ASSEMBLY MANUAL

for the

IMAGINATOR

MODEL I-100
RETROFIT GRAPHICS
DISPLAY BOARD

CLEVELAND CODONICS, INC.
CLEVELAND, OHIO

REV. A

Printed in the United States of America

Although every effort has been made to insure the correctness of this manual, Cleveland Codonics, Inc. assumes no responsibility for any errors that may appear in this manual. Cleveland Codonics, Inc. makes no commitment to update nor to keep current the information contained in this manual.

The information in this manual is subject to change without notice.

CAUTION

The metal-oxide-semiconductors (MOS) supplied with this unit are highly susceptible to destruction from static discharge. Do not remove them from their protective black foam backing or anti-static enclosures until you have read the precautions in the assembly or installation portions of this manual.

WARNING

Before removing or reconnecting any of the terminal's internal wiring harnesses be certain that the terminal is turned off and unplugged to prevent injury to both you and the terminal.

WARNING

When power is applied to the terminal, do not touch the flyback transformer, the high voltage lead, or the anode socket. An electrical shock hazard exists in these areas.

INTRODUCTION

The Imaginator is an intelligent, high efficiency, high resolution (504 by 247 pixel) graphics retrofit unit for your Heath/Zenith H/Z-19 terminal and H/Z-89 computer.

The Imaginator has its own onboard microcomputer to perform graphics processing independent of the host computer. This reduces the burden placed on the host processor and therefore improves execution speed.

A 128 character communications buffer further improves execution speed. This buffer permits the terminal and the host computer to perform their tasks asynchronously.

A graphics command may be entered by typing on the keyboard when the terminal is OFF-LINE or it may be sent via RS-232C from the host computer when the terminal is ON-LINE.

The Imaginator's transparent operation leaves all of the terminal's normal escape functions intact. The terminal's normal alphanumerics are totally independent of the Imaginator's graphics. The two displays can be overlayed on one another and may be individually altered under software control. Both alphanumeric and graphics images can be created in memory and restrained from being displayed on the screen. Once created they can be displayed instantaneously. Alternatively, the images may be displayed as they are created.

The graphics command processor (GCP) can be invoked to accept commands in either ASCII or BINARY format. ASCII mode has the advantage of easy user implementation of the graphics command language. All of the commands can be directly output by high level language programs which are executed in the host computer (e.g., PL/I, FORTAN, PASCAL, BASIC, and of course ASSEMBLY languages). Standard, off-the-shelf, interpreters and compilers are all that are required (those languages need not have any special graphics instructions). No machine language driver programs are required.

The BINARY mode has the advantage of high efficiency. A minimum of information must be sent to specify an operation. Again, no special interpreters or compilers are required but machine language drivers are suggested (even these are not required) for efficiency.

An additional memory-mapped socket is provided for memory expansion. Up to 16K of E/P/ROM can be mounted and addressed by the GCP, or 8K of E/P/ROM and 8K of R/W RAM can be used. Custom programs can be downloaded from the host computer into this memory for fast independent execution.

GRAPHICS INSTRUCTION SET

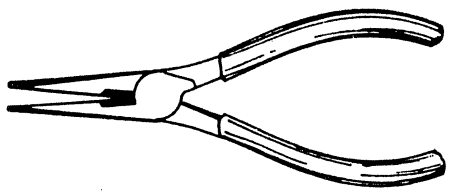
EnterGraphicsMode
MoveTo (X,Y)
PointAt (X,Y)
LineTo (X,Y)
AreaTo (X,Y)
PriLineStyle (Z)
    30 Unique styles
SecLineStyle (Z)
    30 Unique styles
LineType (Z)
    On
    Off
    Complement
    Read Bit
    Toggle to Alternate LineStyle at Boundary
    Read Byte
DisplayToggle (Z)
    Enable/Disable Graphics
    Enable/Disable Alphanumerics
    Erase Graphics
    or any of the eight combinations
BringInProgram (Z_0,Z_1,...,Z_{127})
JumpToProgram
ExitGraphicsMode

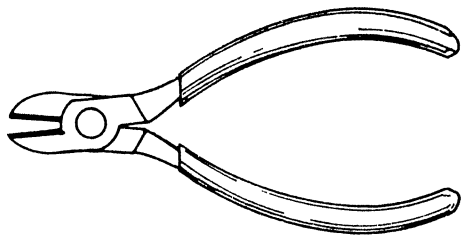
ASSEMBLY

WARNINGS AND CAUTIONS

WARNINGS appear in this manual where conditions exist that could lead to bodily injury.

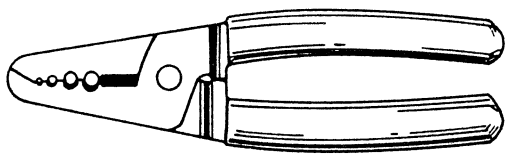
CAUTIONS appear in this manual where conditions exist that could lead to equipment or component damage.





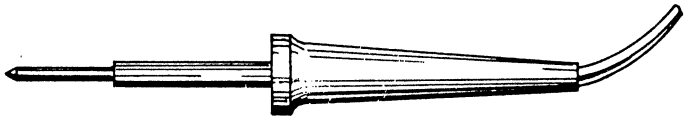
ORGANIZING YOUR WORKSPACE

To construct this kit, give yourself a large unobstructed work-space with plenty of room for this manual, the circuit board, and the circuit components. Place a lamp near your work area for proper lighting.



TOOLS YOU WILL NEED

In addition to the parts supplied with this kit, you will also need the following handtools:
Pliers
Diagonal cutters
Wire strippers
1/8" flat-blade screwdriver
Soldering pencil (25 watts maximum)

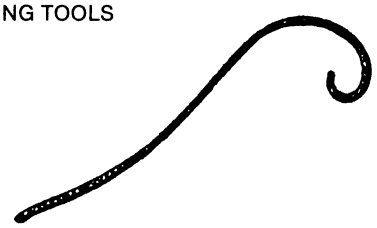


SOME OTHER USEFUL TOOLS

It is also useful to have:
Multimeter (useful for checkout)
Small adjustable wrench
IC extractor

If you accidentally solder a part in the wrong place, the following will help you remove the solder from the joint:
Desoldering bulb
Desoldering braid (copper wick)

DESOLDERING TOOLS



UNPACKING PRECAUTIONS

CAUTION

The metal-oxide-semiconductors (MOS) supplied with this kit are highly susceptible to destruction from static discharge. Do not remove them from their protective black foam backing or anti-static enclosures at this time.

Do not discard any packing material until all of the parts have been accounted for.

PARTS LIST

Open the bag of resistors, capacitors and voltage regulators and check them off the parts list. Organize them according to value by placing them in small bins or containers, or stick their leads in the foam packing material.

