Publication Number 29-448

M46-202 and M46-206
LINE PRINTER CONTROLLER
PROGRAMMING MANUAL

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M46-202 and M46-206
LINE PRINTER CONTROLLER
PROGRAMMING MANUAL

GENERAL DESCRIPTION

The M46-206 Line Printer Controller is designed to operate with a family of printers. These printers have a common interface specification differing only in print speed, power requirements, cabinet styling, and the arrangement of buttons on the Control Panel. INTERDATA part numbers have been assigned to two controllers for this family of printers, namely: M46-202 and M46-206. The M46-202 Line Printer Controller is designed to operate the Centronics Model 101 Line Printer and other equivalent printers capable of printing 60-200 LPM.

These Printers feature a full line (132 character) buffer, an 8 channel VFU (Vertical Format Unit). They print 64 characters per column according to the 7-bit ASCII code at 10 characters per inch. Line spacing is 6 lines per inch.

The Controller performs a modest amount of code conversion in order for the Controller/Printer combination to be compatible with existing INTERDATA test and driver programs. Characters may be loaded into the Printer Buffer via the Controller at speeds up to 200K bytes/second for the M46-206 and 75K bytes/second for the M46-202.

In the following sections, the definitions and procedures apply to both models of controllers. Refer to the Operators Manual, supplied with the Printer, for details on a specific model. Table 1 provides a cross-reference of the Line Printers to their respective Controllers by Marketing part number.

TABLE 1. LINE PRINTER TO CONTROLLER CROSS REFERENCE

LINE PRINTER		CONTROLLER		
MARKETING NUMBER		MARKETING NUMBER		PART NUMBER
M46-204	(200 LPM)	M46-202	(7" BOARD)	02-244
M46-205	(200 LPM) (50 HZ VERSION)			
M46-207	(200 LPM)	M46-206	(7" BOARD)	02-307
M46-208	(200 LPM) (50 HZ VERSION)			
M46-209	(600 LPM)			
M46-210	(600 LPM) (50 HZ VERSION)			

CONFIGURATION

The M46-206 and M46-202 Line Printer Controller and the associated Printer can be installed on the Multiplexor Channel Bus or the Selector Channel Bus of any INTERDATA Processor. See the Section on Interrupts concerning priority on the I/O Bus.

OPERATING PROCEDURES

Control Panel Switches and Indicators

The following is a list of Control Panel Switches and Indicators and their descriptions.

	M46-204 AND M46-205 LINE PRINTERS	M46-207, M46-208, M46-209, AND M46-210 LINE PRINTERS
Power	ON/OFF - This latching switch/indicator turns power ON or OFF to the Printer. It lights in the ON position.	Power On-Indicating Switch. Depressing this switch turns ON primary power in the Printer and lights the switch indicator lamp. Power Off-Indicating Switch. Depressing this switch turns OFF primary power in the Printer and lights the switch indicator lamp.
On Line/ Off Line	SELECT - This latching switch/indicator turns the Printer ON Line or OFF Line. It lights in the SELECT (On-Line) position.	Run-Indicating Switch. Depressing this switch enables print commands and lights the switch indicator lamp. Stop-Indicating Switch. Depressing this switch inhibits print commands and lights the switch indicator lamp.
Paper Advance	Top Of Form – This momentary action switch causes the paper to be advanced to the top of forms punch on the built-in Vertical Forms Control tape reader.	Home-Switch. Depressing this switch sets the paper feeding system to the Home condition and each time this switch is depressed, one paper form length is advanced through the Printer mechanism. This switch can also be used to eject paper forms at the end of a run. This switch is operable only when the STOP indicator is lit. One-Line Switch. Depressing this switch advances the paper form through the Printer one line-at-a-time, each time the switch is depressed. The switch is operable only when the STOP indicator is lit. Slew-Switches. Depressing the Home and One Line Switches together advances the paper form through the printer mechanism at the paper slew rate of 27.5 inches/second as long as both switches are depressed. These switches are operable only when the STOP indicator is lit.
Paper Empty	Forms Override – This momentary action switch resets the Paper Empty condition and allows printing to continue even after a Paper Empty condition is sensed by the Printer. Paper Out – This indicator lights when a Paper Empty condition is sensed by the Printer. This condition is cleared by loading more paper in the Printer or by depressing the FORMS OVERRIDE switch.	
	Forms Thickness Control - This is used to adjust the clearance between the platen and the face of the print head assembly according to the thickness of the paper being used. For this adjustment, refer to the Technical Manual supplied with each Printer.	Tractor Position Knobs. Rotation of these knobs moves the paper feed tractors sideways. Form Thickness Knobs. These graduated and detented knobs are rotated to adjust the spacing between the print drum and print hammers to accommodate different forms and ribbons.

NOTE

The numbers on the knobs do not refer to the number of parts in the form.

Character Align Lever. Used to advance or retard activation of the print hammers with respect to the position of the characters on the spinning print drums as they pass the print hammers.

Latch Lever. Used to latch and unlatch the yoke.

Alarms	Hardware Alarm – This indicator lights if the printer's printing head carriage travels beyond the right-most allowable margin. This happens only if a malfunction occurs within the Printer. The Hardware Alarm condition is cleared by resetting the Safety Limit switch (located at the right side of the Printer carriage assembly), and by depressing the SELECT switch. Note that repeated occurrence of a Hardware Alarm condition indicates a need for maintenance to be performed on the Printer.	Alarm-Indicator. This indicator lamp is lit when any of several fault conditions exist. The fault conditions which can be corrected by the machine operator are: Yoke-Closed Interlock Switch not closed. Yoke-latched Interlock Switch not closed. Blown Motor Fuse
Control Knobs/ Levers	Paper Feed Lever – This lever, located on the right top of the Printer, is used for rapidly feeding paper in the forward direction.	Infinite-Form-Position Control. When the lever of this control is unlatched, the knob may be rotated to adjust the vertical position of the form, when the stop indicator is illuminated and the paper is stationary.
	Paper Advance Knob – This knob, located on the left side of the Printer, is used to adjust the paper position (forward and backward) relative to the Vertical Forms Control punched tape.	Vertical-Form-Position Lever. This lever is used to adjust the location in the vertical direction of the print line with respect to pre-printed forms, when the run indicator is lit and the paper is being indexed during normal printing operations.

Vertical Form Unit

The Printer is equipped with an eight-channel vertical forms control feature which uses standard one inch punched tape, 10 punches per inch, as the control element. The tape is inserted into a reader which is located on the left side of the Printer. The tape format is shown in Figure 1.

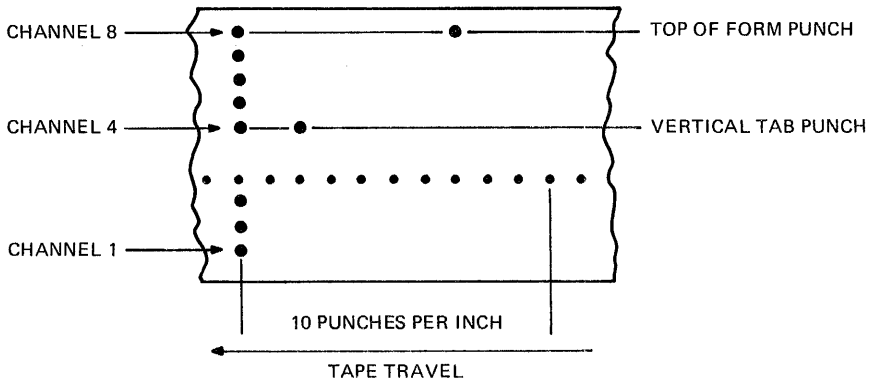


Figure 1. Tape Format

DATA FORMAT

The Controller transmits all upper case codes from X'20' to X'5E' to the Printer without conversion. Note that X'5E' prints as ^ (circumflex) and the code X'5F' ___ (underline) is trapped and converted to X'3C' which prints as < (less than). All lower case codes, X'60' through X'7F', are converted and transmitted as X'40' through X'5F'. Note that the "underline" is printed when the Processor sends X'7F' to the Controller (M46-206) and that character X'7F' is treated as a Carriage Return (CR) in the M46-202 Controller.

M46-202 Controller

Non-printing codes X'00' through X'1F' are ignored with the following exceptions:

BELL (X'07')	This causes the Audio alarm to sound for approximately two seconds.
LF (X'0A')	This causes the paper to be advanced one line.
VT (X'0B')	This causes the paper to be advanced to Channel 5 of the vertical format tape.
FF (X'0C')	This causes the paper to be advanced to Channel 7 of the vertical format tape.
CR (X'0D')	This causes the Line Buffer to be printed, the print head carriage to be returned to the left margin, and the paper to be advanced one line.
SO (X'0E')	This causes the entire contents of the current line to be printed in expanded character size (0.20 inches center to center horizontally instead of 0.10 inches), allowing only 66 characters per line. The X'0E' character may be sent at any time in the course of loading the Line Buffer.

