

Radio Shack®

Service Manual

26-1269

TRS-80®

PTC-64

Printer Controller

Catalog Number 26-1269



CUSTOM MANUFACTURED FOR RADIO SHACK, A DIVISION OF TANDY CORPORATION

TRS-80[®] PTC-64 Printer Controller Service Manual

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1/ INTRODUCTION

The TRS-80 PTC-64 Printer Controller works as an interface between the computer and the printout device. It plugs into the parallel printer port of any TRS-80 microcomputer. The PTC-64 accepts data from the computer at computer transfer speed, stores that information in its internal memory, and then transfers that information to the printer at printer speed. This frees the computer to do other tasks during the printing operation.

As long as the unit is not turned off, the information will be stored until printed. There is a limit of 62K of memory since the unit itself requires 2K of memory for control operations. Special features include a piezo buzzer that can be activated by the computer, and a PAUSE control to cease printing without causing a printer fault. The PTC-64 allows multiple copies of the text and the translation of ASCII data into bit graphics information. For a complete description of these controls, see the Owner's Manual.

Figure 1-1 shows the typical interconnection for the PTC-64 when used with a parallel-type printer. Cable numbers are noted for standard Radio Shack printers. Cable length between the computer and the PTC-64 and between the PTC-64 and the printer should not exceed 12 feet.

When operating the unit, position it on a level surface, free from vibration. Turn off all power when interconnecting the computer, the PTC-64, and the printer. The attaching cables will plug into the PTC-64 only one way. If they are difficult to insert, turn the plug over and try again.

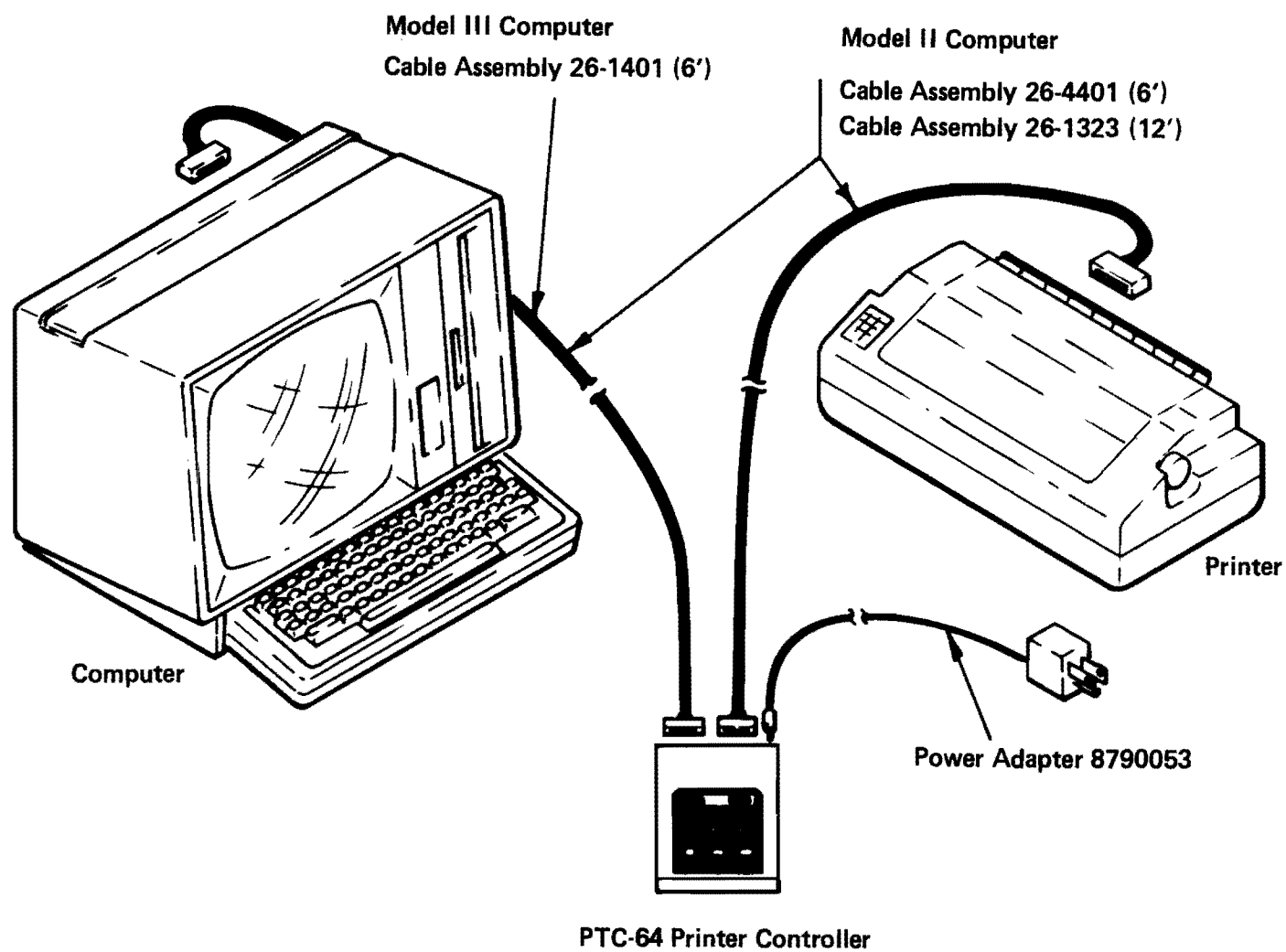


Figure 1-1. Typical PTC-64 Interconnection

2/ SPECIFICATIONS

2.1 Mechanical

Physical Size:

Width - 6.5" (16.5 cm)
Depth - 7.5" (19.05 cm)
Height - 2.375" (6.03 cm)

Weight - 1.1 pounds (400 grams)

Input Connections

Power - Miniature phone jack from AC Adapter
From Computer - 36-pin, latch-type connector
To Printer - 34-pin, dual-row connector

Front Panel Switches

CLEAR Key - marks buffer memory, aborts
printing in progress, and clears any stored
data from the buffer.

COPY Key - initiates printing from mark provided
by CLEAR key.

PAUSE Key - temporarily interrupts printing, resumes
when key is pressed second time.

2.2 Electrical

External Input - 11 VAC @ 600 mA from 115V AC Adapter
(Radio Shack P/N 8790053)

2.3 Environmental

Operating Temperature - 41° F to 104° F (5° C to
40° C)

Humidity - 20 to 80% RH (non-condensing)

Storage Temperature - 32° F to 142° F (0° C to
61° C)

3/ DISASSEMBLY/ASSEMBLY

Refer to the Exploded View, Section 7.

The mechanical assembly of the PTC-64 consists of a top and bottom cover with the PCB sandwiched between. The PCB is connected to the top cover key pad by a ribbon cable that plugs into J1 on the PCB. The computer and printer connections are made to J2 and J3. These connectors are at the rear of the assembly and are attached directly to the PCB.

To disassemble the unit, follow the steps below.

1. Turn off all power to the PTC-64, the computer and the printer.
2. Disconnect all cabling to the PTC-64 (computer cable, printer cable, AC input from adapter).
3. Turn the unit upside down and remove the four screws which connect the top and bottom covers.
4. Carefully turn the unit rightside up. Lift the top cover from the front until the ribbon cable to J1 is accessible.
5. Unplug the ribbon cable from the PCB.
6. Remove two screws from the PCB corners and two screws from the J3 connection.
7. Remove the PCB from the bosses on the bottom cover.
8. Remove the RF shield from the bottom of the PCB.