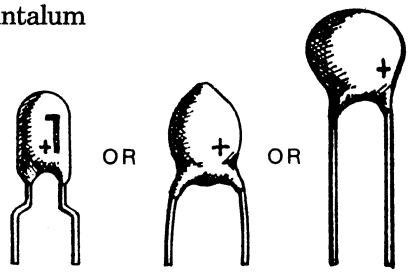
Resistors, ¼ Watt

☐ 10	33 Ohm (orange-orange-black)	R1, R3, R4, R5, R6, R7, R8, R9, R10, R11

Resistors, ½ Watt

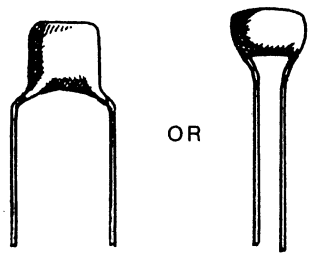
☐ 1	470 Ohm (yellow-violet-brown)	R2

Capacitors, tantalum



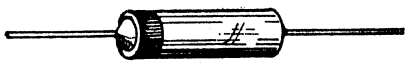
☐ 6	10uf, 25V	C2, C9, C10, C11, C12, C13

Capacitors, ceramic

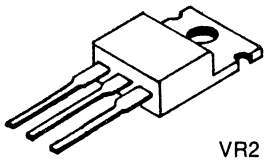


☐ 48	0.1uf	C1, C3-C8, C14-C54
☐ 1	820pf, 50V	C55

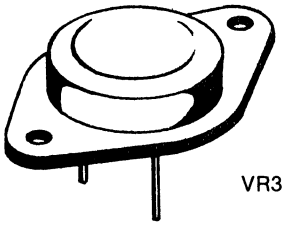
Voltage Regulators



VR1



VR2

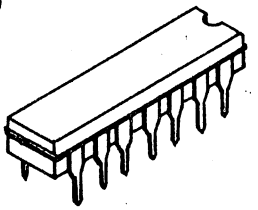


VR3

☑	1	1N751	VR1
☑	1	LM340T-12	VR2
☑	1	LM340K-5	VR3

Check the integrated circuits off the parts list as you identify them.

Integrated Circuits (IC's)



☐	1	74LS04	U21
☐	1	74LS08	U29
☐	1	74LS11	U28
☐	1	74S32	U3
☐	1	74LS32	U34
☐	1	74LS51	U38
☐	5	74LS74	U23, U27, U32, U39, U40
☐	1	74LS138	U22
☐	4	74LS153	U18, U24, U30, U36
☐	6	74LS163	U19, U20, U25, U26, U31, U33
☐	1	74LS166	U1
☐	1	74LS245	U37
☐	5	74LS367	U4, U5, U6, U35, U41

CAUTION

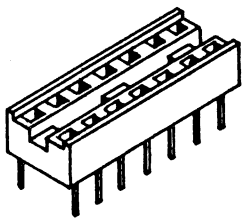
The following metal-oxide-semiconductors (MOS) supplied with this kit are highly susceptible to destruction from static discharge. Do not remove them from their protective, black foam backing or anti-static enclosures at this time.

Locate and check off these remaining integrated circuits from the parts list.

☐	1	9000-0001 or 9000-0002	U9A
☐	8	4116	U10-U17
☐	1	6810	U8

NOTE: The additional 74LS166 and Z-80 CPU required by this kit will be removed from the TERMINAL LOGIC board of your terminal. (Leave them mounted on the TERMINAL LOGIC board for now.) Open the bags containing the IC sockets and check them off the parts list.

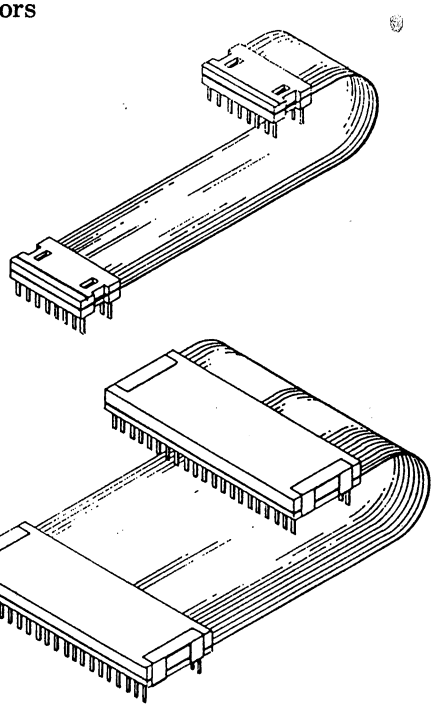
Sockets



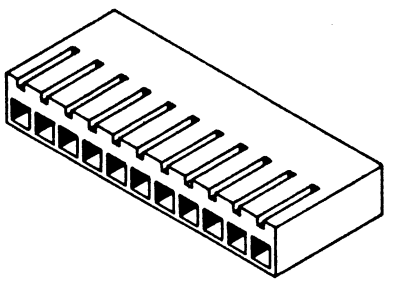
☑	2	40-pin IC socket
☑	2	28-pin IC socket
☑	1	24-pin IC socket
☑	1	20-pin IC socket
☑	27	16-pin IC socket
☑	11	14-pin IC socket

Open the remaining bags of parts and check them off the parts list as they are identified.

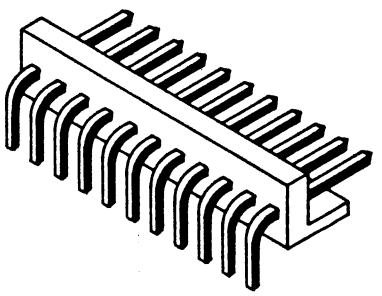
Connectors



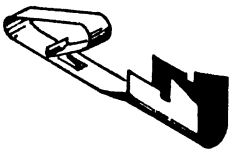
☑ 1 40 conductor ribbon cable assy.
☑ 1 16 conductor ribbon cable assy.



☑ 2 11 hole connector shell



☑ 2 11 pin polarizing wafer

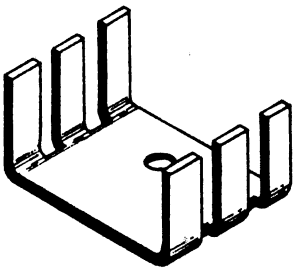


☐ 25 Spring connector (23 required)

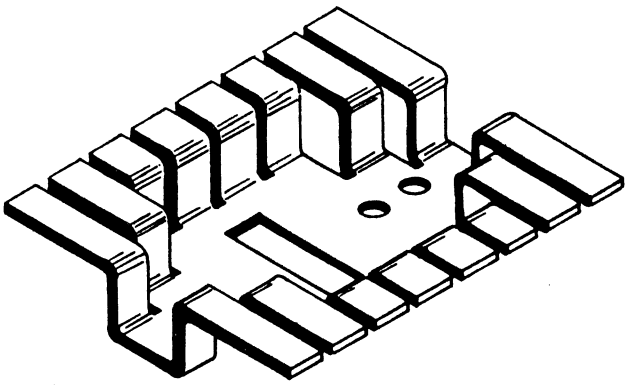
Hardware

☑ 6 6-32 X 3/8 screw
☑ 2 6-32 X ½ screw
☑ 4 6-32 nut
☑ 2 #6 lockwasher

Miscellaneous



☑ 1 Small heatsink



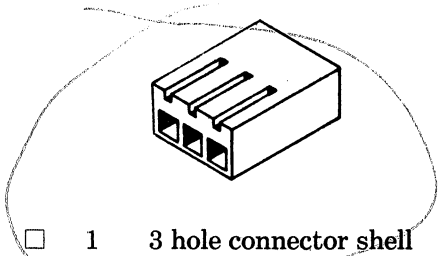
☑ 1 Large heatsink

☑ 2 Card guides
☐ 10 5 inch pieces of wire
☐ 1 Roll of electrical solder

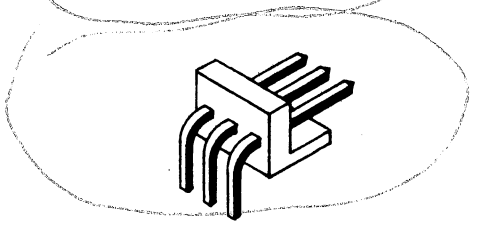
In addition there should be;

☑ 1 Printed circuit board
☑ 1 This instruction manual

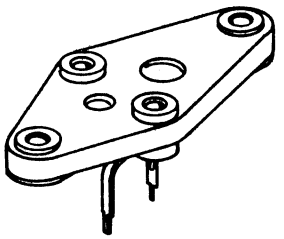
Additional parts required for H/Z-89 only.