M46-206 Controller

Non-printing codes X'00' through X'1F' are undefined with the following exceptions:

LF (X'0A')	This causes the Line Buffer to be printed and the paper to be spaced one line, even if given after a Carriage Return (CR).
VT (X'0B')	This causes the Line Buffer to be printed and the paper to be spaced according to Channel 4 of the VFU tape, even if given after a CR.
FF (X'0C')	This causes the Line Buffer to be printed and the paper to be spaced according to Channel 8 of the VFU tape, even if given after a CR.
CR(X'0D')	This causes the Line Buffer to be printed. The paper is spaced according to the *next character* in the following manner:

X'01'	Single Space
X'0A'	Single Space
X'0B'	VFU Channel 4
X'0C'	VFU Channel 8
X'40' - X'77'	Space 00 to 55 lines
X'78' - X'7F'	Space according to VFU Channels 1 through 8.

If the character following CR is not part of the above list, the Controller sends the code for space 00 lines - i.e., no space. The next time the Line Buffer is printed, over printing occurs. This may or may not be deliberate.

The Carriage Return (CR) 01 sequence can be used with the 02-244 (M46-202) and the 02-307 (M46-206) Controller.

PROGRAMMING INSTRUCTIONS

Status and Command Bytes

Table 2 provides Status and Command Byte Information.

TABLE 2. LINE PRINTER CONTROLLER STATUS AND COMMAND BYTE DATA

BIT NUMBER	0	1	2	3	4	5	6	7
STATUS BYTE		PAPER EMPTY		*INTER-LOCK	BUSY	EX		DU
COMMAND BYTE	DISABLE	ENABLE						

DISARM

*M46-202 ONLY

STATUS

PAPER EMPTY — This bit is set when the Paper Empty condition is activated in the Printer. This condition also sets the EX bit.

INTERLOCK — This bit is set when the Printer carriage assembly overruns the allowable length of travel. This is a result of a hardware fault condition. This condition also sets the Busy bit.

BUSY — This bit is set when the Interface is not ready to accept a character. It may be caused by a functional Printer operation or by the Interlock or Paper Empty condition. When this bit is reset, an interrupt is generated.

EX — This bit is set when either the Paper Empty or Interlock bit is set.

DU — This bit is set when the Printer is not selected (Off-Line), or if power is OFF. An interrupt is generated if this bit changes state in either direction.

COMMAND BYTE

DISABLE — This bit set and ENABLE bit reset allows an interrupt to be queued without interrupting the Processor.

ENABLE — This bit set and DISABLE bit reset allows the Interface to interrupt the Processor. (See INTERRUPTS).

DISARM — With both DISABLE and ENABLE bits set, the interrupt system is DISARMED. Interrupts are not generated or queued.

INSTRUCTIONS

OUTPUT COMMAND (OC or OCR) — The Interface may be Enabled, Disabled or Disarmed with this command.

SENSE STATUS (SS or SSR) — This instruction returns status of the Controller.

WRITE DATA (WD or WDR)
WRITE BLOCK (WB or WBR) — These instructions are used to output characters to the Printer and cause BUSY→0.

READ DATA (RD or RDR) — This instruction is ignored by the Printer.

ACKNOWLEDGE INTERRUPT (AI or AIR) — If the Printer is Enabled, this instruction examines the Status bits when an interrupt is generated. This instruction is valid on 16-Bit Processor only.

PROGRAMMING SEQUENCES

The following is a brief description of different modes of operation. See 16-Bit and 32-Bit Reference Manuals, Publication Numbers 29-298 and 29-365, for general Programming Procedures.

Sense Status I/O Control

This form of I/O Programming uses loops to continually interrogate the status of a device until a specified condition is met. (See Appendix 2 and 3 for Programming Examples.)

Interrupt I/O Control

16 Bit Processor

When using immediate interrupts on a 16 Bit Processor, the appropriate service pointer table must be set up to accommodate a PSW swap. Refer to Appendix 2 for a Programming Example.

32-Bit Processor

Interrupts are handled through the interrupt service pointer table (See Appendix 3 for Programming Example).

Auto Driver Channel I/O (32-Bit Processor Only)

The purpose of the Auto Driver Channel is to free the user from handling every interrupt. The Auto Driver Channel's function is controlled by the set up of the Channel Command Block. See Appendix 3 for Programming Examples.

INTERRUPTS

When interrupts are enabled, the Interface generates an interrupt when:

1. The Busy bit changes from ONE to ZERO.
2. The Paper Empty bit changes from ZERO to ONE.
3. The DU bit changes state in either direction.

NOTE

Since writing out a character causes Busy to change to ZERO, an efficient way to cause an interrupt is to write a null character.

NOTE

When the Line Printer is disabled, the interrupt is queued. When the Line Printer is disarmed, interrupts are not generated or queued.

NOTE

When running in an interrupt environment, the Line Printer, because of its rapid response, should be a lower priority than slower responding devices. If not, the Line Printer should be programmed via status loops with Processor interrupts enabled.

INITIALIZATION

When the Processor is initialized, the Line Printer Controller is disconnected from the Multiplexor Bus, the Busy status bit is reset, and interrupts are disarmed. The Printer is initialized (the Line Buffer reset) either by turning the power ON (ON/OFF switch) to the Printer, or by depressing the SELECT switch.

DEVICE NUMBER

The 02-307 or 02-244 preferred device number is X'62'. See the 16-Bit and 32-Bit Reference Manuals, Publication Numbers 29-398 and 29-365.

SAMPLE PROGRAMS AND FLOW CHARTS

Appendix 2 contains 2 Programming Examples for 16-Bit Processors. The first is a sample program and flowchart for all 16-Bit Processors to output a buffer of characters to the Printer using programmed Sense Status Loops.

The second is a sample program and flowchart for all 16-Bit Processors showing output to the Printer under Immediate Interrupt Control.

Appendix 3 contains three programming examples for 32-Bit Processors. The first is a sample program for all 32-Bit Processors to demonstrate output to the Printer using Sense Status Loops.

The second is a sample program and flowchart for all 32-Bit Processors to demonstrate output to the Printer under Interrupt Control.

The third is a sample program and flowchart for all 32-Bit Processors to demonstrate output to the Printer using the Auto Driver Channel.

APPENDIX 1
CHARACTER DEFINITION TABLE

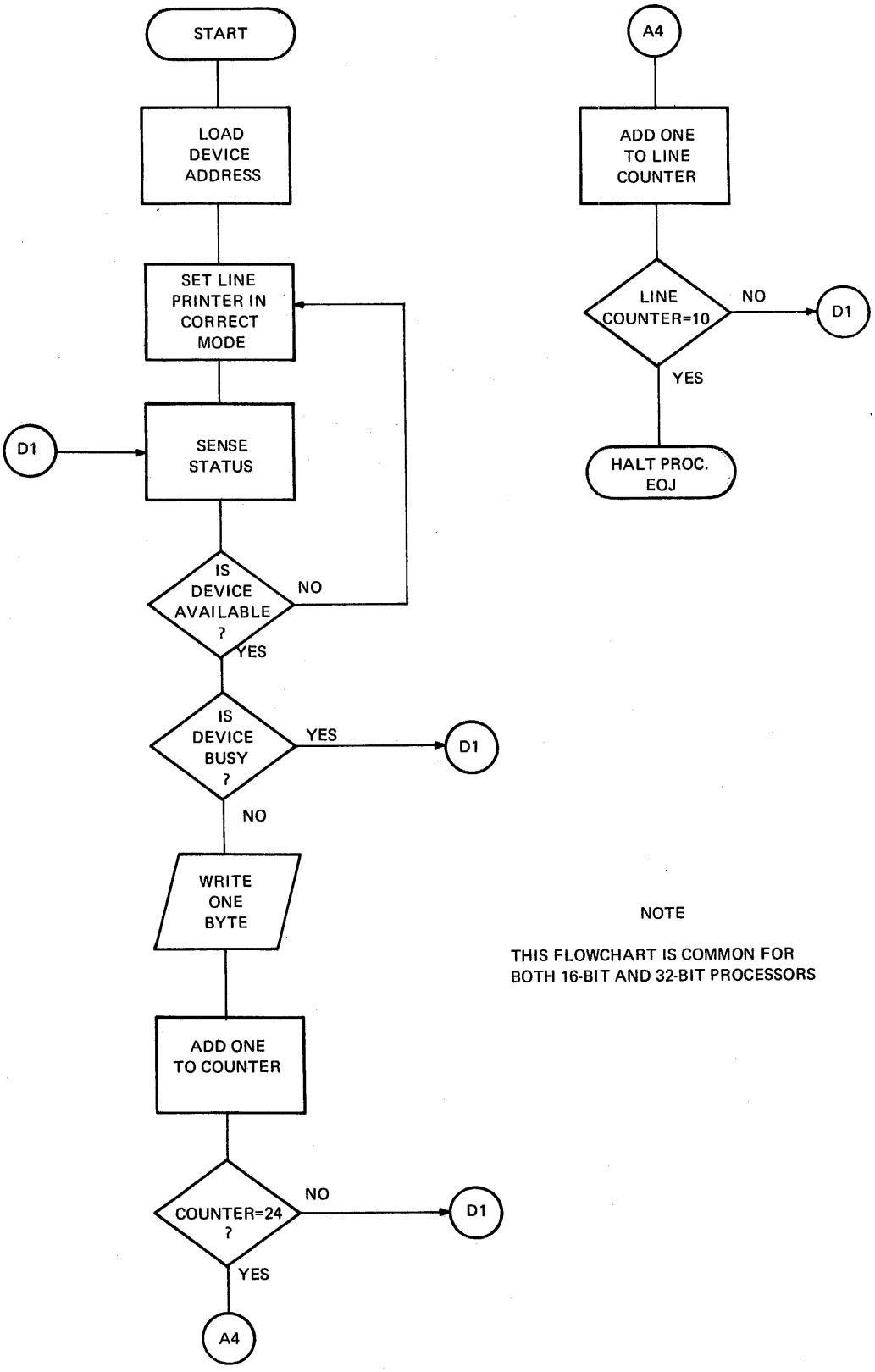
The following differences exist between all the printers.