Reassemble in the reverse order of disassembly. Be sure the RF shield is fastened to the bottom of the PCB. Seat the PCB on the bosses of the bottom cover and secure it with four screws. Exercise care when reattaching the ribbon cable. Be sure that good contact is made and that the cable is properly seated in the connector prior to securing the top and bottom covers.

4/ THEORY OF OPERATION

4.1 Power Supply

The power supply for the PTC-64 consists of an AC adapter (11 VAC @ 600 mA), four diodes (CR2-CR5), two bulk capacitors (C27-C28), and a 7805 +5 Volt regulator (VR1). The AC adapter is plugged into J4 at the rear of the PTC-64. The AC is then full-wave rectified using CR2-CR5. The result, approximately 7 VDC, is presented to the input of VR1. The voltage is regulated by VR1 and filtered (to reduce the ripple voltage) by C28, a 3300 μ F capacitor. VR1 supplies +5 VDC to the circuits on the internal PCB.

4.2 Processor and Support Logic

This circuit uses a Z80A microprocessor operating at 2 MHz. There is 64K of RAM on this board, but under normal conditions only 62K of RAM can be accessed. This exception will be covered in Paragraph 4.3, Address Decoding.

A TTL oscillator is constructed using an 8 MHz series-resonant crystal (Y1), a 74LS00 (U2), miscellaneous resistors (R3-R6), and a capacitor (C9). The output of this circuit goes through two D-type flop-flops (U3) that provide a divide-by-4 function. The resultant 2 MHz output is used as the processor clock (U11 pin 6). The basic 8 MHz signal is used for memory timing.

The Z80A RESET* (pin 26) is connected to a power-on reset circuit which is comprised of diode (CR1), resistor (R23), and capacitor (C17). This circuit is the only means of resetting the Z80 microprocessor.

4.3 Address Decoding

4.3.1 ROM Decoding

This device uses a 2K x 8 ROM for the monitor program. This ROM (U10) is memory-mapped to addresses 000-07FF (Hex) using a 74LS260, 5-input NOR (U8). Under normal conditions, this

disables the first 2K of available RAM, leaving approximately 62K of RAM for buffer storage. Under certain conditions, described in the Owner's Manual, this ROM may be disabled, allowing a special driver program to control the Z80A and access the full 64K of RAM. A 74LS74 (U14) is used to latch the ROM in or out. Pin 9 of U14 is the output of this latch. If this pin is low (0 V), the ROM is enabled; if it is high (greater than 3 V), the ROM is disabled. If the ROM is disabled, there are only two ways to turn it back on. One is to reset the Z80A (power down), and the other is to turn it back on via software. To turn the ROM on using software, execute an OUT to port 2 with bit 0 reset then jump to address 00 hex.

4.3.2 RAM Decoding and Timing

The PTC-64 uses eight 64K x 1 bit RAMs (U15, 16, 21, 22, 26, 27, 29, 30). These are dynamic RAMs which require refreshing 128 rows every 2 milliseconds. This refreshing is accomplished via the RAS* signal (Row Address Strobe), and the RFRSH* signal on the Z80. The Z80 has a built-in refresh counter that performs this function at the end of every instruction fetch. The RAS* signal to the RAMs is generated every time MEMRQ* (from U11) is active and the ROM is not being addressed. A 74LS175 (U6) is used as a shift register to provide the MUX signal to the address multiplexers (U9, U13) and the CAS* (Column Address Strobe) to the RAMs. It is clocked using the 8 MHz clock signal previously discussed. The Q3* output of U6 is ANDed with WR* and RD* to disable CAS* at the end of a memory access.

4.3.3 Processor Interrupts

Pressing a key on the front panel causes interrupts, while NMIs are caused by the computer generating a byte of data. If a user program is downloaded, interrupts may be disabled, but NMI must be supported.

4.3.4 Port Assignments

Address	Read	Write
0	Computer Data	Printer Data
1	Keyboard & Printer Status	Computer Status
2	Clear Pending Interrupt	ROM Enable

Note: Only the two least significant bits are used for port decoding. Therefore, an OUT instruction to port 0, 4, 8, 12, 16, 20 etc. will access the Printer Data Port.

4.3.5 Bit Assignments

Printer Status

Bit 7	CLEAR key from keyboard
Bit 6	COPY key from keyboard
Bit 5	PAUSE key from keyboard
Bit 4	Busy* from printer
Bit 3	Fault* from printer
Bit 2	# Busy from printer
Bit 1	# Paper empty from printer
Bit 0	Ack* from printer

Computer Status

Bit 7	@ Status LED
Bit 6	@ Status LED
Bit 5	Piezo Buzzer
Bit 4	# Fault* to computer and LED
Bit 3	# Busy* to computer
Bit 2	Busy to computer
Bit 1	# Ack* to computer
Bit 0	Paper empty to computer

Special Notes:

- These signals are active low (0 = active)

@ - See Status LED operation description for details

4.3.6 Status LED Operation

The Status LED (DS2) is a tri-color LED that changes color according to the bias of the voltage applied. When a DC voltage is connected to the LED, the green light is turned on. When a reverse-biased DC voltage is connected, the red light is turned on.

When an AC signal is connected, both lights are turned on which causes a yellow light. Using LS00 NAND gates (U18) and LS38 drivers (U24), two port bits are decoded which allow use of all three colors and the off state. These two port bits are the most significant bits of the Computer Status port. On the schematic diagram, they are labeled LEDACT and LEDFUL. The possible combinations are listed below.

Bit 7	Bit 6	State
0	0	Buffer Status LED is off
0	1	Buffer Status LED is red
1	0	Buffer Status LED is green
1	1	Buffer Status LED is yellow

When both bits are a logic 1, the processor signal MEMRQ* is used to generate an alternating DC signal to the LED. This alternates between red and green and generates a yellow appearance.

4.3.7 Printer Data Port

The Printer Data port is comprised of a 74LS374 8-bit latch (U7) and a 74LS123 one-shot multivibrator (U23). When an OUT instruction to port 0 is executed, the one-shot is automatically triggered with the rising edge of the IORQ* signal. The duration is approximately 2.0 microseconds. If the duration is less than 1.5 microseconds, the printer will not operate reliably.

4.3.8 Computer Data Port

The Computer Data port (J3) uses a 74LS244 (U20) as a buffer for data transmitted to the computer. This is not a latch, so data must be read immediately after CSTROBE* goes low. When CSTROBE* goes low, it triggers an NMI to the Z80. This interrupts anything that is in progress and executes a special routine to get a byte of data. CSTROBE* also triggers a one-shot to generate a BUSY back to the computer. For more information on this one-shot, see Paragraph 4.3.10, Busy Generation.

