

DataGeneral

**TECHNICAL
STATEMENT**

TEXT LISTING

068-000182-06

PROGRAM

ANALOG TO DIGITAL CONVERTER
DIAGNOSTIC

TEXT TAPE

097-000182-06

ABSTRACT

THIS IS A MAINTENANCE PROGRAM DESIGNED TO TEST THE FUNCTIONS OF THE 4120, 4032, 4033, AND 4055A-Q A TO D CONVERTERS AND OPTIONS. AT LEAST AN AC SIGNAL WIRE AND A GROUND WIRE ARE REQUIRED TO RUN THIS PROGRAM. FOR TESTING THE MULTIPLEXER SECTION, A SPECIAL RESISTOR LADDER NETWORK MUST BE USED. ALL OTHER SECTIONS MAY BE TESTED WITHOUT THIS NETWORK.

10002 IOPAC

08:54:56 08/19/77

0001 IOPAC MACRO REV 06-20

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; NAME: ADCDC.TX          PART NUMBER: 097-000182
;
; DESCRIPTION: ANALOG TO DIGITAL CONVERTER DIAGNOSTIC
;
; REVISION HISTORY:
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; REV.      DATE
; 00       01/12/71
; 01       03/27/72
; 02       04/25/75
; 03       XX/XX/XX
; 04       XX/XX/XX
; 05       07/23/76
; 06       08/19/77
;
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; 1977
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CPU BIT SWITCH SETTING FOR VOLTAGE

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L88
:MV/:017:177:377:1777:1777:3777:7777:1777:3777:7777:17777:37777:77777
:BIT: VOLTAGE FOR SWITCH SETTING
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8 BIT
0-5VT :19 :.29:2.5:4.9;
+-2.5 :19 :.29:2.5:0 ;
0-10  :39 :.58:4.9:9.9;
+-5    :39 :.58:4.9:0 ;
+-10   :78 :1.2:9.9:0 ;
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10 BIT
0-5VT :4.9:07:62:1.2:2.5:4.99;
+-2.5 :4.9:07:62:1.2:2.5:0 ;
0-10  :9.8:15:1.2:2.5:5.0:9.99;
+-5    :9.8:15:1.2:2.5:4.9:01;
+-10   :19 :.29:2.5:5.0:9.9:02;
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12 BIT
0-5VT :1.2:1.02:1.16:31:62:1.25:2.50:4.99;
+-2.5 :1.2:1.02:1.16:31:62:1.25:2.50:0 ;
0-10  :2.4:1.04:31:62:1.25:5.0:9.99;
+-5    :2.4:1.04:31:62:1.25:5.0:0:01;
+-10   :4.9:07:62:1.2:2.5:5.0:9.9:02;
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13 BIT
0-5VT :.61:1.01:1.08:15:31:62:41:25:2.50:4.99 ;
+-2.5 :.61:1.01:1.08:15:31:62:41:25:2.50:0 ;
0-10  :1.2:1.02:1.16:31:62:1.25:5.0:9.99 ;
+-5    :1.2:1.02:1.16:31:62:1.25:5.0:4.99:0 ;
+-10   :2.4:1.04:31:62:1.25:5.0:9.99:0 ;
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14 BIT
0-5VT :.31:1.00:1.04:1.08:1.16:31:62:41:25:2.50:4.99 ;
+-2.5 :.31:1.00:1.04:1.08:1.16:31:62:41:25:2.50:0 ;
0-10  :.61:1.01:1.08:1.16:31:62:41:25:2.50:9.99 ;
+-5    :.61:1.01:1.08:1.16:31:62:41:25:2.50:5.00:0 ;
+-10   :1.2:1.02:1.16:31:62:1.25:2.50:5.0:9.99:0 ;
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15 BIT
0-5VT :.15:1.00:1.02:1.04:1.08:1.16:31:62:41:25:2.50:4.99 ;
+-2.5 :.15:1.00:1.02:1.04:1.08:1.16:31:62:41:25:2.50:0 ;
0-10  :.31:1.00:1.04:1.08:1.16:31:62:41:25:2.50:9.99 ;
+-5    :.31:1.00:1.04:1.08:1.16:31:62:41:25:2.50:4.99:0 ;
+-10   :.61:1.01:1.08:1.16:31:62:41:25:2.50:5.0:9.99:0 ;
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A TO D CONVERTER DIAGNOSTIC

1.