Printer	Character	Prints
M46-204	5E	↑
M46-205	5E	↑
M46-207	5E	^
M46-208	5E	^
M46-209	5E	^
M46-210	5E	^
M46-204	5F	< (3C)
M46-205	5F	< (3C)
M46-207	5F	< (3C)
M46-208	5F	< (3C)
M46-209	5F	< (3C)
M46-210	5F	< (3C)
M46-204	7E	↑
M46-205	7E	↑
M46-207	7E	^
M46-208	7E	^
M46-209	7E	^
M46-210	7E	^
M46-204	7F	CR
M46-205	7F	CR
M46-207	7F	–
M46-208	7F	–
M46-209	7F	–
M46-210	7F	–

All Controllers convert X'60' thru X'7E' to X'40' thru X'5E'. M46-202 ignores all characters below X'20', and for the M46-206 all characters below X'20' are undefined.

Printer	Character Given After (CR(0D)	Results
M46-206	20-3F	Undefined
M46-206	40-77	Spaces 0 thru 55 lines
M46-206	78	Spaces to Channel 1
M46-206	79	Spaces to Channel 2
M46-206	7A	Spaces to Channel 3
M46-206	7B	Spaces to Channel 4
M46-206	7C	Spaces to Channel 5
M46-206	7D	Spaces to Channel 6
M46-206	7E	Spaces to Channel 7
M46-206	7F	Spaces to Channel 8
M46-206	01	Spaces 1 line
M46-202	01	Ignored
M46-206	LF(0A)	Causes buffer to print and space 1 line.
M46-202	LF(0A)	Causes paper to space 1 line.
M46-206	VT(0B)	Causes buffer to print and space to Channel 4.
M46-202	VT(0B)	Causes buffer to advance to Channel 5.
M46-206	FF(0C)	Causes buffer to print and space to Channel 8.
M46-202	FF(0C)	Causes paper to advance to Channel 7.
M46-206	CR(0D)	Causes buffer to print and advance on next character.
M46-202	CR(0D)	Causes buffer to print and space 1 line.