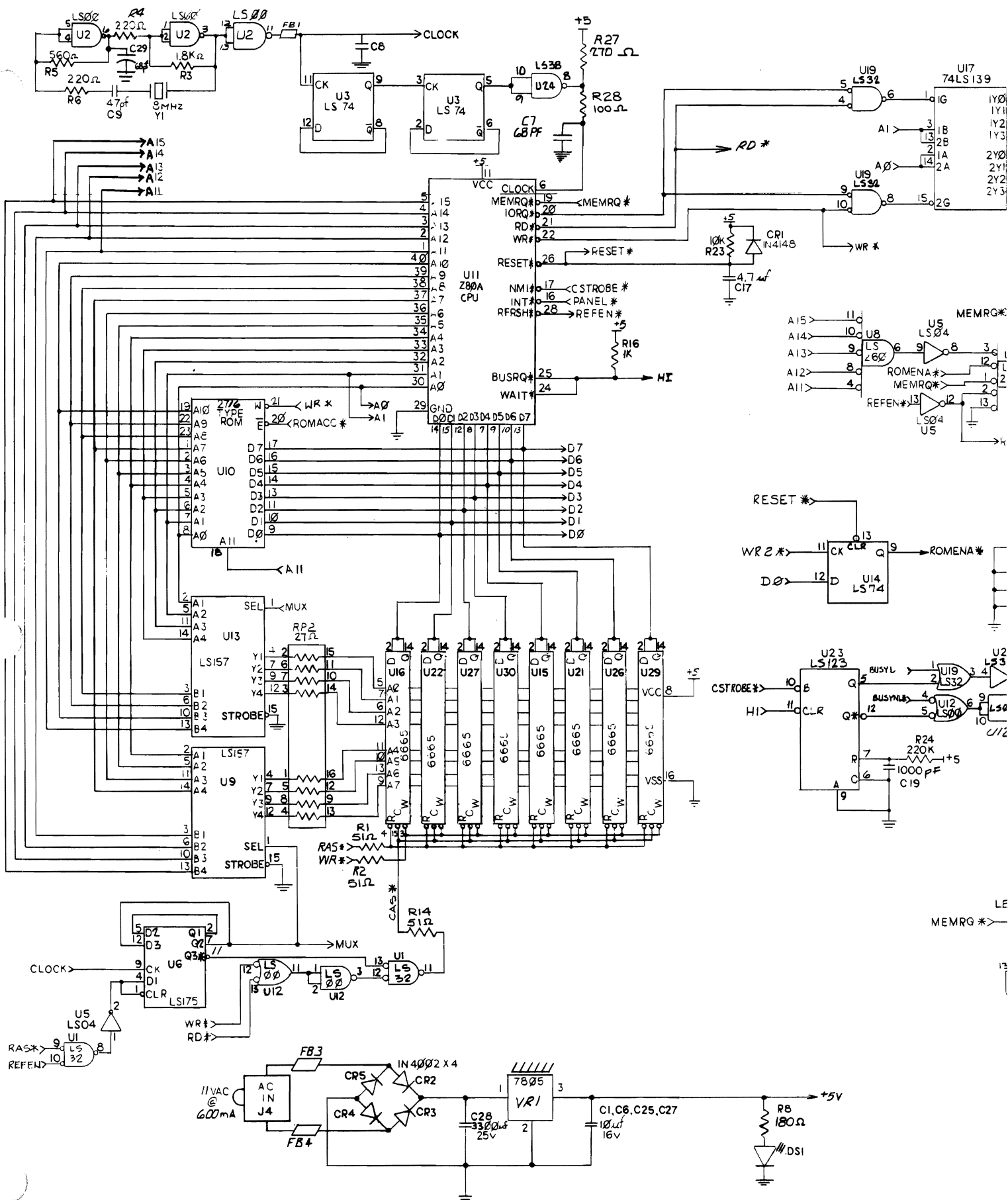
4.3.9 Front Panel Interrupts

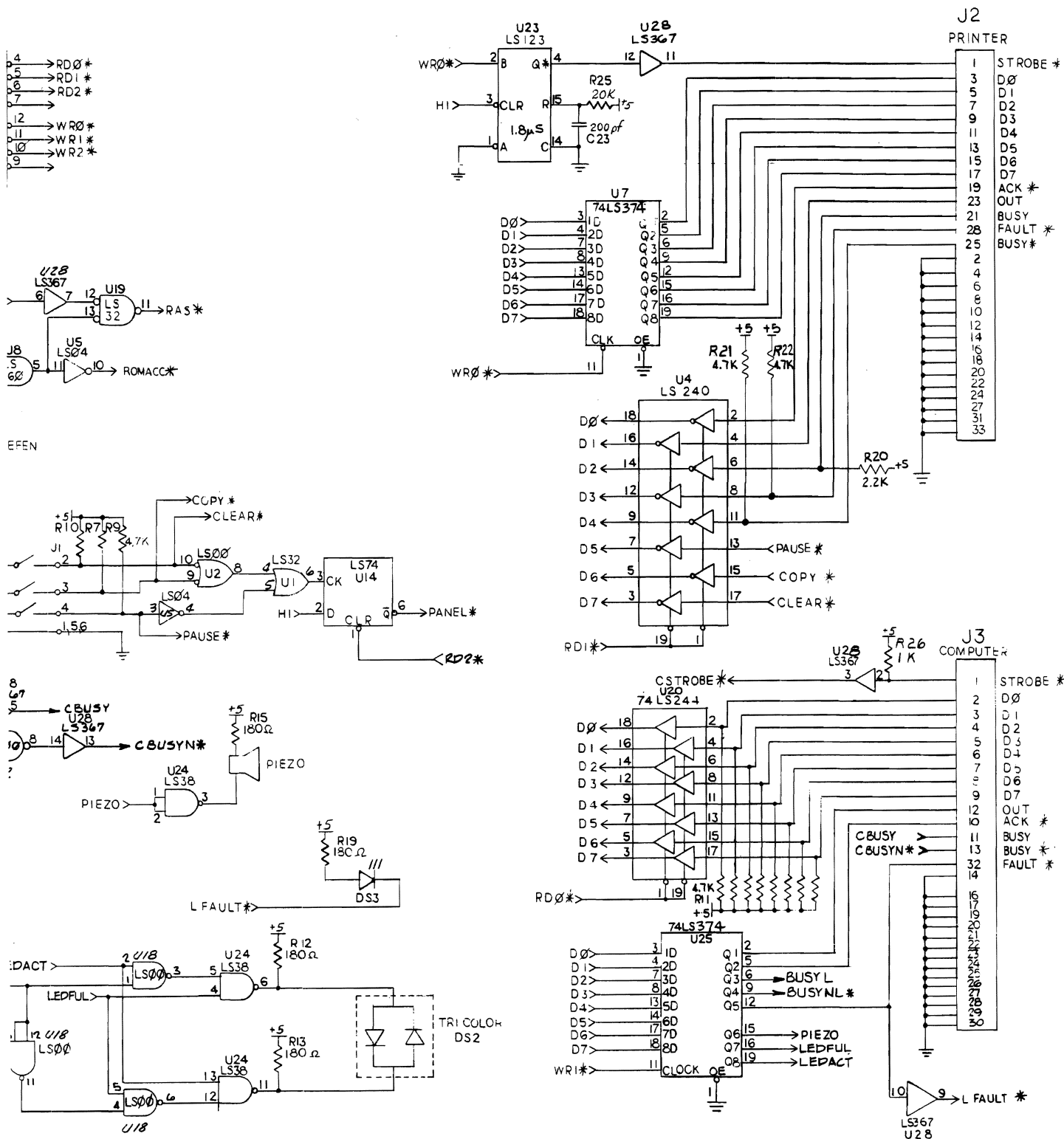
There are three keys on the front panel which are monitored by the processor. They are ORed together to generate a maskable interrupt (INT*) to the Z80 whenever a key is

pressed. To determine which key was pressed, the software reads the Printer Status port. The upper three bits represent the switch status. After processing these keys, the software executes an IN instruction from Port 2. This clears the LS74 latch (U14). This feature prevents keyboard bounce from generating multiple interrupts.

