

Model LP-370

DMA Line Printer Controller

Technical Manual

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1.0 GENERAL DESCRIPTION

1.1 DATA CHANNEL LINE PRINTER CONTROLLER

The Zetaco Model 370 Data Channel Line Printer Controller provides the interface requirements to interface most popular brands of parallel interface printers to the Data General Nova, Eclipse and MV line of computers. The Controller supports line printers with low or high print speeds, dot matrix, band or impact print techniques, ASCII character set, and vertical format control (tape or direct access). The controller additionally has the capability to support horizontal format control, with this feature being self-contained and not dependent upon the printer.

Jumpers ease in configuring the controller board to match the printer interface requirements.

A selftest feature permits quick installation checkout. When activated, the controller sends the 64 character ASCII set or a designated message to test operation of the controller, cable and line printer.

A single piece cable accompanies the controller board to cable the printer to the computer backpanel when the computer chassis is non-FCC compliant.

An internal and external cable set accompanies the controller board to cable the printer to the computer backpanel when the computer chassis is FCC compliant.

The Zetaco Model 370 printer controller along with your printer provide a printing subsystem equivalent to the Data General 4215, 4216, 4327, 4328, 4356, 4363, 4364, 4374 and 6192 printer subsystems. With the Model 370, changes to existing RDOS, AOS or AOS/VS software are unnecessary.

1.2 PROGRAMMABLE INTERVAL TIMER

The Programmable Interval Timer (PIT) is a general purpose timer which may be programmed to generate an interrupt after a specific time delay. This is equivalent to Data General® 4217 Option.

2.0 SPECIFICATIONS

PHYSICAL

Dimensions:

15-inch (38.1 cm) X 15-inch (38.1 cm) Printed Circuit Board. Includes 20-foot cable from CPU backplane to printer. (Specify Centronics or Data Products type connector).

SHIPPING WEIGHT

Ten pounds (4.54 Kg) (includes board, cable and documentation).

ELECTRICAL

Power:

+5V at 2.5 Amps from backplane.

ENVIRONMENTAL

Temperature:

0° to 55° C

Relative Humidity:

10% to 90% (non-condensing)

OPERATIONAL

Device Code:

Line Printer - Switch Selectable
(Normally 17-8)

Pit - Switch Selectable
(Normally 43-8)

Pit Clock Frequencies:

1KHZ, 10KHZ, 100KHZ, 1MHZ

Bus Load:

1 unit (installs in any I/O slot)

3.0 INSTALLATION AND OPTIONS

UNPACKING AND INSTALLATION

All parts comprising the 370 DMA Line Printer Controller are shipped as follows:

- 1) 370 DMA Line Printer Controller Board
- 2) Manual
- 3) Interface Cabling between the Controller and the Line Printer. Cabling shipped is one of two possible cabling configurations.

NON-FCC (Your D.G. chassis is not FCC compliant).

Single piece cable is shipped under this configuration.

FCC (Your D.G. chassis is FCC compliant).

Two piece cable is shipped under this configuration.

3.1 INSTALLATION

This section provides detailed information for installing the Zetaco Series 370 Data Channel Line Printer Controller.

Inspect the controller board for any in-transit damage. Contact the involved carrier and Zetaco if any damage is discovered, specifying the nature and extent of the damage.

Installation of the Data Channel Line Printer Controller involves installing the controller board into the computer, interfacing the controller to the line printer with the supplied cable(s), and matching the controller with the line printer interface characteristics (logic levels). Matching of the controller to various line printer interfaces is covered in the options section 3.2.

It is suggested that the Printer Manufacturer's Manual be referenced for correct switch or jumper settings needed for installation and operation. Please read the following 370 Installation Section carefully.

Before proceeding, ensure primary power is removed from each element in the system. NOTE: Section 3.2.8 covers Direct Access Vertical Format Unit (DAVFU).

3.1.1 LOGIC CARD INSTALLATION

The Data Channel Line Printer Controller is designed to install directly into any spare slot on the bus after the CPU, Memory and I/O board.

For each controller card slot there are two horizontal parallel rows of 100 pins on the back plane. The left group of pins is the "A" connector, and the right hand group (as viewed as looking directly at the backpanel) is called the "B" connector. Numbering of each group of 100 pins is as indicated below (shown only for "A" connector).

BACKPANEL NUMBERING

A2	A1	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30	A31	A32	A33	A34	A35	A36	A37	A38	A39	A40	A41	A42	A43	A44	A45	A46	A47	A48	A49	A50	A51	A52	A53	A54	A55	A56	A57	A58	A59	A60	A61	A62	A63	A64	A65	A66	A67	A68	A69	A70	A71	A72	A73	A74	A75	A76	A77	A78	A79	A80	A81	A82	A83	A84	A85	A86	A87	A88	A89	A90	A91	A92	A93	A94	A95	A96	A97	A98	A99	A100
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Pin 1 is on the top left of the connector; Pin 2 is on the bottom left directly below Pin 1. Pin 99 is the top right pin of the connector, and Pin 100 is the bottom right pin of the connector.

If with the selection of the I/O slot a vacant slot or slots exist between the line printer controller and the board below it, the DCHP (Data Channel Priority) and INTP (Interrupt Priority) signals must be physically jumpered on the computer backpanel to maintain priority interrupt continuity. Install one end of a wirewrap jumper to the DCHP-OUT signal at pin 93 of the "A" connector occupied by the device below the line printer controller. Connect the remaining end to the DCHP-IN signal at pin 94 of the "A" connector occupied by the line printer controller, bridging the vacant slot or slots. Similarly, connect the INTP-OUT signal (pin A95) from the lower device to the INTP-IN signal at pin A96 of the printer controller. This will complete the priority interrupt continuity to the card. If vacant slots exist between the line printer controller and the device above the line printer controller, perform similar strapping of the DCHP and INTP signals to maintain interrupt priority. Reference Figure 3.0 and the computer reference manual for additional information.

