

**TROUBLESHOOTING GUIDE FOR 970 TERMINAL**

This is a general troubleshooting guide to be used with the Operator's Manual, Maintenance Manual, and Service Bulletins as required. By following the procedures described here, you should be able to quickly isolate and repair most field failures.

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## SECTION 1      OVERVIEW OF TERMINAL MODULES

The design of Televideo terminals permits fast fault isolation since the terminal is divided into four main modules.

1. Video monitor
2. Power supply
3. Main logic board
4. Keyboard

The 970 terminal begins a new generation of terminals. The design of the video monitor and DC power supply boards has been simplified to use fewer DC voltages. This change in design makes these two boards unique and noninterchangeable with the earlier Televideo terminals 910, 912, 920, 925 and 950. Interchange the video monitor and power supply boards only with boards of the same type. However a logic board of the older type terminal maybe connected to the video monitor and power supply of the 970.

To verify a malfunctioning module exchange (swap) each module with a known good one. Once the malfunctioning module is identified, refer to the appropriate section in this guide for futher troubleshooting.

## DISCHARGE PROCEDURE

High voltages are retained by the CRT tube and capacitors even after power has been turned off. As soon as you open the case, clip one end of a wire to the chassis. Attach the other end of the wire to an insulated screwdriver, being careful not to touch the metal part of the screwdriver, gently slip the metal end of the screwdriver under the cap of the anode, as shown in Figure 1.1

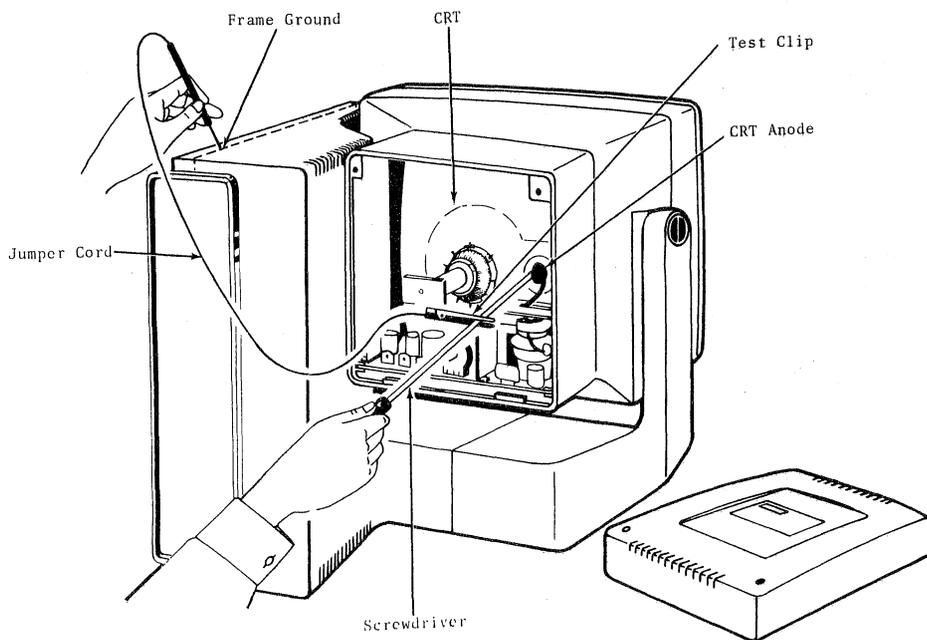


FIGURE 1-1 Discharging Voltages

## SECTION 2      FUNCTIONAL DESCRIPTION OF MODULES

### LOGIC BOARD

The logic board processes, stores and manipulates data received and transmitted, and generates the video and sync signals necessary to display data on the terminal's screen.

The main logic board is divided into the four following active sections.

1. Main processor
2. Display processor
3. 16K RAM memory
4. I/O Interface logic

### POWER SUPPLY

The power supply supplies four DC voltages 12v, -12v, 75v, and 5v to circuits within the terminal. Two fuses located on the power supply are user replaceable.

### VIDEO MONITOR

The video monitor contains horizontal, vertical, and video amplification circuits which produce a television-type noninterlaced raster display. Video signals received from the display circuitry generate pixels (dots) at various positions across scan lines. These pixels, when combined with other pixels of scan lines above and/or below a given line, produce characters.