4.3.10 BUSY Generation

The BUSY and BUSY* signals are outputs of OR gates. The inputs to these OR gates are the output of the one-shot generated by outputting a byte of data to the printer port and the designated output bits on Port 1. This is necessary because of the Z80's clock speed. Since it is operating at 2 MHz, the clock cycle is 500 nS. BUSY must be generated within 50 nS of CSTROBE*. Therefore, the only means of meeting this specification is to generate BUSY in hardware. A one-shot generates a BUSY signal which is active for approximately 90 microseconds. During that period, the NMI service routine will turn on BUSY and BUSY* in Port 1. This will ensure that BUSY remains active until the byte is processed.





Schematic 8000177, Printer Controller 26-1269

Revision A

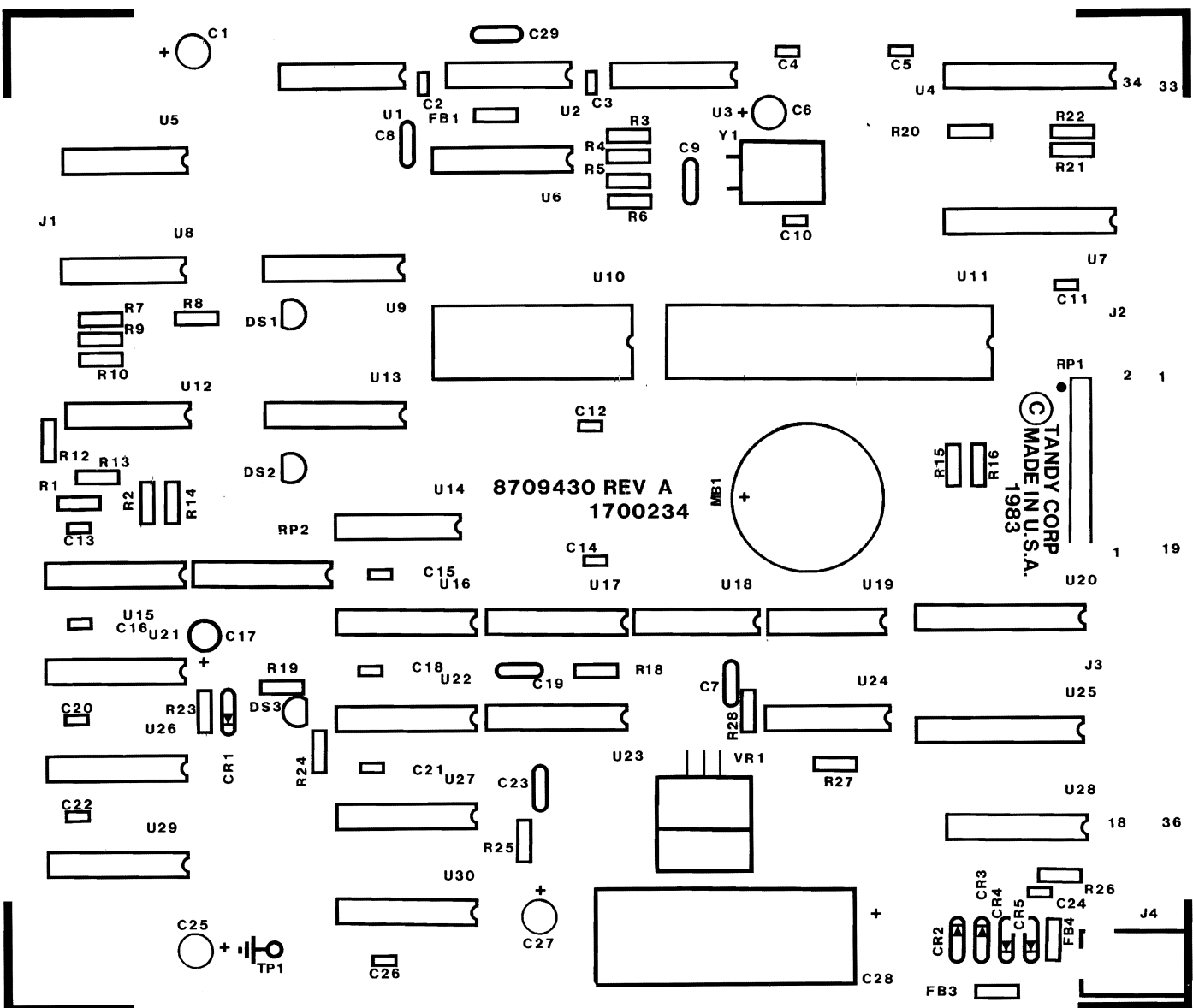


Figure 4-1.

Component Layout, PCB Assembly 8851269
PTC-64 Printer Controller

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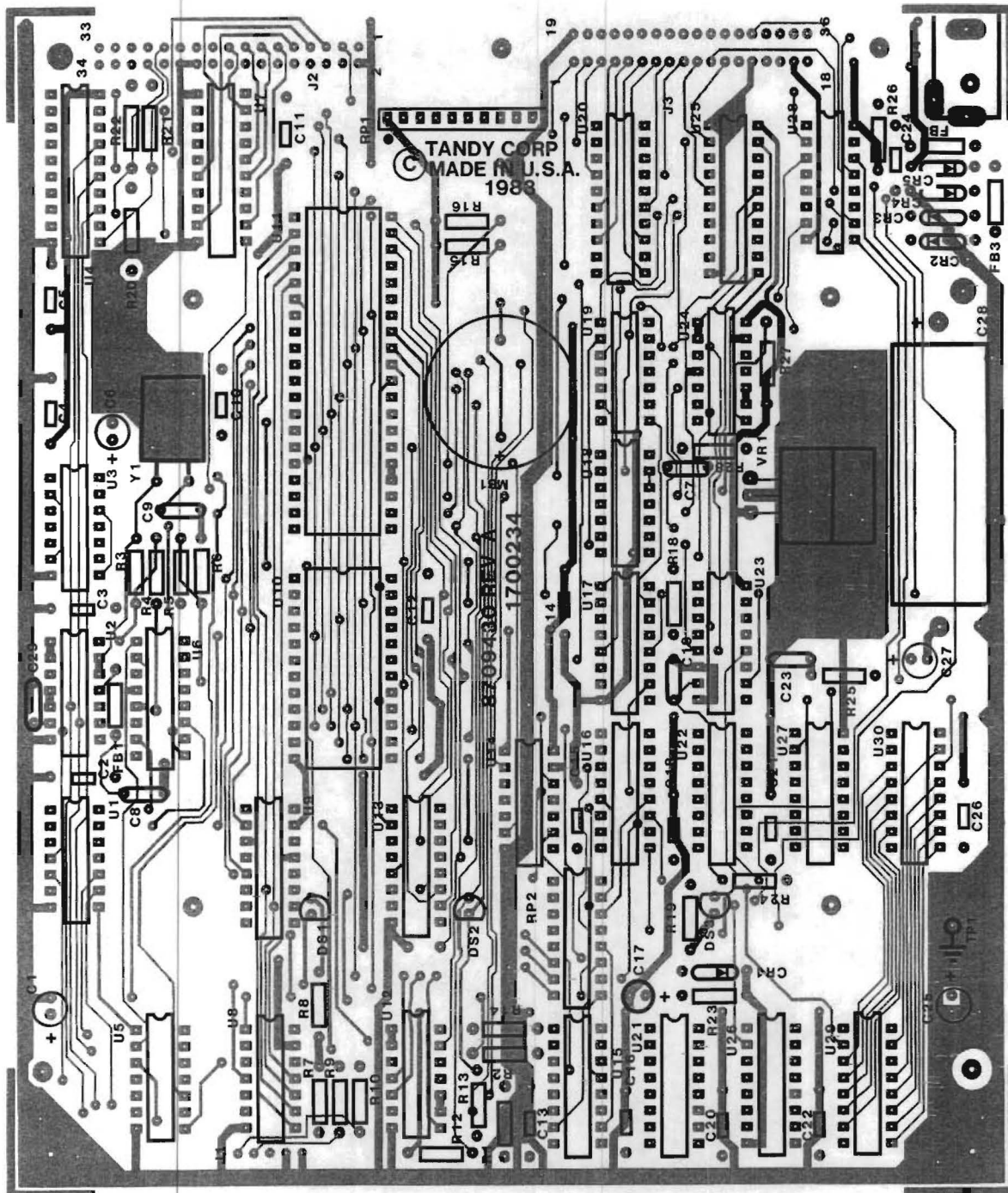


