

Radio Shack®

**Technician Series
Diagnostics Software**

TRS-80®

1/0 PORT TESTER

**OWNERS & SERVICE
MANUAL**

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TECHNICIAN SERIES

TRS-80®

DIAGNOSTIC SOFTWARE

IOTEST3/CMD

Radio Shack®

MODEL III/4 I/O PORT TESTER

- 1 -

Model III & 4 I/O
Port Tester

Introduction:

This is to acquaint you with the use of the Model III/4 I/O Port Tester, a device quite useful in troubleshooting the parallel I/O port on a Model III/4. It will help in verifying the proper operation of the I/O port without the customer bringing in their hard disk or other external devices.

Set Up:

First, connect the ribbon cable provided with the tester to the 50 pin connector on the back of the tester with the cable dressed down. This is the plug on the left as you look at the tester from the back. Next, hook the cable into the I/O port on the computer with the cable dressed out to the rear. Connect the power pack provided, to the tester. Power up the computer first, then turn on the tester. This sequence is important to avoid false errors. The two LED's on the port tester should be illuminated at this time. If this is the first time this tester is being used then proceed to the alignment section.

Executing IOTEST3/CMD:

You should type in: IOTEST3 <ENTER>

You should initially see:

***** MODEL III I/O PORT TEST *****

VERSION 2.4

AUG 3, 1983

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PRESS ANY KEY TO CONTINUE

The next prompt after this will be:

DO YOU WANT TO TEST THE "RESET" SIGNAL ? (Y/N OR <ENTER>)

If you elect to use this portion of the test you will be required to use the <RESET> button. This will necessitate having to re-install the program. Resetting should turn off both of the LED's at this time because the "RESET" signal clears the D latches that power the LED's. The RESET TEST should always be done the first time a unit is checked.

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MODEL III/4 I/O PORT TESTER

The next prompt after the RESET TEST will be:

ENTER THE CONTROL PORT VALUE IN HEX (<ENTER> = CF HEX)

Use the default value for this test.

The menu should now appear:

MENU

- (A) AUTO TEST MODE
- (L) LOOP TEST MODE
- (S) SINGLE TEST MODE
- (P) CHANGE PORT VALUE
- (Q) QUIT TO OPERATING SYSTEM

- (1) ADDRESS & DATA SIGNAL TEST
- (2) ADDRESS SIGNAL ONLY TEST
- (3) FORCED INTERRUPT TEST
- (4) "WAIT" SIGNAL TEST

SELECT TEST MODE ? (A/L/S/P/Q)

You must first select the Mode that is to be used, then test number desired. <BREAK> will get out of any test, and return to the menu.

Test Descriptions:

- (A) AUTO MODE: This test will automatically proceed to the ADDRESS & DATA SIGNAL TEST. If this test passes, then it will skip ADDRESS ONLY TEST and go to the INTERRUPT and WAIT tests. If test (1) fails then the ADDRESS ONLY TEST becomes an option by the user to help trace the error.
- (S) SINGLE TEST MODE: If this mode is selected then any test (1-4) will be executed once.
- (L) LOOP TEST MODE: This test will continually loop through any selected test (1-4). LOOP TEST is quite useful when troubleshooting with an oscilloscope because all signals are repetitive. You can exit LOOP TEST by hitting <BREAK>.
- (Q) QUIT TO OPERATING SYSTEM: Returns to TRSDOS.

Detailed Test Descriptions:

(1) ADDRESS & DATA SIGNAL TEST: This test exercises the A0-A7, D0-D7, OUT*, IN*, and EXTIOSEL ports. In this test, data is written out and certain ports are avoided. Data is read back to test for any change. Errors are displayed on the screen. If the RESET test was not done previously, this test will fail the first time through. In AUTO or SINGLE modes only eight errors can be displayed. In LOOP the first eight are shown, then it waits for any key to be depressed to continue the test. All data written out in LOOP is only one bit set at a time.

(2) ADDRESS ONLY TEST: This test generates (OUT 0CFH) and (OUT 030H) signals to toggle the two LED's on and off. Test points and instructions are also displayed.

(3) INTERRUPT TEST: Data signal, (OUT 0CFH), is fed into EXTIOBUS* port which causes the interrupt. A software flag tests as to whether the interrupt servicing routine has ever been accessed, and displays result.