APPENDIX 2
LINE PRINTER PROGRAMMING
EXAMPLES FOR 16-BIT PROCESSORS



NOTE

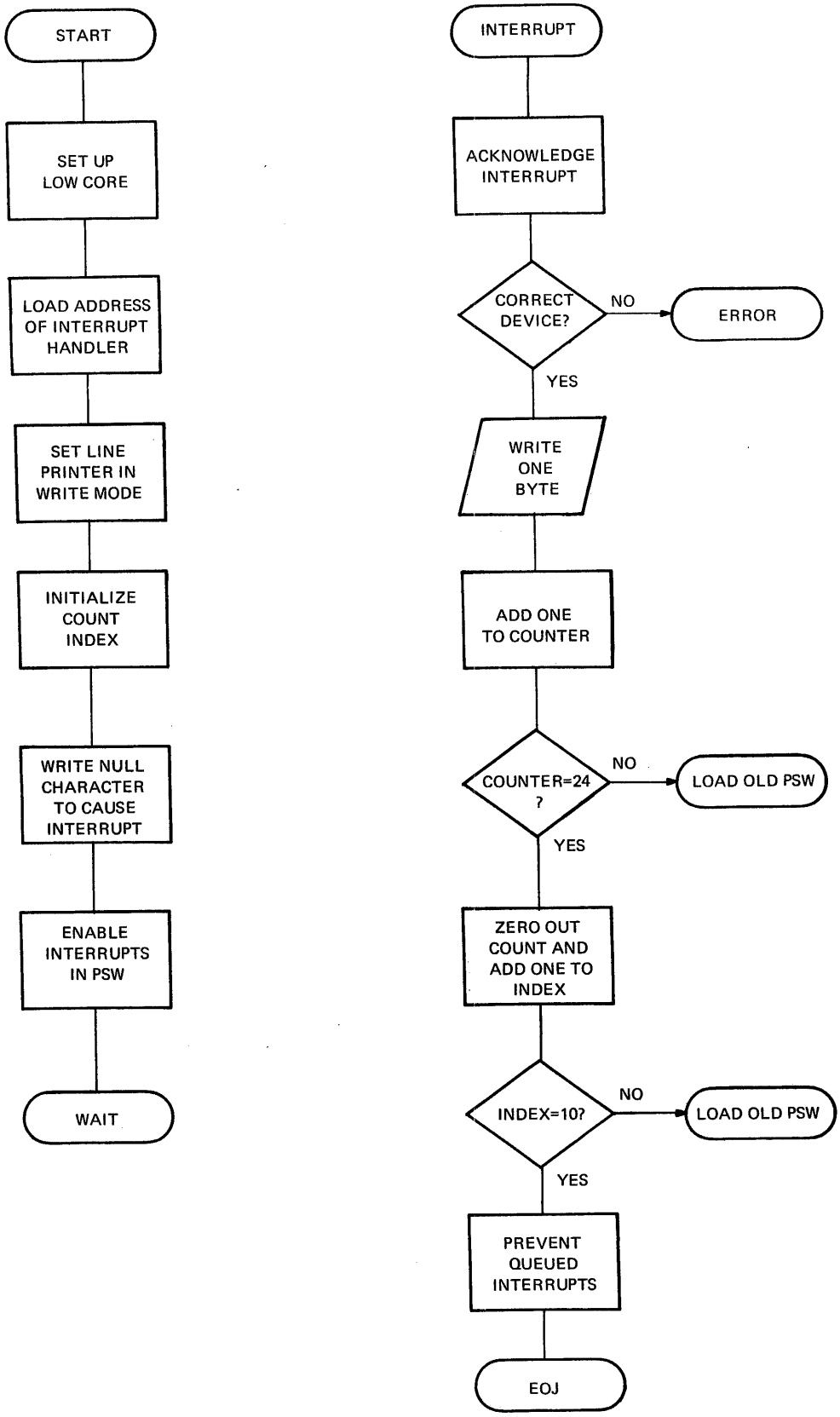
THIS FLOWCHART IS COMMON FOR BOTH 16-BIT AND 32-BIT PROCESSORS

SENSE STATUS LOOPS

```
        APPENDIX 2 SENSE STATUS 16-BIT PROCESSORS                PAGE   1  06:20:40  08/25/78

PROG= LNPRTR     ASSEMBLED BY CAL 03-066R05-00   (32-BIT)

                                          1           SCRAT
                                          2           CROSS
                                          3           WIDTH 120
                                          4           TARGT 16
                                          5  *
                                          6  *   SAMPLE PROGRAM FOR LINE PRINTER ON A 16-BIT PROCESSOR
                                          7  *
                                          8  *   THIS PROGRAM UTILIZES SENSE STATUS LOOPS TO WRITE OUT A BUFFER.10X.
                                          9  *   THE BUFFER IS DEFINED AS ' LINE PRINTER 2.1 TEST'
                                         10  *
                                         11  *   SET UP REGISTERS
                                         12  *
          0000 0001                      13  R1        EQU   1                  DEVICE ADDRESS HOLD REGISTER
          0000 0001                      14  DU        EQU   1                  DEVICE UNAVAILABLE
          0000 0002                      15  R2        EQU   2                  BUFFER LIMIT REGISTER
          0000 0003                      16  R3        EQU   3                  STATUS HOLD REGISTER
          0000 0004                      17  R4        EQU   4                  LINE COUNTER REGISTER
          0000 0008                      18  BSY       EQU   8                  BUSY
                                         19  *
                                         20  *   LOAD DEVICE ADDRESS AND SET LINE PRINTER IN CORRECT MODE
                                         21  *
0000R  4810 004CR                        22  START     LH    R1,LPADR           LOAD DEVICE ADDRESS
0004R  0722                              23            XHR   R2,R2              ZERO OUT REGISTER 2
0006R  0744                              24            XHR   R4,R4              ZERO OUT REGISTER 4
0008R  DE10 004ER                        25  OC        OC    R1,WRTCMD          SET PRINTER IN WRITE MODE
                                         26  *
                                         27  *    SENSE STATUS LOOP
                                         28  *
000CR  9D13                              29  SENSE     SSR   R1,R3              STATUS OF LINE PRINTER
000ER  2013                              30            BTBS  DU,OC              TEST FOR DEVICE UNAVAILABLE
0010R  2082                              31            BTBS  BSY,SENSE          TEST FOR BUSY STATUS
                                         32  *
                                         33  *    FILL UP OUTPUT BUFFER
                                         34  *
0012R  DA12 0034R                        35            WD    R1,BUFFER(R2)      WRITE ONE BYTE FROM BUFFER
0016R  2621                              36            AIS   R2,1               INCREMENT BUFFER
0018R  C520 0018                         37            CLHI  R2,24              IS BUFFER FILLED YET?
001CR  4330 0024R                        38            BE    DONE               YES. GO TO NEXT LINE
0020R  4300 000CR                        39            B     SENSE              NO. GO TO WRITE ANOTHER BYTE
                                         40  *
                                         41  *    THIS ROUTINE COUNTS THE NUMBER OF LINES OUTPUT
                                         42  *
0024R  2641                              43  DONE      AIS   R4,1               INCREMENT LINE COUNT
0026R  C540 000A                         44            CLHI  R4,10              ARE 10 LINES OUTPUT YET?
002AR  4330 0050R                        45            BE    FINAL              YES. GO TO END OF JOB
002ER  0722                              46            XHR   R2,R2              ZERO OUT REGISTER 2
0030R  4300 000CR                        47            B     SENSE              GO TO WRITE ANOTHER BYTE
                                         48  *
                                         49  *    DEFINE BUFFER AND OTHER CONSTANTS
                                         50  *
0034R  204C 494E 4520 5052               51  BUFFER    DC    C' LINE PRINTER 2.1 TEST'
003CR  494E 5445 5220 322E
0044R  3120 5445 5354
```

```
APPENDIX 2 SENSE STATUS 16-BIT PROCESSORS                    PAGE   2  06:20:40  08/25/78

   004AR  0D01                  52          DC     X'0D01'          OUTPUT CR AND SPACE 1 LINE
   004CR  0062                  53  LPADR   DC     X'62'            LINE PRINTER ADDRESS
   004ER  80                    54  WRTCMD  DB     X'80'            WRITE
   0050R  C200 0058R            55  FINAL   LPSW   WAIT1
**  B002  **
   0058R                        56          ALIGN  8
   0058R  8000                  57  WAIT1   DCX    8000
   005AR  0050R                 58          DC     A(FINAL)         PUT PROCESSOR IN FINAL WAIT STATE
   005CR                        59          END
```

```
    APPENDIX 2 SENSE STATUS 16-BIT PROCESSORS                PAGE    3  06:20:40  08/25/78

ASSEMBLED BY CAL 03-066R05-00   (32-BIT)

START OPTIONS:  *NONE*

    1 CAL ERROR    PREVIOUS ERROR ON PAGE   2
   NO CAL WARNINGS
    2 PASSES

 ABSTOP     0000 0000
 ADC        0000 0002
 BSY        0000 0008          18*     31
 BUFFER     0000 0034R         35      51*
 DONE       0000 0024R         38      43*
 DU         0000 0001          14*     30
 FINAL      0000 0050R         45      55*     58
 IMPTOP     0000 005CR
 LADC       0000 0001
 LPADR      0000 004CR         22      53*
 OC         0000 0008R         25*     30
 PURETOP    0000 0000R
 R1         0000 0001          13*     22      25      29      35
 R2         0000 0002          15*     23      23      35      36      37      46      46
 R3         0000 0003          16*     29
 R4         0000 0004          17*     24      24      43      44
 SENSE      0000 000CR         29*     31      39      47
 START      0000 0000R         22*
 WAIT1      0000 0058R         55      57*
 WRTCMD     0000 004ER         25      54*
```



IMMEDIATE INTERRUPTS (16-BIT PROCESSORS)

PROG= LNPRTP ASSEMBLED BY CAL 03-066R05-00 (32-BIT)

```
                                    1           SCRAT
                                    2           CROSS
                                    3           TARGT 16
                                    4           WIDTH 120
                                    5  *
                                    6  *    THIS PROGRAM DEMONSTRATES OUTPUT TO THE LINE PRINTER UNDER
                                    7  *    INTERRUPT CONTROL ON A 16-BIT PROCESSOR
                                    8  *
                                    9  *    THIS PROGRAM WRITES OUT A BUFFER 10 TIMES.
                                   10  *   THE BUFFER IS DEFINED AS ' LINE PRINTER 2.2 TEST'
                                   11  *
                                   12  *    SET UP REGISTERS
                                   13  *
0000 0001                          14  R1        EQU   1                  DEVICE ADDRESS HOLD REGISTER
0000 0002                          15  R2        EQU   2                  WORK REGISTER
0000 0003                          16  COUNT     EQU   3                  BUFFER COUNTER
0000 0004                          17  INDEX     EQU   4                  LINE COUNTER
0000 0005                          18  INT       EQU   5                  INTERRUPT DEVICE HOLD REGISTER
0000 0006                          19  INTSTA    EQU   6                  INTERRUPT STATUS HOLD REGISTER
0000R 4810 005AR                   20            LH    R1,DEVADR          LOAD DEVICE ADDRESS
0004R 0722                         21            XHR   R2,R2              ZERO OUT R2
                                   22  *
                                   23  *    SET UP LOW CORE
                                   24  *
0006R 4020 0040                    25            STH   R2,X'40'           STORE ZERO IN OLD PSW
000AR 4020 0042                    26            STH   R2,X'42'           STORE ZERO IN OLD LOC
000ER 4020 0044                    27            STH   R2,X'44'           STORE ZERO IN NEW PSW
0012R C820 0028R                   28            LHI   R2,LPINT
0016R 4020 0046                    29            STH   R2,X'46'           STORE LINE PR INTRPT HANDLER
                                   30  *                                  IN NEW LOC
001AR DE10 0056R                   31            OC    R1,WRTCMD          SET LP IN WRITE MODE
001ER 0733                         32            XHR   COUNT,COUNT        ZERO OUT COUNT
0020R 0744                         33            XHR   INDEX,INDEX        ZERO OUT INDEX
0022R 9A14                         34            WDR   R1,INDEX           WRITE OUT NULL CHARACTER
0024R C200 0078R                   35  WAIT1     LPSW  WAIT               WAIT FOR INTERRUPT
                                   36  *
                                   37  *    ACKNOWDEDGE INTERRUPT ROUTINE
                                   38  *
0028R 9F56                         39  LPINT     AIR   INT,INTSTA         ACKNOWLEDGE INTERRUPT
002AR 0551                         40            CLHR  INT,R1             TEST FOR CORRECT DEVICE
002CR 4230 0052R                   41            BNE   DONE               IF ERROR GO TO END OF JOB
                                   42  *
                                   43  *    FILL UP OUTPUT BUFFER
                                   44  *
0030R DA13 005CR                   45  WRITE     WD    R1,WRTBUF(COUNT)   WRITE OUT ONE BYTE
0034R 2631                         46            AIS   COUNT,1            INCREMENT COUNT
0036R C530 0018                    47            CLHI  COUNT,24           IS COMPLETE BUFFER OUTPUT YET?
003AR 4330 0042R                   48            BE    ZCOUNT             YES, GO TO CHECK LINE COUNT
003ER C200 0040                    49            LPSW  X'40'              WAIT FOR ANOTHER INTERRUPT
0042R 0733                         50  ZCOUNT    XHR   COUNT,COUNT        ZERO OUT COUNT
0044R 2641                         51            AIS   INDEX,1            INCREMENT INDEX(LINE COUNTER)
0046R C540 000A                    52            CLHI  INDEX,10           ARE 10 LINES OUTPUT YET
004AR 4230 0052R                   53            BNE   DONE              YES GO TO END OF JOB
```

```
APPENDIX 2 IMMEDIATE INTERRUPTS 16-BIT PROCESSORS          PAGE   2  06:21:11  08/25/78

004ER  DE10 0058R                 54            OC    R1,DISARM          PREVENT QUEUED INTERRUPTS
0052R  C200 0040                  55  DONE      LPSW  X'40'
                                  56  *
                                  57  *    DEFINE BUFFER AND OTHER CONSTANTS
                                  58  *
0056R  4000                       59  WRTCMD    DC    X'4000'            WRITE MODE
0058R  C000                       60  DISARM    DC    X'C000'            DISARM MODE
005AR  0062                       61  DEVADR    DC    X'62'              DEVICE ADDRESS
005CR  204C 494E 4520 5052        62  WRTBUF    DC    C' LINE PRINTER 2.2 TEST'
0064R  494E 5445 5220 322E
006CR  3220 5445 5354
0072R  0D01                       63            DC    X'0D01'            CR AND SPACE ONE LINE
0078R                             64            ALIGN 8
0078R  C000                       65  WAIT      DC    X'C000'            ENABLE EXT. INTERRUPTS AND WAIT
007AR  0024R                      66            DC    WAIT1
007CR                             67            END
```

```
    APPENDIX 2 IMMEDIATE INTERRUPTS 16-BIT PROCESSORS          PAGE   3  06:21:11  08/25/78

ASSEMBLED BY CAL 03-066R05-00   (32-BIT)

START OPTIONS:  *NONE*

   NO CAL ERRORS
   NO CAL WARNINGS
    2 PASSES

 ABSTOP     0000 0000
 ADC        0000 0002
 COUNT      0000 0003        16*     32      32      45      46      47      50      50
 DEVADR     0000 005AR       20      61*
 DISARM     0000 0058R       54      60*
 DONE       0000 0052R       41      53      55*
 IMPTOP     0000 007CR
 INDEX      0000 0004        17*     33      33      34      51      52
 INT        0000 0005        18*     39      40
 INTSTA     0000 0006        19*     39
 LADC       0000 0001
 LPINT      0000 0028R       28      39*
 PURETOP    0000 0000R
 R1         0000 0001        14*     20      31      34      40      45      54
 R2         0000 0002        15*     21      21      25      26      27      28      29
 WAIT       0000 0078R       35      65*
 WAIT1      0000 0024R       35*     66
 WRITE      0000 0030R       45*
 WRTBUF     0000 005CR       45      62*
 WRTCMD     0000 0056R       31      59*
 ZCOUNT     0000 0042R       48      50*
```