Figure 4-2. Circuit Trace, PCB Assembly 8851269
Component Side

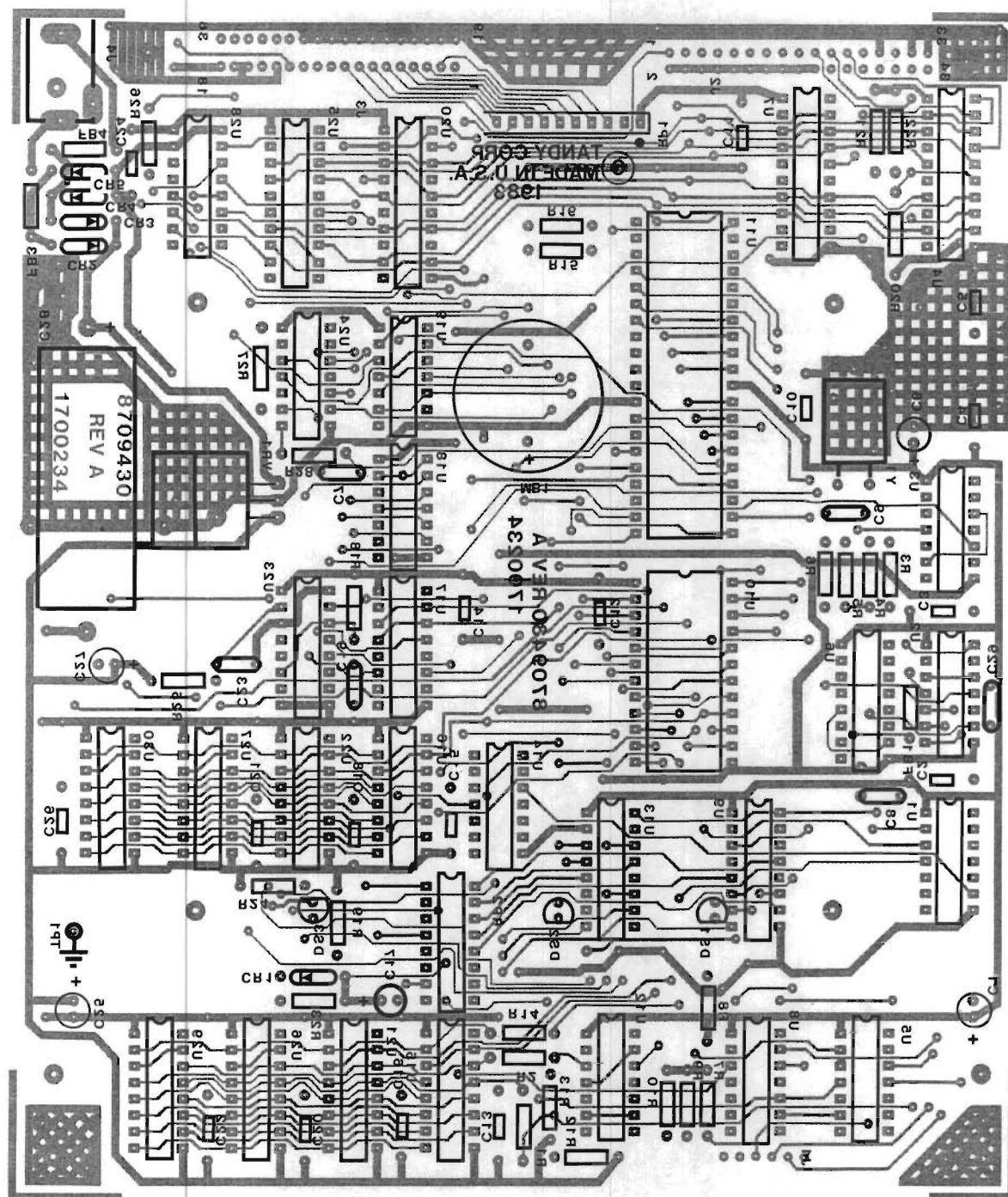


Figure 4-3. Circuit Trace, PCB Assembly 8851269
Solder Side

PARTS LIST, PCB ASSEMBLY 8851269, PTC-64 Assembly

Item	Sym	Description	Mfg P/N
1	1	Printed Circuit Board	8709430
2	1	Connector, 6 Pos (J1)	8519178
3	1	Connector, 34-Pin Rt.Ang.(J2)	8519179
4	1	Connector, 36-Pin (J3)	8519180
5	1	Connector, Power In (J4)	8519111
6	1	Heat Sink, 6070B (VR1)	8549011
7	1	Heat Sink, 6071B (VR1)	8549020
8	1	Screw, #4-40 x 3/8	8569082
9	1	Nut, #4	8579003
10	1	Screw, #6-19 x 1/2	8569087
11	8	Socket, 16-Pin DIP (U15,16, 21,22,26,27,29,30)	8509003
12	1	Socket, 24-Pin DIP (U10)	8509001
13	1	Socket, 40-Pin DIP (U11)	8509002
14	1	Staking Pin (TP1)	8529014
C1		Capacitor, 10 mfd, 16V Axial	8316101
C2		Capacitor, 0.1 mfd, 50V Mono Axial	8374104
C3		Capacitor, 0.1 mfd, 50V Mono Axial	8374104
C4		Capacitor, 0.1 mfd, 50V Mono Axial	8374104
C5		Capacitor, 0.1 mfd, 50V Mono Axial	8374104
C6		Capacitor, 10 mfd, 16V Axial	8316101
C7		Capacitor, 68 pfd, 50V Cer Disk	8300684
C8		Capacitor, 68 pfd, 50V Cer Disk	8300684
C9		Capacitor, 47 pfd, 50V Cer Disk	8300472
C10		Capacitor, 0.1 mfd, 50V Mono Axial	8374104
C11		Capacitor, 0.1 mfd, 50V Mono Axial	8374104
C12		Capacitor, 0.1 mfd, 50V Mono Axial	8374104
C13		Capacitor, 0.1 mfd, 50V Mono Axial	8374104
C14		Capacitor, 0.1 mfd, 50V Mono Axial	8374104
C15		Capacitor, 0.1 mfd, 50V Mono Axial	8374104
C16		Capacitor, 0.1 mfd, 50V Mono Axial	8374104
C17		Capacitor, 4.7 mfd, 10V Elec Rad	8325470
C18		Capacitor, 0.1 mfd, 50V Mono Axial	8374104
C19		Capacitor, 1000 pfd, 50V Cer Disk	8302104
C20		Capacitor, 0.1 mfd, 50V Mono Axial	8374104
C21		Capacitor, 0.1 mfd, 50V Mono Axial	8374104
C22		Capacitor, 0.1 mfd, 50V Mono Axial	8374104
C23		Capacitor, 200 pfd, 50V Cer Disk	8301204
C24		Capacitor, 0.1 mfd, 50V Mono Axial	8374104
C25		Capacitor, 10 mfd, 16V Axial	8316101
C26		Capacitor, 0.1 mfd, 50V Mono Axial	8374104
C27		Capacitor, 10 mfd, 16V Axial	8316101
C28		Capacitor, 4700 mfd, 16V Elec Axial	8317474

PARTS LIST, PCB ASSEMBLY 8851269, PTC-64 Assembly

Item	Sym	Description	Mfg P/N
C29		Capacitor, 68 pfd, 50V Cer Disk	8300684
CR1		Diode, 1N4148	8150148
CR2		Diode, 1N4002	8150002
CR3		Diode, 1N4002	8150002
CR4		Diode, 1N4002	8150002
CR5		Diode, 1N4002	8150002
DS1		Diode, Light Emitting	8469008
DS2		Diode, Tri-Color Light Emitting	8469013
DS3		Diode, Light Emitting	8469008
FB1		Ferrite Bead	8419014
FB2		Not Used	
FB3		Ferrite Bead	8419014
FB4		Ferrite Bead	8419014
MB1		Buzzer, Piezo Electric	8490004
R1		Resistor, 51 ohm, 1/4W 5%	8207056
R2		Resistor, IC, 51 ohm, 1/4W 5%	8207056
R3		Resistor, 1.8K ohm, 1/4W 5%	8207218