ABSTRACT
THIS IS A MAINTENANCE PROGRAM DESIGNED TO TEST THE FUNCTIONS OF THE 4120, 4032, 4033, AND 4055A-Q A TO D CONVERTERS AND OPTIONS. AT LEAST AN AC SIGNAL WIRE AND A GROUND WIRE ARE REQUIRED TO RUN THIS PROGRAM. FOR TESTING THE MULTIPLIER SECTION, A SPECIAL RESISTOR LADDER NETWORK MUST BE USED. ALL OTHER SECTIONS MAY BE TESTED WITHOUT THIS NETWORK. NO MULTIPLIER ACCURACY CHECK IS MADE WITHOUT THE LADDER NETWORK.
THIS PROGRAM WILL RUN WITH LADDER BOARDS NUMBERED AS FOLLOWS:

(001-574-01) (001-464-02)
(001-462-02) (001-465-02)
(001-463-02)

I/O IS HANDLED BY "IOPAC" ROUTINES.

THE MAIN PROGRAM STARTS AT .LOC 2300 ON PAGE 56.

2.

MACHINE REQUIREMENTS
ANY STANDARD NOVA-FAMILY PROCESSOR
8K READ/WRITE MEMORY
TYPE 4032 OR 4033 INTERFACE FOR
TYPE 4055 SERIES CONVERTER OR
TYPE 4120 CONVERTER
TELETYPE; KSR 33 OR ASR 33, OR CRT VISUAL PRINTER

2.1

NOTE: IN ADDITION, FOR NOVA 2 SERIES CPU'S AND/OR THE +/- 10 VOLT A/D'S, IT IS RECOMMENDED THAT A SEPARATE AC AND DC POWER SUPPLY BE USED FOR THE TESTING. (IF A SEPARATE SUPPLY IS NOT AVAILABLE, A SPECIAL FILTER MUST BE USED ON THE NOVA2 AC AND A +/-10 A/D WILL BE IN ERROR IN THE NUMBER OF BITS IN THE A/D)
[THE SPECIAL FILTER IS CONTAINED ON THE ABOVE LISTED LADDER BOARDS--IF NOT AVAILABLE, SEE 2.2 BELOW].
THE AC SUPPLY SHOULD HAVE A PEAK VOLTAGE GREATER THAN 1/2 THE A/D RANGE, AND MUST SWING AT LEAST 1/2 VOLT NEGATIVE.
THE DC SUPPLY SHOULD BE WELL FILTERED WITH LESS THAN 1% RIPPLE WITH AN OUTPUT VOLTAGE BETWEEN 3.0 AND 6.0 VOLTS.
THE SPECIAL POWER SUPPLY BOARD (001-806) SHOULD BE USED FOR ALL TESTING IF AVAILABLE.
IF THE SPECIAL POWER SUPPLY BOARD IS AVAILABLE, CONNECT THE POWER CORD TO A SOURCE OF AC, CONNECT THE GROUND WIRE TO THE INPUT ANALOG GND, +VDC (IF IT IS BEING USED), AND CONNECT THE 6.3 VOLT AC OUTPUT TO THE AC INPUT ON THE LADDER BOARD, OR IF NO LADDER BOARD IS USED, TO CHANNEL 0 (CH 0H IF DIFFERENTIAL), OR TO THE LOW CHANNEL BEING TESTED.

2.2

THE FILTER NETWORK CONSISTS OF THE FOLLOWING:
BETWEEN CHANNEL 0 AND 6.3 VAC 2 CAPS OF

6.8 MFD EACH ARE CONNECTED IN SERIES WITH THEIR + SIDES TOGETHER FOLLOWED BY A 1K RESISTOR IN SERIES WITH ONE CAP AND TIED TO CHANNEL 0 INPUT. IN ADDITION, FROM CHANNEL 0 INPUT THERE MUST BE A 10K RESISTOR TO GROUND. FOR NOVA 2 CPU'S 2 MORE 6.8 MFD CAPS WITH + SIDES TOGETHER MUST BE CONNECTED BETWEEN CHANNEL 0 AND GROUND. (IN PARALLEL WITH THE 10K RESISTOR).

3. SWITCH SETTINGS

STARTING ADDRESS =000002 OR 200 (000003 OPTIONAL)
SWITCH 1(1) =PROCEED FROM ERROR
SWITCH 2(1) =INHIBIT PRINTOUT TO TTY
SWITCH 3(1) =PRINT FAILURE RATE
SWITCH 5(1) =PRINT TO LPT
SWITCH 7(1) =INHIBIT PROGRAMMABLE AMPLIFIER TEST
SWITCH 8(1) =INHIBIT EXTENDED INTERFACE TEST
SWITCH 9(1) =PRINT PC AND AC CONTENTS & CONTINUE