If you have reviewed Options Section 3.2 and have made the necessary switch and jumper settings on the controller, the line printer controller should now be inserted, component side up, into the selected I/O slot and locked into position with the release levers.

3.1.2 CABLING INSTALLATION - NON-FCC CABLING

The Data Channel Line Printer Controller and the line printer are interconnected with the supplied interface cable. At the computer end of the cable is a connector which installs over the appropriate pins on the computer backpanel (see Figure 3.1).

Install the connector on the computer's "B" connector (see Figure 3.2) corresponding to the card slot containing the line printer controller.

NOTE: The mounting of the connector should be double checked since circuitry in both the computer and printer may be damaged/destroyed if the cable is improperly installed.

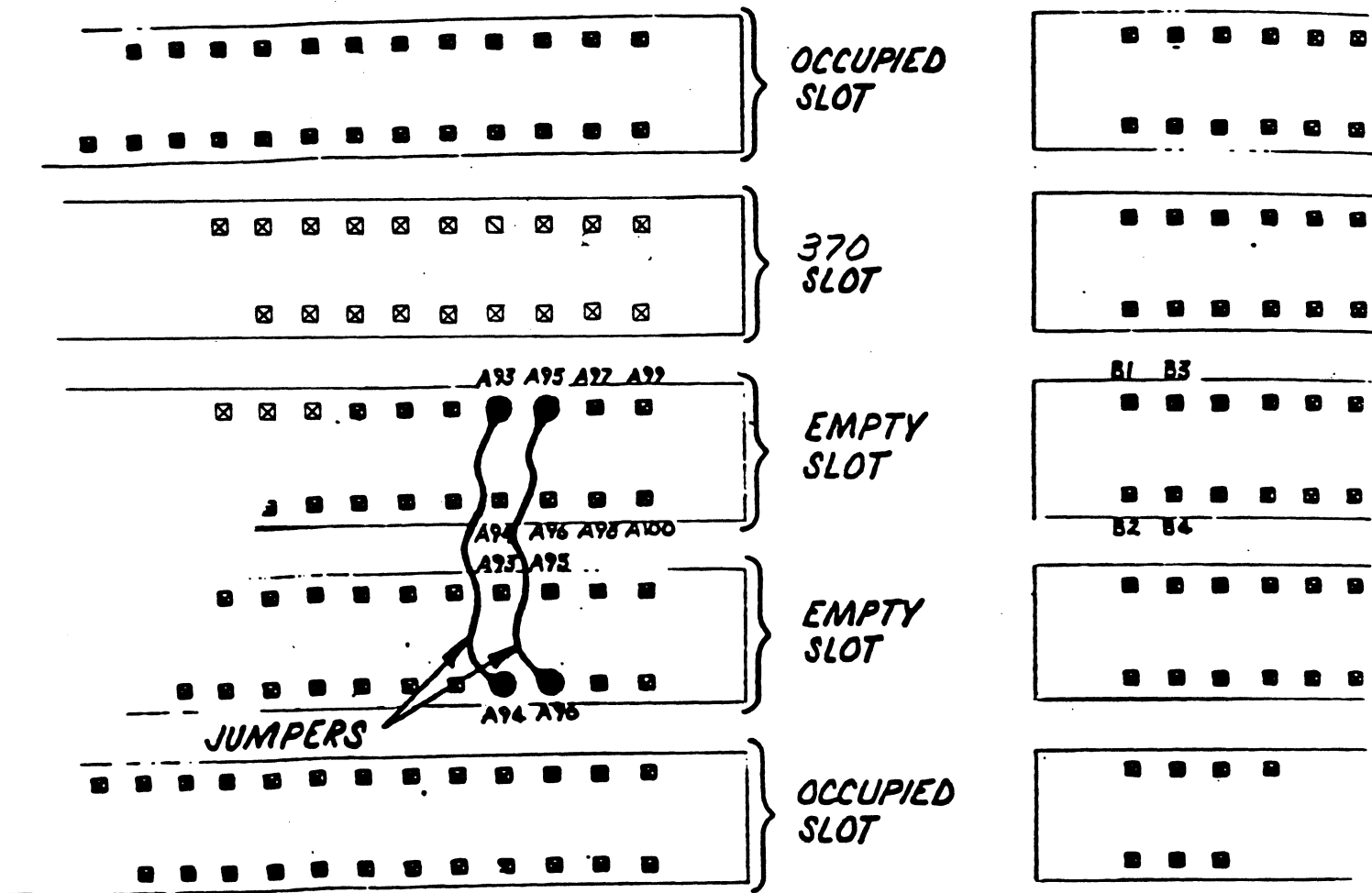
Single piece cable assemblies should be strain relieved at the rear of the computer.

The remaining end of the cable connects directly to the interface connector on the line printer.