R4		Resistor, 220 ohm, 1/4W 5%	8207122
R5		Resistor, 560 ohm, 1/4W 5%	8207156
R6		Resistor, 220 ohm, 1/4W 5%	8207122
R7		Resistor, IC, 4.7K ohm, 1/4W 5%	8207247
R8		Resistor, 180 ohm, 1/4W 5%	8207118
R9		Resistor, 4.7K ohm, 1/4W 5%	8207247
R10		Resistor, 4.7K ohm, 1/4W 5%	8207247
R11		Not Used	
R12		Resistor, 180 ohm, 1/4W 5%	8207118
R13		Resistor, 180 ohm, 1/4W 5%	8207118
R14		Resistor, 51 ohm, 1/4W 5%	8207056
R15		Resistor, 180 ohm, 1/4W 5%	8207118
R16		Resistor, 1K ohm, 1/4W 5%	8207210
R17		Resistor, 1K ohm, 1/4W 5%	8207210
R18		Resistor, 1K ohm, 1/4W 5%	8207210
R19		Resistor, 180 ohm, 1/4W 5%	8207118
R20		Resistor, 2.2K ohm, 1/4W 5%	8207222
R21		Resistor, 4.7K ohm, 1/4W 5%	8207247
R22		Resistor, 4.7K ohm, 1/4W 5%	8207247
R23		Resistor, 10K ohm, 1/4W 5%	8207310

PARTS LIST, PCB ASSEMBLY 8851269, PTC-64 Assembly

Item	Sym	Description	Mfg P/N
R24		Resistor, 220K ohm, 1/4W 5%	8207422
R25		Resistor, 20K ohm, 1/4W 5%	8207320
R26		Resistor, 1K ohm, 1/4W 5%	8207210
R27		Resistor, 150 ohm, 1/4W 5%	8207115
R28		Resistor, 100 ohm, 1/4W 5%	8207110
RP1		Resistor Pack, 4.7K ohm, 10-Pin	8294247
RP2		Resistor Pack, 27 ohm, 16-Pin DIP	8290027
U1		IC, 74LS32, Quad 2-In OR	8020032
U2		IC, 74LS00, Quad 2-In NAND	8020000
U3		IC, 74LS74, Dual Flip Flop	8020074
U4		IC, 74LS240, Octal Buffer	8020240
U5		IC, 74LS04, Hex Inverter	8020004
U6		IC, 74LS175, Quad Flip Flop	8020175
U7		IC, 74LS374, Octal Flip Flop	8020374
U8		IC, 74LS260, 5-In NOR	8020260
U9		IC, 74LS157, Multiplexer	8020157
U10		IC, EPROM 2716, 350ns	
U11		IC, Z80 CPU	8047080
U12		IC, 74LS00, Quad 2-In NAND	8020000
U13		IC, 74LS157, Multiplexer	8020157
U14		IC, 74LS74, Dual Flip Flop	8020074
U15		IC, 6665 RAM, 250 ns	8040665
U16		IC, 6665 RAM, 250 ns	8040665
U17		IC, 74LS139, Decoder	8020139
U18		IC, 74LS00, Quad 2-In NAND	8020000
U19		IC, 74LS32, Quad 2-In OR	8020032
U20		IC, 74LS244, Octal Buffer	8020244
U21		IC, 6665 RAM, 250 ns	8040665
U22		IC, 6665 RAM, 250 ns	8040665
U23		IC, 74LS123, Multivibrator	8020123
U24		IC, 74LS38, Quad 2-In NAND	8020038
U25		IC, 74LS374, Octal Flip Flop	8020374
U26		IC, 6665 RAM, 250 ns	8040665
U27		IC, 6665 RAM, 250 ns	8040665
U28		IC, 74LS367, Hex Bus Driver	8020367
U29		IC, 6665 RAM, 250 ns	8040665
U30		IC, 6665 RAM, 250 ns	8040665
VR1		Voltage Regulator, 7805 +5V	8050805
Y1		Crystal, 8 MHz	8409006

5/ CONNECTOR PIN OUT DESCRIPTIONS

5.1 Parallel Interface Signals and Levels

The 34-pin connector (J2) on the back of the PTC-64 is a parallel interface for connection to a line printer. Eight data bits are output in parallel, and five input data bits are status indicators. All levels are TTL compatible.

The connector pin-outs and signals available are listed on the next page.

