL     = 000004 G
EXQV1   027100
EXQV10  040672
EXQV11  041374
EXQV12  042066
EXQV13  043444
EXQV14  045606
EXQV15  050652
EXQV16  054376
EXQV17  057450
EXQV18  061416
EXQV19  062442
EXQV2   027556
EXQV20  063732
EXQV21  066324
EXQV22  071546
EXQV23  074746
EXQV3   050062
EXQV4   051750
EXQV5   053200
EXQV6   054520
EXQV7   055420
EXQV8   056562
EXQV9   057612
EXR     065552
EXTR1   050414
EXTR21  065462
F$END   = 002100
F$LOAD  = 000035
F1002   040762
F101    027150
F1102   041465
F1103   041603
F1202   042660
F1302   043536
F1303   043622
F1402   045703
F1403   045764
F1404   046034
F1405   046103
F1406   046163
F1408   046234
F1409   046315
F1501   051726
F1502   051755
F1503   052030
F1507   052063
F1508   052134
F1601   056016
F1602   056134
F1603   056244
F1604   056342
F1608   056371
F1701   060356
F1702   060447
F1703   060537
F1704   060614
F1705   060714
F1707   060772
F1901   062553
F1902   062641
F1903   062720
F200    027605
F2001   064034
F201    027703
F202    027770
F203    030035
F2101   070074
F2102   070164
F2103   070255
F2104   070346
F2107   070433
F2108   070521
F2109   070603
F2110   070650
F2201   072430
F2301   073021
F2401   101746
F2402   102051
F300    030552
F304    030747
F305    031057
F306    031150
```

SYMBOL TABLE

```
[illegible]  052040          G$EXCP= 000400          ITRA17  056725          LOP7    026365          L$UNIT  002012 G
[illegible]  052140          G$HILL= 000002          ITRA18  061232          LOT   = 000010 G        L10000  002230
[illegible]  052311          G$LOLI= 000001          ITRA19  062142          LOTFLA  004130 G        L10001  002244
[illegible]  052310          G$NO  = 000000          ITRA20  063272          LOWLVL  003716 G        L10002  002352
[illegible]  053261          G$OFFS= 000400          ITRA8   035742          L$ACP   002110 G        L10003  003450
[illegible]  053315          G$OFSI= 000376          ITRA9   037120          L$APT   002036 G        L10004  007376
[illegible]  053427          G$PRMA= 000001          ITRCNT  004144 G        L$AU    026702 G        L10005  007440
[illegible]  053512          G$PRMD= 000002          ITRC21  064516          L$AUT   002070 G        L10006  007472
[illegible]  053604          G$PRML= 000000          ITRC22  070722          L$AUTO  026514 G        L10007  007536
[illegible]  054605          G$RADA= 000140          ITRC23  072550          L$CCP   002106 G        L10010  007600
[illegible]  054670          G$RADB= 000000          ITRC24  077126          L$CLEA  026600 G        L10011  007632
[illegible]  054751          G$RADD= 000040          ITRDEF  004146 G        L$CO    002032 G        L10012  007662
[illegible]  055007          G$RADL= 000120          IXE   = 004000 G        L$DEPO  002011 G        L10013  007722
[illegible]  055052          G$RADO= 000020          IXEND = 171770 G        L$DESC  007222 G        L10014  007730
[illegible]  055102          G$XFER= 000004          IXSTA = 171000 G        L$DESP  002076 G        L10015  011026
[illegible]  055502          G$YES = 000010          I$AU  = 000041          L$DEVP  002060 G        L10016  017274
[illegible]  055606          G1      002352          I$AUTO= 000041          L$DISP  002124 G        L10017  017304
[illegible]  055665          G10     003450          I$CLN = 000041          L$DLY   002116 G        L10020  017314
[illegible]  055764          G11     003500          I$DU  = 000041          L$DTP   002040 G        L10021  017316
[illegible]  057714          G12     003533          I$HRD = 000041          L$DTYP  002034 G        L10022  022340
[illegible]  060017          G13     003604          I$INIT= 000041          L$DU    026610 G        L10024  024220
[illegible]  060074          G14     002751          I$MOD = 000041          L$DUT   002072 G        L10025  026576