4. OPERATING PROCEDURE --- 4120 TYPE ---

- TURN OFF AND UNPLUG THE CPU, THE TELETYPE, AND ALL OTHER ELECTRICAL EQUIPMENT CONNECTED TO THE SYSTEM.
- BE SURE JUMPERS W1 & W2 ARE REMOVED. INSTALL W55 ONLY IF DATA CHANNEL OPTION IS PRESENT.
- IF YOU HAVE NEITHER A POWER SUPPLY BOARD NOR A LADDER BOARD GO TO 4.4.
IF THE SPECIAL POWER SUPPLY BOARD IS USED SEE 2.1. THEN PROCEED TO 4.51 IF YOU HAVE THE LADDER BOARD OR TO 4.7 IF YOU DON'T.
IF YOU HAVE ONLY A RESISTOR LADDER NETWORK PROCEED TO 4.5.
- CONNECT A WIRE FROM THE SIGNAL (6.3 VAC) AT BACKPANEL PIN 86, SLOT 3 OR SLOT 4 IN THE SUPERNOVA, OR WHATEVER SLOT IS BEING USED BY THE BASIC IO BOARD, TO CHANNEL 0 (CH 0H IF DIFFERENTIAL) OR TO THE LOW CHANNEL.
CONNECT A WIRE FROM B2 (GND) ON ANY SLOT TO ANALOG GND (CH 0L IF DIFFERENTIAL)
NOTE: BE SURE THE A.C. VOLTAGE IS AS SPECIFIED IN 2.1.
GO TO 4.7.
- PLUG THE GND WIRE FROM THE LADDER NETWORK INTO B2 (GND) OF SLOT 3 OR SLOT 4 IN THE SUPERNOVA, PLUG THE +VDC WIRE INTO 84 (+5V) OF THE SAME SLOT, AND PLUG THE VAC WIRE INTO 86 (6.3 VAC) OF THE SAME SLOT.
- PLUG THE RESISTOR LADDER NETWORK INTO THE JACK THAT CONTAINS CHANNEL 0, IN A DIFFERENTIAL SYSTEM THE CHANNEL (0L) SIGNAL GOES TO EITHER CHASSIS GROUND OR TO AC RETURN IF THE SPECIAL POWER SUPPLY BOARD IS USED. IF THE A/D IS SINGLE ENDED

0005 IOPAC

01 RUN A JUMPER FROM GROUND TO ONE CHANNEL GREATER
 02 THAN THE NUMBER OF A/D CHANNELS ON THE LADDER BOARD.
 03 GO TO 4.7.
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4. OPERATING PROCEDURE --- 4055 TYPE ---

4.1 TURN OFF AND UNPLUG THE NOVA, THE A TO D CONVERTER EQUIPMENT, THE TELETYPE, AND ALL OTHER ELECTRICAL EQUIPMENT CONNECTED TO THE SYSTEM.

4.2 CHECK THE PRESENCE OF JUMPER W1 ON INTERFACE AND CLOCK CONNECTION A47-A63. NORMALLY BOTH ARE JUMPED. REMOVE W1 FOR BASIC INTERFACE. CONNECT A47 TO A63 IF EXTENDED INTERFACE HAS NO EXTERNAL CLOCK.

4.3 IF YOU HAVE NEITHER A POWER SUPPLY BOARD NOR A LADDER BOARD GO TO 4.4. IF THE SPECIAL POWER SUPPLY BOARD IS USED SEE 2.1, THEN PROCEED TO 4.51 IF YOU HAVE THE LADDER BOARD OR TO 4.7 IF YOU DON'T. IF YOU HAVE ONLY A RESISTOR LADDER BOARD PROCEED TO 4.5.

4.4 CONNECT A WIRE TO THE SIGNAL (6.3 VAC) AT BACKPANEL PIN 86, SLOT 3 IN THE NOVA 800, OR SLOT 4 IN THE SUPERNOVA, OR SLOT 3 IN THE NOVA 1200, OR WHATEVER SLOT IS BEING USED BY THE BASIC IO BOARD, TO CHANNEL 0 (CH 0H IF DIFFERENTIAL) OR TO THE LOW CHANNEL.

CONNECT A WIRE FROM B2 (GND) ON ANY SLOT TO ANALOG GROUND (CH 0L IF DIFFERENTIAL)

NOTES: BE SURE THE A.C. VOLTAGE IS AS SPECIFIED IN 2.1.
GO TO 4.7.

4.5 PLUG THE GROUND WIRE FROM THE LADDER NETWORK INTO B2(GND) OF SLOT 3 OR SLOT 4, OR WHATEVER SLOT IS USED BY THE BASIC IO BOARD.

PLUG THE +VDC WIRE INTO B4 (+5V) OF THE SAME SLOT, AND PLUG THE VAC WIRE INTO B6 (6.3VAC) OF THE SAME SLOT.

CONNECT THE OTHER END TO THE RESISTOR LADDER BOARD FOR TESTING THE MULTIPLEXER LOGIC.

