Model 265

Slot Saver V Controller

Technical Manual

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REVISION HISTORY

ECO No.	Date	Description	Pages
0523	3/4/86	New Cover	

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PREFACE

This technical manual contains the information required to install, operate and maintain the ZETACO Model 265 Slot Saver V controller. The Controller is compatible with Data General (DG) Nova and Eclipse minicomputers.

This manual is organized in six sections.

SECTION 1	PRODUCT DESCRIPTION - Functional characteristics of the Controller.
SECTION 2	SPECIFICATIONS
SECTION 3	INSTALLATION - Unpacking, inspection, board installation.
SECTION 4	TROUBLESHOOTING - Quick maintenance, troubleshooting helps, and Returned Material Authorization (RMA) information.
SECTION 5	PROGRAMMING
SECTION 6	APPENDIX - Interface signals, pin assignments, distribution panel cabling and logic drawing.

1.0 PRODUCT DESCRIPTION

Physically, the Controller comprises logic contained on a 15" x 15" printed circuit board suitable for installation in slot one of the ZETACO Expansion Chassis. Electrically, the Controller contains the following interfaces:

A. Two Serial I/O Ports.
(Programmed I/O Program Format)

B. One Parallel Line Printer Interface.
(DMA I/O Program Format)

C. ECT/TTL Translators.
This logic provides an interface to the Cray Computer and contains the drivers and receivers associated with the main backplane bus in the ZETACO Chassis.

Connection between the controllers on the board and external equipment is via: 1) 3 cable harnesses for connection to the Cray computer 2) a 20-foot cable for the line printer, and 3) RS232 cables to the terminals.

The 3 cable harnesses for connection to the Cray computer are two 50-pin and one 40-pin flat cables at the Controller end, which terminate in 55-pin round connectors that connect to the Cray interface. This cable is supplied by ZETACO.

The 20-foot line printer cable terminates at the backplane chassis, in an amphenol block on one end and the respective cable connector at the printer end. This cable is supplied by ZETACO.

The RS232 cables are not supplied by ZETACO.

2.0 SPECIFICATIONS

PHYSICAL

Dimensions:

15" (38.1 cm) x 15" (38.1 cm) printed circuit board that plugs into slot one of the ZETACO Expansion Chassis. Includes 20-foot cable from Chassis backplane to printer.

MAXIMUM INTERFACE CONFIGURATION ON ONE BOARD

A. 2 serial I/O channels
B. 1 parallel line printer interface
C. ECL/TTL translators

SHIPPING WEIGHT

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

ELECTRICAL

Power:
- +5V at 6.0 Amps
- -5V at 1.8 Amps
- All from computer power supply

ENVIRONMENTAL

Temperature:
- 0° to 55° C

Relative Humidity:
- 10% to 90% (non-condensing)

OPERATIONAL

Device Code:
- Line Printer
  - Switch selectable (normally 17-8)
- Serial Port 1
  - Switch selectable (normally 10/11-8)
- Serial Port 2
  - Switch selectable (normally 50/51-8)

Bus Load:
- 1 unit (mounts in any I/O slot)

3.0 INSTALLATION

This section contains installation instructions for the Controller. Details of the installation or operation of an associated line printer or terminal will be found in an instruction manual for the respective device.

3.1 UNPACKING AND INSPECTION

All parts comprising the Model 265 are shipped in one package consisting of:

a) Controller
b) Line Printer Cable
c) Cray Interface Cabling
d) Technical Manual

On receipt of the Model 265 from the carrier, inspect the shipping carton immediately for any evidence of damage or mishandling in transit.

If the shipping carton is water stained or damaged, contact the carrier and shipper immediately, specifying the nature and extent of the damage and request that the carrier agent be present when the carton is opened.

ZETACO'S warranty does not cover shipping damage.

For repair or replacement of any ZETACO product damaged in shipment, call ZETACO to obtain RMA instructions.

3.2 BOARD INSTALLATION

To install the Controller, perform the following steps in the order listed. Please review this 5 point summary entirely before beginning installation.

1. Remove the Controller printed circuit board, cable assemblies and manual/s from the packing carton.

2. Verify that the chassis power is off. Do not insert or remove the board with power on.

3. Reference Section 3.3 (Switch Settings and Jumper Options) to ensure the switch and jumper options selected match your requirements.