[illegible]  060126          G15     003077          I$MSG = 000041          L$DVTY  007206 G        L10026  026606
[illegible]  063740          G16     003656          I$PROT= 000040          L$EF    002052 G        L10027  026700
[illegible]  016576 G        G2      002400          I$PTAB= 000041          L$ENVI  002044 G        L10030  026712
[illegible]  017000 G        G3      002456          I$PWR = 000041          L$ERRT  007176 G        L10031  027216
[illegible]  063174          G4      002610          I$RPT = 000041          L$ETP   002102 G        L10032  027114
[illegible]  060015          G5      003237          I$SEG = 000041          L$EXP1  002046 G        L10033  030142
[illegible]  060070          G6      003302          I$SETU= 000041          L$EXP4  002064 G        L10034  031324
[illegible]  000040          HEL     017434          I$SFT = 000041          L$EXP5  002066 G        L10035  032412
[illegible]  000007          HELP  = 000000          I$SRV = 000041          L$HARD  002246 G        L10036  033672
[illegible]  000016          HOE   = 100000 G        I$SUB = 000041          L$HIMP  002120 G        L10037  035152
[illegible]  000041          IBE   = 010000 G        I$TST = 000041          L$HPCP  002016 G        L10040  035716
[illegible]  000004          IDU   = 000040 G        IOTAB   005576 G        L$HPIP  002022 G        L10041  037074
[illegible]  000013          IER   = 020000 G        I$TAB   006476 G        L$HW    002210 G        L10042  040214
[illegible]  000006          INIUUT  023152          J$JMP = 000167          L$ICP   002104 G        L10043  041074
[illegible]  000050          INSERT  012146 G        KLINT   024450          L$INTT  002350 G        L10044  041672
[illegible]  000000          INTFLA  004150 G        LASTFA  012212          L$LADP  002026 G        L10045  042774
[illegible]  000011          INTFL2  004152 G        LCLOCK  024534          L$LAST  104004 G        L10046  043700
[illegible]  000021          INTR    064732          LF      011564          L$LOAD  002100 G        L10047  046402
[illegible]  000017          INTSR   017276 G        LLPA16  040504          L$LUN   002074 G        L10050  052506
[illegible]  000012          INTSR2  017306 G        LLPA17  042270          L$MREV  002050 G        L10051  056534
[illegible]  000003          ISR   = 000100 G        LLPA14  044704          L$NAME  002000 G        L10052  061066
[illegible]  000005          ITRAC1  026760          LLPA8   056360          L$PRIO  002042 G        L10053  062122
[illegible]  000010          ITRAC2  027236          LLWC    004162 G        L$PROT  002342 G        L10054  063252
[illegible]  000002          ITRAC3  030214          LOCATE  027112 G        L$PRT   002112 G        L10055  064476
[illegible]  000014          ITRAC4  031350          LOE   = 040000 G        L$REPP  002062 G        L10056  070022
[illegible]  000001          ITRAC5  032456          LOPCHK  025146          L$REV   002010 G        L10057  072530
GAIN    004156 G             ITRAC6  034000          LOPDES  026444          L$RPT   017320 G        L10060  077106
GETNUM  015575               ITRAC7  035172          LOPEX   025630          L$SOFT  003376 G        L10061  102100
GOOBAD  007732               ITRA10  040240          LOPFLG  004070 G        L$SPC   002056 G        L10062  102320
GOOD    004062 G             ITRA11  041120          LOP1    025646          L$SPCP  002020 G        L10065  104010
GPADD   003774 G             ITRA12  041716          LOP2    025724          L$SPIP  002024 G        L10064  104034
GPFLG   020452               ITRA13  043020          LOP3    025771          L$STA   002030 G        L10065  104040