(4) "WAIT" SIGNAL TEST: This test generates the prompt, PLEASE WAIT 3 SECONDS. The one shot signal is generated periodically and fed to the WAIT* line. The CPU is forced into a WAIT state during the one shot.

Port Analysis:

"xF" Each write to this port will generate a "wait". This will cause LED A to change states.

Bit 0 A "1" written to this bit will generate an interrupt.

Bit 1 Not Used.

Bit 2 A "1" written to this bit will generate a DRQ pulse

Bit 3-7 Not Used.

"x0" Each write to this port will cause LED B to change states.

Bit 0 Not Used.

Bit 1 A "1" written to this bit will enable the RAMS.

Bit 2 Not used.

Bit 3 A "1" written to this bit will enable the DATA buffer.

Bit 3-7 Not Used.

TECHNICIAN SERIES

TRS-80®

DIAGNOSTIC SOFTWARE

I/O PORT TESTER SERVICE SECTION

Radio Shack®

MODEL III/4 I/O PORT TESTER

- 5 -

Alignment, Troubleshooting, and Theory

If this is the first time that this tester has ever been used, it will probably require some calibration. The one shot, which is used in the WAIT test will have to be set to 1ms. Use your oscilloscope on Pin 4 of U11. The INTERRUPT or WAIT test set for LOOP mode will provide continuous pulses from the one shot. Adjust R8, the pot next to the Dip Switch, until a 1ms pulsewidth is obtained. WAIT also checks if a 1ms wait will cause RAM refresh problems, so if there are problems with the program getting lost, shorten the one shot duration and run the test again.

Portions of U12 and U14 are used to light the LED's. If the LED's do not go off when doing the RESET test, look at Pin 13 on U12 or Pin 1 on U14 and hit <RESET>. These pins should go low, resetting the latches and turning off the LED's.

U3 is a bi-directional data buffer, a low on Pin 11 permits data flow in, a high switches it to data out. This IC would be a good suspect if the tester doesn't respond to the computer.

U1 and U2 are 2114 RAM's used to temporarily store data while testing. U16 and 1/2 of S1 are used as decoders for "3x" data, U13 and the other half of S1 are decoders for the "Cx" data. RAM Enable is controlled by 1/2 of U15.

1/2 of U9 is a one shot used in the WAIT SIGNAL TEST. It is the adjustable one shot mentioned previously. 1/2 of U12 and an inverting buffer in U11 are also used in conjunction.

The 'CF' decoder consists of U10, U7, and U5. The '30' decoder is U5, U6, U7, and U10. Refer to schematic for specific sections and pinouts used.

This is a table of address equivalents that can be set by the Dip Switches.

S1					S2			
"xF"	1	2	3	4	"x0"	5	6	7 8
0F	on	on	on	on	00	on	on	on on
1F	off	on	on	on	10	off	on	on on
2F	on	off	on	on	20	on	off	on on
3F	off	off	on	on	30	off	off	on on
4F	on	on	off	on	40	on	on	off on
5F	off	on	off	on	50	off	on	off on
6F	on	off	off	on	60	on	off	off on
7F	off	off	off	on	70	off	off	off on
8F	on	on	on	off	80	on	on	on off
9F	off	on	on	off	90	off	on	on off
AF	on	off	on	off	A0	on	off	on off
BF	off	off	on	off	B0	off	off	on off
CF	on	on	off	off	C0	on	on	off off
DF	off	on	off	off	D0	off	on	off off
EF	on	off	off	off	E0	on	off	off off
FF	off	off	off	off	F0	off	off	off off

Construction Notes

S4 is a 14 pin socket in a 20 pin position, pin 1 matches pin 1

R10 is connected from U11 pin 12 (at the feed thru) to +5 vdc (at 'C7')

W1 connects the 2 8pin holes on the PCB near J1 and J2. The holes are numbered in order and hole 1 is on the same end in each set. The holes are connected 1-1, 2-2, ..., 8-8.

