Five Dollars

Cromemco

PRI

Printer Interface

Instruction Manual

Cromemco™

PRI PRINTER INTERFACE

INSTRUCTION MANUAL

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INTRODUCTION

The Cromemco PRI parallel printer interface board will permit simultaneous operation of the Cromemco 3703 or 3779 dot matrix printer and the 3355A fully formed character printer. The PRI board is designed around the S-100 bus, features automatic ribbon control for the fully formed character printer, and supports interrupts. Although the I/O ports are factory set, they are easily changed by the user.

TECHNICAL SPECIFICATIONS

Input Ports	54,5A
Output Ports	53,54,5A,5B,5C,5D
Note	The most significant 4 bits of the port address can be changed by the user with a minor hardware modification
Bus	S-100
Power Req.	+8 volts @ 1.0 amps
Operating Env.	0-55 degrees Celsius

PORT ASSIGNMENTS

Model 3779 or 3703 Dot Matrix Printer

	Pin	Output Port 54H	Pin	Input Port 54H	Pin	Output Port 53H
Bit 0	13	Data 0				
Bit 1	25	Data 1				
Bit 2	12	Data 2				Interrupt Enable
Bit 3	24	Data 3				
Bit 4	11	Data 4				
Bit 5	23	Data 5	17	BUSY		
Bit 6	10	Data 6				
Bit 7	22	DATA STROBE				
			15	ACKNLG		
Signal Gnd.	14		14			

NOTES

1. The pin numbers specified are valid for both the EIA DB25 connector at the end of a standard Cromemco TU-ART cable (part number TRT-CBL) and the J1 connector on the PRI board (see diagram).

2. ALL LINES ARE TTL LEVEL ACTIVE HIGH except $\overline{\text{DATA STROBE}}$ and ACKNLG STROBE.

3. $\overline{\text{DATA STROBE}}$ indicates that the ASCII information on the DATA lines 0-6 is ready (there is no parity bit).

4. BUSY indicates that the printer is not ready to accept input.

5. $\overline{\text{ACKNLG STROBE}}$ indicates that BUSY has gone LOW and the printer is ready to accept input.

6. INTERRUPT ENABLE enables the PRI (0=off, 1=on) to generate an interrupt when $\overline{\text{ACKNLG}}$ goes LOW.

PORT ASSIGNMENTS

Model 3355A Fully Formed Character Printer

	Pin	Output Port 5AH	Pin	Output Port 5BH	Pin	Output Port 5CH
Bit 0	15	Data 0	8	Data 8	13	RESTORE
Bit 1	1	Data 1	10	Data 9	9	CHAR STROBE
Bit 2	2	Data 2	11	Data 10	25	CARR STROBE
Bit 3	3	Data 3	12	Data 11	24	PAPER FEED
Bit 4	4	Data 4				
Bit 5	5	Data 5			23	TOP OF FORM
Bit 6	6	Data 6				
Bit 7	7	Data 7			20	PRINTER SELECT
Signal Gnd.	14		14		14	

	Pin	Input Port 5AH	Pin	Output Port 5DH
Bit 0	18	IN BUFFER READY		
Bit 1	19	CHECK		
Bit 2	16	PAPER OUT		INTERRUPT ENABLE
Bit 3	21	RIBBON OUT		
Bit 4	17	PRINTER READY		
Bit 5				
Bit 6				
Bit 7				
Signal Gnd.	14		14	

NOTES

1. The pin numbers specified are valid for both the EIA DB25 connector at the end of a standard Cromemco TU-ART cable (part number TRT-CBL) and the J2 connector on the PRI board (see diagram).

2. ALL LINES ARE TTL ACTIVE LOW.

3. $\overline{\text{RESTORE}}$ moves the carriage to the leftmost position, synchronizes the printwheel, and resets the printer logic.

4. $\overline{\text{CHARACTER STROBE}}$ indicates that the ASCII information on the DATA lines 1-7 is ready (there is no parity bit).