PROG= LNPRTR ASSEMBLED BY CAL 03-066R05-00 (32-BIT)

```
                                        1          SCRAT
                                        2          CROSS
                                        3          WIDTH 120
                                        4          TARGT 32
                                        5          NORX3
                                        6  *
                                        7  *   SAMPLE PROGRAM FOR LINE PRINTER ON A 32-BIT PROCESSOR
                                        8  *
                                        9  *   THIS PROGRAM UTILIZES SENSE STATUS LOOPS TO WRITE OUT A BUFFER.10X.
                                       10  *   THE BUFFER IS DEFINED AS ' LINE PRINTER 3.1 TEST'
                                       11  *
                                       12  *   SET UP REGISTERS
                                       13  *
          0000 0001                    14  R1       EQU   1                 DEVICE ADDRESS HOLD REGISTER
          0000 0001                    15  DU       EQU   1                 DEVICE UNAVAILABLE
          0000 0002                    16  R2       EQU   2                 BUFFER LIMIT REGISTER
          0000 0003                    17  R3       EQU   3                 STATUS HOLD REGISTER
          0000 0004                    18  R4       EQU   4                 LINE COUNTER REGISTER
          0000 0008                    19  BSY      EQU   8                 BUSY
                                       20  *
                                       21  *   LOAD DEVICE ADDRESS AND SET LINE PRINTER IN CORRECT MODE
                                       22  *
000000I   4810 8048 =00004CI           23  START    LH    R1,LPADR          LOAD DEVICE ADDRESS
000004I   0722                         24           XR    R2,R2             ZERO OUT REGISTER 2
000006I   0744                         25           XR    R4,R4             ZERO OUT REGISTER 4
000008I   DE10 8042 =00004EI           26  OC       OC    R1,WRTCMD         SET PRINTER IN WRITE MODE
                                       27  *
                                       28  *    SENSE STATUS LOOP
                                       29  *
00000CI   9D13                         30  SENSE    SSR   R1,R3             STATUS OF LINE PRINTER
00000EI   2013                         31           BTBS  DU,OC             TEST FOR DEVICE UNAVAILABLE
000010I   2082                         32           BTBS  BSY,SENSE         TEST FOR BUSY STATUS
                                       33  *
                                       34  *    FILL UP OUTPUT BUFFER
                                       35  *
000012I   DA12 801E =000034I           36           WD    R1,BUFFER(R2)     WRITE ONE BYTE FROM BUFFER
000016I   2621                         37           AIS   R2,1              INCREMENT BUFFER
000018I   C520 0018                    38           CLHI  R2,24             IS BUFFER FILLED YET?
00001CI   4330 8004 =000024I           39           BE    DONE              YES. GO TO NEXT LINE
000020I   4300 FFE8 =00000CI           40           B     SENSE             NO. GO TO WRITE ANOTHER BYTE
                                       41  *
                                       42  *    THIS ROUTINE COUNTS THE NUMBER OF LINES OUTPUT
                                       43  *
000024I   2641                         44  DONE     AIS   R4,1              INCREMENT LINE COUNT
000026I   C540 000A                    45           CLHI  R4,10             ARE 10 LINES OUTPUT YET?
00002AI   4330 8022 =000050I           46           BE    FINAL             YES. GO TO END OF JOB
00002EI   0722                         47           XR    R2,R2             ZERO OUT REGISTER 2
000030I   4300 FFD8 =00000CI           48           B     SENSE             GO TO WRITE ANOTHER BYTE
                                       49  *
                                       50  *    DEFINE BUFFER AND OTHER CONSTANTS
                                       51  *
000034I   204C 494E 4520 5052          52  BUFFER   DC    C' LINE PRINTER 3.1 TEST'
00003CI   494E 5445 5220 332E
```

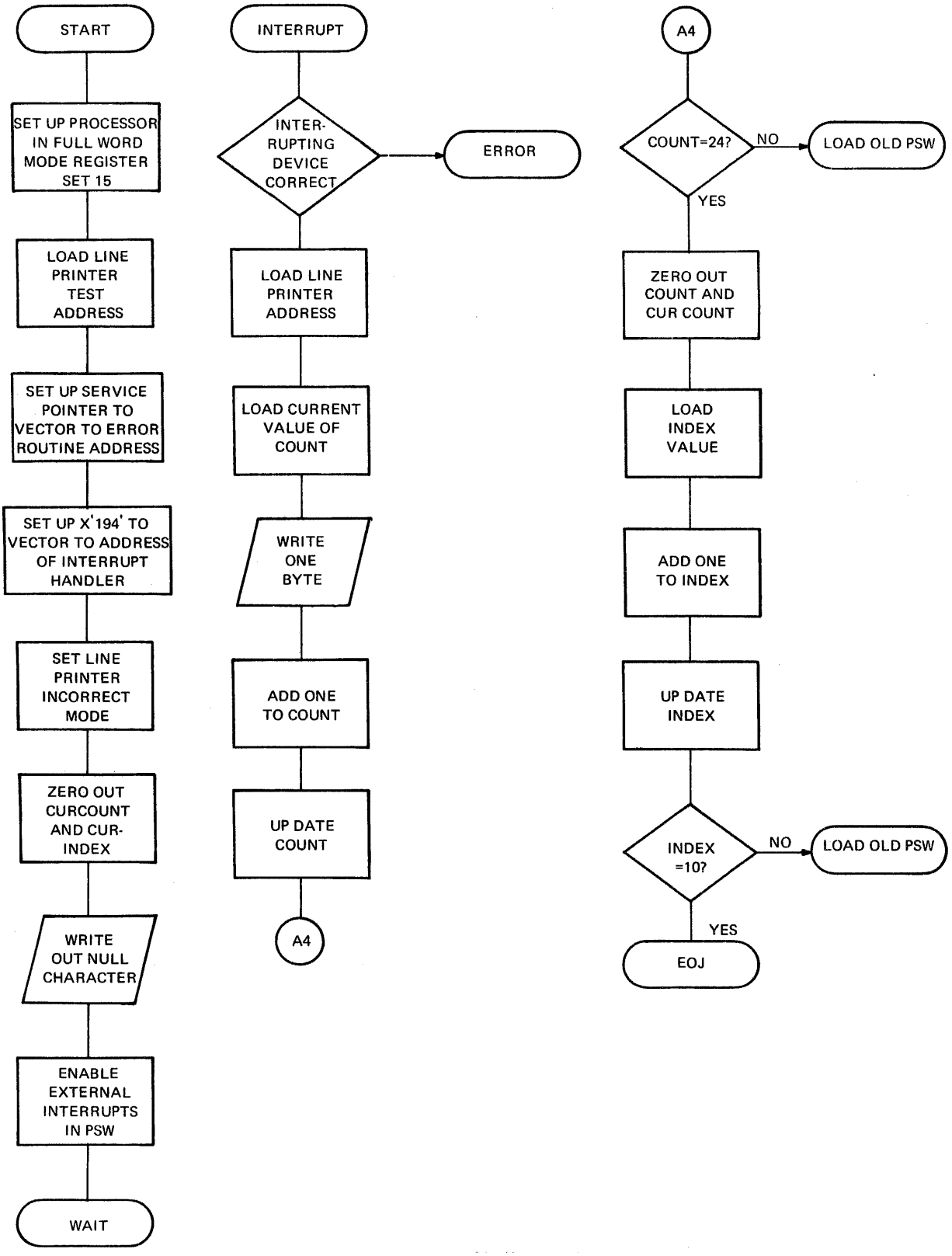
```
000044I  3120 5445 5354
00004AI  0D01
00004CI  0062
00004EI  80
000050I  C200 8004 =000058I
**  B002  **
000058I
000059I  0000 8000
00005CI  0000 0050I
000060I

53                DC     X'0D01'      OUTPUT CR AND SPACE 1 LINE
54  LPADR         DC     X'62'        LINE PRINTER ADDRESS
55  WRTCMD        DB     X'80'        WRITE
56  FINAL         LPSW   WAIT1
57                ALIGN  8
58  WAIT1         DCY    8000         PUT PROCESSOR IN FINAL WAIT STATE
59                DC     A(FINAL)
60                END
```