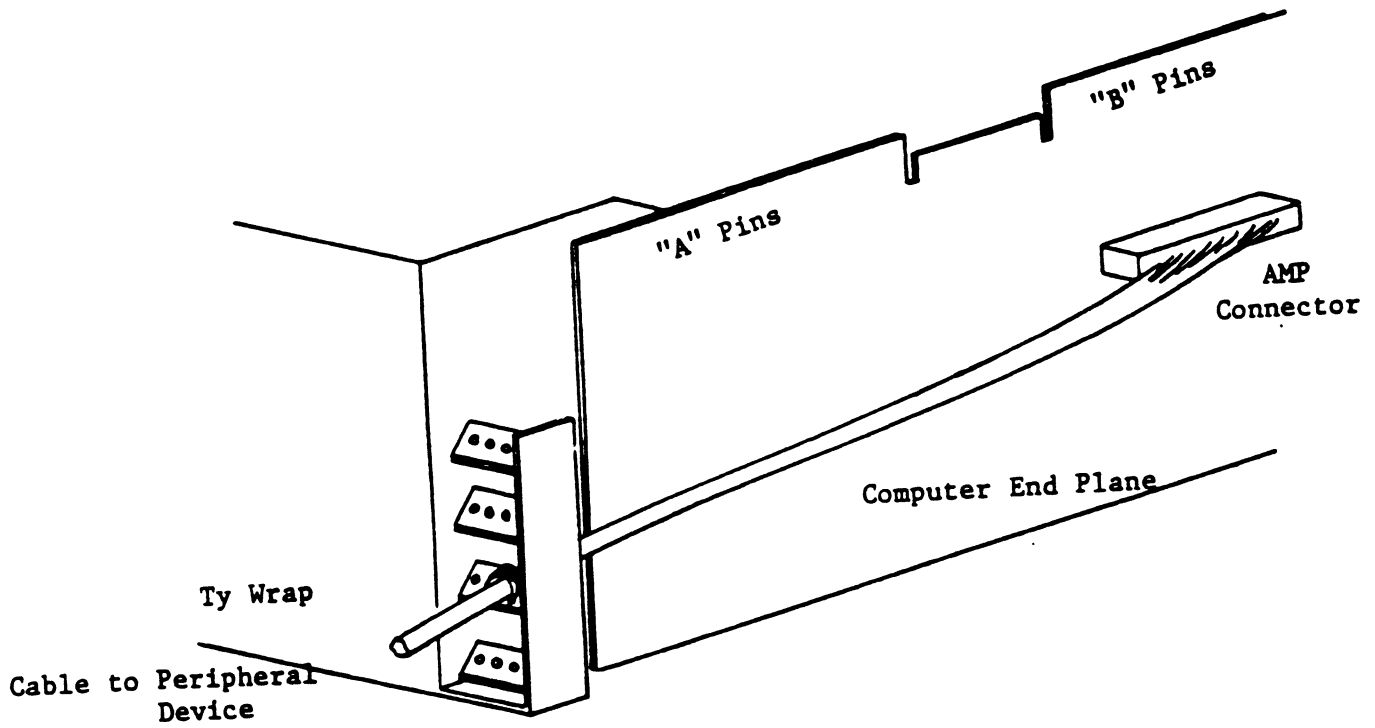
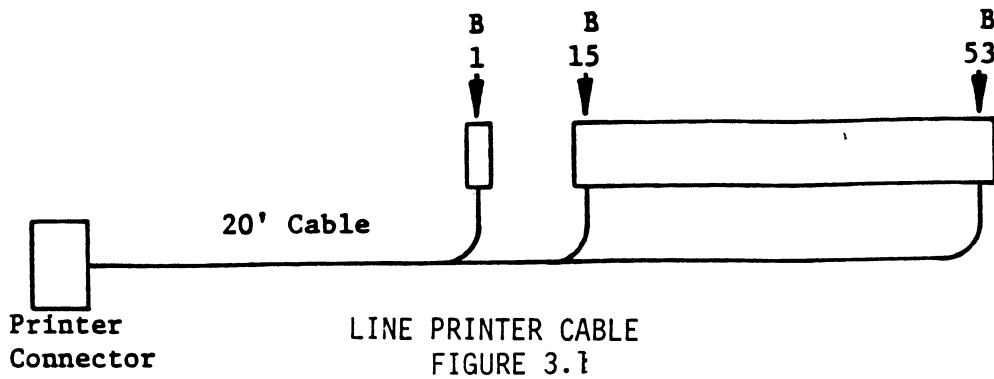
A SIDE