4. Carefully insert the board into Slot one of the ZETACO Expansion Chassis with the locking tabs extended. If the Controller is properly seated in the track, very little pressure is required to seat the board in the edge plane connectors. The board should be removed and the alignment checked if there is resistance to seating. Insure tabs are locked.

5. Install cables. See Section 3.4.

3.3 SWITCH SETTINGS AND JUMPER OPTIONS

This section contains the jumper and switch settings required to configure the Controller for each of the devices available on the board. For each underlined option the user must make a choice which defines the Configuration of the board. Note that the jumper/switch options are also referenced to the logic diagrams in the back of this manual. Also reference the jumper option page in the logic schematics for the physical location of the reference jumper or switch option.

3.3.1 SERIAL PORT 1

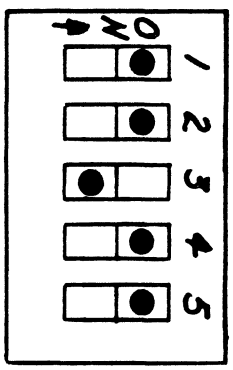
Device Code (Logic Diagram 10)

Switch is at location H5. Normal Device Code for first serial port is 10/11. Other device codes are shown on the table on the following page.

DEVICE CODE	S1	S2	S3	S4	S5
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		
X + 0,1				ON	ON
X + 2,3				ON	OFF
X + 4,5				OFF	ON
X + 6,7				OFF	OFF

DEVICE CODE SELECTION: PORT (1)

TABLE 3.1



SLIDE SWITCH

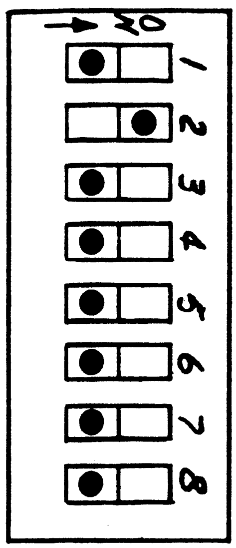
Switch at Location H5

Device Code 10/11

UART Characteristics (Logic Diagram 9)

JUMPER	INSTALLED (I)	NOT INSTALLED (NI)	
W9-6	Odd Parity	Even Parity	
	W9-5	W9-4	
	I	I	5
W9-5,4	NI	I	6
	I	NI	7
	NI	NI	8
W9-3	1 Stop Bit	2 Stop Bits	
W9-2	Enable Parity	Inhibit Parity	

Baud Rate Selection (Logic Diagram 9)



Switch 1 ON - 19200 Baud
Switch 2 ON - 9600 Baud
Switch 3 ON - 4800 Baud
Switch 4 ON - 2400 Baud
Switch 5 ON - 1200 Baud
Switch 6 ON - 600 Baud
Switch 7 ON - 300 Baud
Switch 8 ON - 110 Baud

SLIDE SWITCH

Switch at Location L7

9600 Baud Shown

3.3.2 SERIAL PORT 2

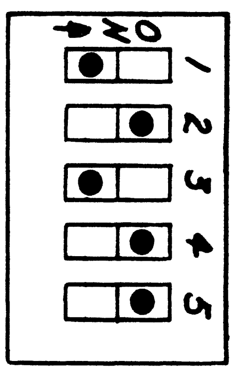
Device Code (Logic Diagram 12)

Switch is at location F5. Normal device code for second serial port is 50/51. Other device codes are listed in the table below.

DEVICE CODE	S1	S2	S3	S4	S5
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		
X + 0,1				ON	ON
X + 2,3				ON	OFF
X + 4,5				OFF	ON
X + 6,7				OFF	OFF

DEVICE CODE SELECTION: PORT (2)

TABLE 3.2



SLIDE SWITCH

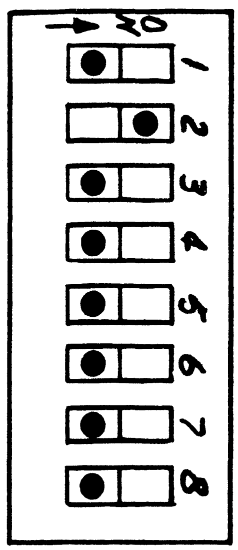
Location F5

Device Code 50/51

UART Characteristics (Logic Diagram 11)

JUMPER	INSTALLED	NOT INSTALLED	
W11-6	Odd Parity	Even Parity	
	W11-5	W11-4	
	ON	ON	5
W11-5,4	OFF	ON	6
	ON	OFF	7
	OFF	OFF	8
W11-3	1 Stop Bit	2 Stop Bits	
W11-2	Enable Parity	Inhibit Parity	