ASSEMBLED BY CAL 03-066R05-00 (32-BIT)

START OPTIONS: *NONE*

1 CAL ERROR PREVIOUS ERROR ON PAGE 2
NO CAL WARNINGS
2 PASSES

ABSTOP	0000 0000								
ADC	0000 0004								
BSY	0000 0008	19*	32						
BUFFER	0000 0034I	36	52*						
DONE	0000 0024I	39	44*						
DU	0000 0001	15*	31						
FINAL	0000 0050I	46	56*	59					
IMPTOP	0000 0060I								
LADC	0000 0002								
LPADR	0000 004CI	23	54*						
OC	0000 0008I	26*	31						
PURETOP	0000 0000P								
R1	0000 0001	14*	23	26	30	36			
R2	0000 0002	16*	24	24	36	37	38	47	47
R3	0000 0003	17*	30						
R4	0000 0004	18*	25	25	44	45			
SENSE	0000 000CI	30*	32	40	48				
START	0000 0000I	23*							
WAIT1	0000 0058I	56	58*						
WRTCMD	0000 004EI	26	55*						



IMMEDIATE INTERRUPTS (32-BIT PROCESSORS)

PROG= LNPRTR ASSEMBLED BY CAL 03-066R05-00 (32-BIT)

```
                                1          SCRAT
                                2          CROSS
                                3          NORX3
                                4          TARGT 32
                                5          WIDTH 120
                                6  *
                                7  *   THIS PROGRAM IS AN EXAMPLE OF IMMEDIATE INTERRUPTS ON A 32-BIT
                                8  *   PROCESSOR. THE PROGRAM OUTPUTS A BUFFER 10 TIMES.
                                9  *   THE BUFFER IS DEFINED AS ' LINE PRINTER 3.2 TEST'
                               10  *
                               11  *   SET UP REGISTERS
                               12  *
0000 0000                      13  R0        EQU   0                 WORK REGISTER
0000 0001                      14  R1        EQU   1                 ERROR ADDRESS HOLD REGISTER
0000 0002                      15  R2        EQU   2                 COUNTER
0000 0003                      16  R3        EQU   3                 STATUS HOLD REGISTER
0000 0004                      17  INDEX     EQU   4                 BUFFER LIMIT HOLD REGISTER
0000 0005                      18  COUNT     EQU   5                 LINT COUNT REGISTER
0000 0006                      19  DEVADR    EQU   6                 DEVICE ADDRESS REGISTER
0000 0007                      20  WORK      EQU   7                 WORK REGISTER
000000I C800 00F0              21  START     LHI   R0,X'00F0'        REGISTER SET 15
000004I 9510                   22            EPSR  R1,R0
000006I 4860 809A =0000A4I     23            LH    DEVADR,LNPRT      LOAD DEVICE ADDRESS
                               24  *
                               25  *     SET UP INTERRUPT SERVICE POINTER TABLE TO POINT TO ERROR ADDRESSES
                               26  *
00000AI 0722                   27            XR    R2,R2             ZERO OUT REGISTER 2
00000CI C810 0082I             28            LHI   R1,ERROR          LOAD ERROR ADDRESS
000010I 4012 0000              29  LOAGAIN   STH   R1,X'00'(R2)      STORE ERROR ADDRESS
000014I 2622                   30            AIS   R2,2              INCREMENT R2
000016I C520 0200              31            CLHI  R2,X'200'         IS TABLE COMPLETE YET
00001AI 4280 FFF2 =000010I     32            BL    LOAGAIN           NO LOAD ANOTHER
                               33  *
                               34  *     SET UP INTERRUPT HANDLER OF LINE PRINTER IN DEVICE POINTER TABLE
                               35  *
00001EI 4870 8082 =0000A4I     36            LH    WORK,LNPRT        LOAD LINE PRINTER ADDRESS
000022I 1171                   37            SLLS  WORK,1            MULTIPLY BY 2
000024I C820 0046I             38            LHI   R2,INT            LOAD INTERRUPT HANDLER
000028I 4027 00D0              39            STH   R2,X'00'(WORK)    STORE INTRPT HANDLER INTO TABLE
00002CI DE60 8072 =0000A2I     40            OC    DEVADR,WRTCMD
000030I 0755                   41            XR    COUNT,COUNT       ZERO OUT COUNT
000032I 4050 8050 =000086I     42            STH   COUNT,CURCOUNT    INITIALIZE CURCOUNT
000036I 4050 804E =000088I     43            STH   COUNT,CURINDEX    INITIALIZE CURINDEX
00003AI 9A65                   44            WDR   DEVADR,COUNT      WRITE OUT NULL CHARACTER
00003CI F810 0000 C0F0         45  GOAGAIN   LI    R1,Y'C0F0'        ENABLE INTERRUPTS,REGISTER SET 15
000042I 9501                   46            EPSR  R0,R1             ACTIVATE
000044I 2204                   47            BS    GOAGAIN
                               48  *
                               49  *     INTERRUPT HANDLER ROUTINE
                               50  *
000046I 0833                   51  INT       LR    R3,R3             SET CONDITION CODE
000048I 4230 8036 =000082I     52            BNZ   ERROR             BRANCH ON BAD STATUS
00004CI 4860 8054 =0000A4I     53            LH    DEVADR,LNPRT
```

