

TESTING THE 6502 ADDRESS LINE

With a 6502 address line tester, you can test all address lines on any logic board that uses a 6502 chip.

When the 6502 receives instruction hex EA (a NOP), it does nothing except increment the program counter and read the next instruction. If the next instruction is also a NOP, the microprocessor is forced to count through all 65,536 possible addresses on its 16-bit address bus.



If you then monitor the address bus lines with an oscilloscope, each address line will display a square wave, with a period twice that of the next lower address line. This gives you a predictable set of signals to trace.

TOOLS REQUIRED

1. Wire cutters
2. Soldering iron
3. Solder

PARTS REQUIRED

1. 40-pin wire wrap socket (not available from TeleVideo)
2. 6502 microprocessor (Part No. 2049600)
3. Jumper wire

PROCEDURE

Construction of test assembly:

1. Cut pins 26 through 33 on the bottom of the wire wrap socket by about 1/4 inch. This will prevent them from making contact with the pins in the socket of the pcb (see Figure 24-1).
2. Wire pins 29, 31, and 33 to pin 1 (ground), and pins 26, 27, 28, 30, and 32 to pin 8 (+5V) to force the hex EA instruction on the data bus (see Figure 24-1).
3. Plug the 6502 into the wire wrap socket. Make sure that its notch faces in the same direction as the notch on the wire wrap socket (see Figure 24-1).

Operation of test assembly:

1. Remove the 6502 CPU from the board to be tested and set it aside.
2. Install the test assembly (with a known good 6502) in the wire wrap socket. Make sure that the notch faces in the same direction as that on the other chips.
3. Apply power to the logic board.
4. Inspect the address lines for the wave forms listed in Table 24-1.
5. If you do not detect any pulses on the address lines, check for the following signals:

Pin	2	Ready (should be high)
	8	+5V
	37	Phase 0 clock
	38	Set overflow (should be high)
	40	Reset (should be high)

If any of these inputs are held in an incorrect state, the microprocessor will not work. Before continuing, correct any problems with these lines.

Figure 24-1 shows a top and a bottom view of the wire wrap socket.

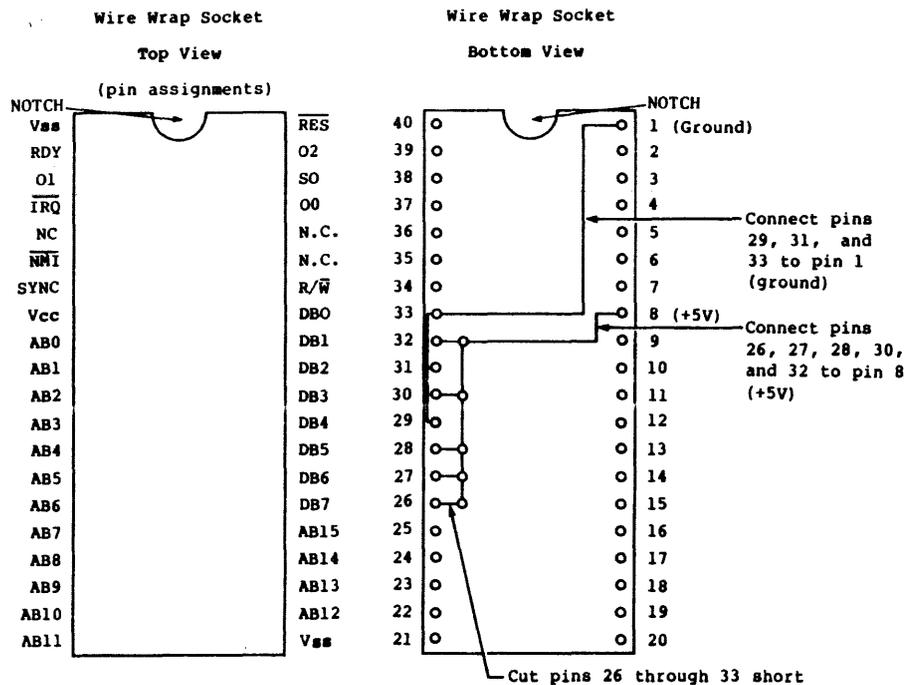


Figure 24-1 Wire Wrap Socket

Table 4-1

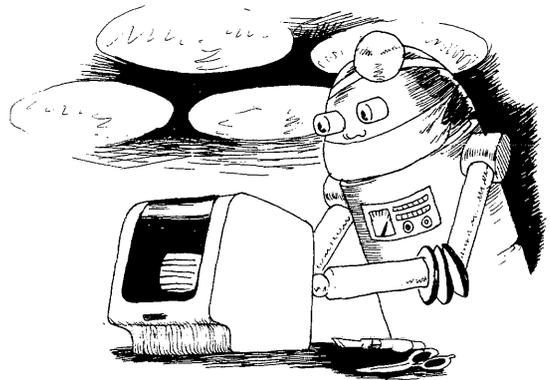
Expected Wave Forms

Pin No	Name	Wave form
1	Vss	Ground
2	RDY	+5V
3	O1 (out)	.6u second period square wave
4	IRQ	+5V noisy
5	N.C.	Ground
6	NMI	+5V noisy
7	SYNC	1.2u second period square wave
8	Vcc	+5V
9	AB0	2.4u second period square wave
10	AB1	4.8u second period square wave
11	AB2	9.6u second period square wave
12	AB3	19.2u second period square wave
13	AB4	38.4u second period square wave
14	AB5	76.8u second period square wave
15	AB6	150u second period square wave
16	AB7	.3m second period square wave
17	AB8	.6m second period square wave
18	AB9	1.2m second period square wave
19	AB10	2.4m second period square wave
20	AB11	4.8m second period square wave
21	Vss	Ground
22	AB12	9.6m second period square wave
23	AB13	19.2 second period square wave
24	AB14	38.4m second period square wave
25	AB15	76.8m second period square wave
26	DB7	Tied high
27	DB6	Tied high
28	DB5	Tied high
29	DB4	Tied low
30	DB3	Tied low
31	DB2	Tied low
32	DB1	Tied high
33	DB0	Tied low
34	R/W	4V to 4.5V noisy
35	N.C.	Ground noisy
36	N.C.	Ground noisy
37	O0 (in)	.6u second period square wave with ringing
38	S.O.	+5V noisy
39	O2 (out)	.6u second period square wave
40	RES	+5V noisy

WAS THAT CHIP DEFECTIVE, OR JUST A VICTIM OF ESD?