☐ 1 3 hole connector shell



☐ 1 3 pin polarizing wafer

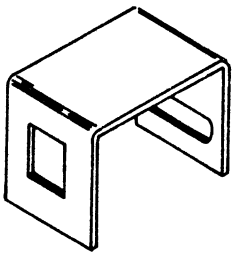


☐ 1 TO-3 socket

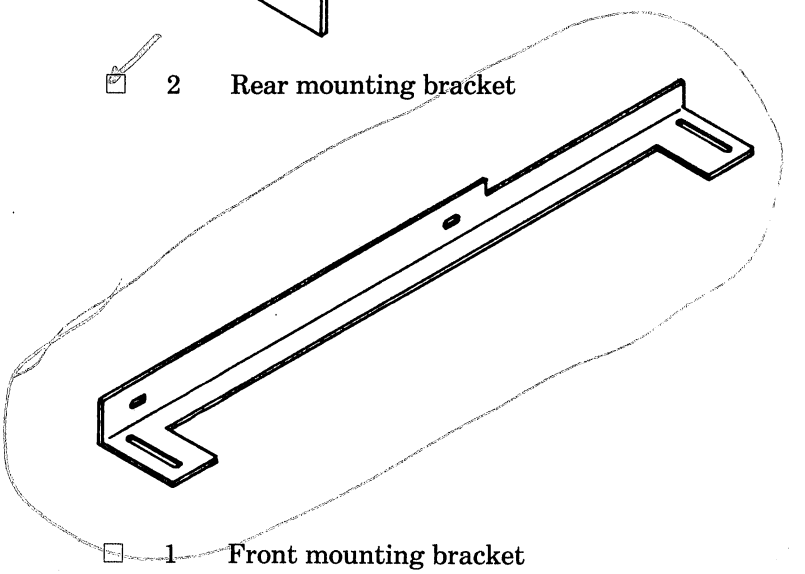
☐ 2 Spacers

☐ 2 Brass inserts.

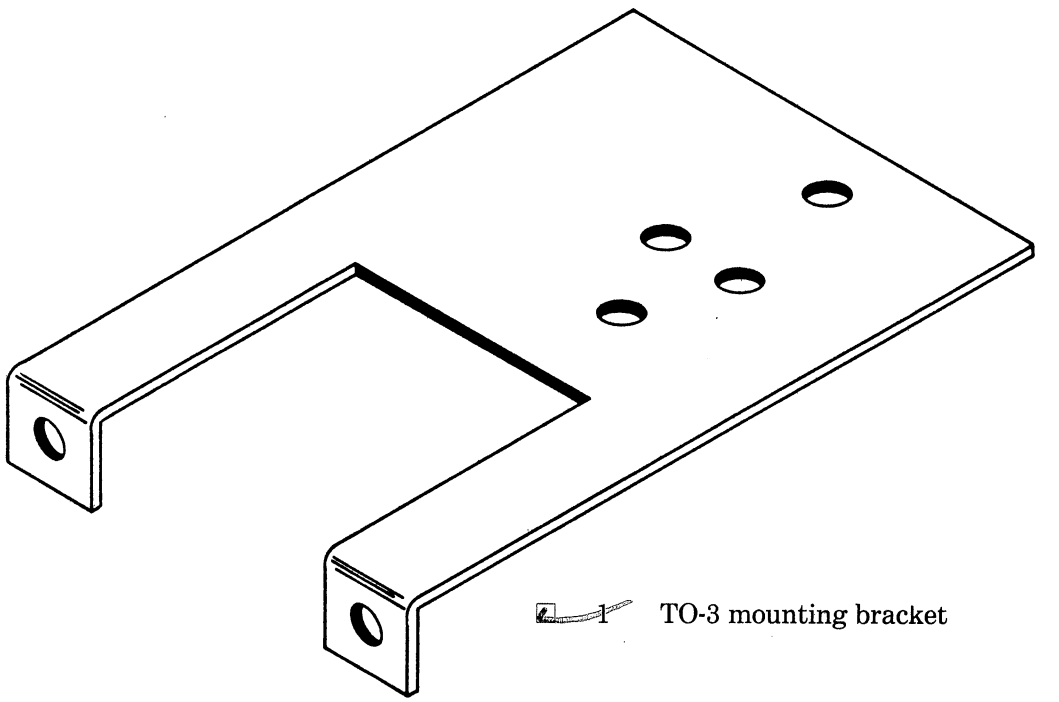
☐ 3 18 inch pieces of wire



☐ 2 Rear mounting bracket



☐ 1 Front mounting bracket



☐ 1 TO-3 mounting bracket

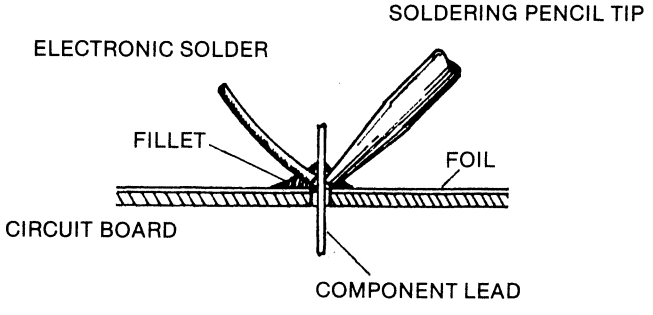
BASIC ASSEMBLY TECHNIQUES

It's usually a good idea to briefly read through these instructions before you actually start the construction so there won't be any surprises. Once you've read through the instructions, inspect the circuit board for possible shipping damage, such as deep scratches or torn traces. Place the circuit board component side (i.e., the side with the printing) up.

When you are asked to install a component, first bend its leads with a pair of pliers so that the part will fit the hole pattern exactly. When inserting the components into the board, it is considered good practice to orient the non-polarized parts (e.g., resistors and ceramic capacitors), in a uniform manner. For instance, all resistors could have their tolerance band toward the top of the circuit board. This makes their values easier to read so mistakes are less likely.

Hold the part in place with your hand and flip the circuit board over. Rest the component on a small wood block or similar pad so that the component is sandwiched between the block and weight of the board, thus holding it flat against the surface of the circuit board.

When soldering a connection, wedge the tip of the soldering pencil solidly between the component lead and circuit pad, insuring that both lead and the pad are equally heated. This is the key to preventing a cold solder joint. Apply the solder to the joint opposite of the soldering tip. As soon as the solder begins to melt and forms a fillet, remove the solder wire. Only a very small amount of solder is required. Once the solder fillet has formed, withdraw the soldering pencil by lifting it up along the lead. This prevents the solder from being dragged across the circuit board which could create a solder bridge.