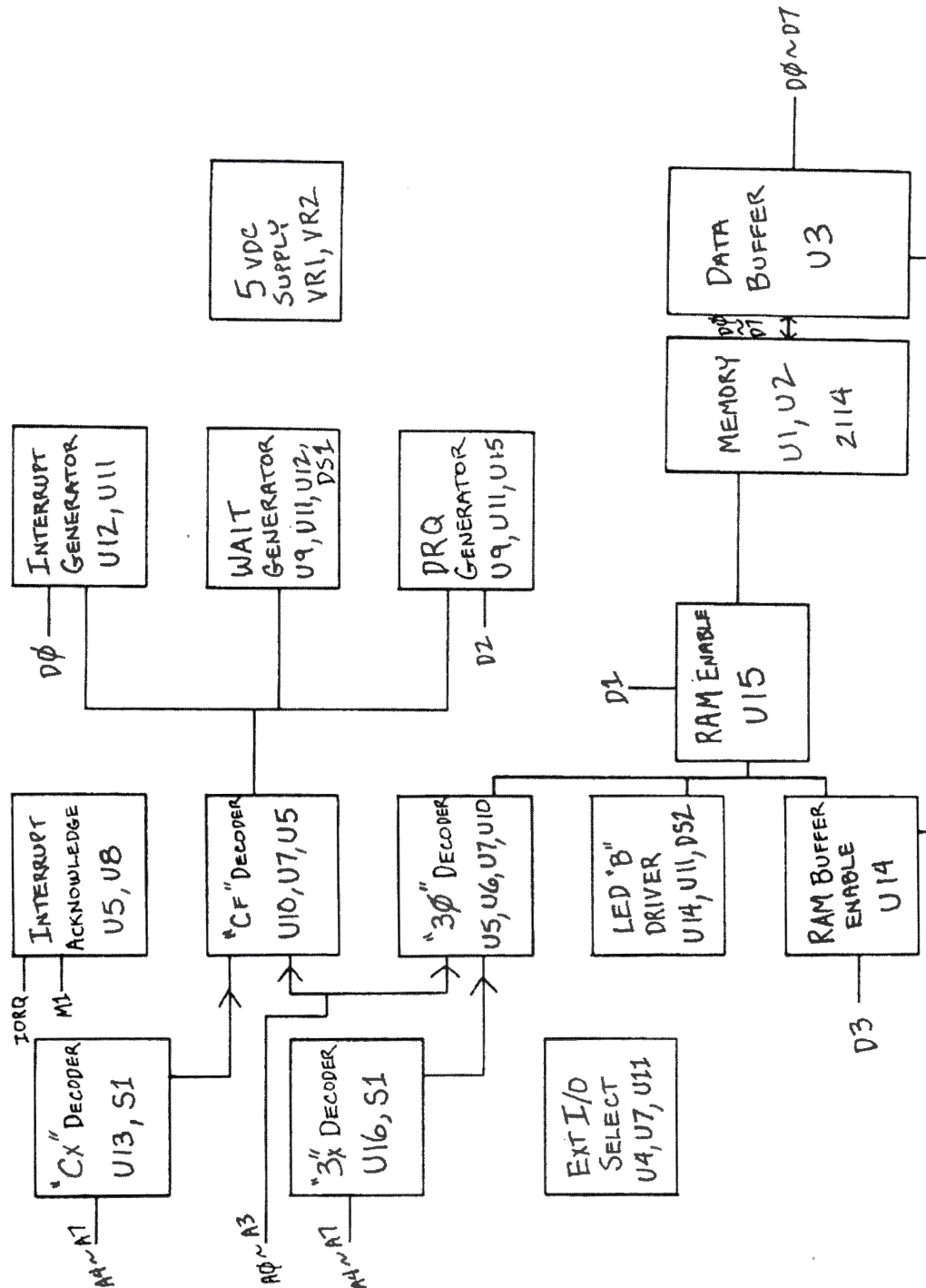
W2 connects pin 1 of U8 (at the feed thru) to pin 2 of U4

W3 connects pin 1 of U4 to pin 10 of U7

J3 is the Model III connector and J1 is the Model II connector

Testing

Set dip switch S1 to 1,2,7, &8 on and 3,4,5,&6 off. Turn R8 and R9 to the center position. The Power supply should be plugged into P1. The 50pin cable should then be plugged into J2 on the I/O port tester and into the expansion buss on the Model III. The Model III and the I/O port tester are then turned on. The diagnostic disk should then be booted. Run the program 'IOTEST3'. Do not test reset, default the port address to CF, and proceed to the AUTO test. If the tester is functioning properly, all four tests should pass.