### KEYBOARD

Data is encoded by a 8049 microprocessor located in position A6 of the keyboard. The encoded data is sent to the main logic board serially via the coiled interface cable. On the main logic board the serial data is converted to parallel and applied to the main processor which by way of terminal firmware deciphers the two bytes of encoded data received from the keyboard processor.

## SECTION 3    TROUBLESHOOTING THE LOGIC BOARD

### 3.1 VISUAL INSPECTION

With the logic board installed and power removed, remove the two screws at the bottom of the vented cooling tower and swing the bottom part of the panel away from the case, and check the items listed below.

1.    Socketed chips: are they all securely seated into their sockets and are the chip pins all straight?
2.    Connectors: look for  
      Loose, damaged or corroded connectors  
      Bad crimps
3.    Wires: are any broken, loose or frayed?
4.    Components: are any components deformed or discolored?

With the logic board removed, make the following inspections.

To remove the logic board:

1.    Turn the power off.
2.    On the logic board, carefully disconnect:  
      P1, P2, P3, P4 and P5 connectors
3.    Remove the four screws in the four corners of the logic board
4.    Carefully remove the logic board.

With the logic board removed, closely inspect the board for:

1. Deformed, discolored or missing components.
2. Cracked, broken or lifted traces.
3. Poor solder joints (loose solder balls, cold solder joints, or solder bridges).
4. Bent pins on the IC chips.

#### NOTE!

If defects are found, correct them and retest the terminal before continuing.

### 3.2 LSI FAILURES

Since most malfunctions involve LSI chips, this step may quickly remedy most failures. Exchange all socketed chips with known good chips, testing the terminal after exchanging each LSI chip. If the logic board still malfunctions after completing the previous steps, confirm the operation of the data lines as outlined in the section Data Line Operation.

The remainder of this section involves troubleshooting to the component level and requires schematics, an oscilloscope, a working knowledge of transistor-transistor logic (TTL) with experience in TTL troubleshooting.

### 3.3 DATA LINE OPERATION

Confirm that the data lines are operating properly before proceeding further.

#### NOTE!

It is beyond the scope of this troubleshooting guide to list all possible data line problems.

With the logic board reconnected check the data and address lines that interface the Z80 CPU chip with the rest of the terminal logic. There should be activity on all data and address lines with voltages ranging from 0v to 5v. If the malfunction persists after you have confirmed proper operation of the data lines, follow the procedure in the next section, Debugging Table.

### 3.4 SELFTESTS

The following tests are designed to aid the service personnel in troubleshooting the 970 terminal.

Two 25 pin male RS232 connectors are needed to make a test cable. The cable is an one to one pin assignment for the following pin requirements: 2, 3, 4, 5, 6, 7, 8 and 20. This cable is to be used when testing the communications of the terminal.

Display tests: Depressing shift SET UP 1 will display all characters and attributes on the screen. Depressing shift SET UP 3, 4 or ESC # 8 will fill the entire screen with one particular character. This test is helpful when adjusting the terminal focus, height or linearity.

Communication tests: A test cable as outlined above is required to successfully exercise the test. Connect one end of the test cable to P3 and the other end to P4. Depress shift SET UP 2 or one of the sequences below. The result of the test, PASS or FAIL will be displayed in the lower right of the status line.

Confidence test: Confidence test will perform certain tests to the terminal. Depress ESC [ 2 ; Ps y to initiate the test. Ps is the parameter indicating the test to be done. Ps is computed by taking the weight indicated for each desired test and adding them together. The values assigned each test are defined in table 3.1.

TABLE 3-1

WEIGHT	TEST PERFORMED
1	ROM AND RAM TEST (CHECK ROMS' LRC AND TEST DISPLAYABLE RAM)
2	RS-232C PORT TEST (P3-P4 LOOPBACK CONNECTOR REQUIRED)
4	EIA CONTROL TEST (P3-P4 LOOPBACK CONNECTOR REQUIRED)
8	REPEAT SELECTED TEST(S) INDEFINITELY (UNTIL FAILURE OR POWER OFF)

## NOTE!

The items listed in the table in this section are only suspect areas; they should not be automatically replaced when the symptoms listed are present.