Baud Rate Selection (Logic Diagram 11)



Switch 1 ON - 19200 Baud
Switch 2 ON - 9600 Baud
Switch 3 ON - 4800 Baud
Switch 4 ON - 2400 Baud
Switch 5 ON - 1200 Baud
Switch 6 ON - 600 Baud
Switch 7 ON - 300 Baud
Switch 8 ON - 110 Baud

SLIDE SWITCH

Switch at Location M7

9600 Baud Shown

3.3.3 LINE PRINTER

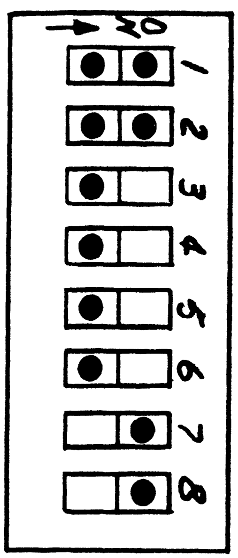
Device Code (Logic Diagram 13)

The line printer device code is normally 17-8. Reference Table 3.3 for setting other device codes. Device code switch is located at M9.

DEVICE CODE	S1 N/A	S2 N/A	S3	S4	S5	S6	S7	S8
0X						ON	ON	ON
1X						OFF	ON	ON
2X						ON	OFF	ON
3X						OFF	OFF	ON
4X						ON	ON	OFF
5X						OFF	ON	OFF
6X						ON	OFF	OFF
7X						OFF	OFF	OFF
X0			ON	ON	ON			
X1			OFF	ON	ON			
X2			ON	OFF	ON			
X3			OFF	OFF	ON			
X4			ON	ON	OFF			
X5			OFF	ON	OFF			
X6			ON	OFF	OFF			
X7			OFF	OFF	OFF			

DEVICE CODE SELECTION: LINE PRINTER

TABLE 3.3



NOTE: Switches 1 and 2 are not used, consequently the switches can be on or off.

SLIDE SWITCH

Location M9

Device Code 17

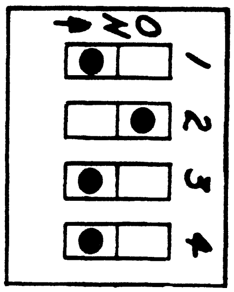
Line Printer Data Polarity (Logic Diagram 18)

W18-1 Installed = (+3V) True Data Output
W18-1 Removed + (0V) True Data Output

Output Strobe Clock Width (Logic Diagram 21)

This switch is for selecting pulse width of the Line Printer Data Strobe. Normally 1.3 usec

S1 = .65 usec
S2 = 1.3 usec
S3 = 2.6 usec
S4 = 5.2 usec



Switch at Location F9

1.3 usec strobe shown

JUMPERS

Vertical Format Command Decode (Logic Diagram 22)

W22-1 Installed = VFU Command 13-8
W22-2 Installed = VFU Command 22-8

Line Printer On Line Status (Logic Diagram 22)

W22-5 installed if on-line status from printer is (+3V) true signal. Not installed if (0V) true signal.

Line Printer No Paper Status (Logic Diagram 22)

W22-4 installed if no-paper status from printer is (+3V) true signal. Not installed if (0V) true signal.

Line Printer Data Strobe Polarity (Logic Diagram 23)

W23-6 installed = (0V) True Data Strobe
W23-7 installed = (+3V) True Data Strobe

Control Character Mask (Logic Diagram 13)

W23-4 installed prohibits sending paper feed/line (12-8) command to the line printer. S23-1 installed prohibits sending carriage return (15-8) command to the line printer. W23-2 or W23-3 installed prohibits sending VFU Data to printer.

Line Printer Acknowledge/Demand Ready Polarity (Logic Diagram 13)

W23-5 installed = (+3V) True Signal
W23-5 not installed = (0V) True Signal

Print/Plot Control (Logic Diagram 23)

W23-8 installed = (+3V) True Signal
W23-8 not installed = (0V) True Signal

3.4 CABLE INSTALLATION

Electrical connections between the Model 265 Controller and peripheral equipment located outside the chassis are made with external cable assemblies to the backplane of the computer, or off the handle-edge of the board.