BLOCK DIAGRAM

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MODEL III/4 I/O PORT TESTER

I/O PORT TESTER PARTS LISTING

Parts list for the I/O port tester

SYM	Name	Part No.	Vendor
-	PC Board	1700220	Tech Supp

Connectors

P1	Connector 5-pin din	8519002	Tandy inst
J1	Connector 50-pin	8519117	Tandy inst.
J2	Connector 50-pin	8519117	Tandy inst.

Wires

W1	6" 8 cond wire		Tandy W & C
W2	3" #30 KYNAR		Generic
W3	3" #30 KYNAR		Generic
W4	2' 50 cond cable		Tandy W & C

Power supply

T1	Network III type power supply	8790002	Tandy Dist. prod.
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Mechanical parts

VR2	Heat sink, top	8549003	Tandy inst.
VR2	Heat sink, bottom	8549004	Tandy inst.
10	Case top	8719191	Tandy app.
10	Case bottom	8719190	Tandy app.
20	Rubber foot, rear 1/4"	8590119	Tandy app.
20	Rubber foot, front 7/16"	8589005	Tandy app.
60	Screw 4 X 1/2 (PC board)	8569151	Tandy app.
40	Screw #4 X 3/4 (case)	8569149	Tandy app.
10	Nut keep #4-40	8579003	Tandy app.
10	Screw #4-40 X3/8"	8569002	Tandy app.

Capacitors

C21	capacitor, .01uf 50V 10% mono	8383104	Tandy inst.
C19	capacitor, .02uf 100V 20% poly	8353225	Tandy inst.
C20	capacitor, .02uf 100V 20% poly	8353225	Tandy inst.
C1	capacitor, .1uf 50V mono rad.	8384104	Tandy inst.
through			
C16	capacitor, .1uf 50V mono rad.	8384104	Tandy inst.
C18	capacitor, 22uf 16V Elec. rad.	8326221	Tandy inst.
C17	capacitor, 470 uf 35V elec rad		Home computers

Switches

S2	Switch, PWR ON/OFF	8489036	Tandy inst.
S1	Switch, 16-pin dip spst	8489004	Tandy inst.

Resistors

R1	resistor, 220 ohm 1/4 W 5%	8207122	Tandy inst.
R2	resistor, 220 ohm 1/4 W 5%	8207122	Tandy inst.
R4	resistor, 470 ohm 1/4 W 5%	8207147	Tandy inst.
R10	resistor, 470 ohm 1/4 W 5%	8207147	Tandy inst.
R3	resistor, 5.1k ohm 1/4 W 5%	8207251	Tandy inst.
R7	resistor, 5.1k ohm 1/4 W 5%	8207251	Tandy inst.
R6	resistor, 47k ohm 1/4 W 5%	8207347	Tandy inst.
R5	resistor, 4.7k ohm 1/4 W 5%	8207247	Tandy inst.
RP1	resistor, 4.7k ohm sip 8-pin	8292246	Tandy inst.
RP2	resistor, 4.7k ohm sip 8-pin	8292246	Tandy inst.

IC sockets

S4	Socket, 14-pin	8509008	Tandy inst.
S5	Socket, 14-pin	8509008	Tandy inst.
S6	Socket, 14-pin	8509008	Tandy inst.
S7	Socket, 14-pin	8509008	Tandy inst.
S8	Socket, 14-pin	8509008	Tandy inst.
S10	Socket, 14-pin	8509008	Tandy inst.
S11	Socket, 14-pin	8509008	Tandy inst.
S12	Socket, 14-pin	8509008	Tandy inst.
S14	Socket, 14-pin	8509008	Tandy inst.
S15	Socket, 14-pin	8509008	Tandy inst.
S9	Socket, 16-pin	8509003	Tandy inst.
S13	Socket, 16-pin	8509003	Tandy inst.
S16	Socket, 16-pin	8509003	Tandy inst.
S1	Socket, 18-pin	8509006	Tandy inst.
S2	Socket, 18-pin	8509006	Tandy inst.
S3	Socket, 20-pin	8509009	Tandy inst.