Is your normally reliable terminal suddenly suffering from mysterious glitches and component failures? If so, electrostatic discharge (ESD) could be the culprit.

ESD is by far the most common cause of component failure. The released static charge can damage or destroy circuitry both before and after you install a component. And while some electronic components are less susceptible to ESD than others, most can be affected. ESD can even damage input-protected devices such as EPROMs.



ESD does not always cause instant failure. Because it often causes miniscule degradations of a circuit, a component may function for some time before it mysteriously fails or causes glitches.

Even small amounts of voltage can affect components. A 100-volt charge is enough to damage EPROMs, but you probably would not realize ESD was causing any damage. Most people can not hear or feel ESD unless it's above 3,000 volts. You can generate and hold a charge ten times that amount just by walking across a synthetic carpet.

Avoid ESD damage by setting up your workstation to minimize static build-up. We recommend the following precautions:

1. Wear a wrist grounding strap, grounded through a 1-megohm resistor, when handling components. Be sure it's attached to a metal conduit, pipe, or building frame.
2. Hold boards by their edges to avoid touching pins, traces, connectors, etc. Never slide or throw boards or components.
3. Wear antistatic smocks and cotton gloves. Keep clothing (especially synthetic clothing) away from static-sensitive devices.
4. Use equipment that helps prevent static charge build-up--conductive table mats, for example. Use only static-protective bags and containers.
5. Avoid using parts you know have been mishandled or improperly stored.

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Service Bulletin

Issue No. 58

MODIFYING THE 955 LOGIC BOARD TO ELIMINATE FALSE "P3ER" ERROR

When using the main RS232 port of the 955 terminal, you may experience a false "P3ER" on the status line while communicating in block mode and half duplex with pins 4 and 5 jumpered together. The modification steps described here will eliminate false "P3ER" error.

TOOLS REQUIRED

1. Medium Phillips Screwdriver
2. 3/16-inch nut driver
3. 25-watt soldering iron
4. Solder
5. X-ACTO knife or single-sided razor blade

PARTS REQUIRED

1. 22-gauge jumper wire

NOTE: There are two types of 955 logic boards. Determine which one you have so that you can perform the correct modification. The long logic board (10 7/8" x 8 1/4") completely covers the bottom of its tray. The short logic board (8 7/8" x 8 1/4") only covers three-fourths of its tray.

WARNING! DO NOT OPEN THE CASE UNLESS YOU ARE A QUALIFIED TECHNICIAN. OPENING THE CASE EXPOSES YOU TO POTENTIAL SHOCK HAZARDS.

BE CAREFUL WHEN YOU REMOVE AND MODIFY THE LOGIC BOARD. ANY DAMAGE INCURRED WHILE PERFORMING THIS MODIFICATION MAY RESULT IN EXPENSIVE FACTORY REPAIR.

PROCEDURES

1. Turn off the terminal.
2. Unplug the power cord from the wall outlet and the terminal.
3. Disconnect the keyboard cable from the RJ-11 connector and any RS-232C cables from the main and printer ports.
4. Turn the terminal's screen away from you. Remove the two Phillips screws that hold the logic board tray in place.
5. Pull the logic board tray toward you to remove it. You must disconnect the red (P5) and white (P2) logic board connectors to slide the tray completely out of the terminal.

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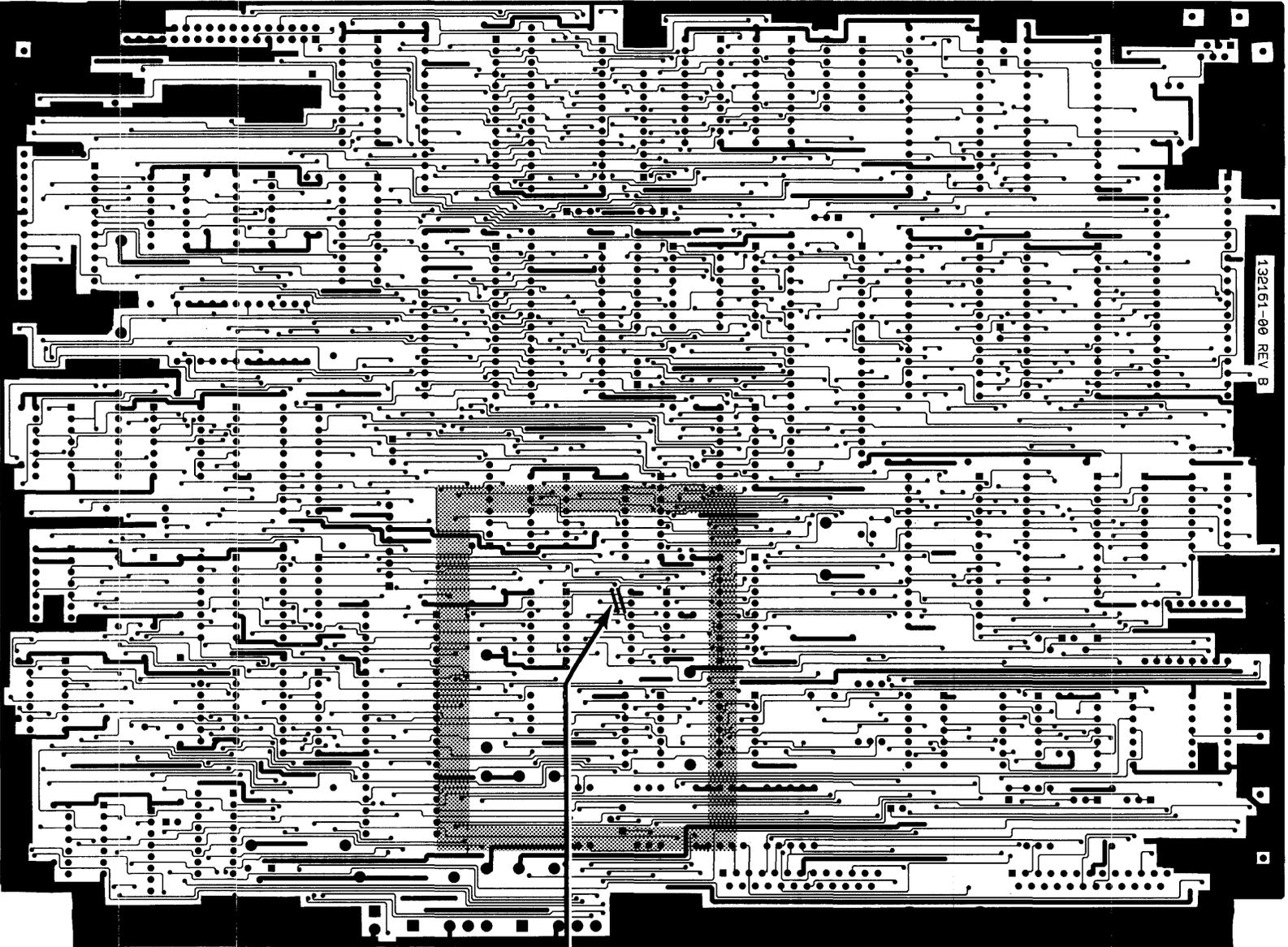
6. Remove four brass screws securing the shroud to the logic board.
7. Remove six Phillips screws securing the logic board to its tray and lift the board out of the tray.