4.51 CONNECT THE PLUG OF THE RESISTOR LADDER BOARD TO THE A TO D CONVERTER. CONNECT THE GROUND CLIP OF THE RESISTOR LADDER BOARD TO THE CHASSIS OF THE NOVA OR TO ANALOG GROUND IF A DIFFERENTIAL SYSTEM.

10006 IOPAC

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4.7 PLUG IN AND TURN ON THE SYSTEM.

4.8 LOAD THE PROGRAM VIA THE BINARY LOADER

4.9 SET SWITCHES TO 000002 OR 200 (OR OPTIONAL 000003 SEE SECT. 5.-)

4.10 PRESS RESET

4.11 PRESS START

NOTE: WHEN IT IS DESIRED TO START THE PROGRAM AT A GIVEN ADDRESS AND ALSO HAVE A GIVEN CONFIGURATION OF DATA SWITCHES SET UPON STARTING, DO THE FOLLOWING:
 ENTER THE STARTING ADDRESS IN THE DATA SWITCHES PRESS "EXAMINE", RESET ALL SWITCHES EXCEPT THOSE DESIRED TO BE ON, PRESS "CONTINUE"

4.12 THE PROGRAM WILL REQUEST THAT YOU TYPE IN SEVERAL QUANTITIES. TYPE EACH NUMBER AND CARRIAGE-RETURN OR A SPACE.
 IF YOU ARE NOT USING THE MUX RESISTOR LADDER BOARD, TYPE "1" FOR THE NUMBER OF CHANNELS, AND "0" FOR LOW CHANNEL. INCREMENT THESE NUMBERS AND REPEAT THIS TEST UNTIL ALL CHANNELS ARE TESTED.

EXAMPLE:

COMPUTER TYPES:
 "THE CPU TYPE IS:"
 YOU RESPOND WITH ONE OF THE FOLLOWING CODES:
 NOVA 800 = 0
 NOVA2 (800) = 0
 SUPERNOVA = 0
 NOVA 1200 = 1
 NOVA2 (1200) = 1
 NOVA = 2
 NOVA3 (8K CORE MEMORY) = 0
 NOVA3 (16K CORE MEMORY) = 3
 NOVA3 = 4
 (SEMICONDUCTOR MEMORY)
 ECLIPSE 0 = 3
 (NON-INTERLEAVED)
 CORE MEMORY
 ECLIPSE 2 = 4
 (2-WAY INTERLEAVED)
 ECLIPSE 4 = 5
 (4-WAY INTERLEAVED)
 ECLIPSE 8 = 6
 (8-WAY INTERLEAVED)

"TYPE A/D DEVICE CODE(OCTAL), LOWER VOLTAGE LIMIT, UPPER VOLTAGE LIMIT,

0007 IOPAC

01 NUMBER OF BITS, NUMBER OF CHANNELS(DECIMAL),
02 AND LOW CHANNEL WITH A.C.(DECIMAL)."
03 YOU TYPE:
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0008 IOPAC

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5.2 THE PROGRAM WILL ASK THE TOTAL NUMBER OF CHANNELS IN THE A/D AND THE LOWEST CHANNEL TO BE TESTED.

5.3 THE PROGRAM THEN SCANS THE A/D CHANNELS LOOKING FOR A GROUNDED CHANNEL. WHEN ONE IS FOUND, THE CHANNEL NUMBER WILL BE PRINTED OUT IN DECIMAL ON THE TELETYPE, FOLLOWED BY THE DC BIT OFFSET MEASURED. (UNDER NORMAL CONDITIONS THIS VALUE SHOULD BE EQUAL TO 0 BITS OFFSET)

5.4 THIS TEST ASSUMES ALL OTHER CHANNELS ARE FLOATING AND CHECKS FOR A CHANNEL WITH LESS THAN 40 MILLIVOLTS ON IT AT ALL TIMES.

AFTER TESTING ALL CHANNELS BY THIS TECHNIQUE (MOVING THE NETWORK FROM CHANNEL TO CHANNEL WHILE THE PROGRAM IS SCANNING) THE PROGRAM MAY BE RESTARTED AS USUAL IF SO DESIRED.

THE PROGRAM WILL REQUEST THAT YOU TYPE A T OR AN F FOR "TRUE" OR "FALSE" FOR THE FOLLOWING.

4.13 THE PROGRAM WILL ASK (T OR F) IF THE A/D BEING TESTED HAS AN EXTENDED INTERFACE BOARD.

4.14 THE PROGRAM WILL ASK (T OR F) IF YOU WISH A 0.1% LADDER TOLERANCE. "F" WILL GIVE THE STANDARD 1% TOLERANCE. IF THE LADDER BOARD IS PRESENT. NOTE... UNLESS THE ACCURACY OF THE LADDER BOARD RESISTORS HAS BEEN CHECKED, USE 1% !