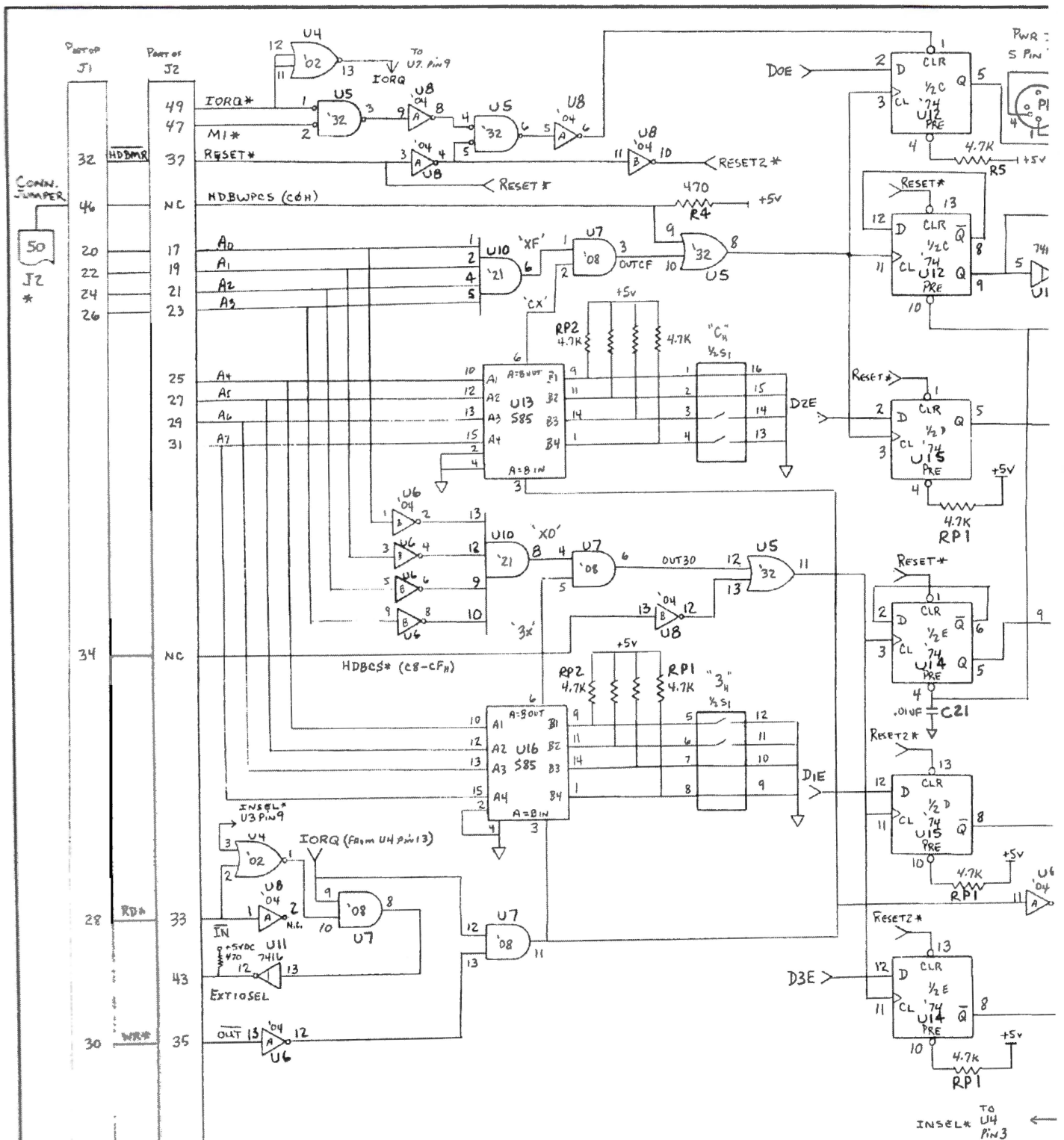
IC's

U11	IC 7416 Hex inverter	8000016	Tandy inst.
U13	IC 74S85 Comparator	9010085	Tandy inst.
U16	IC 74S85 Comparator	9010085	Tandy inst.
U6	IC 74LS04 Hex inverter	8020004	Tandy inst.
U8	IC 74LS04 Hex inverter	8020004	Tandy inst.
U7	IC 74LS08 Quad 2-in AND	8020008	Tandy inst.
U5	IC 74LS32 Quad 2-in OR	8020032	Tandy inst.
U12	IC 74LS74 Flip-Flop	8020074	Tandy inst.
U14	IC 74LS74 Flip-Flop	8020074	Tandy inst.
U15	IC 74LS74 Flip-Flop	8020074	Tandy inst.
U4	IC 74LS02 Nor gate	8020002	Tandy inst.