Clean the tip of the soldering pencil occasionally with a damp sponge or cloth.

Do not use soldering paste. It is not required since all of the parts are pretinned.

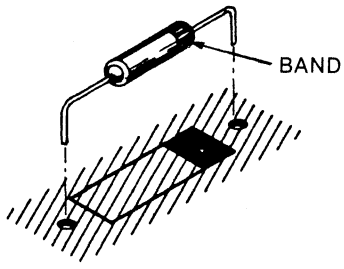
Do not heat a joint too long. Electronic components can be damaged by too much heat.

WARNING

When clipping off excess lead, hold the lead end to prevent it from flying up and causing a possible eye injury.

Form, insert, solder and clip the excess lead on the following.

- ☑ Install a 33 Ohm resistor (orange-orange-black) at R1
- ☑ Install a 33 Ohm resistor (orange-orange-black) at R3
- ☑ Install a 33 Ohm resistor (orange-orange-black) at R4
- ☑ Install a 33 Ohm resistor (orange-orange-black) at R5
- ☑ Install a 33 Ohm resistor (orange-orange-black) at R6
- ☑ Install a 33 Ohm resistor (orange-orange-black) at R7
- ☑ Install a 33 Ohm resistor (orange-orange-black) at R8
- ☑ Install a 33 Ohm resistor (orange-orange-black) at R9
- ☑ Install a 33 Ohm resistor (orange-orange-black) at R10
- ☑ Install a 33 Ohm resistor (orange-orange-black) at R11
- ☑ Install a 470 Ohm resistor (yellow-violet-brown) at R2
- ☐ Install the zener diode (1N751) at VR1. Match the band on the zener diode with the band marked on the circuit board. (This component must be oriented properly to function correctly. Be careful not to overheat the component.)



When installing IC sockets, be certain to orient them properly. The IC sockets have some kind of notch or dot at one end. Orient this marking with the marking on the circuit board. Be sure not to accidentally mount a 14 pin socket where a 16 pin socket was meant to be. After the socket has been inserted into the board, flip the board over while holding the socket to keep it from falling out. Check to make sure all the pins are through the holes. Solder two diagonally opposing corner pins to hold the socket in place. If the socket is not seated flatly against the surface of the circuit board, apply pressure on the socket with your finger while reheating the pin. Be careful not to burn your finger. There is no need to trim the excess lead on these components. **Do not** solder the rest of the pins at this time.

- [ ] Install a 40-pin socket at J4
- [ ] Install a 40-pin socket at U7
- [ ] Install a 28-pin socket at U9A
- [ ] Install a 28-pin socket at U9B
- [ ] Install a 24-pin socket at U8
- [ ] Install a 20-pin socket at U37
- [ ] Install a 16-pin socket at J1
- [ ] Install a 16-pin socket at U1
- [ ] Install a 16-pin socket at U2
- [ ] Install a 16-pin socket at U4
- [ ] Install a 16-pin socket at U5
- [ ] Install a 16-pin socket at U6
- [ ] Install a 16-pin socket at U18
- [ ] Install a 16-pin socket at U19
- [ ] Install a 16-pin socket at U20
- [ ] Install a 16-pin socket at U22
- [ ] Install a 16-pin socket at U24
- [ ] Install a 16-pin socket at U25
- [ ] Install a 16-pin socket at U26
- [ ] Install a 16-pin socket at U30
- [ ] Install a 16-pin socket at U31
- [ ] Install a 16-pin socket at U33
- [ ] Install a 16-pin socket at U35
- [ ] Install a 16-pin socket at U36
- [ ] Install a 16-pin socket at U41
- [ ] Install a 16-pin socket at U10
- [ ] Install a 16-pin socket at U11
- [ ] Install a 16-pin socket at U12
- [ ] Install a 16-pin socket at U13
- [ ] Install a 16-pin socket at U14
- [ ] Install a 16-pin socket at U15
- [ ] Install a 16-pin socket at U16
- [ ] Install a 16-pin socket at U17
- [ ] Install a 14-pin socket at U3
- [ ] Install a 14-pin socket at U21
- [ ] Install a 14-pin socket at U23
- [ ] Install a 14-pin socket at U27
- [ ] Install a 14-pin socket at U28
- [ ] Install a 14-pin socket at U29
- [ ] Install a 14-pin socket at U32
- [ ] Install a 14-pin socket at U34
- [ ] Install a 14-pin socket at U38
- [ ] Install a 14-pin socket at U39
- [ ] Install a 14-pin socket at U40

- [ ] Double check the orientation of each IC socket. They should all be oriented in the same direction.

- [ ] Solder the remaining pins of each IC socket. (Be careful not to use an excess of solder which could create a solder bridge between traces. **Do not** install any integrated circuits at this time.)

When installing capacitors, keep any insulating coating on the leads above the circuit board. It is difficult to solder a lead if the insulation is pushed into the hole. These parts are **not** polarity sensitive.

Insert, solder, and trim the excess lead on the following:

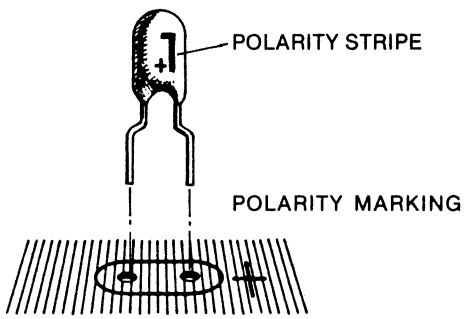
- [ ] Install a 0.1uf capacitor at C1
- [ ] Install a 0.1uf capacitor at C3
- [ ] Install a 0.1uf capacitor at C4
- [ ] Install a 0.1uf capacitor at C5
- [ ] Install a 0.1uf capacitor at C6
- [ ] Install a 0.1uf capacitor at C7
- [ ] Install a 0.1uf capacitor at C8
- [ ] Install a 0.1uf capacitor at C14
- [ ] Install a 0.1uf capacitor at C15
- [ ] Install a 0.1uf capacitor at C16
- [ ] Install a 0.1uf capacitor at C17
- [ ] Install a 0.1uf capacitor at C18
- [ ] Install a 0.1uf capacitor at C19
- [ ] Install a 0.1uf capacitor at C20
- [ ] Install a 0.1uf capacitor at C21
- [ ] Install a 0.1uf capacitor at C22
- [ ] Install a 0.1uf capacitor at C23
- [ ] Install a 0.1uf capacitor at C24
- [ ] Install a 0.1uf capacitor at C25
- [ ] Install a 0.1uf capacitor at C26
- [ ] Install a 0.1uf capacitor at C27
- [ ] Install a 0.1uf capacitor at C28
- [ ] Install a 0.1uf capacitor at C29
- [ ] Install a 0.1uf capacitor at C30
- [ ] Install a 0.1uf capacitor at C31
- [ ] Install a 0.1uf capacitor at C32
- [ ] Install a 0.1uf capacitor at C33
- [ ] Install a 0.1uf capacitor at C34
- [ ] Install a 0.1uf capacitor at C35
- [ ] Install a 0.1uf capacitor at C36
- [ ] Install a 0.1uf capacitor at C37
- [ ] Install a 0.1uf capacitor at C38