MAKING THE MODIFICATION

NOTE: PIN 1 OF JUMPER W5 IS INDICATED BY A SQUARE.

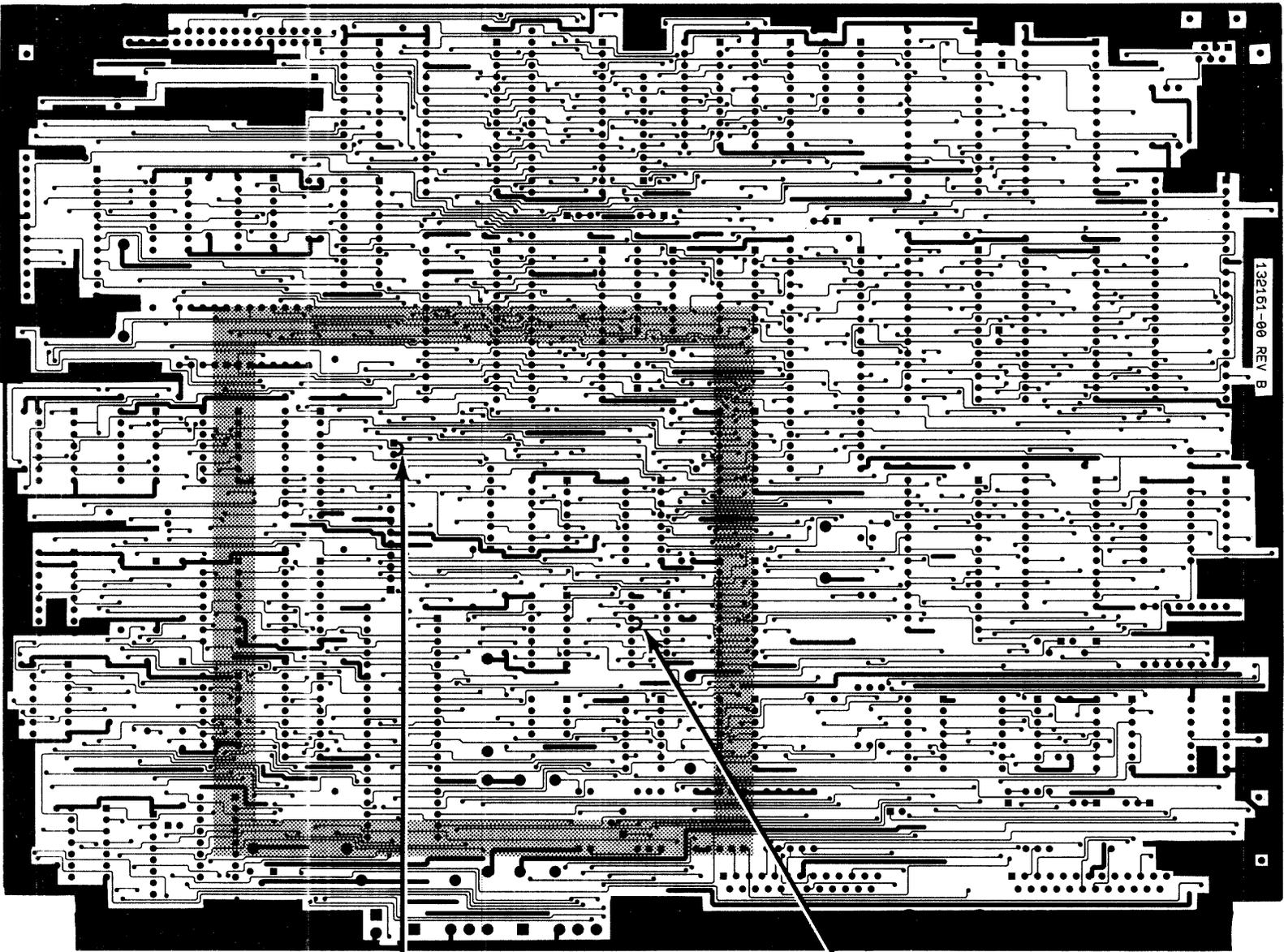
1. The Long Logic Board
 - a. Cut the trace on the solder side of the logic board as shown in Figure 58-1.
 - b. Install jumpers on the solder side of the logic board as shown in Figure 58-2.
2. The Short Logic Board
 - a. Cut the trace on the solder side of the logic board as shown in Figure 58-3.
 - b. Install one jumper on the solder side of the logic board as shown in Figure 58-4.

Figure 58-1
Trace Cut on Solder Side of Logic Board



Cut trace between W5 pin 1 and
U23 pin 13 at U23 pin 13.