U9	IC 74LS123 Multivibrator	8020123	Tandy inst.
U3	IC AM8303 BUS transceiver	8060303	Tandy inst.
VR2	Voltage Regulator 7805 1.5A	8050805	Tandy inst.
U1	RAM 2114	8042114	Tandy app.
U2	RAM 2114	8042114	Tandy app.
VR1	Bridge rectifier VM28		Home comp

Leds

DS1	LED, red assy	8469012	Tandy inst.
DS2	LED, red assy	8469012	Tandy inst.

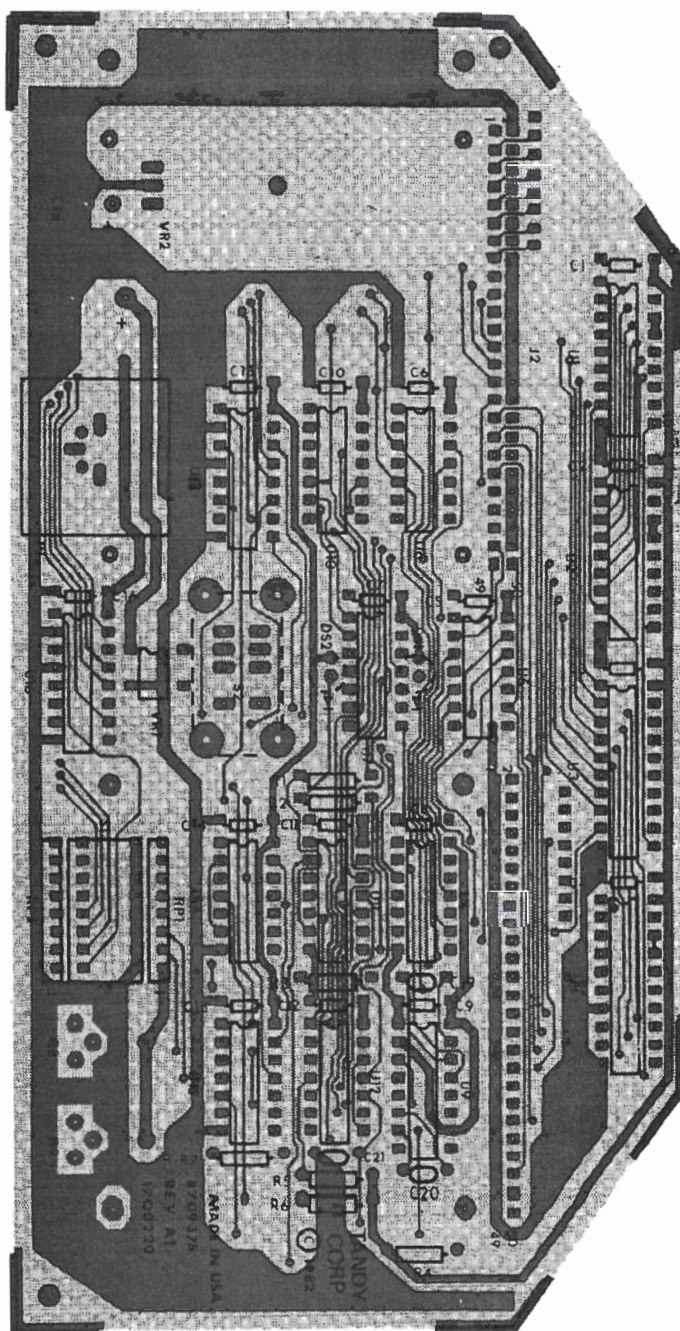
SCHEMATIC DIAGRAMS



MATERIAL	UNLESS OTHERWISE SPECIFIED
	TOLEI
FINISH	.XX = ± .010
	ANGL
	HOLE DIA
	.014 - .251
DIMENSIONS / AND APPLY A	.251 - .75
	.751 - U
	DO NOT SCALE