SYMPTOM	SUSPECT AREAS		SCHEMATIC
	PART NO.	POSITION	PAGE
No video	Z80	A80	#1
	9007	A69	#4
	6116	A56	#5
	74LS166	A50	#5
	74S251	A48	#5
	2N2219	Q3	#6
Constant or no beep	8049 (KYBD)	A6	#1
	Z80	A80	#1
	Firmware	A82,87,99	#2
No cursor	9007	A69	#4
	74LS374	A6	#6
Distorted characters	6116	A56	#5
	74LS245	A65	#5
	74LS374	A64	#5
	74LS173	A33	#5
	74LS157	A40	#5
	74LS166	A50	#5
	74S251	A48	#5
	Firmware	A82,87,99	#2
Bad video every other line	9006	A54,60	#8
Bad attribute " " "	9006	A53,59	#8
Loss of specific attribute	9007	A69	#4
	74LS374	A37,45	#8
Horizontal bar	9007	A69	#4
	74LS32	A68	#4
	74LS32	A7	#9
No transmit P3	75188	A43	#7
	Z80 SIO	A74	#7
	Z80 CTC	A92	#10
No transmit P4	75188	A51	#7
	Z80 SIO	A74	#7
	Z80 CTC	A92	#10

970 DEBUGGING TABLE CONTINUED

SYMPTOM	SUSPECT AREAS		SCHEMATIC
	PART NO.	POSITION	PAGE
No transmit P7	26LS31	A89	#7
	Z80 SIO	A85	#7
	Z80 CTC	A92	#10
No receive P3	75189	A27	#7
	74LS08	A58	#7
	Z80 SIO	A74	#7
	Z80 CTC	A92	#10
No receive P4	75189	A57	#7
	Z80 SIO	A74	#7
	Z80 CTC	A92	#10
No receive P7	26LS32	A84	#7
	Z80 SIO	A85	#7
	Z80 CTC	A92	#10
Incorrect or no kybd response	7414	A100	#7
	Z80 SIO	A85	#7
	Z80 CTC	A92	#10
	74LS138	A93	#9
Incorrect Baud rate	Z80 CTC	A92	#10
	74LS138	A93	#9
	74LS163	A115	#1
Loss of Bidirectional communication	74LS374	A23	#2
	74LS32	A62	#7

## SECTION 4      TROUBLESHOOTING THE KEYBOARD

### 4.1   VISUAL   INSPECTION

Disconnect the keyboard from the rest of the terminal and remove the six screws from the bottom of the keyboard case. Carefully lift off the top of the keyboard case and set it aside.

Check the Key switches for the following:

1. Foreign objects (e.g., paperclips, staples, matches)
2. Liquid residue (e.g., coffee, soft drink)
3. Broken keyswitches
4. Missing or incorrectly placed keycaps

#### NOTE!

If defects are found, correct them and retest the terminal before continuing.

Visual Inspection with the keyboard removed from the case

Remove the screws from the corners of the keyboard and remove the keyboard from its case.

Inspect the keyboard for:

1. Deformed or discolored components
2. Cracked, shorted, or lifted traces
3. Poor solder joints (loose solder balls, solder bridges, or cold solder joints)

SYMPTOM	SUSPECT AREAS		SCHMATIC
	PART NO.	POSITION	PAGE
One key inoperative/ intermittent	Keyswitch		#1
	Open trace, solder joint		#1
	8049 (kybd)	A6	#1
Several keys inoper- ative/intermittent	Open/shorted trace		#1
	8049	A6	#1
	74LS145	A4,5	#1
	Resistorpack	RP1	#1
All keys inoperative	Open/shorted trace		#1
	8049	A6	#1
	Regulator	VR1	#1
	Crystal	Y1	#1
Incorrect characters	Shorted trace		#1
	8049	A6	#1
No beep or key click	8049	A6	#1

## SECTION 5      TROUBLESHOOTING THE VIDEO MONITOR

### 5.1 VISUAL INSPECTION

With the video monitor installed turn off the power to the terminal, remove the two screws from the rear of the CRT case and place the cover aside. Check the following possible problem areas:

1. Connectors: look for
  - A. Loose or damaged connectors
  - B. Dirty contacts
  - C. Bad crimps
2. Wires: are any broken, loose, or frayed?
3. Components: are any deformed, leaking, or discolored?