Figure 58-2
Jumper Location on Solder Side of Logic Board

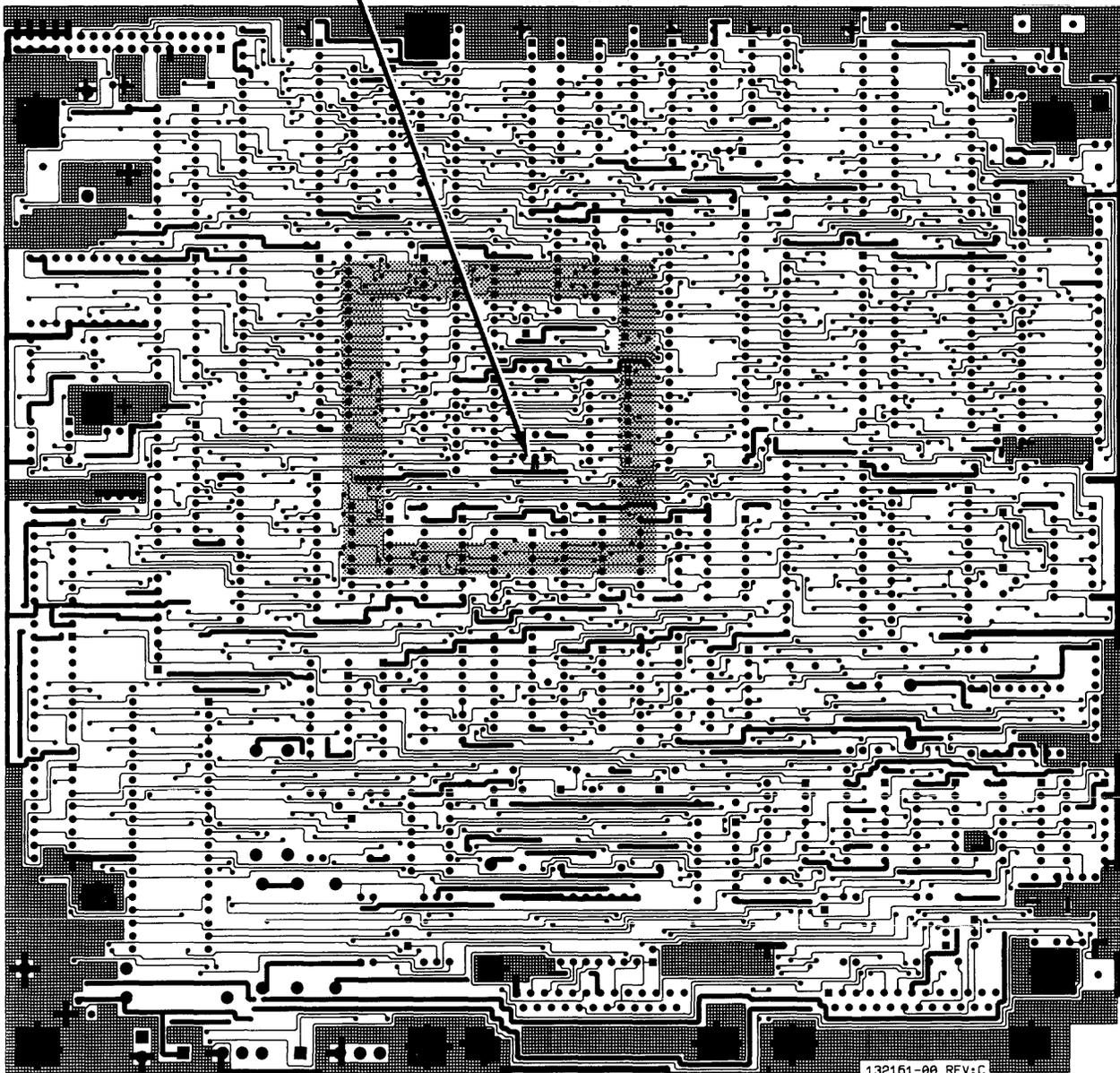
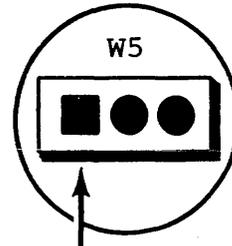


Install jumper between
U23 pin 12 to U23 pin 13.

Install jumper between
W5 pin 1 and W5 pin 2.

Figure 58-3
Trace Cut on Solder Side of Logic Board

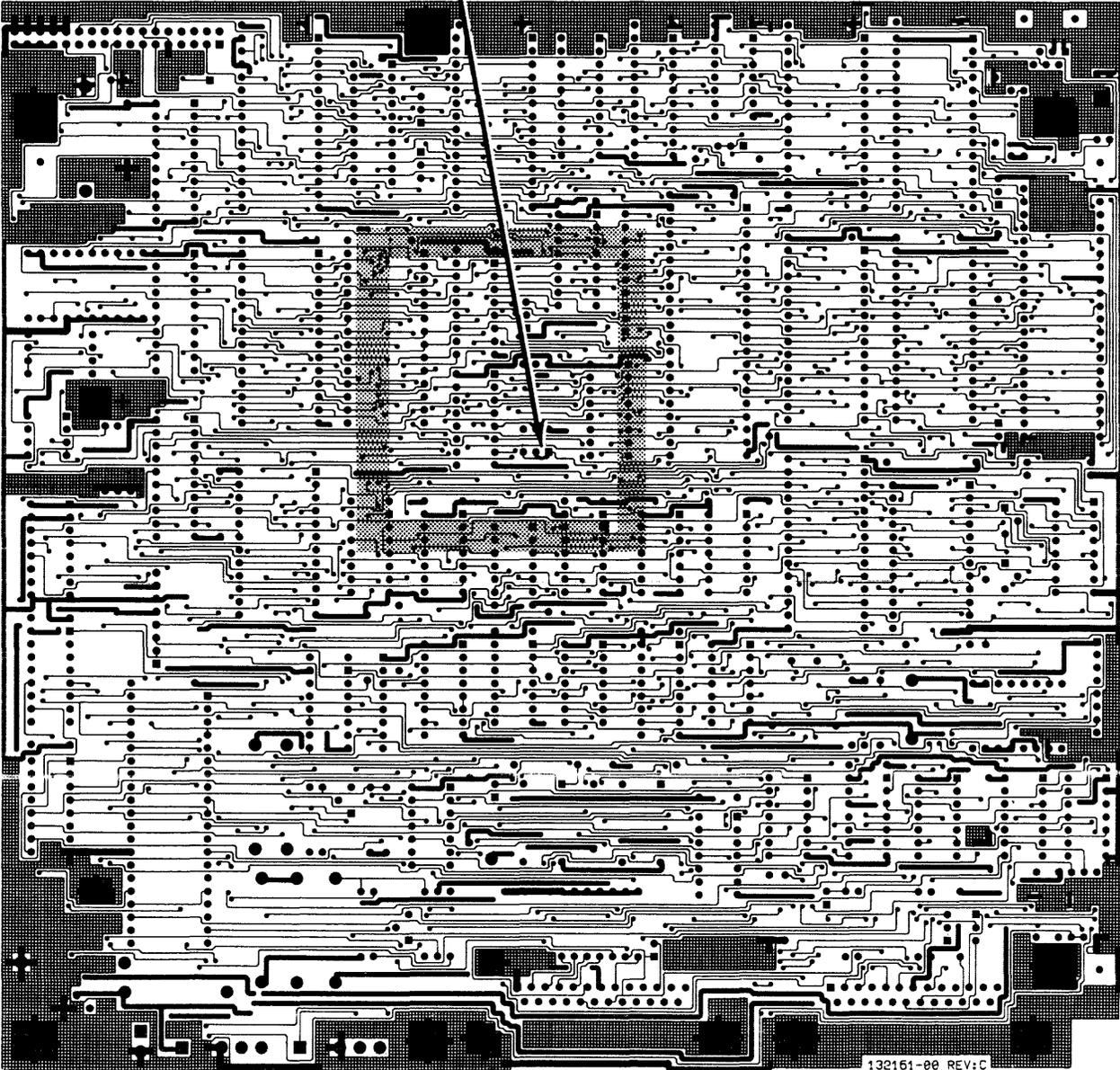
Cut trace between W5 pin 1 to W5 pin 3.