B SIDE

COMPUTER CHASSIS



BACKPANEL PRIORITY JUMPERS
FIGURE 3.0

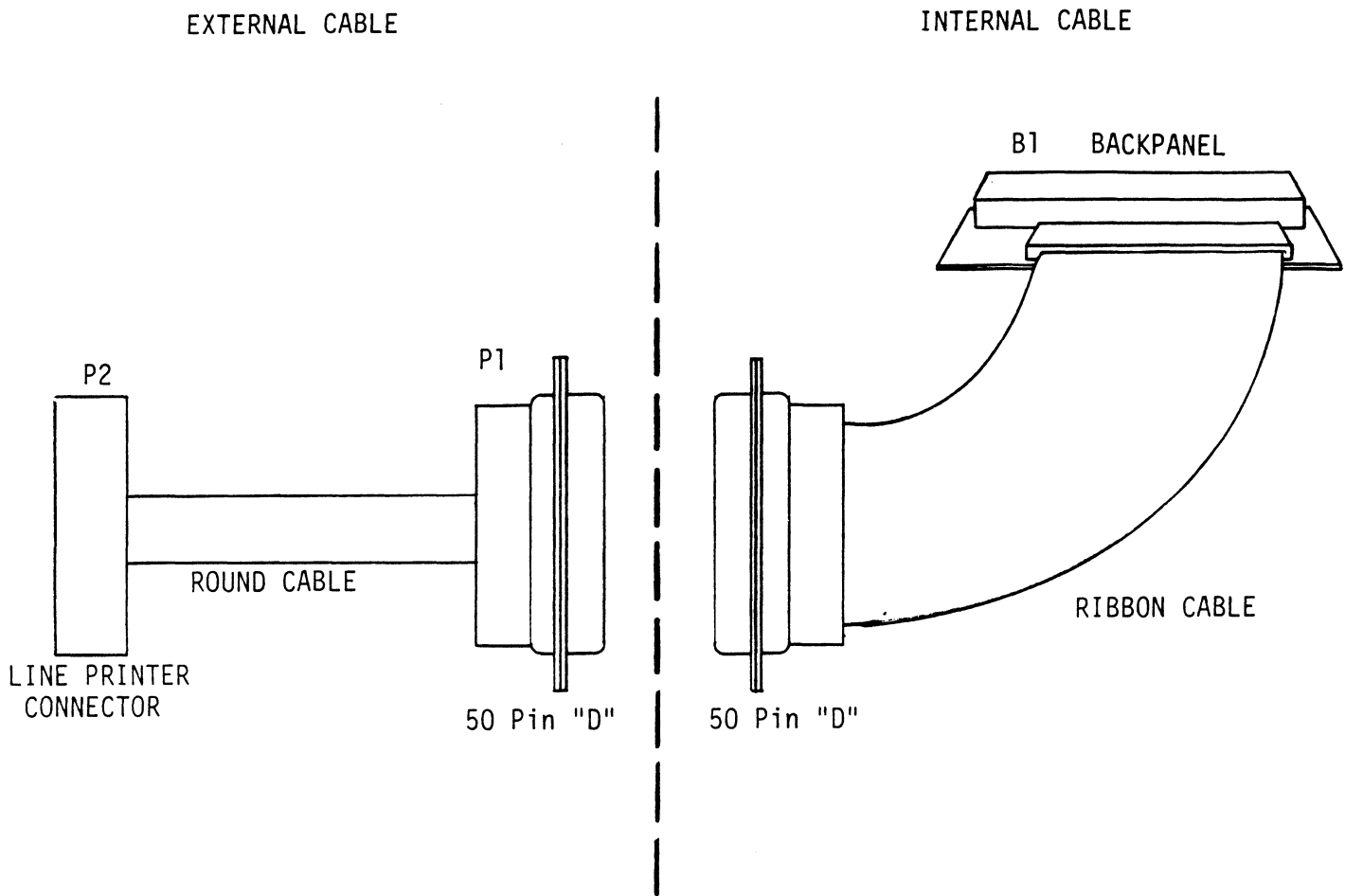


NON-FCC CABLING
FIGURE 3.2

3.1.3 CABLING INSTALLATION - FCC CABLING

The Data Channel Line Printer controller and the line printer are interconnected with the internal and external cable set (see Figure 3.3).

Computer Bulkhead
Panel of "D" Cut Outs



FCC CABLING
FIGURE 3.3

INTERNAL CABLE

At the computer end of the internal cable is a connector which installs over the appropriate pins on the computer backpanel. Install the 72 pin connector on the computer's "B" connector corresponding to the card slot containing the line printer controller. NOTE: Pin 1 of backpanel corresponds to pin marked 1 of the internal paddle board connection. See Figure 3.3.

NOTE: The mounting of the connector, on the computer's "B" connector, should be double checked since circuitry in the computer, the controller, or the printer may be damaged if the cable is improperly installed.

Attach the 50 Pin "D" connector to the "D" connector bulkhead panel on your Data General mini-computer.

EXTERNAL CABLE

Attach the 50 Pin "D" connector to the 50 Pin "D" internal connector you have just connected to the bulkhead panel.

Attach the remaining end of the external cable to the line printer.

P1 marked on the connector is for CPU Bulkhead. P2 is for the printer.

3.2 LINE PRINTER OPTIONS

Reference Line Printer Switch/Jumper Selection chart at the end of this section. Jumpers have been set at the factory upon the initial order. Double check the switch/jumpers (etched PC line) to insure correct configuration.

3.2.1 DEVICE CODE (Logic Sheet 2)

The Line Printer Device Code is normally 17-8 (8 represents octal). Device code switch is located at D12. (See Table 3.1). Example of Device Code 17:

S1	S2	S3	S4	S5	S6
On	On	Off	Off	Off	Off

SWITCH LOCATION D12

DEVICE CODE	S1	S2	S3	S4	S5	S6
0X	ON	ON	ON	--	--	--
1X	ON	ON	OFF	--	--	--
2X	ON	OFF	ON	--	--	--
3X	ON	OFF	OFF	--	--	--
4X	OFF	ON	ON	--	--	--
5X	OFF	ON	OFF	--	--	--
6X	OFF	OFF	ON	--	--	--
7X	OFF	OFF	OFF	--	--	--
<hr/>						
X0	--	--	--	ON	ON	ON
X1	--	--	--	ON	ON	OFF
X2	--	--	--	ON	OFF	ON
X3	--	--	--	ON	OFF	OFF
X4	--	--	--	OFF	ON	ON
X5	--	--	--	OFF	ON	OFF
X6	--	--	--	OFF	OFF	ON
X7	--	--	--	OFF	OFF	OFF

-- = DON'T CARE

DEVICE CODE SELECTION
TABLE 3.1

3.2.2 LINE PRINTER DATA POLARITY (Logic Sheet 8)

J801 Installed = (+3V) True Data Output
(Centronics & Data Products)

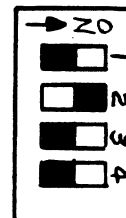
J801 Removed = (0V) True Data Output

3.2.3 LINE PRINTER CLOCK CONTROL (Logic Sheet 11)

This switch is for selecting pulse width of the Line Printer Data Strobe. Normally .8 usec (S2 is on).

S1 = .4 usec
 S2 = .8 (Centronics & Data Products)
 S3 = 1.6
 S4 = 3.2 (G.E. Terminet)

Switch is located at Location AA1.



3.2.4 VERTICAL FORMAT COMMAND DECODE (Logic Sheet 15)

J1200 Installed = VFU Command 13-8

J1201 Installed = VFU Command 22-8

3.2.5 LINE PRINTER READY STATUS (Logic Sheet 12)

J1203 installed if Ready or Selected status from printer is (+3V) true signal.

3.2.6 LINE PRINTER ON LINE STATUS (Logic Sheet 12)

J1204 installed if On-Line status from printer is (+3V) true signal.

3.2.7 LINE PRINTER DATA STROBE POLARITY (Logic Sheet 13)

J1302 Installed = (0V) True Data Strobe
(Centronics)

J1303 Installed = (+3V) True Data Strobe
(Data Products)

3.2.8 CONTROL CHARACTER MASK (Logic Sheet 13)

J1304 installed prohibits sending paper feed/line (12-8) command to the line printer. J1305 installed prohibits sending carriage return (15-8) command to the line printer. J1307 or J1308 installed prohibits sending VFU Data to printer.