If any defects are found, correct them and retest the terminal before continuing.

With the video monitor removed--The following inspections should be made.

To remove the video monitor:

1. With the power off remove and set the cover aside and disconnect the following connections on the video monitor:
  - A. J1 (DC voltages)
  - B. P10 (signal)
  - C. J11 (yoke)
2. Disconnect the following parts on the CRT tube:
  - A. CRT socket (small circuit board at rear of tube)  
CAUTION pull socket off straight back to avoid breaking the small nipple of tube.
  - B. Anode lead (WARNING see discharge procedure in section one)
  - C. Ground wire
3. Remove the securing screws on the video monitor.
4. Carefully slide the video monitor out of the case.

With the video monitor removed inspect it for:

1. Deformed, leaking, or discolored components
2. Missing or damaged components
3. Cracked or lifted traces
4. Poor solder joints (loose solder balls, solder bridges, or cold solder joints)

**NOTE!**

If defects are found, correct them and retest the terminal before continuing.

If no defects are found, reinstall the video monitor and apply power.

**WARNING!**

High voltages are present on the video monitor . USE EXTREME CARE during troubleshooting.

The four adjustments which can be made to the video monitor are listed in Table 5-1. The controls are shown in Figure 5-1.

**TABLE 5-1**

PROBLEM	CONTROL
Intensity of characters too bright, too dim	Bright
Whole screen is too tall or too short	Height
Characters are not even in height from the top to the bottom of the screen	Linearity
Characters are not in focus	Focus

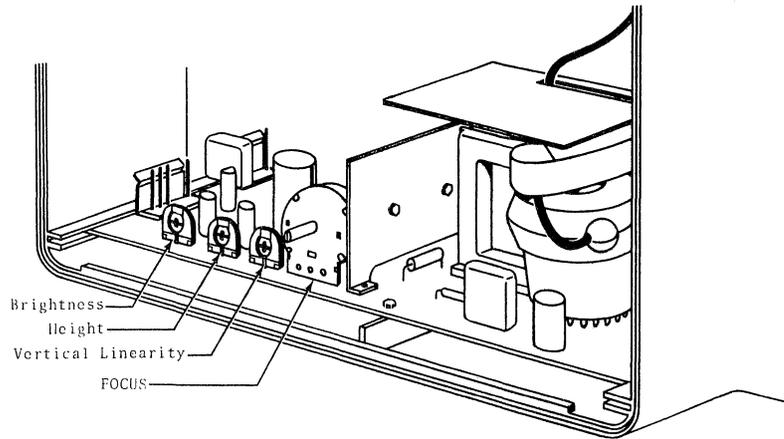


FIGURE 5-1

## 5.2 VIDEO MONITOR DEBUGGING GUIDE

The remainder of this section deals with specific malfunctions and possible causes.

SYMPTOM: No Vertical Deflection

1. Check the emitter of Q201 for the vert. signal.
  - A. If it is present, proceed to step 2.
  - B. If it is not present, check the base of Q201.
  - C. If the vertical deflection is not present at the base, troubleshoot between the base of Q201 and P10 pin five.
2. Check the collector of Q202 for the vert. signal.
  - A. If it is present, proceed to step 3.
  - B. If it is not present, check the base of Q202.
  - C. If the vertical deflection is not present at the base, troubleshoot back from the base of Q202.

3. Check the negative side of C207 for vertical deflection.
  - A. If vertical deflection is present, the vertical drive of the video monitor is good. The following areas should be checked if the vertical deflection continues to fail.
    - (1) Connectors P10 and J12
    - (2) Yoke windings
  - B. Check emitter of Q203.
  - C. Check base of Q203.
  - D. If vertical deflection present at base of Q203 suspect Q203.
  - E. If not present at base of Q203, troubleshoot back.
  - F. If Q203 emitter is good, check Q204 emitter.
  - G. Check base of Q204.
  - H. If vertical deflection present at base of Q204 suspect Q204.
  - I. If not present at base, troubleshoot back from Q204. Since Q203 and Q204 are a matched pair of push/pull amplifiers, replace both if one fails.