G$CNTD  000200               ITRA14  043724          LOP4    026067          L$SW    002032 G        L10066  104060
G$DECM= 000470               ITRA15  046574          LOP5    026166          L$TEST  002114 G        L10067  104064
G$DISP= 000003               ITRA16  052566          LOP6    026265          L$TIML  002014 G        L10070  104104
```

SYMBOL TABLE

```
L10071  104100
L10072  104130
L10073  104124
L10074  104154
L10075  104150
L10076  104200
L10077  104174
L10100  104224
L10101  104220
L10102  104250
L10103  104244
L10104  104274
L10105  104270
L10106  104320
L10107  104314
L10110  104344
L10111  104340
L10112  104370
L10113  104364
L10114  104414
L10115  104410
L10116  104440
L10117  104434
L10120  104464
L10121  104460
L10123  104504
MAFTOL  050766
MANIO   002234 G
MANTST  002232 G
MAN23   074544
MASCOM  010756
MASK    010754 G
MES151  051340
MES152  051415
MES153  051474
MES154  051571
MES155  051666
MES162  055305
MES163  055441
MES164  055521
MES165  055017 G
MES171  060035
MES172  060136
MES173  060247
MES211  067434
MES212  067452
MES213  067467
MES214  067550
MES221  071662
MES222  071700
MES223  071715
MES224  071767
MES225  072040
MES226  072171
MES251  075214
MES252  075243
MES253  075320
MES241  100173
MES242  100246
MES243  100306
MMES1   063020
MMES2   063042
MMES71  064104
MMES72  064214
MMES73  064234
MMES74  064254
MOD     003700 G
MODE    004134 G
MUXC    050666
MUXPAR  050336
MUXTOL  050766
NERRS   011444
NEWST   022656
NEXT    023160
NH      = 000032
NO      022334
NOCLOK  024606
NODEV   007250 G
NOUNIT  012516
NR1     015556
NR2     015560
NTEST   024056
NTESTS= 000031
NTEST1  024152
NXM     017266 G
NXMFLG  004060 G
NXTOUT  023106
ONEFIL= 000001
OTHCSA  003726 G
OTHCSB  003730 G
OTHDAT  003724 G
OTHMOD  003722 G
OTHVEC  003732 G
OUTDE1  004166 G
OUTDE2  004170 G
OUT1    056501
OUT15   051455
OUT2    056516
OUT231  077002
OUT232  076762
OUT24   101731
O$APTS= 000001
O$AU    = 000001
O$BGNR= 000001
O$BGNS= 000001
O$DU    = 000001
O$ERRT= 000001
O$GNSW= 000001
O$POIN= 000001
O$SETU= 000001
PADD    004140 G
PAT1    002256 G
PAT2    002240 G
PLMI    056457
PME151  052212
PME152  052265
PME153  052337
PME154  052430
PME155  052467
PME16A  055213
PME161  054725
PME162  055055
PME163  055346
PME164  055603
PME165  055151
PME166  055666
PME167  055757
PME211  067571
PME212  067665
PME213  067747
PME214  070022
PME221  072162
PME222  072260
PME223  072332
PME23A  075402
PME23B  075530
PME23D  075626
PME23E  075715
PME231  075753
PME232  076040
PME233  076121
PME234  076205
PME235  076275
PME236  076352
PME237  076421
PME238  076507
PME239  076576
PME24A  100364
PME24B  100474
PME24C  100604
PME24D  100675
PME24E  100750
PME24F  101036
PME24G  101145
PME24H  101235
PME24I  101307
PME241  101375
PME242  101530
PME243  101604
PME244  101661
PNT     = 001000 G
PRA     020654
PREX    020444
PRI     = 002000 G
PRIO    003712 G
PRI00   = 000000 G
PRI01   = 000040 G
PRI02   = 000100 G
PRI03   = 000140 G
PRI04   = 000200 G
PRI05   = 000240 G
PRI06   = 000300 G
PRI07   = 000340 G
PRMST   076655
PROMT   017002
PR1     020746
PR2     020773
PR2A    021100
PR2B    021177
PR2C    021271
PR2D    021332
PR2E    0214
PR2F    021525
PR2G    021621
PR3     021715
PR3A    022022
PR4     022061
PR5     022112
PR6     022133
PR7     022234
PSAD    015006
PSDA    014564
PSEUL1  023550
PSUB8   036210
PS151   046750
PWRFL   023030
QVP     002242 G
QVR10   040644
QVR12   042540
QVR14   045560
QVR8    036534
RA      016572 G
RANDOM  016534 G
RB      016574 G
RDY     020612
READ    016536 G
RECON   017536
REDTIM  004164 G
REERM   016450
REGADD  010760 G
REGERR  010762 G
REGMSG  011247
REGTST  010402 G
REGTS1  010440 G
RERR1   011030
RERR2   011102
RERR3   011160
RESTRT  022634
RETME1  017174
RFLG    020462
RGAV    030102
RWMAK   051264