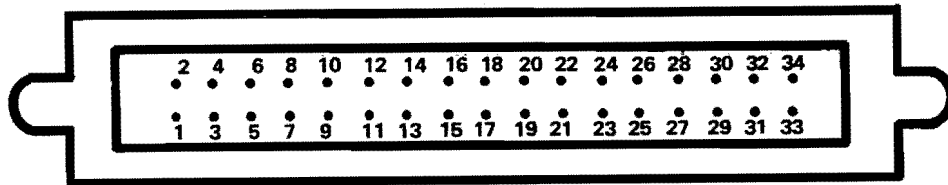


Figure 5-1. J2 Pin Arrangement

Signal	Function	Pin #
STROBE*	1.8μs pulse to clock the data from PTC-64 to printer	1
DATA 0	Bit 0 (lsb) of output data byte	3
DATA 1	Bit 1 of output data byte	5
DATA 2	Bit 2 of output data byte	7
DATA 3	Bit 3 of output data byte	9
DATA 4	Bit 4 of output data byte	11
DATA 5	Bit 5 of output data byte	13
DATA 6	Bit 6 of output data byte	15
DATA 7	Bit 7 (msb) of output data byte	17
ACK*	Input to PTC-64 from Printer, low pulse indicates data byte received	19
BUSY	Input to PTC-64 from Printer, high indicates busy	21
OUT	Input to PTC-64 from Printer, high indicates no paper - if Printer doesn't provide this, signal is forced low	23
BUSY*	Input to PTC-64 from Printer, logical inverse of BUSY	25
FAULT*	Input to PTC-64 from Printer low indicates fault (paper empty, light detect, deselect, etc.)	28
GROUND	Common signal ground	2,4,6,8 10,12, 14,16, 18,20, 22,24, 27,31 33
NC	Not connected	29,30 32,34

*These signals are active-low.

5.2 Parallel Interface

A 36-pin plastic female connector (J3) on the left rear of the PCT-64 allows connection to a computer.

The pin arrangement of the connector, signal summary, and the interface timing are shown below.

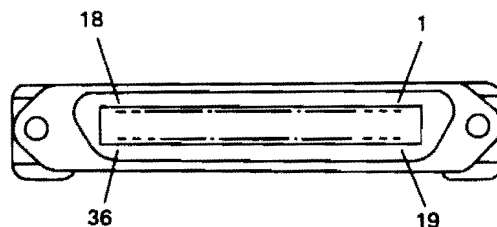


Figure 5-2. J3 Pin Arrangement

Signal Pin	Return Pin	Name of Signals
1	19	STROBE*
2	20	DATA 0
3	21	DATA 1
4	22	DATA 2
5	23	DATA 3
6	24	DATA 4
7	25	DATA 5
8	26	DATA 6
9	27	DATA 7
10	28	ACK*
11	29	BUSY
12	--	OUT (Paper Out)
13	--	BUSY*
14	--	OV
15	--	NC
16	--	OV
17	--	CHASSIS GROUND
18	--	5V (80mA Maximum)
30	--	OV
31	--	NC
32	--	FAULT*
		(Printer Error Condition)
33	--	NC
34	--	NC
35	--	NC
36	--	NC

6/ TROUBLESHOOTING

6.1 Isolate the Problem

If the PTC-64 is not operating, check the Power Supply circuit first. Watch the POWER LED on the front panel; when unit is turned ON, the LED lights. If the LED does not light, turn to Paragraph 6.2. If it does light, ask yourself the following questions.

- 1) Does the beeper sound when you press any key?
- 2) Does the PTC-64 perform a RAM test? (FAULT LED lights upon power-up.)

If you answered "no" to either question, go to Paragraph 6.3. If you answered "yes", continue.

- 3) Does the PTC-64 pass the RAM test? If not, go to Paragraph 6.4.
- 4) Is the message sent correctly to the printer when the Self-Test is performed? If not, go to Paragraph 6.5.

If you answered "yes" to the above questions, but the PTC-64 will not accept correct data from the computer, see Paragraph 6.6.

6.2 Power Supply

Verify that the AC adapter is providing the right AC voltage. The output voltage should be between 11 and 18 volts AC when measured with a DVM. If the AC adapter is working correctly, plug it into the PTC-64 and measure the DC voltage at Pin 1 of VR1 (7805). This input voltage should be at least 7 VDC. If not, replace CR2 - CR5. Measure the output at pin 3; it should be 5 VDC +/- 0.25V. If the output voltage is out of range, replace VR1. Once you have verified that you have a +5 VDC supply, make sure that DS1 (POWER LED) is functioning. If not, replace DS1.

6.3 Processor

The Z-80 microprocessor (U11) depends on many other circuits for proper operation. The first and foremost of these is the clock circuit. Since the Theory of Operation (Section 4) describes all of these circuits, we will simply verify that the clock is working. Put a probe on U3 pin 11 (LS74). This should be an 8 MHz clock (125 ns period). If this is not present, U2 or Y1 is probably bad. Refer to Section 4. If the clock is present, measure U3 pin 5. This should show a 2 MHz clock (500 ns period). If it doesn't, replace U3. If the clock is present, verify that it also exists at pin 6 of U11.

After you have verified that the clock is working correctly, check U11 pin 11 for +5 V. If that voltage is not present, go to section 5.2 Power Supply. If the power supply is working correctly, check pin 26 of U11, the RESET* signal. If this is low, replace the components shown on the schematic for Power On Reset.

Those are the only signals that could prevent the microprocessor from working. If you have found no other solution, replace U11. If the PTC-64 still does not operate correctly, replace the ROM and check the address decoding circuitry. Refer to Section 4.

If the microprocessor is working, but will not recognize any of the keys from the front panel, the interrupt circuitry is not working. There are only two possible reasons that interrupts would not work. Either the keyboard is not working (or not plugged in), or U14, 74LS74, is faulty.

Look at pin 3 of U14 (LS74). It should toggle from ground to +5V when a key is pressed. If it does not then replace the keyboard, otherwise, check pin 6 of U14. It should go to ground when the key is pressed. This signal should also go to pin 16 of U11. If it is not present, replace U14.

If you are getting interrupts, but the PTC-64 is not performing the specified function, it is possible that the proper key is not being returned. Check the inputs to U4 (pins 3,5,7,9,12,14,16,18). If these inputs are toggling, replace U4.

6.4 RAM Replacement

When there is a RAM error, a message is printed that indicates where the error occurred. It will look something like this:

Buffer memory error...Wrote,Read : 55,57

The first number (5) is the hex value written to memory, and the second value (57) is what was read back. The PTC-64 only writes out a 55 and then AA to check all memory bits.

If you get a RAM error message, look at the table below to see which RAMs need replacing. If you still get a memory error after replacing the RAMs, then refer to Section 4 for memory timing description and check-out.