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Figure 58-4
Jumper Location on Solder Side of Logic Board

Install jumper between W5 pin 1 and W5 pin 2.



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Issue No. 60

REMOVING AND REPLACING THE 955 CASE-STYLE LOGIC BOARD

This procedure explains how you can remove and replace the 955 case-style logic board.

TOOLS REQUIRED

1. Phillips screwdriver

PROCEDURE

WARNING! When you open the terminal case you expose components that are potential shock hazards (even after the terminal has been disconnected from the wall outlet). **DO NOT ATTEMPT TO REMOVE THE LOGIC BOARD UNLESS YOU ARE A QUALIFIED TECHNICIAN.**

CAUTION! To protect against electrostatic discharge (ESD) damage, wear a wrist grounding strap and handle the logic board and components in a static-free environment. **IF YOU DAMAGE THE LOGIC BOARD OR COMPONENTS, FACTORY REPAIR OR REPLACEMENT COULD BE EXPENSIVE.** For more information about avoiding ESD damage, see Service Bulletin 32.

Removing the Logic Board Tray

1. Turn off the terminal.
2. Disconnect the power cord and data cable(s) from the rear of the terminal. Disconnect the keyboard cable from the front of the terminal.
3. Turn the terminal so the screen faces away from you. Remove the two Phillips screws that hold the logic board tray in place. The screws are located at the rear of the terminal. The logic board tray slides into the base.
4. Carefully pull the logic board tray toward you to remove it. You must disconnect the red (P5) and white (P2) logic board connectors to slide the tray completely out of the terminal.

Replacing the Logic Board Tray

1. Fit the metal flanges on the logic board tray into the guides at the rear of the terminal. Hold the connector cables up so they do not interfere with replacing the tray.
2. Reconnect the red connector (P5) and the white connector (P2) on the logic board.

3. Align the keyboard connector with the opening in the front of the terminal.
4. Replace the two Phillips screws in the rear of the terminal.
5. Reconnect the power cord, data cable(s) and the keyboard cable.

Service Bulletin

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Issue No. 61

REMOVING THE MONITOR REAR HOUSING AND BEZEL ON THE 955 CASE-STYLE TERMINAL

This bulletin tells you how to remove the monitor rear housing and bezel on the 955 case-style terminal.

TOOLS REQUIRED

1. Phillips screwdriver

WARNING! When you open the terminal case you expose components that are potential shock hazards (even when the terminal is unplugged from the wall outlet). **DO NOT ATTEMPT TO OPEN THE TERMINAL'S CASE UNLESS YOU ARE A QUALIFIED TECHNICIAN.**

Opening the Case

See Figure 61-1 as reference for opening the case.

1. Turn off the terminal.
2. Disconnect the power cord and data cable(s) from the back of the terminal. Disconnect the keyboard cable from the front of the terminal.
3. Turn the terminal so the screen faces away from you.
4. Remove the three screws that secure the monitor rear housing to the case, (remove the screw under the power cord first, then remove the two screws near the top of the housing).

NOTE! Remove the screws completely. If necessary, tip the unit backwards slightly.

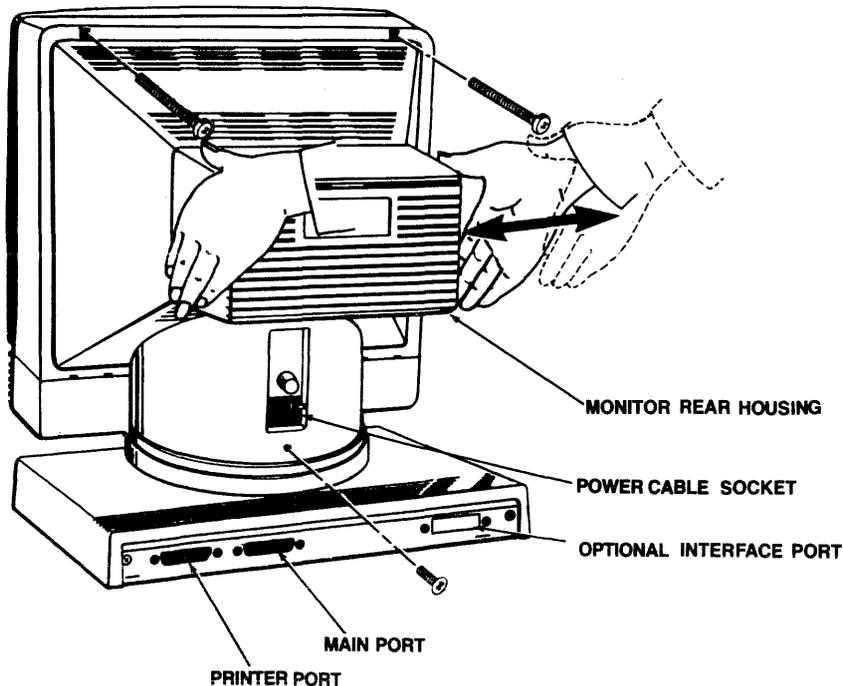
5. To release the clamp holding the bezel and monitor rear housing together (See Figure 61-1):
 - a. Grasp the housing with your left hand.
 - b. Sharply tap the right side of the housing with the heel of your right hand.
6. Lift off the monitor rear housing.
7. Carefully turn the screen away from you while holding the bezel in place. Remove the two Phillips screws (located inside the case, one on each side of the power supply) securing the bezel to the case.