Backplane Connections. There are two horizontal parallel rows of 100 pins on the backplane. The left group of pins is the A connector, and the right group (as viewed from the back of the chassis) is called the B connector. Numbering of each group of 100 pins is as indicated below (shown only for A connector).

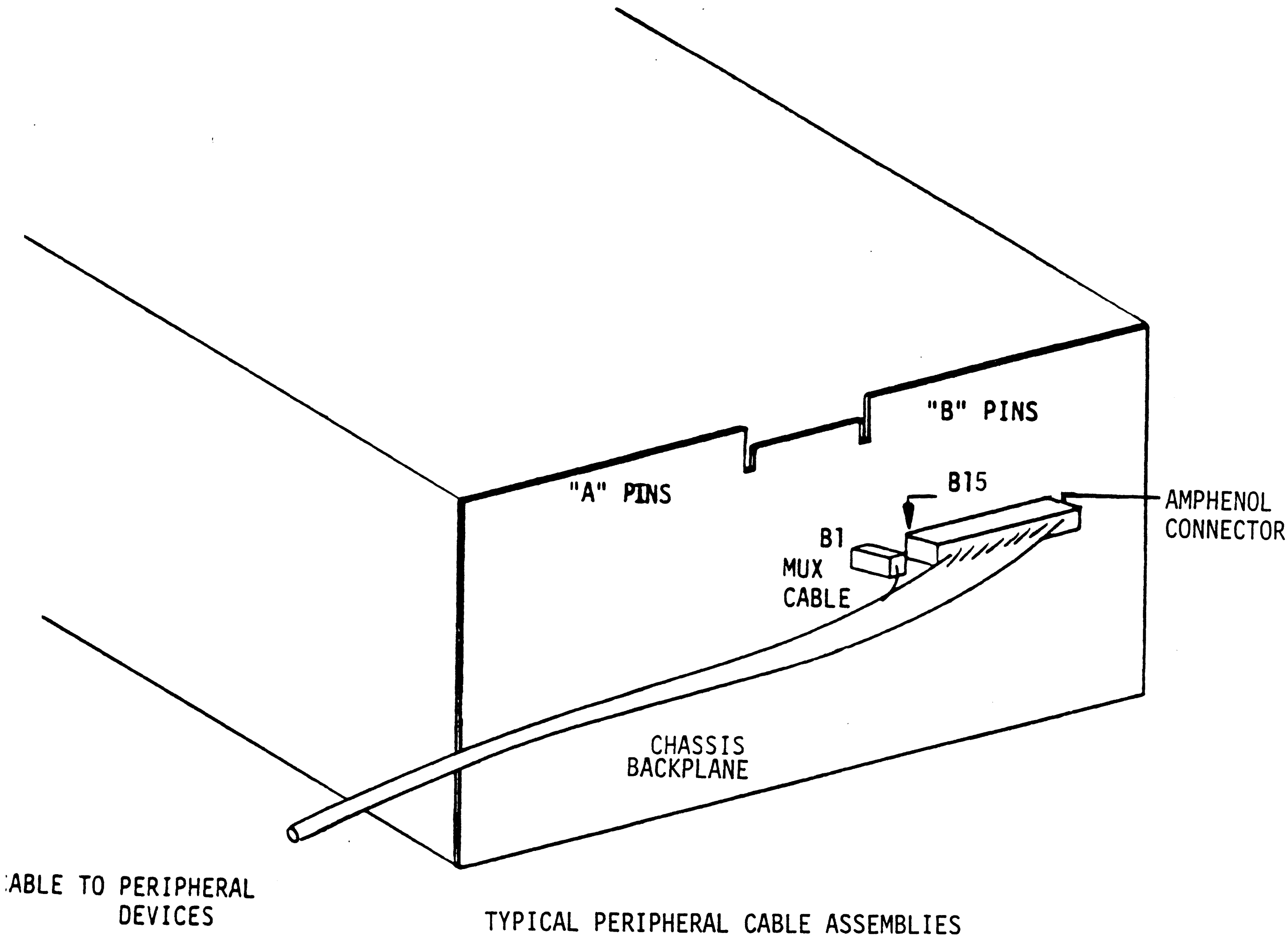
A1	A3	A5	A7	A9	A11	A13	A15	A17	A19	A21	A23	A25	A27	A29	A31	A33	A35	A37	A39	A41	A43	A45	A47	A49	A51	A53	A55	A57	A59	A61	A63	A65	A67	A69	A71	A73	A75	A77	A79	A81	A83	A85	A87	A89	A91	A93	A95	A97	A99
A2	A4	A6	A8	A10	A12	A14	A16	A18	A20	A22	A24	A26	A28	A30	A32	A34	A36	A38	A40	A42	A44	A46	A48	A50	A52	A54	A56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

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.