- [ ] Install a 0.1uf capacitor at C39
- [ ] Install a 0.1uf capacitor at C40
- [ ] Install a 0.1uf capacitor at C41
- [ ] Install a 0.1uf capacitor at C42
- [ ] Install a 0.1uf capacitor at C43
- [ ] Install a 0.1uf capacitor at C44
- [ ] Install a 0.1uf capacitor at C45
- [ ] Install a 0.1uf capacitor at C46
- [ ] Install a 0.1uf capacitor at C47
- [ ] Install a 0.1uf capacitor at C48
- [ ] Install a 0.1uf capacitor at C49
- [ ] Install a 0.1uf capacitor at C50
- [ ] Install a 0.1uf capacitor at C51
- [ ] Install a 0.1uf capacitor at C52
- [ ] Install a 0.1uf capacitor at C53
- [ ] Install a 0.1uf capacitor at C54

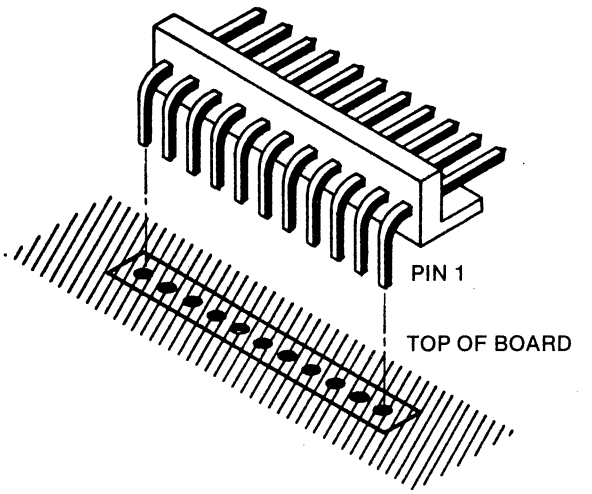
When installing tantalum capacitors observe the polarity (polarized component). **Always** position the capacitors so the plus (+) marking on the capacitor matches those on the circuit board.

Insert, solder, and trim the excess lead on the following:

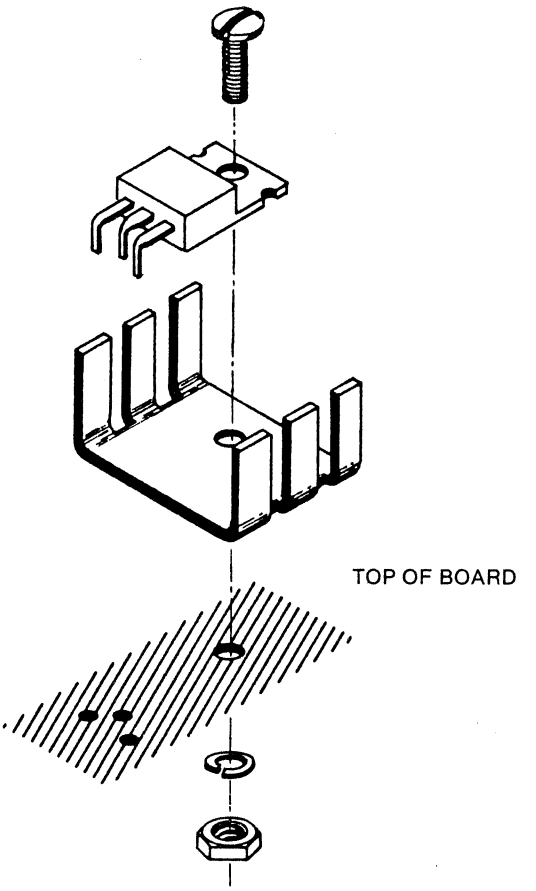
- [ ] Install a 10uf tantalum capacitor at C2
- [ ] Install a 10uf tantalum capacitor at C9
- [ ] Install a 10uf tantalum capacitor at C10
- [ ] Install a 10uf tantalum capacitor at C11
- [ ] Install a 10uf tantalum capacitor at C12
- [ ] Install a 10uf tantalum capacitor at C13



- [ ] Install an 11-pin polarizing wafer at J2. Its pins should point toward the top of the circuit board and should be parallel with the board's surface. Solder a middle pin first, verify that the polarizing wafer's pins are indeed parallel, then solder the remaining pins. Slight warpage of the polarizing wafer is common and causes no harm, so don't stress the solder connections by forcing the wafer flat.



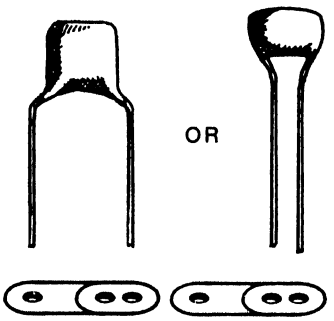
- [ ] In a similar manner install the remaining 11-pin polarizing wafer at J3.
- [ ] Bend the leads of the LM340T-12 voltage regulator so they fit the hole pattern when the voltage regulator is aligned with its mounting hole at VR2.



☐ Place the small heatsink under the voltage regulator and secure it using a 6-32 X 3/8 screw, #6 lockwasher and 6-32 nut. Orient the heatsink so that the shorter distance between the heatsink's mounting hole and the edge of the heatsink is toward the top of the circuit board. The lockwasher and nut should be on the circuit side of the circuit board (i.e., opposite the component side). Snug but don't crush.

☐ Solder the three leads, being careful not to overheat the component. Permit the component to cool down between leads.

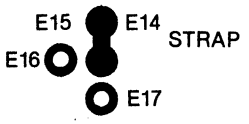
☐ Trim the excess lead.



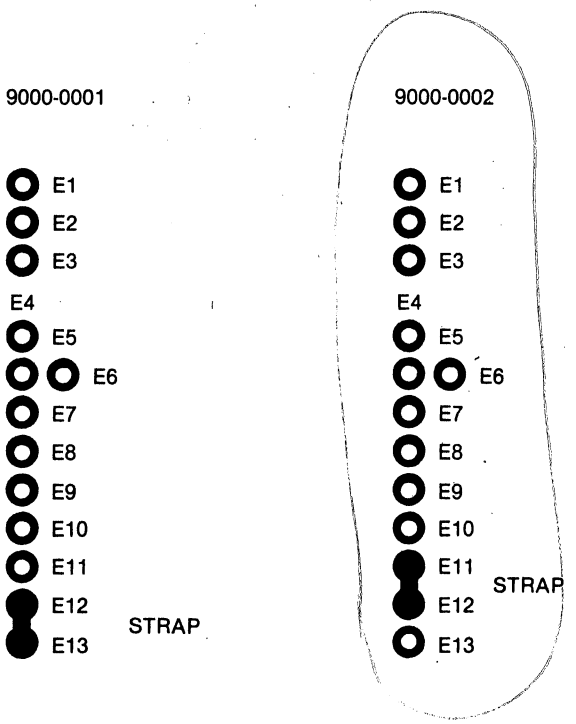
☐ Install a 820pf capacitor at C55.