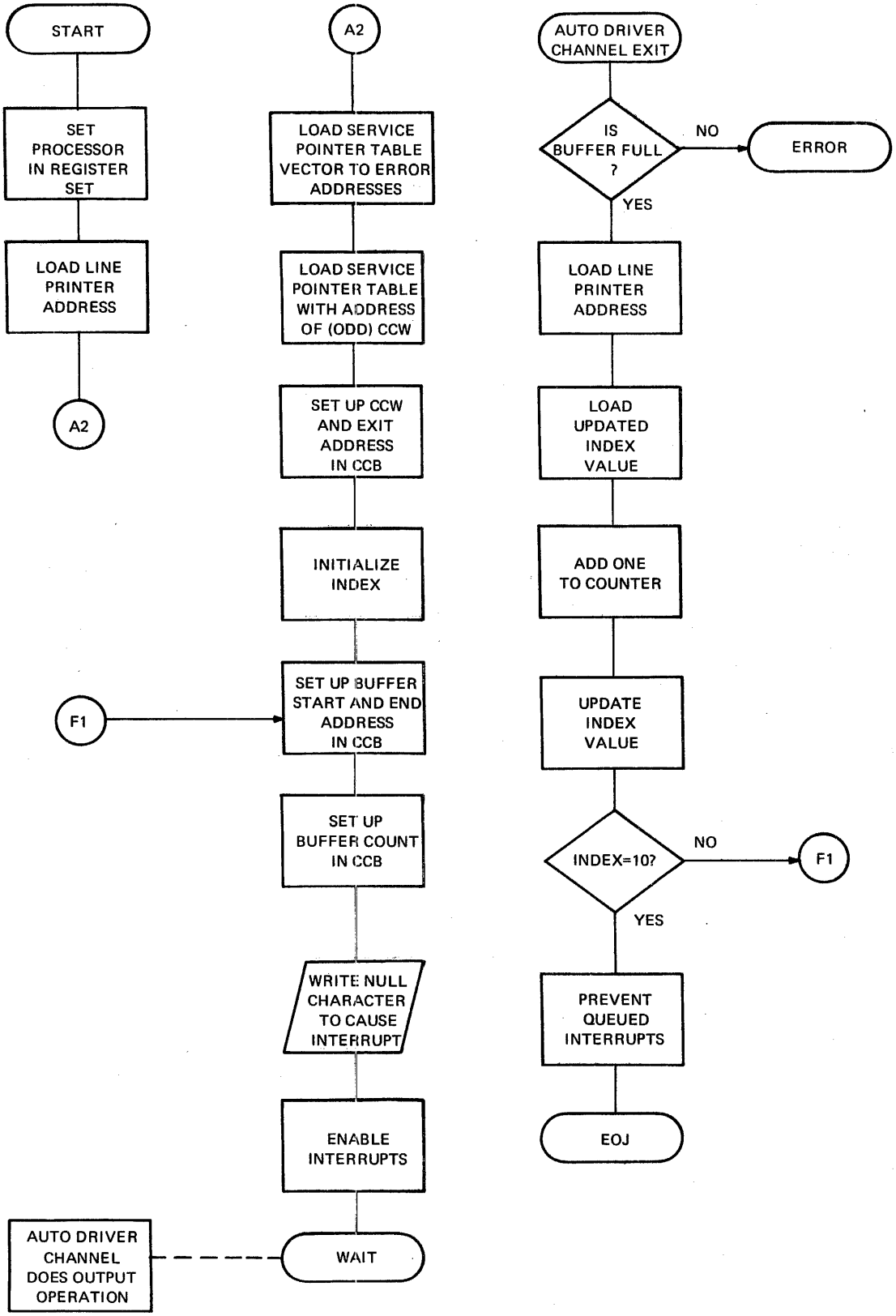
```
000050I  4650 8032 =000086I     54            LH    COUNT,CURCOUNT       INITIALIZE COUNT
000054I  DA65 8032 =00008AI     55            WD    DEVADR,WRTBUF(COUNT) WRITE OUT ONE BYTE OF BUFFER
                                56  *
                                57  *     ADD ONE BYTE TO BUFFER
                                58  *
000058I  2651                   59            AIS   COUNT,1              INCREMENT COUNT
00005AI  4050 8028 =000086I     60            STH   COUNT,CURCOUNT       UPDATE CURCOUNT
00005EI  C550 0018              61            CLHI  COUNT,24             IS COMPLETE BUFFER OUTPUT YET
000062I  4330 8002 =000068I     62            BE    ZCOUNT               YES GO TO LINE COUNT
000066I  1800                   63            LPSWR R0                   LOAD OLD PSW
                                64  *
                                65  *     COUNTER FOR OUTPUT OF 10 LINES
                                66  *
000068I  0755                   67  ZCOUNT    XR    COUNT,COUNT          ZERO OUT COUNT
00006AI  4050 8018 =000086I     68            STH   COUNT,CURCOUNT       INITIALIZE CURCOUNT
00006EI  4840 8016 =000088I     69            LH    INDEX,CURINDEX       INITIALIZE INDEX REGISTER
000072I  2641                   70            AIS   INDEX,1              INCREMENT INDEX(LINE COUNTER)
000074I  4040 8010 =000088I     71            STH   INDEX,CURINDEX       UPDATE INDEX
000078I  C540 000A              72            CLHI  INDEX,10             ARE TEN LINE OUTPUT YET?
00007CI  4330 8026 =0000A6I     73            BE    DONE                 YES GO TO EOJ
000080I  1800                   74            LPSWR R0                   LOAD OLD PSW
         0000 0082I             75  ERROR     EQU   *
000082I  4300 FF7A =000000I     76            B     START
000086I  0000                   77  CURCOUNT  DC    X'0'
000088I  0000                   78  CURINDEX  DC    X'0'
00008AI  204C 494E 4520 5052    79  WRTBUF    DC    C' LINE PRINTER 3.2 TEST'
000092I  494E 5445 5220 332E
00009AI  3220 5445 5354
0000A0I  0D01                   80            DC    X'0D01'              CR AND SPACE ONE LINE
0000A2I  4000                   81  WRTCMD    DC    X'4000'              WRITE MODE
0000A4I  0062                   82  LNPRT     DC    X'62'                LINE PRINTER ADDRESS
0000A6I  C200 8006 =0000B0I     83  DONE      LPSW  WAIT
0000B0I                         84            ALIGN 8
0000B0I  0000 8000              85  WAIT      DC    Y'8000'
0000B4I  0000 00A6I             86            DC    A(DONE)
0000B8I                         87            END
```

ASSEMBLED BY CAL 03-066R05-00 (32-BIT)

START OPTIONS: *NONE*

NO CAL ERRORS
NO CAL WARNINGS
2 PASSES

ABSTOP	0000 0000												
ADC	0000 0004												
COUNT	0000 0005	18*	41	41	42	43	44	54	55	59	60	61	67	67
		68												
CURCOUNT	0000 0086I	42	54	60	68	77*								
CURINDEX	0000 0088I	43	69	71	78*									
DEVADR	0000 0006	19*	23	40	44	53	55							
DONE	0000 00A6I	73	83*	86										
ERROR	0000 0082I	28	52	75*										
GOAGAIN	0000 003CI	45*	47											
IMPTOP	0000 00B8I													
INDEX	0000 0004	17*	69	70	71	72								
INT	0000 0046I	38	51*											
LADC	0000 0002													
LDAGAIN	0000 0010I	29*	32											
LNPRT	0000 00A4I	23	36	53	82*									
PURETOP	0000 0000P													
R0	0000 0000	13*	21	22	46	63	74							
R1	0000 0001	14*	22	28	29	45	46							
R2	0000 0002	15*	27	27	29	30	31	38	39					
R3	0000 0003	16*	51	51										
START	0000 0000I	21*	76											
WAIT	0000 00B0I	83	85*											
WORK	0000 0007	20*	36	37	39									
WRTBUF	0000 008AI	55	79*											
WRTCMD	0000 00A2I	40	81*											
ZCOUNT	0000 0068I	62	67*											



AUTO DRIVER CHANNEL (32-BIT PROCESSORS)