NOTE: J1307 or J1308 must be installed if your printer is not a Data Products printer or if your printer is a Data Products printer without the Direct Access Vertical Format Unit (DAVFU).

3.2.9 LINE PRINTER ACKNOWLEDGE/DEMAND POLARITY (Logic Sheet 13)

J1306 Installed = (+3V) Acknowledge/Demand

J1306 Not Installed = (0V) Acknowledge/Demand
(Centronics & Data Products)

3.2.10 VFU BYTE NEXT CONVERSION (Logic Sheet 8)

J802 Installed = Converts VFU Byte Command into a Form Feed Command.

This jumper must be installed in all Non-Data Products printers or Data Products printers without Direct Access VFU feature (DAVFU).

J803 Installed = Does not convert VFU Byte Command

This jumper must be installed only if the printer is a Data Products printer with a Direct Access Vertical Format Unit (DAVFU).

Jumper 802 and 803 are in pairs and only one to be installed at a time.

The following table can be used as a guideline for option jumpering for the following printers. Reference jumper selection sheet in Schematics Section of manual for jumper locations.

DATA PRODUCTS INTERFACED MODELS

J801 Installed (+3V) True Data Output
J802 Installed if Printer does not have DAVFU feature.
J803 Installed if Printer has DAVFU feature.
Jumper 802 and 803 are in pairs and only one to be installed at a time.
J1203 Installed (+3V) True Ready
J1204 Installed (+3V) True On Line
J1303 Installed (+3V) True Data Strobe

Set Data Strobe Pulse width to .8 usec(see Section 3.2.3).

CENTRONICS INTERFACED MODELS

J801 Installed (+3V) True Data Output
J802 Installed Converts VFU Byte to Form Feed.
J803 Not Installed. Does not convert VFU Byte to Form Feed.
Jumper 802 and 803 are in pairs and only one to be installed at a time.
J1203 Installed (+3V) True Printer Selected
J1204 Installed (+3V) True on Line
J1302 Installed (0V) True Data Strobe

J1304 May have to be installed if double-spacing occurs between print lines.

Set Data Strobe Pulse width to .8 usec(see Section 3.2.3).

CONTROL DATA & PRINTRONIX

Same as Data Products without DAVFU feature.

GENERAL ELECTRIC TERMINET 310/340 SERIES WITH UNBUFFERED PARALLEL (C/INT) INTERFACE

Ensure the following jumper options are installed within the printer.

J1 Out,	J2 In	(0V) True Data Strobe
J3 Out,	J4 In	Data Sampled at leading edge of data strobe
J6 In,	J7 Out	Delete does not inhibit data strobe
J12 In,	J13, Out	CR causes print action to be followed by LF
J14 In		Printer's Logic is reset when selected
J15 Out		Underline not decoded as CR
J18 Out		Delete code does not reset Printer's Logic
J19 In,	J20, In	Busy is Low Level when Printer cannot receive data
J21 In,	J22, Out	Enable VT and FF
J27 Out,	J28, In	ACKNLG delay begins at trailing edge of data strobe
J29 Out		
J30 In		Character following ESC is
J31 Out		decoded and printed normally
J32 In		

Printer Controller options

J801	Installed	(+3V) True Data Output
J802	Installed	Converts VFU Byte to Form Feed.
J803	Not Installed.	Does not Convert VFU Byte to Form Feed.
J1203	Installed	(+3V) True Printer Selected
J1204	Installed	(0V) True Printer Fault
J1302	Installed	(0V) True Data Strobe
J1304	Installed	Mask LF (12-8) Command

Set Data Strobe Pulse width to 3.2 usec (see Section 3.2.3).

3.3 PIT OPTIONS

3.3.1 FREQUENCY SELECT (Logic Sheet 16)

Switch Position C12

SW1 = 1 microsecond
SW2 = 10 microsecond
SW3 = 100 microsecond
SW4 = 1 microsecond

Switch does not apply if the PIT option was not purchased.

3.3.2 TIME DELAY SELECT (Logic Sheet 17)

J1700 Installed =

PIT Time delay may be specified only once. Time delay interrupt will continuously occur as specified (RTC Operation).

J1701 Installed= (Normal Operation)

PIT Time Delay must be specified each time. An interrupt time delay is required.

3.3.3 DEVICE CODE (Logic Sheet 16)

The PIT Device Code is normally 43-8, but can be set to any device code.

Switch does not apply if the PIT option was not purchased.

SWITCH LOCATION B12

DEVICE CODE	S1	S2	S3	S4	S5	S6
0X	ON	ON	ON	--	--	--
1X	ON	ON	OFF	--	--	--
2X	ON	OFF	ON	--	--	--
3X	ON	OFF	OFF	--	--	--
4X	OFF	ON	ON	--	--	--
5X	OFF	ON	OFF	--	--	--
6X	OFF	OFF	ON	--	--	--
7X	OFF	OFF	OFF	--	--	--
X0	--	--	--	ON	ON	ON
X1	--	--	--	ON	ON	OFF
X2	--	--	--	ON	OFF	ON
X3	--	--	--	ON	OFF	OFF
X4	--	--	--	OFF	ON	ON
X5	--	--	--	OFF	ON	OFF
X6	--	--	--	OFF	OFF	ON
X7	--	--	--	OFF	OFF	OFF