Closing the Case

1. Replace the bezel:

- a. Place the bezel face down in front of the terminal. Raise the bezel slightly and hook its two bottom tabs into the openings (one under the contrast adjustor; one under the ON/OFF switch) in the lower case.
 - b. Swing the bezel up to frame the screen, matching the ON/OFF switch and contrast adjustor with the openings in the bezel.
 - c. Carefully turn the screen away from you while holding the bezel in place. Insert and tighten the two Phillips screws (located inside the case, one on each side of the power supply) securing the bezel to the case.
2. a. Position the monitor rear housing on the case, as shown in Figure 61-1.
 - b. Align the screw hole under the power cord with the lower screw hole in the housing.
 - c. Fit the four tabs in the housing over the edge of the lower case.
 - d. Fit the tab in the top of the bezel into the slot in the top of the monitor rear housing. Squeeze the bezel and housing together.
 - e. Insert and tighten the Phillips screw under the power cord and the two Phillips screws near the top of the housing.

Figure 61-1
Opening the Case



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Issue No. 62

ADDING PAGES OF MEMORY ON THE 955 TERMINAL

The 955 is normally shipped with one page of memory. However, you can add up to four, 24-line pages of memory by adding memory chips. This bulletin tells you how to add memory to the 955 terminal.

PARTS REQUIRED

1. 8K x 8 static RAM, 100-ns memory chips. (Each chip is one page of memory.) The approved manufacturer is Mitsubishi, part number #M5165P-10.

Memory Kits	TeleVideo P/N	Price
Second Page Kit	132425-00	\$ 80.00
Third and Fourth Page Kit	132426-00	80.00
Second, Third, and Fourth Page Kit	132427-00	160.00

NOTE: All new 8K x 8 static RAM chips must have a maximum access of 100 ns.

TOOLS REQUIRED

1. Phillips screwdriver
2. Chip puller, (except when adding only third- and fourth-page memory).

PROCEDURE

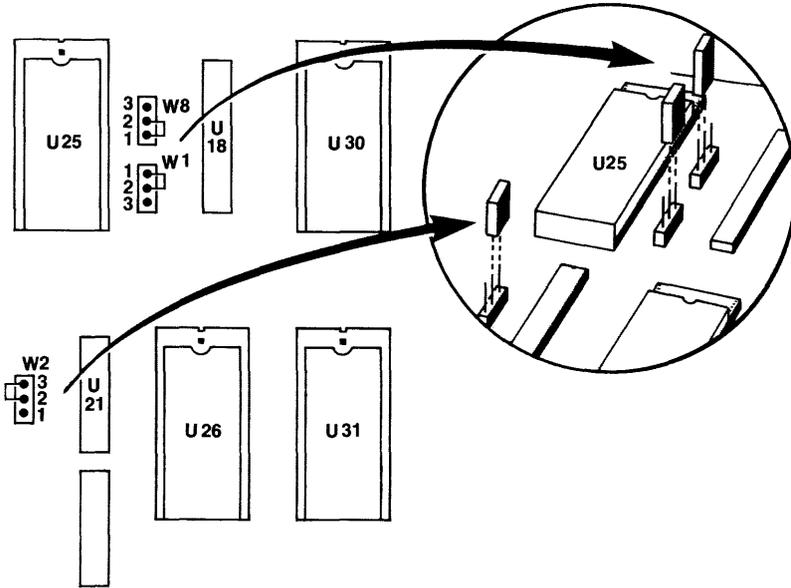
See Service Bulletin 60 for instructions on removing the logic board.

After you have removed the logic board;

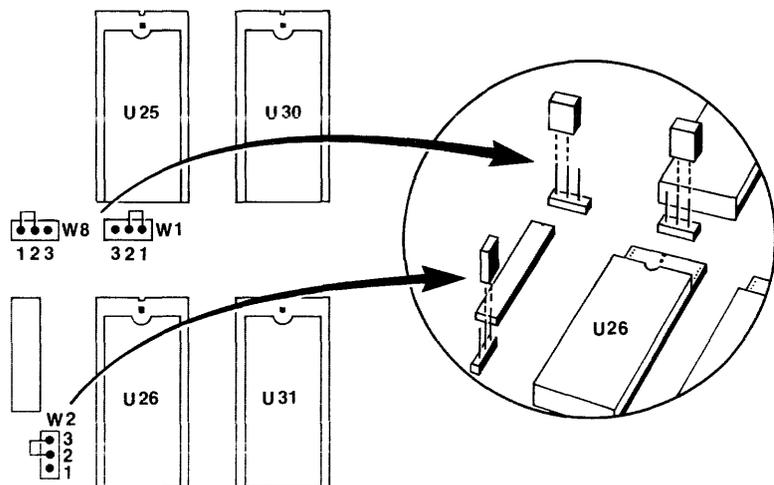
NOTE: There are two types of 955 logic boards. Determine which one you have so that you can perform the correct modification. The long logic board (10 7/8" x 8 1/4") completely covers the bottom of its tray. The short logic board (8 7/8" x 8 1/4") only covers three-fourths of its tray.

1. Using the chip puller carefully remove the 2K x 8 static RAM chips from locations U25, U26, U30 and U31 on the logic board. (This is not necessary if you are adding third- and fourth-page memory).

2. Make the following jumper changes on the logic board. (This does not apply when installing third- and fourth-page memory).
3. The Short Logic Board
 - a. Slide the jumper on W1, to pins 1 and 2.
 - b. Slide the jumper on W2, pins 2 and 3.
 - c. Slide the jumper on W8, pins 1 and 2.



4. The Long Logic Board
 - a. Slide the jumper on W1, to pins 1 and 2.
 - b. Slide the jumper on W2, pins 2 and 3.
 - c. Slide the jumper on W8, pins 1 and 2.