3.4.1 LINE PRINTER CABLING

Plug the amphenol connector over the pins of the backplane connectors. The line printer cable plugs over the "B" side covering, pins 15 through 53, with a signal plug at B1. (See Figure 3.1).

Press connectors toward the backplane until fully seated. When fully seated, the I/O connector assembly should be flush against the backplane.

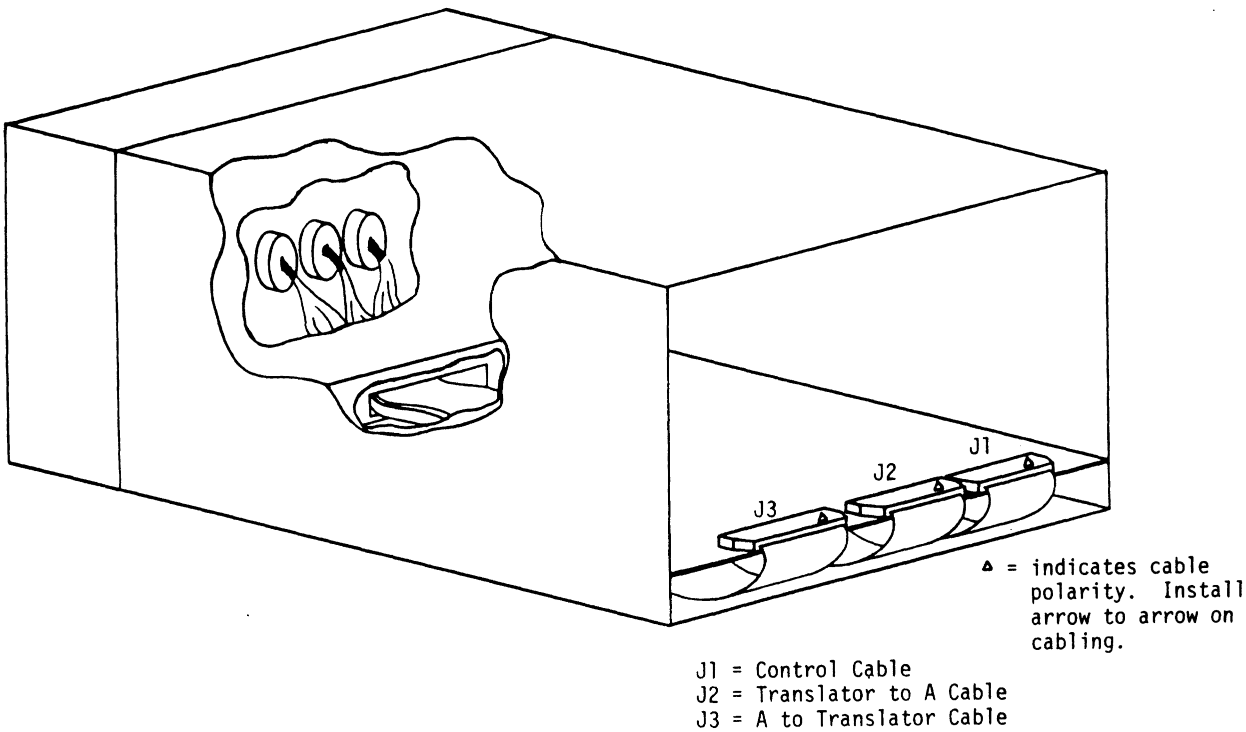


TYPICAL PERIPHERAL CABLE ASSEMBLIES

FIGURE 3.1

Connect printer connector to the printer.

Cray Interface Cabling. There are 3 ribbon cables associated with cabling the Model 265 Controller to the Cray Interface. 1) 50-pin ribbon cable labeled J2 (Translator to A) 2) 50-pin ribbon cable labeled J3 (A to Translator) 3) 40-pin ribbon cable labeled J1 (Control). These cables connect to the 3 connectors at the back of the board according to the respective silkscreen labels on the board at the one end, and connect to a cabling panel at the other end. (Reference Figure 3.2).