NOTE: The jumper arrangement described below defines a standard board. If you plan to enhance the Imaginator as described under **Modifications**, do not do so at this time. We recommend that the following jumper configuration should be used until you know that the board functions properly:

☐ Form a jumper by bending a small loop in a piece of scrap lead cut from a component previously mounted. Solder it in place. Trim the excess lead.



☐ Determine if the U9A GCP is numbered 9000-0001 or 9000-0002.



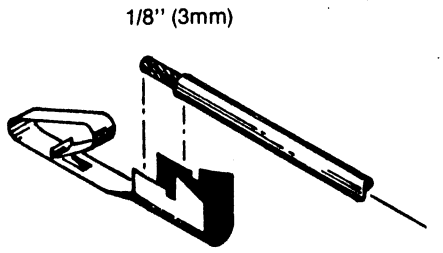
☐ Mount the 3-pin polarizing wafer on the component side of the board at J5. Its pins should point toward the right side of the circuit board and should be parallel with the board's surface.

☐ Trim each of the three 18 inch wires to a length of 15 inches (380mm).

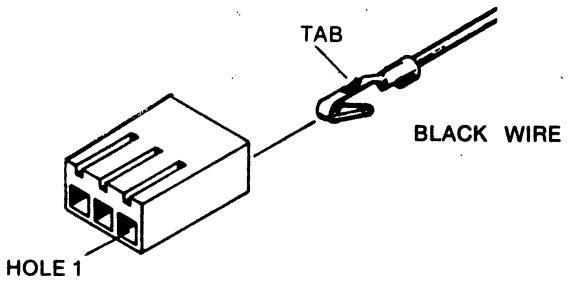
☐ Strip 1/8 inch (3mm) of insulation off of one end of each of these three wires.

☐ Strip 1/4 inch (6mm) of insulation off of the remaining end of these three wires.

☐ Crimp and solder a spring connector onto the 1/8 inch end of each of these three wires.

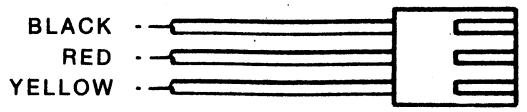


☐ Insert the spring connector of the BLACK wire into hole 1 of the 3 hole connector shell. The small tab on the spring connector should face the slotted side of the connector shell. Gently tug on the wire to be certain that it is locked in place.



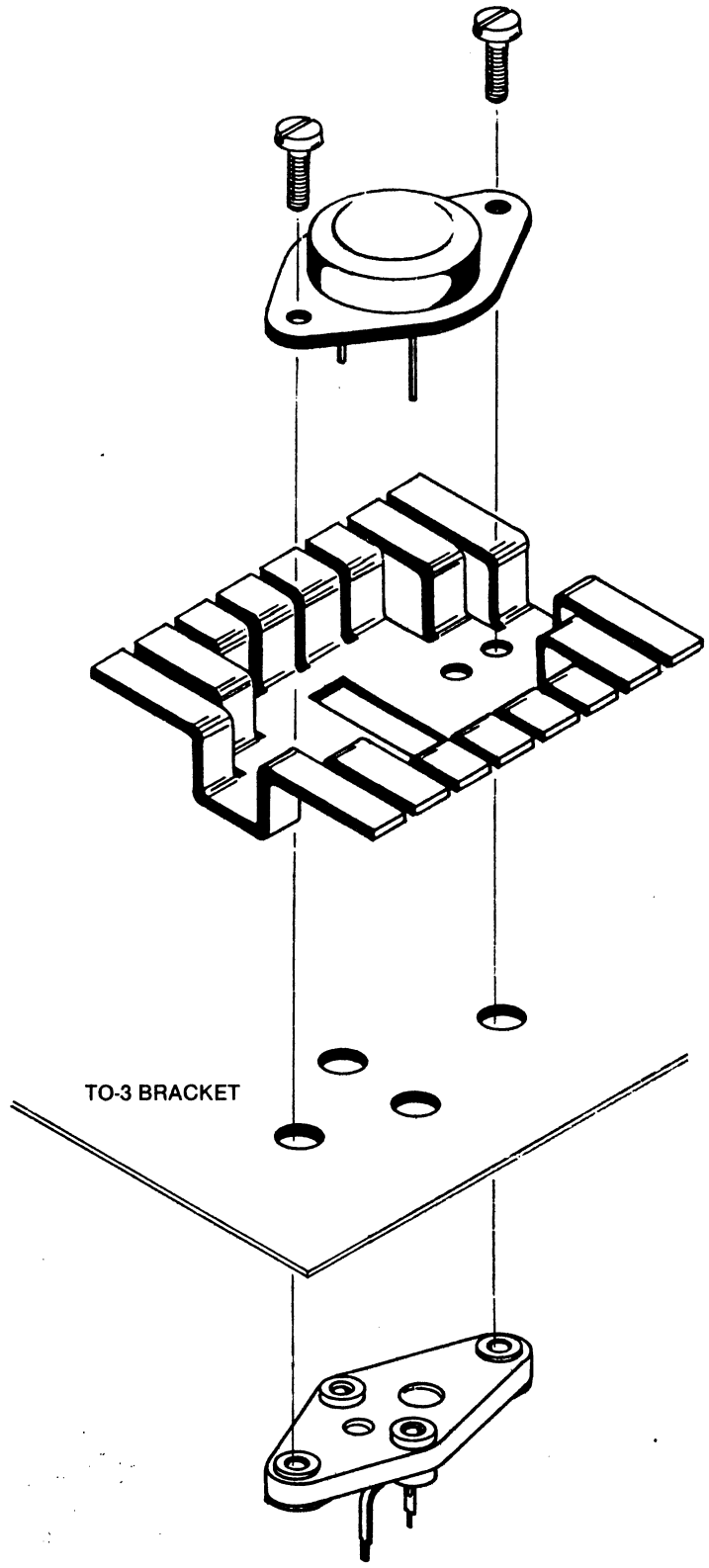
In a similar manner, insert one end of the remaining two wires into the same connector shell.

☐ The RED wire into hole 2.
☐ The YELLOW wire into hole 3.



☐ Loosely twist the three wires together so they stay together as a single bundle.

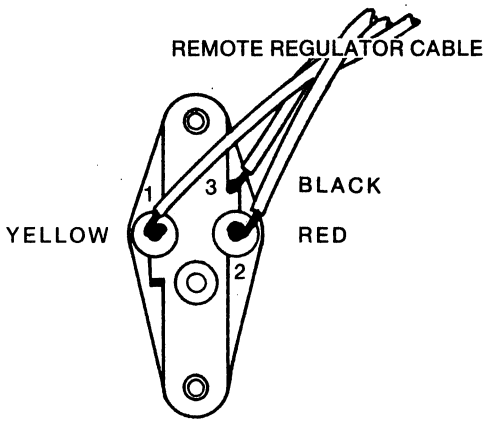
☐ Secure the TO-3 socket, the TO-3 bracket, the large heatsink and the LM340K-5 voltage regulator together with the screws provided.