SAVCNT  025012
SAVR    036566
SECPA   063742
SELECT  011714 G
SETCLK  024222
SETEX   025072
SFI     004066 G
SFPTBL  002232 G
SLZERO  061422
SNUM    015562
STADD   012514 G
STARES  022644
START   022350
STAT    020260
STFLG   020450
SVCGBL= 000000
SVCINS= 000001
SVCSUB= 000001
SVCTAG= 000001
SVCTST= 000001
SYLSYM= 010000
TABOFF  054524
TAB23   074760
TADS    020464
TIMIN   063744
TIMMSG  025076
TITLE   017642
TKB     = 177562
TKS     = 177560
TM15    051100
TM16    054623
TM17    057544
TM18    061515
TNA     012074
TNUM    020650
TOLOF   050674
TOLRA   050672
TOL1    076707
TPB     = 177566
TPS     = 177564
TSHD1   027116 G
TSHD10  040676 G
TSHD11  041400 G
TSHD12  042572 G
TSHD13  043450 G
TSHD14  045612 G
TSHD15  051006 G
TSHD16  054530 G
TSHD17  057454 G
TSHD18  061424 G
TSHD19  062450 G
TSHD2   027562 G
TSHD20  063746 G
TSHD21  067340 G
TSHD22  071566 G
TSHD23  075120 G
TSHD24  100100 G
TSHD25  102236 G
TSHD3   030626 G
TSHD4   031760 G
TSHD5   033204 G
TSHD6   034624 G
TSHD7   035424 G
```

SYMBOL TABLE

```
TSHD8   036570 G      T$PTAB= 010122      T$$PRO= 010023      T24     077110 G      WMES1   064342
TSHD9   037616 G      T$PTHV= 000020      T$$PTA= 010122      T25     102102 G      WMES2   064421
TSTEN1  027106        T$PTNU= 000020      T$$RPT= 010022      T3      030144 G      WME151  051202
TSTFLG  004054 G      T$SAVL= 177777      T$$SEG= 010004      T4      031326 G      WME152  051304
TSUFLG  004056 G      T$SEGL= 177777      T$$SOF= 010003      T5      032414 G      WME171  057646
TT      020546        T$SEKO= 010004      T$$SRV= 010032      T6      033674 G      WME172  057747
TTINT   024740        T$SIZE= 000240      T$$SW = 010001      T7      035154 G      WME181  061617
T$ARGC= 000001        T$SUBN= 000000      T$$TES= 010062      T8      035720 G      WME182  061744
T$CODE= 000032        T$TAGL= 177777      T1      026714 G    T9      037076 G      WME183  062030
T$ERRN= 004542        T$TAGN= 010124      T10     040216 G    UAM   = 000200 G      WME184  061712
T$EXCP= 000000        T$TEMP= 000000      T11     041076 G    USCLOK  024542        WRDY    011570 G
T$FLAG= 000040        T$TEST= 000031      T12     041674 G    VALCNT  054526        WRDY1   011620
T$FREE= 104504        T$TSTM= 177777      T13     042776 G    VBPTAB  004776 G      WRERM   016242
T$GMAN= 000000        T$TSTS= 000001      T14     043702 G    VEC     003710 G      WRITE   016122 G
T$HILI= 000007        T$$AU = 010030      T15     046404 G    VOLOUT  054406        WT25    011522 G
T$LAST= 000001        T$$AUT= 010025      T16     052510 G    VOLPA   053744        WT25M   011506 G
T$LOLI= 000000        T$$CLE= 010026      T17     056536 G    VOLTE   050670        WT500   011514 G
T$LSTM= 010000        T$$DAT= 010123      T18     061070 G    VOLVA   050676        X$ALWA= 000000
T$LTNO= 000031        T$$DU = 010027      T19     062124 G    VUPTAB  004176 G      X$FALS= 000040
T$NEST= 177777        T$$HAR= 010002      T2      027220 G    WAIT    011526        X$OFFS= 000400
T$NS0 = 000000        T$$HW = 010000      T20     063254 G    WARN    023652        X$TRUE= 000020
T$NS1 = 000001        T$$INI= 010024      T21     064500 G    WARN1   023756        ZERO    022330
T$NS2 = 000003        T$$MSG= 010015      T22     070704 G    WFLG    011616        $PATCH  102322 G
T$PCNT= 000000        T$$PC = 000020      T23     072532 G
. ABS.    104504      000
          000000      001
ERRORS DETECTED:  0

VIRTUAL MEMORY USED:  31296 WORDS  ( 123 PAGES)
DYNAMIC MEMORY:  17890 WORDS  ( 68 PAGES)
ELAPSED TIME:  00:11:46
/IXVA0.BIN,ZIXVA0.SEQ/CR/-SP=[50,200]SVC/ML,[7,116]ZIXVA0.SRC
```

B1
C1
D1
E1
F1
G1
H1
I1
J1
K1
L1
M1
N1

B2
C2
D2
E2
F2
G2
H2
I2
J2
K2
L2
M2
N2

B3
C3
D3
E3
F3
G3
H3
I3
J3
K3
L3
M3
N3

B4
C4
D4
E4
F4
G4
H4
I4
J4
K4
L4