-- = DON'T CARE

DEVICE CODE SELECTION
TABLE 3.2

3.4 INTERFACE

3.4.1 COMPUTER INTERFACE

<u>SIGNAL</u>	<u>BACKPANEL PIN</u>
<u>CLR</u>	A50
<u>DATA 0</u>	B62
<u>DATA 1</u>	B65
<u>DATA 2</u>	B82
<u>DATA 3</u>	B73
<u>DATA 4</u>	B61
<u>DATA 5</u>	B57
<u>DATA 6</u>	B95
<u>DATA 7</u>	B55
<u>DATA 8</u>	B60
<u>DATA 9</u>	B63
<u>DATA 10</u>	B75
<u>DATA 11</u>	B58
<u>DATA 12</u>	B59
<u>DATA 13</u>	B64
<u>DATA 14</u>	B56
<u>DATA 15</u>	B66
<u>DATIA</u>	A44
<u>DATIB</u>	A42
<u>DATIC</u>	A54
<u>DATOB</u>	A56
<u>DATOC</u>	A48
<u>DCHA</u>	A60
<u>DCHO</u>	B33
* <u>DCHP IN</u>	A94
* <u>DCHP OUT</u>	A93
<u>DCHR</u>	B35
<u>DS0</u>	A72
<u>DS1</u>	A68
<u>DS2</u>	A66
<u>DS3</u>	A46
<u>DS4</u>	A62
<u>DS5</u>	A64
<u>INTA</u>	A40
* <u>INTP IN</u>	A96
* <u>INTP OUT</u>	A95
<u>INTR</u>	B29
<u>IORST</u>	A70
<u>MSKO</u>	A38
<u>RQENB</u>	B41
<u>SELB</u>	A82
<u>SELD</u>	A80
<u>STRT</u>	A52

*For the two pairs of priority-determining signals, the IN signal comes from the processor or the preceding device; the OUT signal goes to the next device. If the computer is operated with an interface board removed (or a slot is not used), jumper Pin A93 to A94 and A95 to A96 to maintain bus continuity.

3.4.2 LINE PRINTER INTERFACE

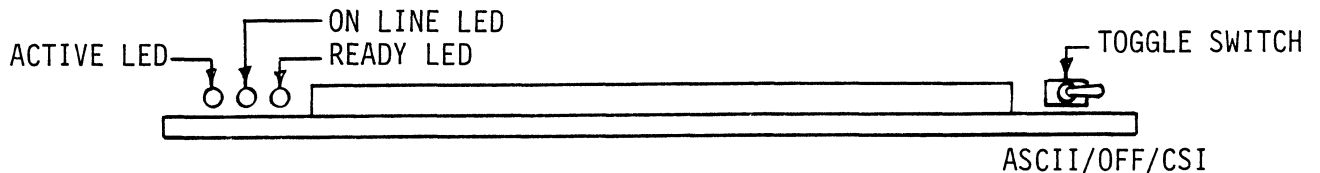
<u>SIGNAL</u>	<u>BACKPANEL PIN</u>
DATA 8	B36
DATA 7	B49
DATA 6	B31
DATA 5	B27
DATA 4	B25
DATA 3	B23
DATA 2	B19
DATA 1	B15
DATA STROBE	B53
DEMAND/ACKNOWLEDGE	B38
READY/SELECTED	B54
ON LINE/PAPER EMPTY/FAULT	B40

3.5 INITIAL POWER UP

Sections 3.1 and 3.2 outlined the controller board, cable installation and explained the switch and jumper options on the controller board. Review these sections again.

Restore primary power to each element in the system.

If the cabling to the printer is correct and the line printer's ready and on line status jumpers match the printer's polarity for these signals, the on line and ready LED's, on the controller board, will be illuminated when the printer is on line and not illuminated when the printer is off line.



SELFTTEST

The selftest feature is activated by the 3 position toggle switch. The middle switch position disables the selftest. The left switch position activates printing the 64 character ASCII set. The right switch position activates a preprogrammed message. Activate the selftest feature and visually inspect the print out for correctness and clarity.

If the selftest feature functions properly, correct printout, then proceed to test the printer subsystem under the operating system. If the printout does not appear proper, remove power from the subsystem and recheck the controller and printer switch and jumper options.

3.6 SYSTEM PRINTING PROBLEMS HELPS

3.6.1 LINE OF PRINT AT THE TOP OF EACH PAGE

This may occur under the AOS or AOS/VS operating systems if Jumper J1307 is not installed. If this is your symptom, install Jumper J1307.

3.6.2 AN "A" IS DISPLAYED AT THE BOTTOM OF A PAGE AND TOP OF FORM DOES NOT FUNCTION PROPERLY

This may occur under the AOS or AOS/VS operating systems if your printer is not a Data Products printer or a Data Products printer without the DAVFU feature. If your printer is a non-Data Products printer or a Data Products printer without the DAVFU feature, install Jumper J802.

4.0 DIAGNOSTICS

Diagnostics are not supplied by Zetaco for the Model 370 DMA LPT Controller. We suggest you use Data General's DCHPT-TST Diagnostic Test as the diagnostic test program.

5.0 TROUBLESHOOTING

The following short diagnostic routines, entered through the data switches of the computer console will establish within minutes whether the controller, cable and printer have been properly connected and are functioning properly.

Test A: Program to repeatedly print characters using Busy/Done logic. The octal program is entered through the console data switches starting at location 100.

<u>MEMORY LOCATION</u>	<u>OCTAL PROGRAM</u>	<u>SYMBOLIC CODE</u>
100	062677	IORST
101	062017	DOB,0 LPT
102	067017	DOC,1 LPT
103	060117	NIOS, LPT
104	063517	SKPBZ
105	777	JUMP .-1
106	101	JUMP .-5

Set accumulator 0 = 000002 Starting memory address
Set accumulator 1 = 177774 Number of BYTES

1	040502	A,B
2	006412	CR,LF 1/2

This program prints the letters A and B, then does a carriage return and a line feed.

To run under Done logic, change the instruction in location 104 to 063617.

If the program does not cause printing, hit the console stop switch. Then step the instruction step switch several times and observe the program addresses being executed. If the program just cycles in the two instruction Busy loops (Locations 104 and 105), then a problem exists with one of the following:

1. The printer is not working. Test by itself with selftest feature or external test device.
2. The cable has been improperly installed. Carefully check installation.

3. A problem exists within the controller. Check that the controller is in the correct slot and that the option jumpers on the controller board are applicable to your printer.