CRAY INTERFACE CABLING

FIGURE 3.2

4.0 TROUBLESHOOTING

This section contains quick maintenance and troubleshooting tips that may be helpful to isolate problems.

4.1 SERIAL PORTS

Test A: Program to Repeatedly Output a Single Character Using BUSY/DONE logic.

The octal program listed below is entered through the console data switches starting at location 100. The starting address (100) is set in the switches and then the EXAMINE switch is hit to load this address. The console switches can then be set to the ASCII value of the character to be printed (i.e. octal 100=@, octal 101=A, etc). The program is started by pressing the CONTINUE switch.

The program reads the selected character from the computer data switches, sends out the character to the teletype or CRT and then waits in a SKIP BUSY (or DONE) loop for the serial shifting of the character to the terminal to be completed. The process requires no response from the terminal and will repeatedly send out the same character. If the terminal does not have an automatic line feed, it will be necessary to take the terminal off-line to advance the line. If proper transmission is occurring, the console switches can be changed on the fly to change the character sent out.

MEMORY LOCATION	OCTAL PROGRAM	SYMBOLIC CODE	COMMENTS
100	062677	IORST	I/O Reset
101	060477	READS 0,CPU	Reads console switches
102	061111	DOAS 0,TTO	Send out character
103	063511	SKPBZ TTO	Skip Busy
104	000777	JMP .-1	Wait for completion
105	773	JMP .-5	Repeat

To run under DONE logic, change the instruction at location 103 to 063611. If no output occurs, a problem exists with one of the following:

1. The cable has been improperly installed. Carefully check installation.

2. Terminal not on-line.

3. Wrong baud rate selected.

4. A problem exists with the Controller. Check that controller and cable are plugged to the same slot.

Test B: Device Output Under Interrupt Control

MEMORY LOCATION	OCTAL PROGRAM	SYMBOLIC CODE		COMMENTS
1	70	JMP	Location 70	
60	062677	IORST		I/O Reset
	060177	INTEN		Enables interrupt
	072077	MSKO	2,CPU	Mask instruction
	061111	DOAS	0,TTO	Output a character
	400	JMP	*	Wait for interrupt
70	065477	INTA	1,CPU	Device code AC1
	063077	HALT		

The program is started at location 60, and the interrupt processing routine is placed at location 70. Before starting the program, the operator must first place a mask word (all zeros for normal operation or 000001 for teletype output disable) in accumulator 2. The character to be printed must also be placed in AC0.

The program sends out one character and then waits for an interrupt. When the interrupt occurs, the program passes through location 1 to get to the interrupt routine at location 70. The INTA instruction places the device code of the interrupting device (device 11 in this case) in AC1 and then halts. By changing the halt to JMP 60 or JMP *-8 (770), the program will run continuously.

If BIT 15 in the mask word is equal to one, the TELETYPE OUTPUT flag is disabled and the program will hang on the JMP* instruction at location 64. If BIT 15 is unequal to one, the program will run normally.

1. Insure only one device code is set.

Test C: Read One Character Under Either BUSY or DONE Logic

MEMORY LOCATION	OCTAL PROGRAM	SYMBOLIC CODE	COMMENTS
110	062677	IORST	
	060110	NIOS	Enable CRT Interface Controller
	063510	SKPBZ	Wait for character to be struck on keyboard
	777	JMP *-1	
	060410	DIA 0,TTI	Read character ACO
	063077	HALT	Halt, display ACO
	773	JMP *-5	

The program enables the Controller and then waits for a keystroke. The ASCII code for the character is placed in the accumulator zero (i.e. A = 101). By hitting the CONTINUE switch, the next character tape is read. By changing the third instruction to 063610 SKPDN, you may run under DONE logic.

1. The cable has been improperly installed. Carefully check installation.

2. Terminal not on-line.

3. Wrong baud rate selected.

4. A problem exists with the Controller. Check that Controller and cable are plugged to the same slot.

Test D: Read One Character Using INTERRUPT Logic

The program is started at location 40, and location 50 contains the interrupt processing routine. Before starting the program, the operator must first place a mask word (all zeros for normal operation or 000002 for teletype input disable) in accumulator 2. After the program is started at location 40, the operator should strike a key on the keyboard.