4.15 THE PROGRAM WILL ASK (T OR F) IF THE A TO D CONVERTER IS TYPE 4120.

4.16 THE PROGRAM WILL ASK (T OR F) (4120 ONLY) IF THE CONVERTER HAS A PROGRAMMABLE AMPLIFIER.

4.17 THE PROGRAM WILL ASK (T OR F) (4055 ONLY) IF THERE IS A SAMPLE & HOLD OR IF THERE IS A MULTIPLEXER.

4.18 THE PROGRAM WILL RUN UNTIL MANUALLY STOPPED OR AN ERROR IS DETECTED. AT THE END OF EACH PROGRAM PASS THE WORD "PASS" WILL BE PRINTED. ALLOW THE PROGRAM TO COMPLETE SEVERAL PASSES.

5.0 THERE IS A SPECIAL SELECTION ROUTINE AVAILABLE FOR BOTH TYPE A/D CONVERTERS IF THE LADDER NETWORK IS NOT AVAILABLE. THIS ROUTINE SCANS THE A/D CHANNELS LOOKING FOR A GROUNDED CHANNEL. WHEN ONE IS FOUND THE CHANNEL NUMBER WILL BE PRINTED OUT IN DECIMAL ON THE TELETYPE FOLLOWED BY THE DC BIT OFFSET MEASURED. AFTER COMPLETING SEVERAL "PASSES" ONLY ON CHANNEL 0, THIS ROUTINE MAY BE CALLED UP BY RESTARTING AT .LOC 3.

5.1 A SINGLE WIRE W/51 OHM RESISTOR IS REQUIRED FOR TESTING. THIS NETWORK IS CONNECTED BETWEEN THE CHANNEL TESTED AND GROUND ON SINGLE ENDED SYSTEMS AND IS CONNECTED BETWEEN THE HIGH INPUT AND LOW INPUT OF THE DIFFERENTIAL CHANNEL BEING TESTED.

10009 IOPAC

01 PROGRAM OUTPUT/ERROR DESCRIPTION

02

03 6.0

04 IF A MALFUNCTION IS DETECTED THE PROGRAM

05 WILL HALT AT LOCATION ERR1+1. AC3 WILL

06 CONTAIN THE LOCATION OF THE ERROR, +1.

07 EXAMINE THE LISTING TO DETERMINE IF OTHER

08 AC CONTENTS ARE IMPORTANT. THE OPERATOR

09 MAY CHANGE SWITCH SETTINGS AT THIS TIME

10 IF DESIRED. IF SWITCHES 1 AND 2 ARE ZERO

11 (OFF) PRESSING CONTINUE WILL CAUSE A PRINT-OUT

12 OF THE ERROR LOCATION. THE ROUTINE WILL

13 ENTER A LOOP SUITABLE FOR SCOPING.

14 WHEN THE PROGRAM IS IN A SCOPE LOOP, SETTING

15 SWITCH 3(1) WILL CAUSE THE FAILURE RATE TO BE

16 PRINTED. SETTING SWITCH 1(1) WILL CAUSE THE

17 PROGRAM TO PROCEED TO THE NEXT TEST.

18

19 6.2 THE FOLLOWING ERROR MESSAGES ARE POSSIBLE:

20 THERE IS NO PROGRAMMABLE AMPLIFIER

21

22 12 BITS

23

24 EXTENDED A TO D INTERFACE

25

26 24 MICROSECONDS IS CORRECT TIME MEASURED TIME IS

27 35 MICROSECONDS

28

29 THESE NUMBERS, OF COURSE, ARE ONLY REPRESENTATIVE.

30 THEY INDICATE THAT THE PROGRAM DOESN'T DETECT THESE

31 VARIABLES TO BE EQUAL TO WHAT YOU TYPED IN. THEY ARE

32 THE NUMBER OF BITS IN THE CONVERTER,

33 WHETHER YOU HAVE A PROGRAMMABLE AMPLIFIER

34 WHETHER YOU ARE USING A BASIC OR EXTENDED INTERFACE,

35 THE SPECIFIED TOTAL TIME FOR CONVERSION, AND

36 THE TIME FOR A CONVERSION OPERATION, FROM

37 START PULSE TO DONE STATUS.

38

39 7.0 RESTRICTIONS/MISC

40 NO COMPLETE DATA ACCURACY CHECK IS MADE.

41

10010 IOPAC

01

02

03 .TITL IOPAC.WU

04

05 I/O HANDLER PACKAGE (03)

06

07 ABSTRACT: THIS PACKAGE ALLOWS THE USER THE DIRECT ABILITY

08 TO INTERFACE A PROGRAM WITH THE TIO, TII, PTP, PTR, AND

09 LPT. IOPAC CAN HANDLE AS WELL .TXT MATERIAL.

10 IT ALSO CAN READ AND WRITE AND INTERMIX DECIMAL, BINARY,

11 AND OCTAL CODING, EITHER + OR -.

12 THE SIZE OF THE IOPAC ATTACHED TO A PROGRAM IS

13 DEPENDENT ON THE LEADER CODING. THIS IS HANDLED IN THE

14 PROGRAM CALLED "LEADR". TO MAKE A MACRO ASSEMBLY THE

15 ORDER MUST BE "MAC - LEADR IOPAC MAIN - OR ERRORS WILL

16 RESULT."

17

18 LEADR: THIS PROGRAM CARRIES HEADER MATERIAL TO DETERMINE THE

19 IOPAC ROUTINES TO BE LOADED AT MACRO ASSEMBLY TIME.

20 .DUSR IS USED AS A DEFINITION. IF THE ARGUMENT = 0

21 THE CODING INVOLVED WILL BE LOADED; IF = 1, THE

22 CODING IS DELETED.

23

24 IOPAC: IOPAC CONSISTS OF 27 SELECTABLE ROUTINES, AND 34 MACRO

25 EXPANSIONS OF WHICH 6 ARE SPECIALLY LOADED, AND AN INPUT

26 AND OUTPUT HANDLER. THE LOADING IS CONTROLLED BY

27 LEADR (SEE ABOVE). EACH ROUTINE REQUIRES EITHER 3

28 DIRECT LOCATIONS OR THE NUMBER (X).

29

30 THE ROUTINES ARE CALLED BY:

31 SPECIALS:

32 CR?. X,Y,END ;IS THE READ CODE A CR

33 X = CODE READ IN AC(X)

34 Y = CR CHECK IN AC(Y)

35 END = JUMP POINT IF CR

36

37 ETB. X,Y,END ;IS THE READ CODE AN END OF

38 TRANSMISSION BLOCK (CTR W).

39 X = CODE READ IN AC(X)

40 Y = ETB CHECK IN AC(Y)

41 END = JUMP POINT IF ETB

42

43 LF. DEVICE ;GIVE A LINE FEED TO A LEGAL

44 DEVICE (TTO,LPT)

45

46 TAB. DEVICE ;GIVE A TAB TO A LEGAL

47 DEVICE (8 SPACE TAB INDIVIDUALLY

48 SET UP FOR TIO & LPT)

49

50 FF. DEVICE ;GIVE A FORM FEED TO A LEGAL

51 DEVICE (LPT, VP)

52

53 END. AC(X),END ;CHECK LOCATION .END TO

54 SEE IF > 0. IF SO WILL

55 JUMP TO LOCATION "END".

56

57

58 END OF SPECIALS:

59 SAVE. LEVEL ;(2)SAVE THE AC'S

60

0011 IOPAC

01 LEVEL = 0,1,2,3 LEVEL 1 RESERVED
 02 FOR DALLY., LEVELS 2,3 RESERVED
 03 FOR INTERRUPTS. ALL ARE USEABLE.
 04
 05
 06 ?(2)RESTORE THE AC'S BY LEVEL #
 07
 08 ?PUSH STACKING REGISTER
 09 WITH 30 AVAILABLE LOCATIONS.
 10 NAME = LOCATOR TO BE PUSHED.
 11
 12 ?POP UNSTACKING REGISTER
 13 WORKING WITH PUSH.
 14 NAME = LOCATOR TO BE POPPED.
 15
 16 ?ECHO CHARACTER IN AC(X)
 17
 18 ?(1)YES OR NO ? IS THE TTI
 19 INPUT A Y ? IF SO RETURN
 20 AT +1, IF N RETURN AT +2
 21 IF NEITHER RETURN AT .
 22
 23 ?(1)TRUE OR FALSE? IS THE
 24 TTI INPUT A T ? IF SO
 25 RETURN AT +1, IF F RETURN
 26 AT +2, IF NEITHER RETURN AT .
 27
 28 MYINT. MSKO,CTR A,CTR B,CTR C,CTR D,CTR E,@
 29 ?(1)ADD A PRIORITY INTERRUPT
 30 ROUTINE LINKING THE CLI
 31 BY CONTROL Z. OTHER
 32 CODES ARE ALLOWED.
 33 THESE LINK VIA JUMP
 34 ADDRESSES IN CALL.
 35 CINT.*STAK.* & UNSTK. ARE
 36 REQUIRED FOR OPERATION.
 37 USUALLY .LOC 50 -> 60 ARE USED.
 38
 39 ?(1)CHECK TO SEE IF THERE IS A
 40 TTI INTERRUPT CODE IN AC1.
 41 IF YES RETURN WITH TTI DONE SET
 42 AND ENABLE INTERRUPTS, OTHERWISE
 43 CLEAR DONE. THE AC'S ARE SAVED.
 44 ASSEMBLED UNDER LINTRP.
 45
 46 ?(7)STACK TTI CODES AS THEY
 47 INTERRUPT CPU OPERATION.
 48 30 WORDS ARE AVAILABLE,
 49 LEVELS 0,1, & 2 AVAILABLE.
 50 (IN MYINT. TTI INTERRUPT
 51 OVERFLOW RESETS THE STACK
 52 AND HALTS THE CPU. CONT-
 53 INUE RESTARTS PROGRAM AT
 54 HALT POINT.) NORMAL RETURN AT .
 55 OVERFLOW RETURN AT +1
 56 STACK. 2 RESERVED FOR INTER-
 57 RUPT SYSTEM.
 58
 59 ?(1)UNSTACK THE TTI CODES
 60 FROM THE BOTTOM AS THEY ARE