PROG= LNPRTR ASSEMBLED BY CAL 03-066R05-00 (32-BIT)

```
                                        1           SCRAT
                                        2           CROSS
                                        3           NORX3
                                        4           TARGT 32
                                        5           WIDTH 120
                                        6  *
                                        7  *    THIS PROGRAM DEMONSTRATES THE LINE PRINTER UNDER AUTO-DRIVER
                                        8  *    CHANNEL CONTROL TO OUTPUT A BUFFER OF 24 CHARACTERS 10 TIMES
                                        9  *   THE BUFFER IS DEFINED AS ' LINE PRINTER 3.3 TEST'
                                       10  *
                                       11  *    SET UP REGISTERS
                                       12  *
0000 0000                              13  R0        EQU   0                 WORK REGISTER
0000 0001                              14  R1        EQU   1                 WORK REGISTER
0000 0002                              15  STAT      EQU   2                 STATUS REGISTER
0000 0002                              16  DEVADR    EQU   2                 DEVICE ADDRESS REGISTER
0000 0006                              17  R6        EQU   6                 WORK REGISTER
0000 0007                              18  R7        EQU   7                 WORK REGISTER
0000 0008                              19  R8        EQU   8                 ERROR ADDRESS REGISTER
0000 0009                              20  R9        EQU   9                 INCREMENT COUNTER REGISTER
0000 000A                              21  R10       EQU   10                NULL CHARACTER REGISTER
0000 000F                              22  R15       EQU   15                LINE COUNTER REGISTER
                                       23  *
                                       24  *    SET UP PROCESSOR IN REG SET 15
                                       25  *
000000I  F800 0000 00F0                26            LI    R0,Y'00F0'        REG SET 15
000006I  9510                          27            EPSR  R1,R0             SET PSW
000008I  07AA                          28            XR    R10,R10           ZERO OUT REG 10
00000AI  4820 8088 =000096I            29  START1    LH    DEVADR,LPADR      LOAD DEVICE ADDRESS
00000EI  C800 00B9I                    30            LHI   R0,CCW+1          LOAD ODD CHAN. COM.WORD ADDRESS
                                       31  *
                                       32  *    SET UP SERVICE POINTER TABLE TO VECTOR TO ERROR ADDRESSES
                                       33  *
000012I  0799                          34            XR    R9,R9             ZERO OUT REG 9
000014I  C880 0090I                    35            LHI   R8,ERROR          LOAD ERROR ROUTINE ADDRESS
000018I  4089 00D0                     36  LDAGAIN   STH   R8,X'D0'(R9)      STORE ERROR ROUT ADR IN TOP OF TABLE
00001CI  2692                          37            AIS   R9,2              INCREMENT COUNTER
00001EI  C590 0200                     38            CLHI  R9,X'200'         IS TABLE FULL YET
000022I  4280 FFF2 =000018I            39            BL    LDAGAIN           NO,LOAD ANOTHER
                                       40  *
                                       41  *   SET UP LINE PRINTER ADR IN TABLE
                                       42  *
000026I  4870 806C =000096I            43            LH    R7,LPADR          LOAD LP ADDRESS
00002AI  1171                          44            SLLS  R7,1              MULTIPLY BY 2
00002CI  4007 00D0                     45            STH   R0,X'D0'(R7)      STORE IN TABLE
                                       46  *
                                       47  *    SET UP CHANNEL COMMAND BLOCK
                                       48  *
000030I  E670 803A =00006EI            49            LA    R7,FINISH         LOAD SUBROUTINE ADDRESS
000034I  4070 8094 =0000CCI            50            STH   R7,SUBADR         STORE IN CCB
000038I  C870 2585                     51            LHI   R7,X'2585'        STATUS MASK FAST WRITE
00003CI  4070 8078 =0000B8I            52            STH   R7,CCW            STORE IN CCB
000040I  07FF                          53            XR    R15,R15           ZERO OUT REGISTER 15
```

```
000042I  40F0 804E =000094I      54              STH   R15,INDEX          INITIALIZE INDEX
000046I  DE20 8050 =00009AI      55              OC    DEVADR,WRTCMD       SET LINE PRINTER IN WRITE MODE
00004AI  E660 804E =00009CI      56  REPEAT      LA    R6,WRTBUFS          LOAD WRITE BUFFER STARTING ADDRESS
00004EI  E670 8061 =0000B3I      57              LA    R7,WRTBUFE          LOAD WRITE BUFFER ENDING ADDRESS
000052I  5070 8066 =0000BCI      58              ST    R7,BUFEND           STORE END ADDRESS IN CCB
000056I  0B67                    59              SR    R6,R7               COMPUTE BUFFER SIZE
000058I  4060 805E =0000BAI      60              STH   R6,BUFCOUNT         STORE BUFFER SIZE IN CCB
00005CI  08AA                    61              LR    R10,R10             SET CONDITION CODE
00005EI  2132                    62              BNZS  SKIP                IF 0 SEND WDR COMMAND
000060I  9A2A                    63              WDR   DEVADR,R10          WRITE A NULL CHARACTER
000062I  F810 0000 C0F0          64  SKIP        LI    R1,Y'C0F0'          SET REG SET 15
000068I  9501                    65              EPSR  R0,R1
00006AI  4300 FFDC =00004AI      66              B     REPEAT
                                 67  *
                                 68  *     AUTO DRIVER CHANNEL EXIT
                                 69  *
00006EI  4320 801E =000090I      70  FINISH      BFC   STAT,ERROR          TEST FOR BAD STATUS
000072I  4820 8020 =000096I      71              LH    DEVADR,LPADR        LOAD DEVICE ADDRESS
                                 72  *
                                 73  *     COUNTER FOR 10 LINES OF OUTPUT
                                 74  *
000076I  48F0 801A =000094I      75              LH    R15,INDEX           INITIALIZE INDEX
00007AI  26F1                    76              AIS   R15,1               INCREMENT COUNTER
00007CI  40F0 8014 =000094I      77              STH   R15,INDEX           UPDATE INDEX
000080I  C5F0 000A               78              CLHI  R15,10              ARE 10 LINES OUTPUT YET?
000084I  4280 FFC2 =00004AI      79              BL    REPEAT              NO,OUTPUT ANOTHER
000088I  DE20 800C =000098I      80              OC    DEVADR,DISARM       PREVENT QUEUED INTERRUPTS
00008CI  4300 803E =0000CEI      81              B     WAIT1               GO TO EOJ
         0000 0090I              82  ERROR       EQU   *
000090I  4300 FF76 =00000AI      83              B     START1
000094I  0000                    84  INDEX       DC    X'0'
000096I  0062                    85  LPADR       DC    X'62'
000098I  C000                    86  DISARM      DC    X'C000'
00009AI  4000                    87  WRTCMD      DC    X'4000'
00009CI  204C 494E 4520 5052     88  WRTBUFS     DC    C' LINE PRINTER 3.3 TEST'
0000A4I  494E 5445 5220 332E
0000ACI  3320 5445 5354
0000B2I  0D01                    89              DC    X'0D01'
         0000 00B3I              90  WRTBUFE     EQU   *-1
0000B8I                          91              ALIGN 8
                                 92  *
                                 93  *     STORAGE FOR ENTIRE CHANNEL COMMAND BLOCK
                                 94  *     NOTE: FOR EASE OF READING EACH SECTION OF BLOCK
                                 95  *     DEFINED EXPLICITLY WHETHER USED OR NOT USED
                                 96  *
0000B8I  0000                    97  CCW         DC    H'0'                * CHANNEL COMMAND WORD
0000BAI  0000                    98  BUFCOUNT    DC    H'0'                * BUFFER COUNT
0000BCI  0000 0000               99  BUFEND      DC    F'0'                * END ADDRESS OF BUFFER
0000C0I  0000                   100  CHECK       DC    H'0'                * CHECK
0000C2I  0000                   101  BUF1CNT     DC    H'0'                * BUFFER ONE COUNT
0000C4I  0000 0000              102  BUF1END     DC    F'0'                * BUFFER ONE END ADDRESS
0000C8I  0000 0000              103  TABLE       DC    F'0'                * TABLE
0000CCI  0000                   104  SUBADR      DC    H'0'                * SUBROUTINE ADDRESS
0000CEI  C200 8006 =0000D8I     105  WAIT1       LPSW  WAIT
0000D8I                         106              ALIGN 8
```

```
0000D8I  0000 8000          107  WAIT    DC    Y'8000'
0000DCI  0000 00D8I         108          DC    A(WAIT)          PUT PROCESSOR IN WAIT STATE
0000E0I                     109          END
```

ASSEMBLED BY CAL 03-066R05-00 (32-BIT)

START OPTIONS: *NONE*

NO CAL ERRORS
NO CAL WARNINGS
2 PASSES

ABSTOP	0000 0000											
ADC	0000 0004											
BUF1CNT	0000 00C2I	101*										
BUF1END	0000 00C4I	102*										
BUFCOUNT	0000 00BAI	60	98*									
BUFEND	0000 00BCI	58	99*									
CCW	0000 00B8I	36	52	97*								
CHECK	0000 00C0I	100*										
DEVADR	0000 0002	16*	29	55	63	71	80					
DISARM	0000 0098I	80	86*									
ERROR	0000 0090I	35	70	82*								
FINISH	0000 006EI	49	70*									
IMPTOP	0000 00E0I											
INDEX	0000 0094I	54	75	77	84*							
LADC	0000 0002											
LDAGAIN	0000 0018I	36*	39									
LPADR	0000 0096I	29	43	71	85*							
PURETOP	0000 0000P											
R0	0000 0000	13*	26	27	30	45	65					
R1	0000 0001	14*	27	64	65							
R10	0000 000A	21*	28	28	61	61	63					
R15	0000 000F	22*	53	53	54	75	76	77	78			
R6	0000 0006	17*	56	59	60							
R7	0000 0007	18*	43	44	45	49	50	51	52	57	58	59
R8	0000 0008	19*	35	36								
R9	0000 0009	20*	34	34	36	37	38					
REPEAT	0000 004AI	56*	66	79								
SKIP	0000 0062I	62	64*									
START1	0000 000AI	29*	83									
STAT	0000 0002	15*	70									
SUBADR	0000 00CCI	50	104*									
TABLE	0000 00C8I	103*										
WAIT	0000 00D8I	105	107*	108								
WAIT1	0000 00CEI	81	105*									
WRTBUFE	0000 00B3I	57	90*									
WRTBUFS	0000 009CI	56	88*									
WRTCMD	0000 009AI	55	87*									

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