MEMORY LOCATION	OCTAL PROGRAM	SYMBOLIC CODE	COMMENTS
1	50	JMP Location 50	
40	062677	IORST	
	060177	INTEN	Enable interrupts
	072077	MSKO 2,CPU	Mask instruction
	060110	NIOS TTI	Start paper tape reader
	400	JMP *	Wait for interrupt
50	065477	INTA 1,CPU	Device Code AC1
	060410	DIA 0,CPU	Character AC0
	063077	HALT	
	060210	NIOC TTI	Clear interrupt and continue
	41	JMP Location 41	

The character read and the device code are placed in accumulators 0 and 1, respectively. If mask bit 14 = 1, the reader will advance tape to the next character and load the Controller registers, but it will not generate an interrupt. The program will hang on the JMP * instruction at location 44.

1. Insure only one device code is set.

4.2 LINE PRINTER

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.

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

Set accumulator 000002 Starting memory address

Set accumulator 1=177774 Number of bytes

MEMORY LOCATION	OCTAL PROGRAM	SYMBOLIC CODE
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 at location 104 to 063617.

If the program does not cause printing, depress 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 Self-test 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.

MEMORY LOCATION	OCTAL PROGRAM	SYMBOLIC CODE
110	062677	IORST
111	064417	DIA,1 LPT
112	063077	HALT
113	000110	JUMP .-4

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, BIT 15 of ACI should be on.

1. Check to see if the printer is on-line.

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.

CUSTOMER SUPPORT

Our warranty attests the quality of materials and workmanship in our products. If a malfunction does occur, our service personnel will assist you in any way possible. If the difficulty cannot be eliminated by use of the following service instructions and technical advice is required, please telephone the ZETACO Technical Support Department (612-941-9480) with 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 a 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. Please run the test sequence BEFORE considering product return.

Returned Material Authorization:

Before returning a product to ZETACO for repair, please ask our Sales Secretary for a RMA 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.

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 effort to test a suspected malfunctioning controller should be made before returning the controller to ZETACO for repair. This will: 1) Determine if the board is defective. Many boards returned for repair are not defective, causing the user unnecessary system down-time, paperwork and handling. Please test the board thoroughly before returning it. 2) Increase the speed and accuracy of a products repair, which is often dependent upon a complete understanding of the user's checkout test results, problem characteristics, and the user system configuration.

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

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

   ____

   ____

2. Describe the system configuration (peripherals, I/O controllers, model of computer, etc.) ____________

   ____

   ____

3. Has the controller been returned before? For same problem? ____________________________

   ____

   ____

Please fill in:

MODEL #: ____________________

SERIAL #: ____________________

RMA #: ____________________

Returned by: ____
(Company name)

5.0 PROGRAMMING

The two serial I/O channel controllers operate under program control. The line printer controller operates under DMA control. This section contains the information required to program the computer to provide data to and accept data from the serial ports and provide data to the line printer.

5.1 SERIAL I/O CHANNELS (TTY)

The TTY separates the input and output functions into two distinct devices, each with its own device code, its own BUSY, DONE and interrupt flags, and its own interrupt mask assignment.

Placing a character code in the output buffer and setting Output Busy causes the TTO to print the character or perform the designated control function. Striking a key places the code for the associated character in the input buffer of the TTI for retrieval by the program.

5.1.1 SERIAL PORT OUTPUT

The TTO output uses only one I/O transfer instruction. Output BUSY and DONE are controlled or sensed by BITS 8 and 9 in all I/O instructions with device code 11-8, mnemonic TTO. Output interrupt disable is controlled by interrupt mask BIT 15. The configuration of the instruction is as follows:

DATA OUT A, TELETYPE OUTPUT

DOA -, TTO

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

Load the contents of AC BITS 8 - 15 into the output buffer and perform the function specified by F. Setting Output Busy turns on the transmitter, causing it to send the contents of the output buffer serially to the Serial Device (the buffer is cleared during transmission). The terminal displays the character or performs the indicated control function. Completion of transmission clears Output BUSY and sets Output DONE, requesting an interrupt if output disable is clear.

Do not give an NIOS without first loading the buffer. To transmit any character, including null, either give a DOAS or give a DOA followed by an NIOS. Clearing Output BUSY while the transmitter is running (as with an NIOC) terminates the transmission, but the terminal still displays whatever character is represented by the indeterminate code it receives.

A carriage return and a line feed must be given to position the terminal at the beginning of a new line.