5. $\overline{\text{CARRIAGE STROBE}}$ indicates that carriage position information ($\overline{\text{DATA 0-10}}$) and direction of carriage travel ($\overline{\text{DATA 11}}$,=0 for right, =1 for left) are ready.

6. PAPER FEED indicates that paper feed increments information (DATA 0-10) and paper feed direction (DATA 11, =0 for up, =1 for down) are ready.

7. TOP OF FORM advances the paper to its starting point at the top of form.

8. PRINTER SELECT selects the printer for operation.

9. INPUT BUFFER READY indicates that the printer is ready to accept an input command.

10. CHECK indicates that the printer has malfunctioned.

11. PAPER OUT indicates that the printer is out of paper.

12. RIBBON OUT indicates that the printer is out of ribbon.

13. PRINTER READY indicates that the printer is ready to accept data and control inputs.

14. Pin 22 signals ribbon position (0=up, 1=down). This function is automatically controlled by the PRI board.

15. INTERRUPT ENABLE enables the PRI (0=off, 1=on) to generate an interrupt when INPUT BUFFER READY goes LOW.

FEATURES

CHANGING THE PORT ASSIGNMENTS

As the board is viewed from the component side, notice the four holes in the upper right corner (just above IC5) marked A7, A6, A5, and A4. Install a four pole DIP switch between these holes and the adjacent set of holes. Orient the switch so that the "ON" position is closest to the top edge of the board (away from IC5). Before soldering the switch in place cut the vertical traces on the solder side of the board running from the hole marked A4 and from the hole marked A6.

Once the traces have been cut and the switch has been soldered in place, the upper four bits of the port address can be set using the switch. For example, if all four switches are "ON" (F0H) the I/O ports will be addressed at F3H, F4H, FAH, FBH, FCH, and FDH while if just switch A4 is on (1H) they will be addressed at 13H, 14H, 1AH, 1BH, 1CH, and 1DH.

AUTOMATIC RIBBON CONTROL

The Cromemco PRI board automatically controls the raising and lowering of the ribbon on the fully formed character printer by the means of a timer. The ribbon will be raised into the printing position slightly before the first character in a string is printed and will remain raised until no characters have been printed for approximately one second.

INTERRUPTS

The Cromemco PRI is capable of interrupting the processor upon the completion of a printer task. The PRI provides the lower byte (which is user selectable) of the vector address during an interrupt acknowledge cycle. To enable the PRI for interrupt operation bit 2 of output port 53H must be set for the dot matrix printer and bit 2 of output port 5DH must be set for the fully formed character printer. Interrupt operation may be disabled by resetting bit 2 of output port 53H for the dot matrix printer and bit 2 of output port 5DH for the fully formed character printer.

The lower byte of the vector address is set by switch 1 for the fully formed character printer and switch 2 for the dot matrix printer. Note that when setting the positions of switch 1 and switch 2 that ON=0, OFF=1.

INSTALLATION

1. Set switch 1 (fully formed character printer) to 5CH if Cromemco interrupt software is being used. Switch positions 1, 3, 7, and 8 should be ON and 2, 4, 5, and 6 should be OFF.

2. Set switch 2 (dot matrix printer) to 34H if Cromemco interrupt software is being used. Switch positions 1, 2, 5, 7, and 8 should be ON and 3, 4, and 6 should be OFF.

3. Power system DOWN and insert the PRI into the bus.

4. If the PRI is installed in a multi-user system the existing priority jumper cable should be used. The PRI should be installed next to the last Tu-Art in the bus and the priority jumper cable from the priority out connector on the last Tu-Art should be connected to IN J3 on the PRI.

5. If a dot matrix printer is being used connect the ribbon cable to J1 on the PRI. If a fully formed character printer is used connect the ribbon cable to J2 on the PRI.