Prior to calling Zetaco, run tests A and B and note results of these tests plus all symptoms.

Test B: Program to read printer status bits.

Location	110	062677
	111	064417
	112	063077
	113	000110

Enter octal program into memory through console data switches. Start at location 110. The program reads a printer status word and then halts. If the printer is powered, selected, and no error conditions exist bits 14 and 15 of ACI should be both bits on.

CUSTOMER SERVICE

Our warranty attests the quality of materials and workmanship in our products. If malfunction does occur, our service personnel will assist in any way possible. If the difficulty cannot be eliminated by use of the following service instructions and technical advise is required, please phone Zetaco giving the serial number, board name, model number, and problem description. You will be placed in contact with the appropriate technical assistance.

PRODUCT RETURN

Pre-return Checkout.

If controller malfunction is suspected, the use of test software is needed to determine if the controller is the problem and what in particular is wrong with the controller. The tests applicable to this board are listed on the next page of the manual. Please run the test sequence BEFORE considering product return.

Returned Material Authorization.

Before returning a product to Zetaco for repair, please ask for a "Returned Material Authorization" number. Each product returned requires a separate RMA number. Use of this number in correspondence and on a tag attached to the product will ensure proper handling and avoid unnecessary delays.

Returned Material Information.

Information concerning the problem description, system configuration, diagnostic program name, revision level, and results, i.e., error program counter number should be included with the returning material. A form is provided for this information on the next page of the manual.

Packaging.

To safeguard your materials during shipment, please use packaging that is adequate to protect them from damage. Mark the box "Delicate Instrument" and indicate the RMA number(s) on the shipping label.

(Include with returning material)

MATERIAL RETURN INFORMATION

All possible efforts to test a suspected malfunctioning controller should be made before returning the controller to Zetaco for repair. This will: 1) Determine if in fact the board is defective (many boards returned for repair are not defective, causing the user unnecessary system down-time, paper work, and handling while proper testing would indicate the board is working properly). 2) Increase the speed and accuracy of a product's repair which is often dependent upon a complete understanding of the user checkout test results, problem characteristics, and the user system configuration. Checkout results for the DMA Line Printer Controller should be obtained by performing the following tests. (Include error program counter #'s and accumulator contents if applicable).

<u>FUNCTION</u>	<u>TEST</u>	<u>RESULTS</u>
PIT	D.G. Pit Diag.	
DMA LPT	1. Self-Test 2. D.G. DCHPT TST 3. Operate under RDOS	

Other tests performed:

Please allow our service department to do the best job possible by answering the following questions thoroughly and returning this sheet with the malfunctioning board.

1. Does the problem appear to be intermittent or heat sensitive? (If yes, explain).

2. What operating system are you running under? (AOS RDOS, DDOS, DTOS, AOS/VS).

3. Describe the system configuration (i.e., peripherals, I/O controllers, model of computer, etc.).

4. Has the controller been returned before? _____
Same problem? _____

TO BE FILLED OUT BY CUSTOMER:

Model #: _____

Serial #: _____

RMA #: _____

Returned by: _____ (Company Name)

6.0 PROGRAMMING NOTES

6.1 DATA CHANNEL LINE PRINTER

The Data Channel Line Printer normally has device code 17-8, mnemonic DCLP, and uses five of the I/O transfer instructions. Busy and Done are sensed by Bits 8 & 9 in the I/O skip instructions. The Clear and Start functions control these flags in the usual manner, and the I/O pulse function is not used. Interrupt disable is controlled by interrupt priority mask Bit 7.

The Clear function clears Busy, Done and the other flags in the controller and terminates operations if the controller is currently processing data.

The Start function sets Busy and Data Channel Sync logic and clears Done.

The five instructions program data channel transfers to and from the subsystem. Two of these instructions supply the controller with all necessary information for any print operation. The other instructions allow the program to determine, in detail, the current state of the subsystem.

The device flag commands control the line printer controller's Busy and Done flags as follows:

F=S Starts the printer by setting the Busy flag and clearing the Done flag.

F=C Clears the printer by clearing both the Busy and Done flags.

F=P Not Used.

The I/O Mnemonics code and description for each data channel line printer controller instruction are listed on the following page.

LOAD MEMORY ADDRESS REGISTER - DOB - DCLP

0	1	1	AC	AC	1	0	0	F	F	0	0	1	1	1	1
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Load Bits 0-15 of the specified AC into the controller's Current Address Register. The controller's Busy and Done flags are set according to the function specified by F. The contents of the specified AC remain unchanged. The format of the specified AC is as follows:

STARTING MEMORY ADDRESS														Byte Pointer	
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

<u>BITS</u>	<u>NAME</u>	<u>CONTENTS</u>
0-14	Memory Address	Location of the next word in memory to be used for data channel transfer.
15	Byte Pointer	Indicator for the first byte to be transferred. When zero, data transfer begins with high order byte. When one, data transfer begins with low order byte.

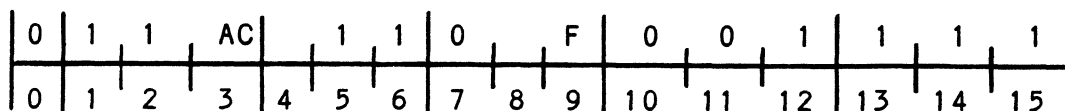
READ MEMORY ADDRESS REGISTER - DIB - DCLP

0	1	1	AC	AC	0	1	1	F	F	0	0	1	1	1	1
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

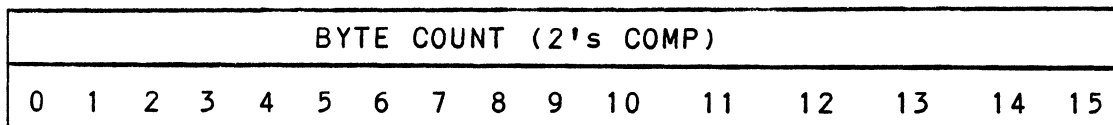
Places the contents of the controller's Current Address register in Bits 1-15 and the byte pointer in Bit 0 of the specified AC. After the data transfer, set the controller's Busy and Done flags according to the function specified by F. The format of the specified AC is as follows:

Byte Pointer	CURRENT MEMORY ADDRESS															
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
<u>BITS</u>	<u>NAME</u>			<u>CONTENTS</u>												
0	Byte Pointer			Indicator for byte to be printed next. When zero, high order byte; when one, low order byte.												
1-15	Memory Address			Location of the next word in memory to be used for a data channel transfer.												