**SYMPTOM: No Horizontal Deflection**

1. Check the collector of Q305 for horizontal pulses.
  - A. If the pulse is present, proceed to step 2.
  - B. If absent check the base of Q305.
  - C. If the Horizontal deflection is not present at the base troubleshoot between the base of Q305 and P10 pin one.
2. Check the output of IC301 at pin 3 if absent suspect IC301.
3. Check the collector of Q303 for horizontal pulse.
  - A. If present proceed to step 4.
  - B. If absent monitor the emitter of Q303.
  - C. If not present at the emitter troubleshoot back.

4. Check the collector of Q301 for horizontal deflection pulses.
  - A. If pulses are present proceed to step 5.
  - B. If missing check for a signal at the base of Q301.
  - C. If no signal present troubleshoot back.
5. Check the collector of Q302 for the horizontal signal.
  - A. If present the horizontal deflection amplifiers are operating properly. Check the connection from J11 to the yoke windings.
  - B. If not present check the base of Q302 for the signal.
  - C. If the signal is absent at the base of Q302 troubleshoot back.

## SECTION 6      TROUBLESHOOTING THE POWER SUUPLY

### 6.1    VISUAL INSPECTION

With the Power Supply Installed--Turn off power to the terminal, complete the procedure on removal of the logic board, and check the following possible problem areas:

1.    Connectors: look for
  - A. Loose or damaged connectors
  - B. Dirty contacts
  - C. Bad crimps
  - D. Bad fuse
2.    Wires: are any broken, loose, or frayed?
3.    Components: are any deformed, leaking, or discolored?

#### NOTE!

Check the fuse with an ohm meter. Do not rely on a visual check.

4.    Loose fuse holder
5.    If defects are found, correct them and retest the terminal.

With the Power Supply removed--The following inspections should be made.

To remove the power supply:

1. Turn off the power and unplug the power cord from the wall outlet.
2. Remove the main logic board as outlined in section 3.
3. Disconnect K1, K2 on the power supply PCB.
4. Carefully slide the power supply PCB up away from the regulators and remove it.

With the Power Supply Removed--Inspect the power supply for:

1. Deformed, leaking, or discolored components
2. Burned or lifted traces
3. Bad crimps on K1 and K2 connectors
4. Poor connections

If defects are found, correct the defects and retest the terminal before proceeding.

## 6.2 POWER SUPPLY DEBUGGING GUIDE

The remainder of this section deals with specific malfunctions and possible causes.

SYMPTOM: No +5V DC

1. Remove F103 and check for approximately 34V DC. If the correct voltage is not present, suspect the following components:
  - A. D105 through D108
  - B. Bad crimps, or poor connections to K1.
2. If the correct voltage is present, suspect the following components:
  - A. F103
  - B. 80506Z
  - C. C106 through C112

SYMPTOM: +5V DC is low

1. Check the following components:
  - A. IC103 (80506Z)
  - B. C106 through C112
  - C. Damaged or loose connectors

SYMPTOM: No +12V DC

1. Remove F102 and check for approximately 26V DC. If the voltage is not present, suspect the following components:
  - A. D101 through D104
  - B. Bad crimps or poor connections to K1.
2. If the correct voltage is present, suspect the following components:
  - A. IC101 (3122P)
  - B. Q101
  - C. C101, C102, C103, and C116

SYMPTOM: +12V DC is low

1. Check the following components:
  - A. R102
  - B. IC101 (3122P)
  - C. C103
  - D. Damaged or loose connectors

SYMPTOM: No -12V DC

1. Check the following components:
  - A. D101 through D104
  - B. C104 and C105
  - C. IC102 (7912)
  - D. Damaged or loose connections

SYMPTOM: No +75V DC

1. Check the following components:
  - A. D109
  - B. C113, C114, and C115
  - C. Q102 and Q103

SYMPTOM: +75V DC is low

1. Adjust SFR3
2. If unable to adjust SFR3, check the following components
  - A. Q102 and Q103
  - B. D110