0012 IOPAC

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NEEDED. WHEN FULLY UNSTACKED
 RESET STACK MARKERS.
 LEVELS 0,1, & 2 AVAILABLE.
 NORMAL RETURN AT .
 IF FULLY UNSTACKED
 RETURN AT +1
 UNSTK. 2 RESERVED FOR INTER-
 RUPT SYSTEM.

?(2)GIVE A CR TO A LEGAL
 DEVICE (LPT,TT0)
 THE IOPAC AUTOMATICALLY GIVES
 A LF IF A CR IS SEEN ON OUTPUT.

?(2)GIVE A CR & LF TO A LEGAL
 DEVICE (LPT,TT0)

?(7)A DELAY GENERATOR
 TIME = X TIMES 0.1 MS
 MACHINE = 800,1200,
 OR 2000 SERIES.
 REQUIRES LEVEL 1 SAVE. AND REST.
 2.5 SECONDS MAXIMUM.

?(7)A DELAY GENERATOR
 EXTERNALLY ADDRESSABLE
 BY A VARIABLE NAME IN
 I/O. CHARACTERISTICS ARE
 THE SAME AS DALLY.

?(1)MULTIPLY ROUTINE.
 AC 1 TIMES AC 2
 PRODUCT IN AC 0 AND AC 1.

?(1)DIVIDE ROUTINE.
 AC 0 HAS HIGH ORDER
 AC 1 HAS LOW ORDER
 AC 2 HAS DIVISOR
 AC 0 HAS REMAINDER
 AC 1 HAS QUOTIENT
 IF CARRY=1, DIVIDEND
 ASSUMED NEGATIVE.

?(4)A MICRO-SECOND TIMER USING
 INTERRUPTS
 NAME = LOCATOR FOR TIMER NAME
 OPS CODE = OCTAL START DEVICE
 CODE USING .DEVG.
 MSKO = MASKING CODE FOR DEVICE
 INTERRUPT.
 .CPUT = CPU TYPE CODE IS READ
 IN AT RUN TIME.
 20 MS MAXIMUM TIME ALLOWED.
 0 IS RETURNED IF THERE IS
 A TIMING ERROR DETECTED.
 REQUIRES DIV.
 TYPE CODES:
 NOVA 800 = 0
 NOVA2 (800) = "

CR. DEVICE

CRLF. DEVICE

DALLY. TIME,MACHINE

OALLY. TIME,MACHINE

MUL.

DIV.

USECT. NAME,OPS CODE,MSKO

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```

01 SUPERNOVA      = "
02 NOVA 1200      = 1
03 NOVA2 (1200)   = "
04 NOVA          = 2
05 NOVA3         = 0
06 (8K CORE MEMORY)
07 NOVA3         = 3
08 (16K CORE MEMORY)
09 NOVA3         = 4
10 (SEMICONDUCTOR MEMORY)
11 ECLIPSE 0     = 3
12 (NON-INTERLEAVED)
13 (CORE)
14 ECLIPSE 2     = 4
15 (2 WAY INTERLEAVED)
16 ECLIPSE 4     = 5
17 (4 WAY INTERLEAVED)
18 ECLIPSE 8     = 6
19 (8 WAY INTERLEAVED)

```

```

20 CDC. START,END,OLD I/O CODE ;(4)CHANGE ALL I/O DEVICE
21 CODES WITHIN THE START AND END
22 LOCATIONS WHICH AGREE WITH THE
23 CALL, TO THE DEVICE CODE GIVEN
24 IN .DEV. IF THE OLD
25 CODE IS ODD, INCREMENT
26 .DEV. BEFORE MASKING THE CODE.
27 .DEV. IS ENTERED AT RUN TIME
28 AND IS ASSUMED TO BE EVEN FOR
29 FOR MULTI-CODE DEVICES.
30
31
32

```