5. Install the new 8K x 8 static RAM chips in locations:

U25, U31 - Second-Page Memory Only

U25, U26, U30, U31 - Second-, Third- and Fourth-Page Memory

U26, U30 - Third- and Fourth-Page Memory
(U25 and U31 should already contain new
8K x 8 RAM chips that were installed when
the second-page memory kit was installed.)

See Service Bulletin 60 for instructions on replacing the logic board.

Memory Kits are available from TeleVideo's Spare Parts Department.

Service Bulletin

Issue No. 63

955 TERMINAL 115/230 VAC BLOWING LINE FUSES

Some early 955 terminals contain a Fast-Blow line fuse which fails when the unit is turned on. This occurs because the initial current surge exceeds the maximum rating for the fuse (.5 amp for 230V line; 1.0 amp for 115V line).

You can correct this problem by replacing the fuse with a Slow-Blow fuse of the same voltage rated value and increasing the current value, as described in this bulletin.

CAUTION! Use the recommended fuse to protect the terminal from external AC power line transients that can damage electronic equipment and/or cause fires.

PARTS REQUIRED

One 1.5 amp 125V or 250V 3ag Slow-Blow fuse for 115V input power
or

One .75 amp 250V 3ag Slow-Blow fuse for 230V input power

NOTE: Also replace the fuse warning label (part no. 131368-00) on the back of the terminal. Call TeleVideo's RMA department for the part.

PROCEDURE

1. Turn off the power and unplug the terminal's power cord.
2. Remove the fuse holder by unscrewing it counterclockwise.
3. Remove the fuse and replace it with either:

A 1.5 amp 125V or 250V 3ag Slow-Blow fuse for 115V input power

or

A .75 amp 250V 3ag Slow-Blow fuse for 230V input power.
4. Replace and tighten the fuse holder.
5. Plug in the terminal's power cord.

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Service Bulletin

Issue No. 64

955 TERMINAL DATA CARRIER DETECT (DCD) MALFUNCTION

955 terminals with revision C or D logic boards may have handshaking problems with RS232 interfacing of the DCD signal. Possible symptoms include: garbled data, missing data and/or P3 error messages.

To eliminate this problem, remove the 4.7K ohm resistor at R25 on the logic board, as described in this bulletin.

TOOLS REQUIRED

1. A Phillips screwdriver
2. Small wire cutters

PROCEDURE

WARNING! DO NOT OPEN THE CASE UNLESS YOU ARE A QUALIFIED TECHNICIAN. OPENING THE CASE EXPOSES YOU TO POTENTIAL SHOCK HAZARDS, EVEN AFTER POWER HAS BEEN TURNED OFF AND THE POWER CORD DISCONNECTED.

BE CAREFUL WHEN YOU REMOVE AND MODIFY THE LOGIC BOARD. ANY DAMAGE INCURRED WHILE PERFORMING THIS MODIFICATION MAY RESULT IN EXPENSIVE FACTORY REPAIR.

1. Turn off the terminal. Disconnect the power cord and data cable(s) from the back of the terminal; disconnect the keyboard cable from the front of the terminal.
 2. Rotate the complete unit so the back faces you. Remove the two Phillips screws (in the base) that secure the logic board tray.
 3. Grasp the logic board tray by its center tab and pull the tray toward you to remove it. Disconnect the red (P5) and white (P2) logic board connectors to slide the tray completely out of the terminal.
 4. Locate R25 on the logic board (it is near the center of the board, between U34 and U28).
 5. Use wire cutters to remove the 4.7K ohm resistor from R25.
 6. Reattach the red connector (P5) and the white connector (P2) on the logic board.
 7. Replace the logic board tray in the base; insert and tighten the two Phillips screws that secure the tray.
 8. Reconnect the power cord, the data cable(s) and the keyboard cable.
 9. Mark your schematic to show R25 has been deleted.
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Issue No. 65

CORRECTING KEYBOARD RESET IN 905, 955 and 922 TERMINALS

In some 905, 955 and/or 922 terminals the keyboard microcomputer fails to reset properly when CTRL RESET is pressed. To correct this problem, short out R1 resistor on the keyboard printed circuit board, as described in this bulletin.

TOOLS REQUIRED

1. 25-watt soldering iron, solder and solder vacuum
2. Small pair of needle-nose pliers
3. Wire cutters (diagonals)
4. Flux remover

PARTS REQUIRED

1. Jumper wire (min. size, 36 gauge; max. size, 26 gauge)

PROCEDURE

WARNING! DO NOT OPEN THE CASE UNLESS YOU ARE A QUALIFIED TECHNICIAN. OPENING THE CASE EXPOSES YOU TO POTENTIAL SHOCK HAZARDS, EVEN AFTER POWER HAS BEEN TURNED OFF AND THE POWER CORD DISCONNECTED.

BE CAREFUL WHEN YOU REMOVE AND MODIFY THE KEYBOARD CIRCUITRY. ANY DAMAGE INCURRED WHILE PERFORMING THIS MODIFICATION MAY RESULT IN EXPENSIVE FACTORY REPAIR.

NEVER DISCONNECT OR ATTACH THE KEYBOARD CABLE WHILE THE POWER IS ON; THE VOLTAGE TRANSIENTS CREATED MAY CAUSE A COMPONENT FAILURE.

1. Turn off the terminal and disconnect the keyboard cable.
2. Turn the keyboard upside down and remove the six recessed Phillips screws.
3. Turn the keyboard rightside up and remove the top cover.
4. Locate resistor R1 on the keyboard printed circuit board (5 and 1/2 inches from the upper left corner).
5. Short out R1 by laying the jumper wire across the body of the resistor; connect one end of the wire to each lead on the resistor. Be sure the wire does not touch the circuit board.
6. Solder the wire in place, making sure that the solder build-up does not touch the printed circuit board and short out. Remove the solder flux.
7. Replace the top cover. Turn the keyboard upside down; replace and tighten the six recessed Phillips screws that secure the top and bottom covers.

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Service Bulletin

Issue No. 67

MODIFYING THE 955 VIDEO MODULE TO STOP VIDEO FADE-OUT

In some 955 terminals the video may fade, either after a few minutes or after several hours. If this happens, check that the video module has been modified as described below. If it has not been modified, follow the procedure in this bulletin to correct the problem.