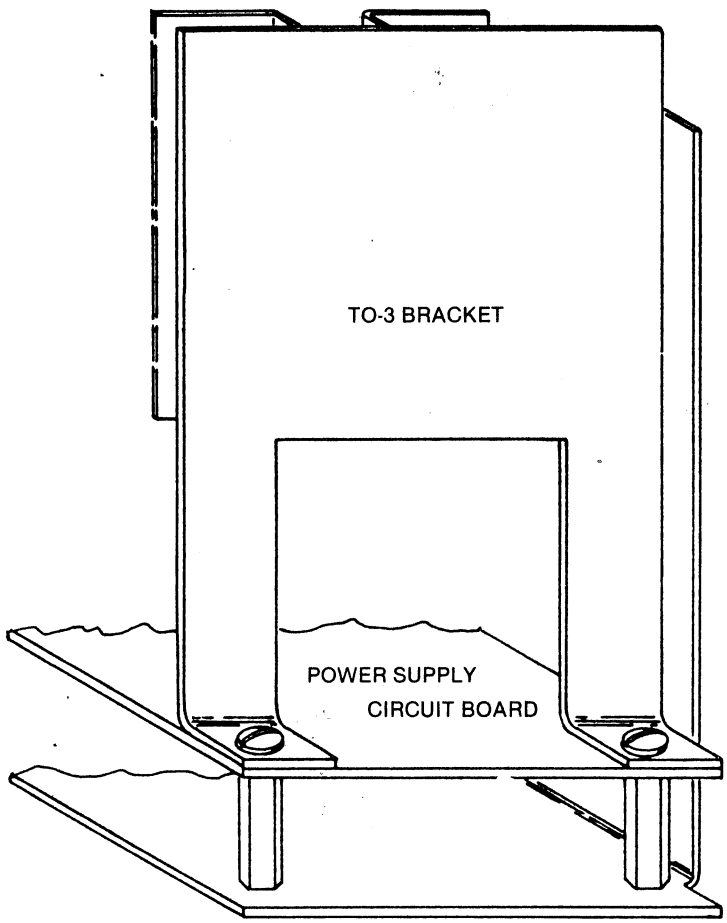
☐ Form a secure mechanical connection and then solder the free end of the BLACK wire to the ground lug of the TO-3 socket.

☐ In a similar manner, attach the RED wire to lug 2.

☐ Attach the YELLOW wire to lug 1.

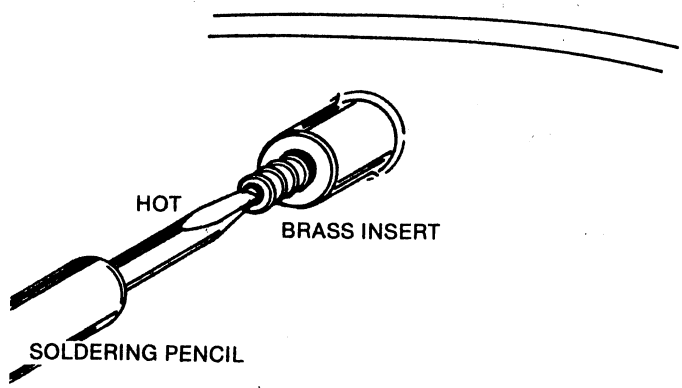


☐ Remove the two rear screws that are used to fasten the power supply circuit board to its mounting spacers. Mount the TO-3 bracket assembly here with two 6-32 X 3/8 screws.

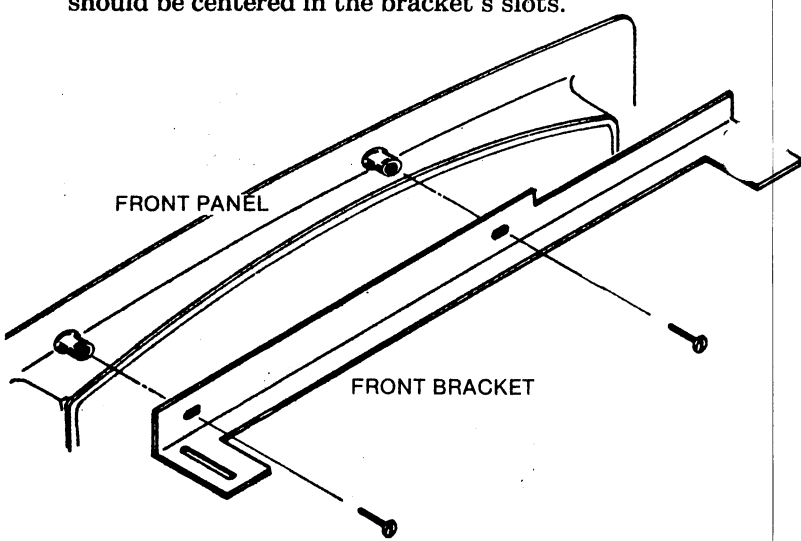


☐ Make certain that the bracket does not come into contact with any of the exposed wires or leads of the other components mounted in that region.

☐ With a hot soldering pencil, push the brass inserts into the two holes on the front panel. Do not heat too long. The inserts should be flush with the surface of the hole - no deeper.



☐ Fasten the front mounting bracket to the front panel using two 6-32 X 3/8 screws. The screws should be centered in the bracket's slots.



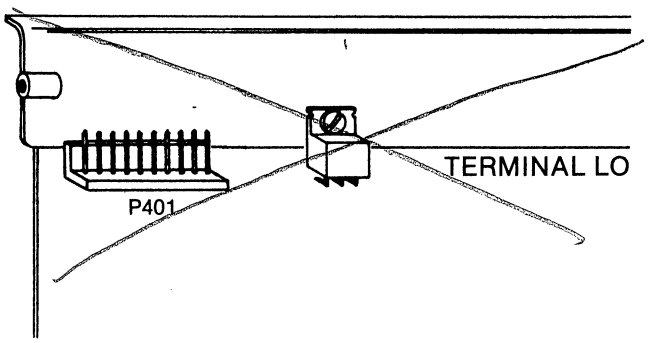
☐ Cleaning the flux from the circuit side of the circuit board is not required but can easily be done by scrubbing with isopropyl alcohol, using a small brush. Be careful not to splatter the liquid into your eyes. **Wear safety goggles.**

☐ You've heard this before. Carefully double-check the orientation of each of the components, paying particular attention to the zener diode and the six tantalum capacitors.

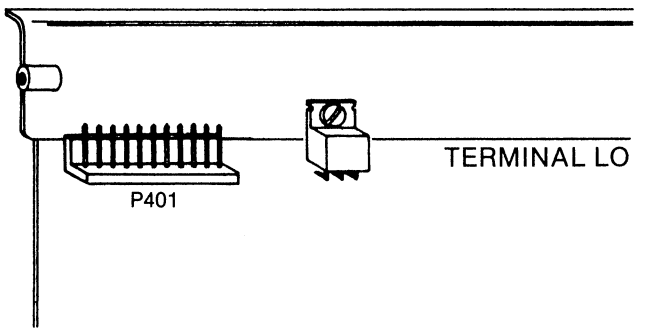
☐ Carefully double-check each of the solder connections to be certain that there are no cold joints or solder bridges. Hairline thin solder bridges are very difficult to see. Reheat any suspicious joints.

☐ Set the board aside temporarily.

NOTE: Some of the following procedures differ depending on the type of terminal you have. Open the terminal's cover and take a look at the power harness connector on the TERMINAL LOGIC board (P401). Early models use a connector with 10 pins; later models use a connector with 11 pins. Count the pins (not wires) and determine which model you own. 10 PIN MODEL and 11 PIN MODEL will be used to denote the two types. Do only the procedures that correspond to your terminal. Leaf on ahead and cross out those sections that do not pertain to your terminal type.