```

33 READ. NAME,DEVICE,SPECIAL ;(4)READ ASCII MATERIAL
34 FROM ANY LEGAL DEVICE
35 AND END READ WITH A CR
36 OR TAB, OR IF SPECIAL = 1,
37 WITH ETB (CTR W).
38 NAME = LOCATOR FOR THE READING
39 BLOCK. BLOCK IS USER
40 DEFINED AS TO ITS SIZE
41 2 CHARACTERS/WORD
42 DEVICE = ANY LEGAL DEVICE
43 (PTR,TTI)
44 SPECIAL = 0, OR 1
45 REQUIRES ECHO., LIN

```

```

46 WRITE. NAME,DEVICE,SPECIAL ;WRITE ASCII
47 MATERIAL ON A DEVICE
48 FROM A GIVEN NAME.
49 NAME = LOCATOR FOR BLOCK
50 OF ASCII MATERIAL ENDING
51 WITH A CR OR TAB, OR IF SPECIAL
52 = 1, WITH ETB (CTR W).
53 DEVICE = ANY LEGAL DEVICE
54 (TTO,LPT,PTP)
55 SPECIAL = 0, OR 1
56 REQUIRES LOUT

```

```

57 PRINT. NAME,DEVICE
58 ;PRINT .TXT MATERIAL ON
59 ANY LEGAL DEVICE
60

```

0014 IOPAC

```

01 (TTO,LPT,PTP)
02 REQUIRES LOUT
03
04 UBTD. NAME,DEVICE
05 ;PRINT OUT A DECIMAL NUMBER
06 FROM BINARY LOCATOR.
07 LEADING ZERO SUPPRESSION (LZS)
08 NAME = LOCATOR FOR BINARY NUMBER
09 (TTO,LPT,PTP)
10 REQUIRES LOUT

```

```

11
12 UBTD. NAME,DEVICE
13 ;READ A DECIMAL NUMBER AND
14 CONVERT TO BINARY STORING IT IN
15 NAME. END INPUT BY CR, TAB,
16 OR SPACE.
17 ACO HAS NUMBER ON RETURN.
18 NAME = DECIMAL WORD'S LOCATOR
19 (TTI,PTR)
20 DEVICES = ANY LEGAL DEVICE
21 REQUIRES LIN, & ECHO.
22 MAX SIZE = 32768

```

```

23
24 UBTD. NAME,DEVICE
25 ;READ AN OCTAL NUMBER AND STORE
26 IT IN NAME. END INPUT BY CR,
27 TAB, OR SPACE.
28 ACO HAS NUMBER ON RETURN.
29 NAME = OCTAL WORD LOCATOR
30 DEVICES = ANY LEGAL DEVICE
31 (TTI,PTR)
32 REQUIRES LIN
33 MAX SIZE = 7777

```

```

34
35 UBTD. NAME,DEVICE,SUPPRESS ;PRINT THE OCTAL WORD
36 IN NAME WITH LZS.
37 NAME = OCTAL WORD LOCATOR
38 DEVICES = ANY LEGAL DEVICE
39 (LPT,TTO,PTP)
40 IF SUPPRESS>0 NEGATIVE
41 NUMBERS ARE SUPPRESSED.
42 REQUIRES LOUT

```

```

43
44 UBINR. NAME,DEVICE
45 ;READ A BINARY NUMBER AND STORE
46 IT IN NAME. END INPUT BY CR
47 OR TAB.
48 ACO HAS NUMBER ON RETURN.
49 NAME = BINARY WORD LOCATOR
50 DEVICES = ANY LEGAL DEVICE
51 (TTI,PTR)
52 REQUIRES LIN

```

```

53
54 UBINP. NAME,DEVICE
55 ;PRINT THE BINARY WORD IN NAME
56 WITH LZS
57 NAME = BINARY WORD LOCATOR
58 DEVICES = ANY LEGAL DEVICE
59 (TTO,LPT,PTP)
60 REQUIRES LOUT

```

```

61 HANDLERS:
62 1: LIN(XX): INPUT ROUTINES FOR PTR AND TTI
63 TTI INCLUDES RUBOUT FACILITY.
64 INPUT IS ENDED BY A CR OR TAB.

```


0015 IOPAC

01 PTR ENDS INPUT AT ETB (END OF
02 TRANSMISSION BLOCK) CODE=CTR W.
03 (XX) REPRESENTS T, P, OR L.
04 TT=TTI PT=PTR
05
06 2: LOUT(X): OUTPUT ROUTINES FOR PTP, LPT, & TTO
07 LPT & TTO INCLUDE A TAB FACILITY AND
08 INCLUDE A CR GIVING A LF FACILITY.
09 PTP ENDS OUTPUT WITH AN ETB (CTR W).
10 (X) REPRESENTS T, P, OR L.
11 T=TTO P=PTP L=LPT
12
13
14
15
16

0016 IOPAC

**00000 TOTAL ERRORS. 00000 PASS 1 ERRORS