THEORY OF OPERATION

The PRI printer interface card is accessed by the CPU as a standard I/O device. As the processor does an OUTput to the card, the I/O port number is placed on the lower 8 bits of the S-100 address bus, A0 through A7; the signal SOUT (pin 45 of the S-100 bus) is issued at the same time. The signal OUT on the PRI will then be active (LOW). The least significant 4 bits (A0 through A3) of the address bus are decoded by IC16 and IC28 which supply active LOW strobes for ports 03H, 04H, 0AH, 0BH, 0CH, 0DH, and ignore all others. The upper 4 address bits (A4 through A7) are decoded by IC6 on the PRI board. (The default value is 05H; however, it may be changed by

cutting two traces and adding a dip switch. See the section on changing port assignments.) When a correct port number for OUTputs has been decoded (one of 53H, 54H, 5BH, 5CH, or 5DH), pin 8 of IC 17 will go LOW. This in conjunction with IC 16, and IC28, and the signal OUT will cause one of the 4 outputs of IC5 to go LOW and enable one of the corresponding 8-bit latches, IC1 through IC4. The data is then available to the corresponding printer through either of the connectors J1 or J2.

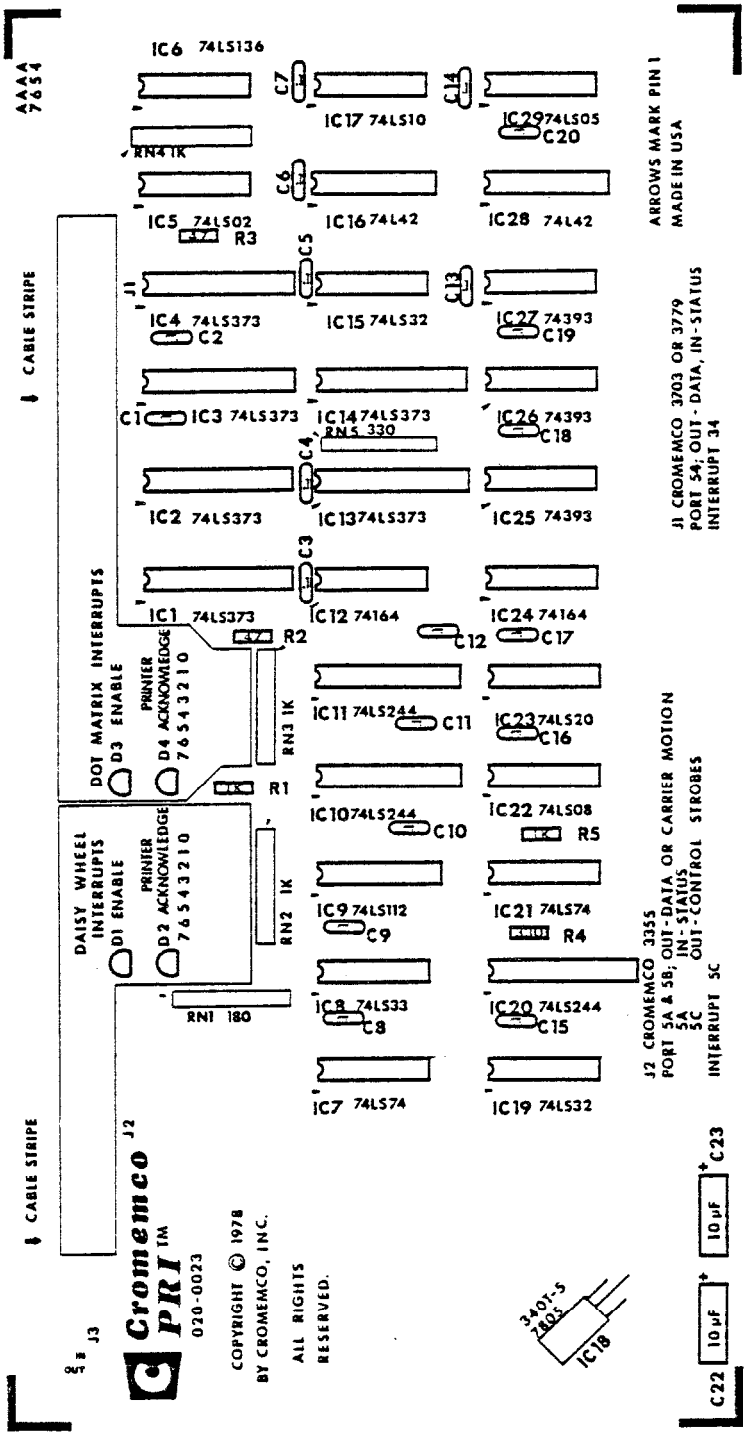
As the processor does an INput from the PRI card, it also places the 8 bits of the port address onto the address bus along with the signal SNIP (pin 46 of the S-100 bus). This causes the PRI signal IN to go active (LOW), which in conjunction with the signals from IC16 and IC28 enables the outputs of either IC13 or IC14, respectively. The PRI then places the incoming status data from the corresponding printer onto the S-100 (input) data bus, DI0 through DI7.