5.1.2 SERIAL DEVICE INPUT

The TTI input uses only one I/O transfer instruction. Input BUSY and DONE are controlled or sensed by BITS 8 and 9 in all I/O instructions with device code 10, mnemonic TTI. Input interrupt disable is controlled by interrupt mask BIT 14. The configuration of the transfer instruction is as follows:

DATA IN A, TELETYPE INPUT

DIA -, TTI

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

Transfer the contents of the input buffer into AC BITS 8 - 15 and perform the function specified by F.

Reception from the keyboard requires no initiating action by the program; striking a key transmits the code for the character serially to the input buffer. The completion of reception clears Input BUSY (if set) and sets Input DONE, requesting an interrupt if Input interrupt disable is clear.

After DONE sets, the character is available for retrieval by a DIA.

5.2 DATA CHANNEL LINE PRINTER

The Data Channel (DCH) 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 and 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 and Pulse functions set 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 Same as start command.

The I/O mnemonics code and description for each DCH line printer controller instruction are listed below.

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 controllers Current Address Register. The controllers 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

Bits	Name	Contents
0-14	Memory Address	Location of the next word in memory to be used for DCH 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

This instruction places the contents of the controllers Current Address register in BITS 1-15 and the byte pointer in BIT 0 of the specified AC. After the data transfer, set the controllers BUSY and DONE flags according to the function specified by F. The format of the specified AC is as follows:

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

Bits	Name	Contents
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 DCH transfer.

LOAD BYTE COUNT REGISTER - DOC - DCLP

0	1	1	AC		1	1	0	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 controllers Byte Count Register. The controllers 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:

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

Bits	Name	Contents
0-15	Byte Count	Two's complement of the number of bytes to be transferred.

READ BYTE COUNT REGISTER - DIC - DCLP

0	1	1	AC		1	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

It loads the contents of the controller's Byte Count Register in BITS 0-15 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 A is as follows:

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

Bits	Name	Contents
0-15	Byte Count	Two's complement of the number of bytes to be transferred.

READ STATUS - DIA - DCLP

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

Places the contents of the controllers 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:

0 1 2 3 4 5 6 7 8 9 10 11	12	13	14	15
	TAB RUNAWAY	STATUS CHANGE	NO PAP	ON LINE

Bits	Name	Contents
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	No Paper	The printer's paper supply is depleted.
15	$\overline{\text{On Line}}$	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 6	CH 5	CH 4	CH 3	CH 2	CH 1			CH 12	CH 11	CH 10	CH 9	CH 8	CH 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 FMA 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

6.0 APPENDIX

6.1 COMPUTER INTERFACE SIGNALS

SIGNAL	BACKPANEL PIN
CLR	A50
DATA 0	B62
DATA 1	B65
DATA 2	BB82
DATA 3	B73
DATA 4	B61
DATA 5	B57
DATA 6	B95
DATA 7	B55
DATA 8	BB60
DATA 9	B63
DATA 10	B75
DATA 11	B58
DATA 12	B59
DATA 13	B64
DATA 14	B56
DATA 15	B66
DATA IA	A44
DATA IB	A42
DATA IC	A54
DATA OA	A58
DATA OB	A56
DATA OC	A48
DCHA	A60
DCHI	B37
DCHO	B33
*DCHP IN	A94
*DCHP OUT	A93
DSO	A72
DS1	A68
DS2	A66
DS3	A46
DS4	A62
DS5	A64
INTA	A40
*INTP IN	A96
*INTP OUT	A95
INTR	B29
IOPLS	A74
IORST	A70
MSKO	A38
RQENB	B41
SELB	A82
SELD	A80
STRT	A52

*For the two pairs of priority-determining signals, the IN signal comes from the processor or the preceeding 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 to A96 to maintain bus continuity.

6.2 DEVICE INTERFACE SIGNALS

SIGNAL	BACKPANEL PIN
SERIAL PORT I	
SERIAL PORT OUT (200-067-00)	A85
SERIAL DATA IN (200-067-00)	B69
CLEAR TO SEND OUT	A90
SERIAL PORT II	
SERIAL DATA OUT (200-067-00)	A81
SERIAL DATA IN (200-067-00)	A92
CLEAR TO SEND	B11
PRINTER	
BIT 1	B15
BIT 2	B19
BIT 3	B23
BIT 4	B25
BIT 5	B27
BIT 6	B31
BIT 7	B49
BIT 8	B36

$\overline{\text{ON LINE}}$	B54
PICLK	B53
NO PAPER	B40
$\overline{\text{READY}}$	B38
PRINT/$\overline{\text{PLOT}}$	B48

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