LOAD BYTE COUNT REGISTER - DOC - DCLP

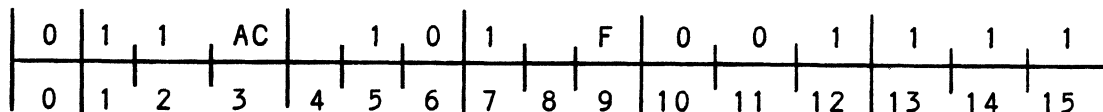


Load Bits 0-15 of the specified AC into the controller's Byte Count Register. The controller's Busy and Done flags are set according to the function specified by F. The contents of the specified AC remain unchanged. The format of the specified AC is as follows:



<u>BITS</u>	<u>NAME</u>			<u>CONTENTS</u>												
0-15	Byte Count			Two's complement of the number of bytes to be transferred.												

READ BYTE COUNT REGISTER - DIC - DCLP



Loads the contents of the controller's Byte Count Register in Bits 0-15 of the specified AC. After the data transfer, set the controller's Busy and Done flags according to the function specified by F. The format of the specified AC is as follows:

BYTE COUNT (2's COMP)															
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

<u>BITS</u>	<u>NAME</u>	<u>CONTENTS</u>
0-15	Byte Count	Two's complement of the number of bytes to be transferred.

READ STATUS - DIA - DCLP

0	1	1	AC	0	0	1	F	0	0	1	1	1	1		
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Places the contents of the controller's status lines in Bits 12-15 of the specified AC. After the data transfer, sets the controller's Busy and Done flags according to the function specified by F. The format of the specified accumulator is as follows:

												TAB STATUS RUNAWAY CHANGE		RDY	ON LINE
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

<u>BITS</u>	<u>NAME</u>	<u>CONTENTS</u>
0-11	-----	Reserved for future use.
12	Tab Runaway	A tab operation has been specified but no tab stops were set.
13	Status Change	One of the printer status lines has changed state.
14	Ready	The printer is not performing a print operation and is ready to receive a command.
15	On Line	The line printer is on line to processor.

MEMORY BYTE FORMATS

Data from memory must be arranged in the following formats:

Data Characters

X	CHARACTER N							X	CHARACTER N+1						
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

VFU Load Characters

		CH	CH	CH	CH	CH	CH			CH	CH	CH	CH	CH	CH
		6	5	4	3	2	1			12	11	10	9	8	7
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Tab Load Characters

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
							Set/ Clear Tab Loc N								Set/ Clear Tab Loc N

NOTES:

After DMA VFU START character, all VFU LOAD characters must be formatted as follows:

BYTE	X	1	CH 6	CH 5	CH 4	CH 3	CH 2	CH 1
BYTE N+1	X	1	CH 12	CH 11	CH 10	CH 9	CH 8	CH 7

After VTU BYTE NEXT character, the VFU command character must be formatted as follows:

X	1	0	1/0	SLEW CODE 8	SLEW CODE 4	SLEW CODE 2	SLEW CODE 1
---	---	---	-----	-------------------	-------------------	-------------------	-------------------

After TAB LOAD START character, TAB STOP Act/Clear characters must be formatted as follows:

X	0	0	0	0	0	0	1/0
---	---	---	---	---	---	---	-----

6.2 PROGRAMMABLE INTERVAL TIMER

Two instructions in the standard I/O format program the PIT. One of these instructions supplies the controller with the information necessary to begin the counting operation. The second instruction allows the program to determine the current count contained in the Time Count Register.

The device flag commands control the timer's Busy and Done flags as follows:

F=S Initiates the counting sequence by setting the Busy flag to one and the Done flag to zero.

F=C Clears the PIT by setting the Done flag to one and the Busy flag to zero. Also resets the Time Count Register.

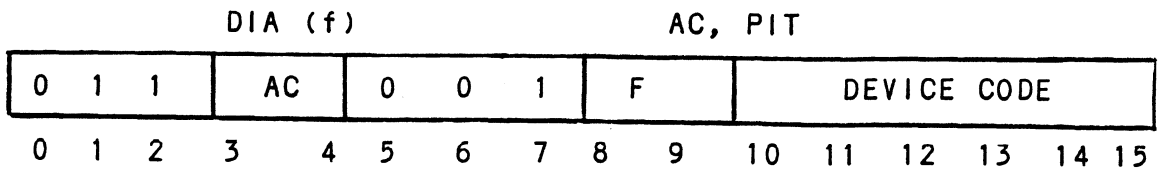
F=P Used to set the diagnostic mode and then pulse the commercial I/O subassembly timing generation circuit.

6.2.1 LOAD TIME COUNT REGISTER

DOA (f)				AC, PIT											
0	1	1	AC	0	1	0	F	DEVICE CODE							
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

This instruction loads Bits 0-15 of the specified AC into the PIT time count register. After the data transfer, the PIT's Busy and Done flags are set according to the function specified by F. The specified accumulator must be preloaded with the two's complement of the Starting Time Count.

6.2.2 READ TIME COUNT REGISTER



This instruction places the contents of the PIT Time Count Register into Bits 0-15 of the specified AC. After the data transfer, the PIT's Busy and Done flags are set according to the function specified by F.

The data placed into the specified AC is the two's complement of the current time count.

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