The PRI card controls the ribbon lift for the CROMEMCO Model 3355A fully formed character printer. The ribbon lift command is generated on-board when the PRI receives a character strobe. However, to allow time for the printer to fully raise its ribbon before accepting a character, the transmission of the character strobe is delayed by 8 2MHz-clock cycles (IC24, IC25, IC26, and IC27). If no character is sent to the PRI for approximately one second, IC24 will deactivate the ribbon lift, lowering the ribbon.

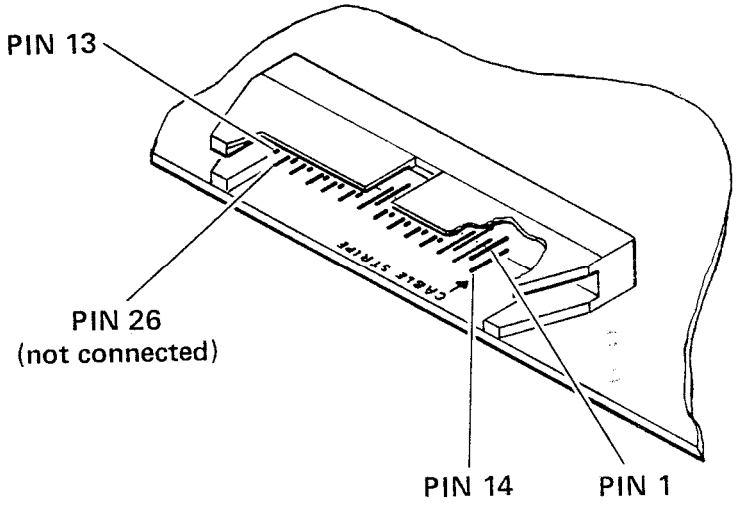
The PRI interrupts the processor by pulling pINT pin 73 (S-100) LOW through the output of IC8. This is conditioned by the state of the interrupt enable flip-flop IC7, the priority flip-flop IC21 and the interrupt flip-flop in IC9. After the interrupt enable flip-flop has been set (output bit 2 HIGH to port 53H or 5DH), the interrupt sequence is started with an INPUT BUFFER READY signal (J2 pin 18) from the fully formed character printer or an ACKNLG signal (J1 pin 15) from the dot matrix printer. Either of these two signals will clock the appropriate interrupt flip-flop IC9 and change the Q output of IC9 to a LOW state. This signal combined with the Q output of IC7

(the enable flip-flop) will change the state of IC8 to a HIGH. The state of IC23, which enables IC10 or IC11 to gate the interrupt vector address onto the bus, is determined by its inputs, interrupt acknowledge (pin 96 sINTA S-100), the interrupt flip-flop IC9, pDBIN (pin 78, S-100), and the priority flip-flop IC21. Interrupt priority connector J3 is monitored by the interrupt priority flip-flop IC21. When PRIORITY IN from J3 goes LOW, IC21 is cleared causing the Q output to go LOW which prevents IC23 from acknowledging the host.

Five volts is supplied to the PRI board by IC18 requiring approximately 1.0A from the 8 volt unregulated supply. Note that all signals to the Model 3355A fully formed character printer are active LOW, while most of the signals to the 3700-series dot matrix printers are active HIGH.



Parts Location Diagram



Pin Connections

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3. a description of the problem, and
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