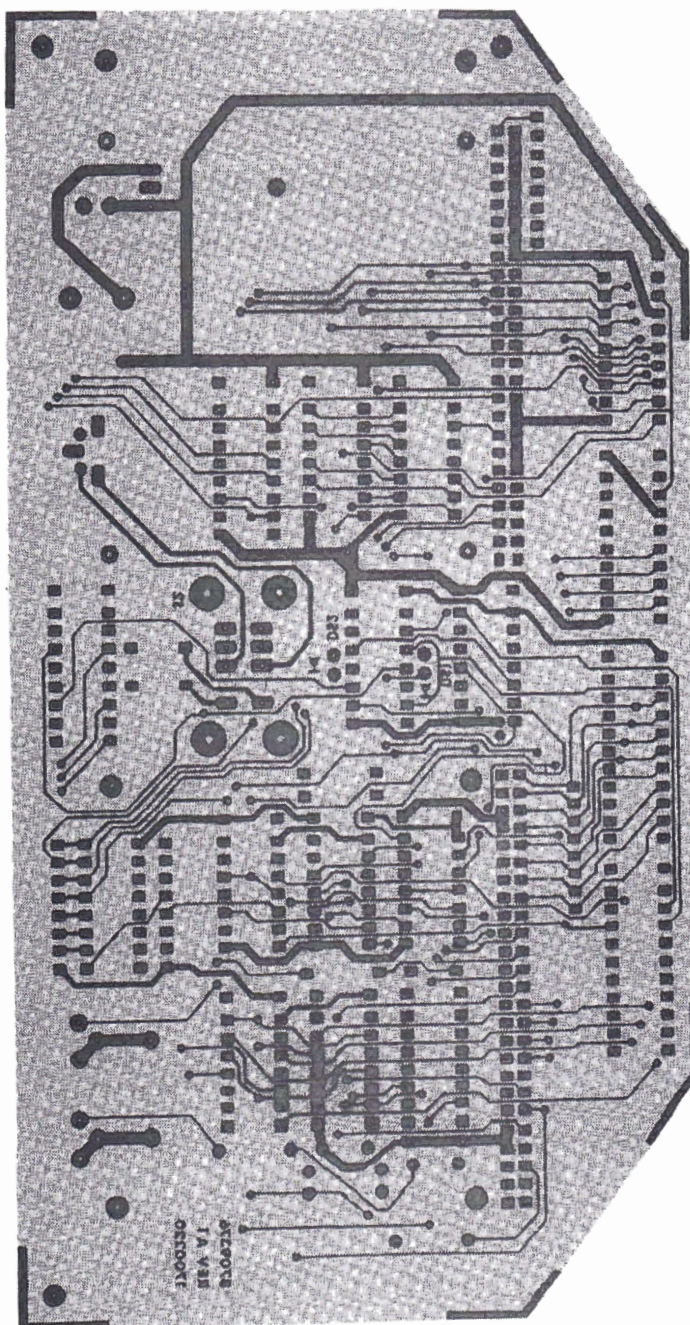
PC BOARD LAYOUT

*Wires**U4 Pin 1 - U7 Pin 10**U4 Pin 2 - U8 Pin 1**V+ - U4 Pin 12*



PC BOARD TOP VIEW

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MODEL III/4 I/O PORT TESTER



PC BOARD BOTTOM VIEW

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MODEL III/4 I/O PORT TESTER

Troubleshooting Hints:

The Address & Data Signal Test is the most complete test of the I/O bus. If you get an error, execute the Address Only Test. This will isolate it to one of the two busses by checking the address but not the data bus. If no errors are found on this test then it would be a good guess that the data bus is the source of the errors on the A & D Signal Test. Use your oscilloscope to check for data (or lack of it) on the suspect bus.

In troubleshooting a failure on the interrupt test, it would be best to start at the I/O Port connector and step back through the interrupt circuitry using the oscilloscope to follow the signal. Use LOOP mode to get continuous interrupts.

Troubleshooting for failures on the WAIT Test should be done using the same techniques as on the interrupt test, check back through the wait circuitry to the Z-80.

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