Value Written: 55

Value Read

Suspect Parts

First Digit:

Second Digit:

0	U15,26	0	U16,27
1	U26	1	U27
2	U15,21,26	2	U16,22,27
3	U21,26	3	U22,27
4	U15	4	U16
6	U15,21	6	U16,22
7	U21	7	U22
8	U15,26,29	8	U16,27,30
9	U26,29	9	U27,30
A	U15,21,26,29	A	U16,22,27,30
B	U21,26,29	B	U22,27,30
C	U15,29	C	U16,30
D	U29	D	U30
E	U15,21,29	E	U16,22,30
F	U21,29	F	U22,30

Value Written: AA

Value Read Suspect Parts

First Digit:

Second Digit:

0	U21,29	0	U22,30
1	U15,21,29	1	U16,22,30
2	U29	2	U30
3	U15,29	3	U16,30
4	U15,26,29	4	U16,27,30
5	U15,21,26,29	5	U16,22,27,30
6	U26,29	6	U27,30
7	U15,26,29	7	U16,27,30
8	U21	8	U22
9	U15,21	9	U16,22
B	U15	B	U16
C	U21,26	C	U22,27
D	U15,21,26	C	U16,22,27
E	U26	E	U27
F	U15,26	F	U16,27

6.5 Printer Port

If data is accepted by the PTC-64, but is not printed or not printed correctly, there could be a fault with the Printer Port. The first step is to isolate the problem.

Disconnect the PTC-64 and connect the computer directly to the printer. If the printer is functional, the problem is in the PTC-64. If it is not functional, either your printer is bad or you have a defective cable.

If the PTC-64 is the problem, execute the Self-Test (press the CLEAR and PAUSE keys together) to be sure that the problem is with the Printer Port rather than the Computer Port. At the end of the test, a message will be printed. If it is not printed, or printed incorrectly, proceed with the Printer Port troubleshooting, otherwise, check the Computer Port.

If invalid data is printed, the data latch probably has a stuck bit. Replacing U7 (74LS374) should correct this problem. If no data at all is printed, check pin 4 of U23.

It should generate a 1.8 μ s signal. If you have no signal, replace U23. If the pulse is too short, replace R25 and C23.

There is one other condition that could keep the printer from working. If the PTC-64 could not read good status from the printer, then it would never transmit data, U4 (LS240) is the status register from the printer. Make sure that the proper status is getting to the inputs of that register.

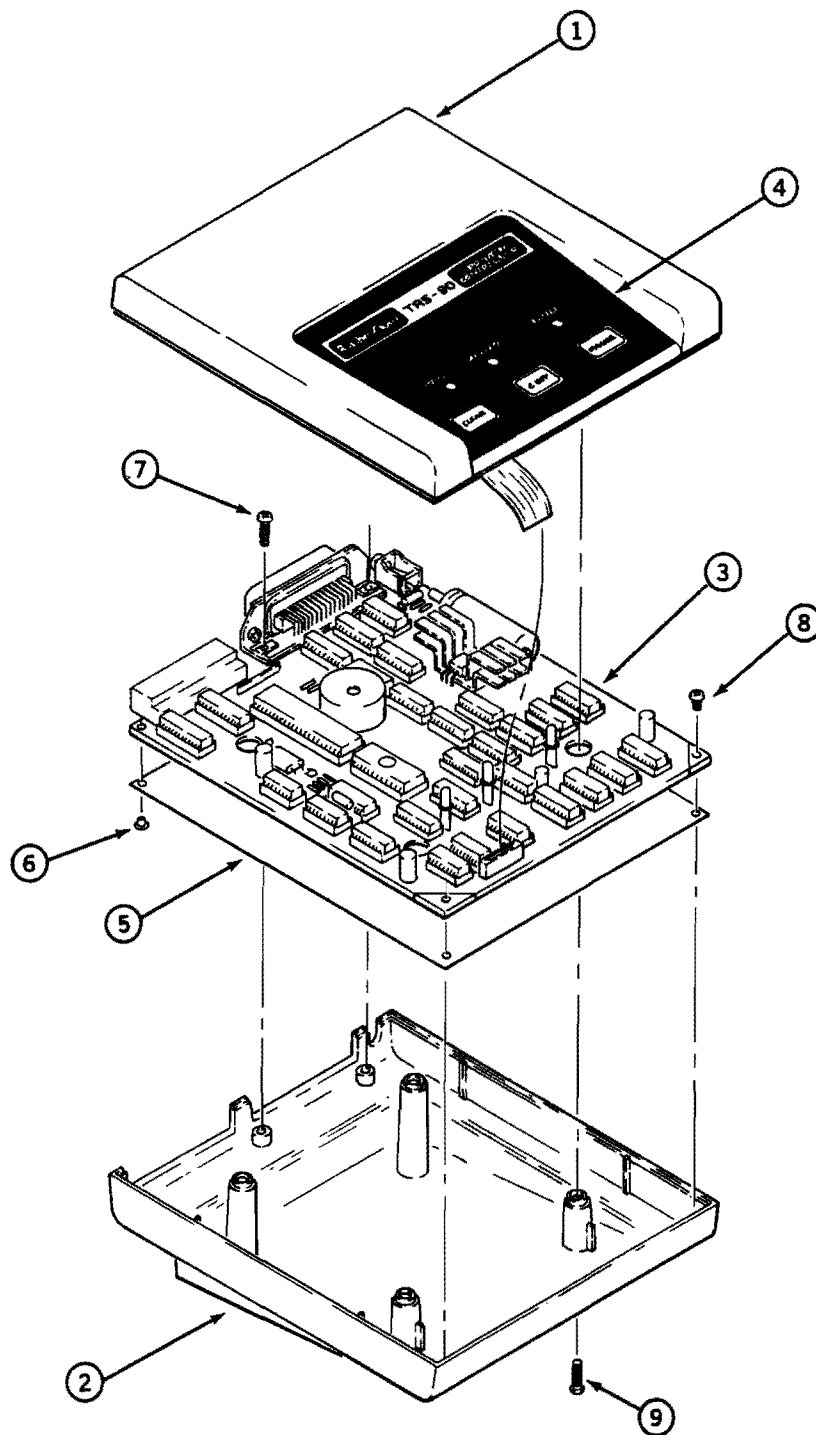
6.6 Computer Port

When the computer has data to transfer to the PTC-64, it first checks the status. If the PTC-64 does not provide good status (not busy, no fault), the computer will not transmit the data.

If no data will print, see if the FAULT LED is lit. If it is, there is a printer fault and the Printer Controller will not accept data. Correct the printer problem.

If the data is being transmitted, yet invalid data being printed, the problem is probably in the data register. Replace U20 (LS244) and begin the troubleshooting tests again.

If no data is being transmitted, (look at STATUS LED), then the STROBE from the computer is not getting to U11. Check U28 pin 3 for an active low pulse. If the pulse is not present, replace U28. One other potential fault could be the computer cable itself. Since STROBE is on pin 1, it is the outside wire of the flat cable and could have problems with intermittent connection. Try replacing the cable.



Exploded View, PTC-64

7/ EXPLODED VIEW WITH PARTS LIST

Printer Controller PTC-64

Ref	Qty	Description	Mfg P/N
1	1	Case, Top	8719325
2	1	Case, Bottom	8719326
3	1	PCB Assembly	8851269
4	1	Membrane Keyboard/Overlay	8790532
5	1	Shield, PCB	8729264
6	2	Trimounts (PCB to Shield)	8559033
7	2	Screw, #4 x 3/8" (connector mount)	8569102
8	2	Screw, #4 x 1/4" (PCB mount)	8569032
9	4	Screw, #6-19 x 1/2" PPH	8569087

MISCELLANEOUS

1	AC Adapter, External	8790053
1	Label, Serial	87891004
1	Label, Backpanel	87891013

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