TOOLS REQUIRED

1. 25-watt soldering iron, solder and solder vacuum
2. Phillips screwdriver
3. Long-nose pliers
4. Wire cutters
5. Flux remover

PARTS REQUIRED

1. One modification kit, part no. 131492-00; or,
 - a. One 1N4757A Zener Diode, part no. 131795-00
 - b. One 22K ohm CF resistor, 1/4W +/- 10%, part no. 131800-00

PROCEDURE

WARNING! DO NOT OPEN THE CASE UNLESS YOU ARE A QUALIFIED TECHNICIAN. OPENING THE CASE EXPOSES YOU TO POTENTIAL SHOCK HAZARDS, EVEN AFTER POWER HAS BEEN TURNED OFF AND THE POWER CORD DISCONNECTED. AS SOON AS YOU OPEN THE CASE, DISCHARGE VOLTAGES AS DESCRIBED IN YOUR UNIT'S MAINTENANCE MANUAL.

BE CAREFUL WHEN YOU PERFORM THIS MODIFICATION. ANY DAMAGE INCURRED MAY RESULT IN EXPENSIVE FACTORY REPAIR.

1. Turn off the terminal.
2. Disconnect the power cord and data cable(s) from the back of the terminal; disconnect the keyboard cable from the front of the terminal.
3. Turn the terminal so the screen faces away from you.
4. Remove the three screws that secure the monitor rear housing to the case (remove the screws completely; if necessary, tip the unit backwards slightly).
5. Release the clamp holding the bezel and monitor rear housing together (See Figure 67-1):

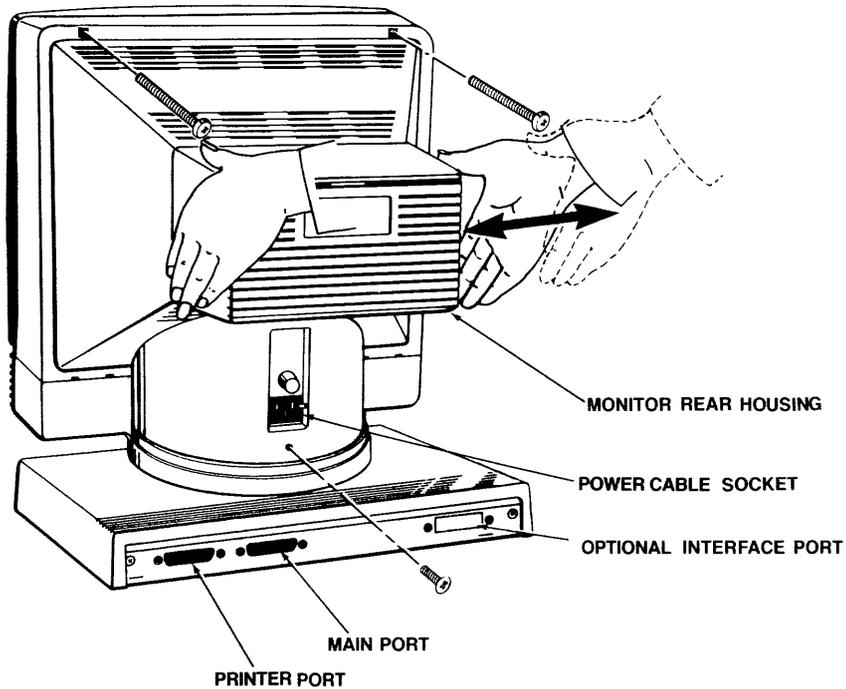
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- a. Grasp the housing with your left hand.
- b. Sharply tap the right side of the housing with the heel of your right hand.

Figure 67-1
Opening the Case



6. Lift off the monitor rear housing and discharge voltages as described in your unit's maintenance manual.
7. Disconnect the voltage lead at the anode by gently lifting the rubber cap and unhinging the metal lead.
8. Carefully remove the CRT connector (small PCB at the back of the CRT).
9. Remove the power connector (red), the video connector (white) and the yoke connector (blue) from the video board.
10. Loosen the four Phillips screws (one on each support bracket) that secure the video module base.
11. Remove the four Phillips screws that hold the video board to its base and slide the board out of the terminal.

12. Install the 22K ohm resistor at R302 on the **solder** side of the video board, as shown in Figure 67-2.
13. Install the zener diode at D505 on the **component** side of the video board, as shown in Figure 67-3.
14. Reinstall the video module and reassemble the terminal.

Figure 67-2
955 Video Module, Solder Side

NOTE: TO BE INSTALLED ON SOLDER SIDE, NOT ON COMPONENT SIDE

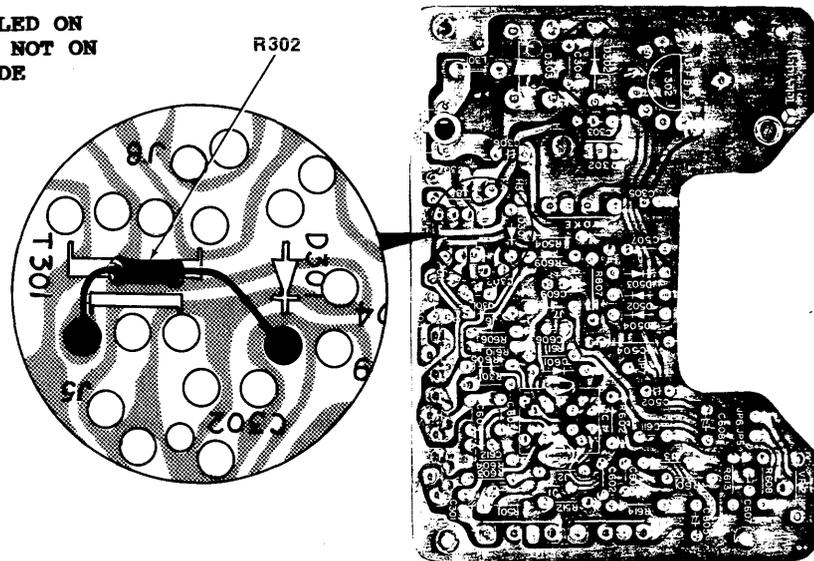


Figure 67-3
955 Video Module, Component Side