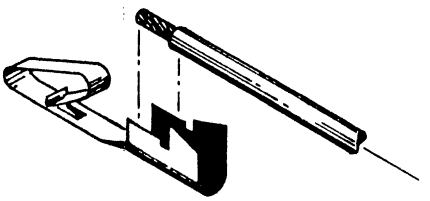
OR



PERFORM ON ALL MODELS

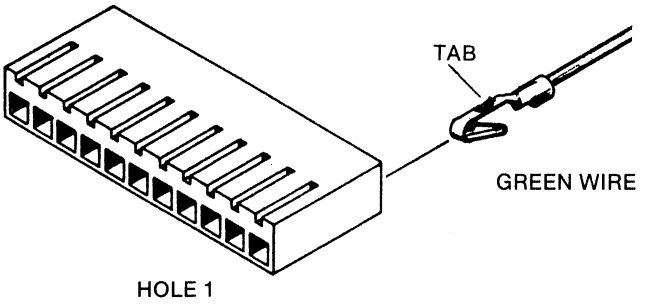
- Trim each of the 10 pieces of wire to a length of 5 inches (125mm).
- Strip 1/8 inch (3mm) of insulation off of both ends of each wire.
- Crimp and solder a spring connector onto each wire end.

1/8" (3mm)



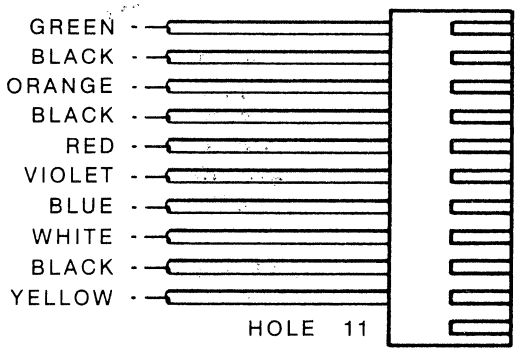
- Insert one end of the GREEN wire into hole one of an 11 hole connector shell. The small tab on the spring connector should face the slotted side of the connector shell. Gently tug on the wire to be certain that it is locked in place.

11 HOLE CONNECTOR SHELL



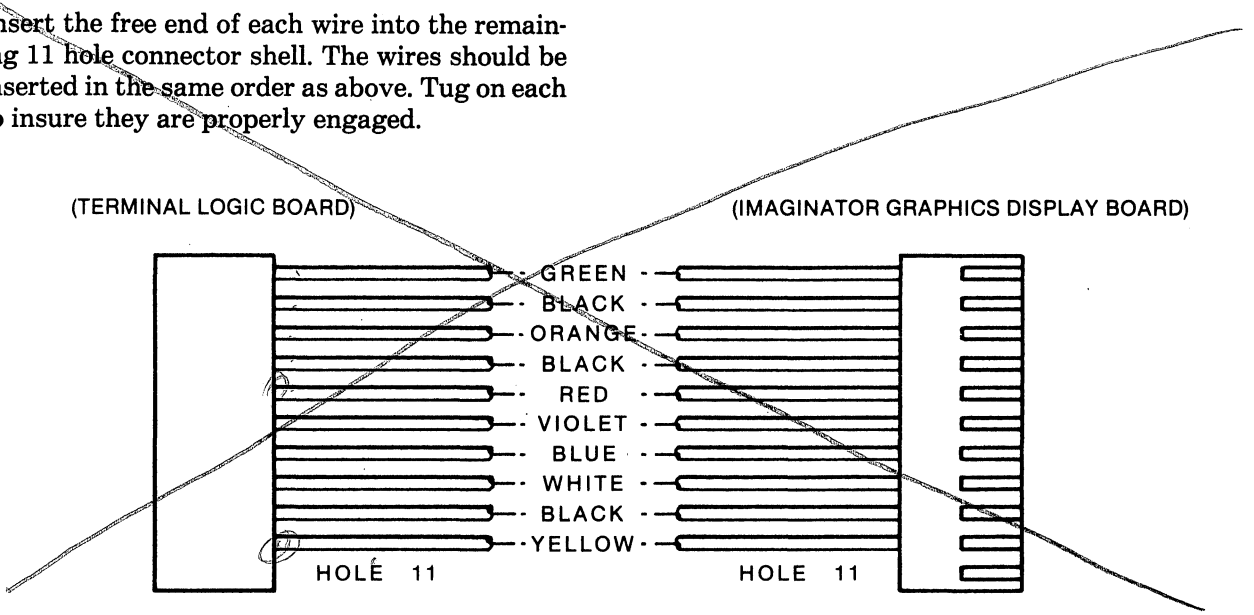
In a similar manner insert one end of each of the remaining wires into the same connector shell.

- A BLACK wire into hole 2
- The ORANGE wire into hole 3
- A BLACK wire into hole 4
- The RED wire into hole 5
- The VIOLET wire into hole 6
- Skip hole 7 *(H/Z-89's require the BLUE wire here.)*
- The WHITE wire into hole 8
- The remaining BLACK wire into hole 9
- The YELLOW wire into hole 10
- Skip hole 11



PERFORM ONLY FOR 10 PIN MODELS

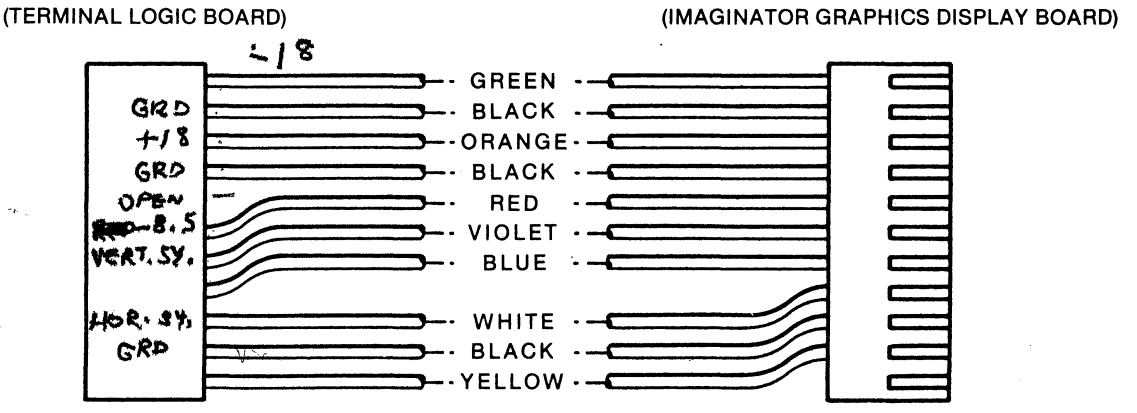
☐ Insert the free end of each wire into the remaining 11 hole connector shell. The wires should be inserted in the same order as above. Tug on each to insure they are properly engaged.



RELAY POWER HARNESS

PERFORM ONLY FOR 11 PIN MODELS

☐ Insert the free end of each wire into the remaining 11 hole connector shell. The wires should be inserted in the same order as above except skip hole 5 and shift the remaining wires over one hole with the RED wire in hole 6 etc. Tug on each to insure they are properly engaged.



RELAY POWER HARNESS

PERFORM ON ALL MODELS

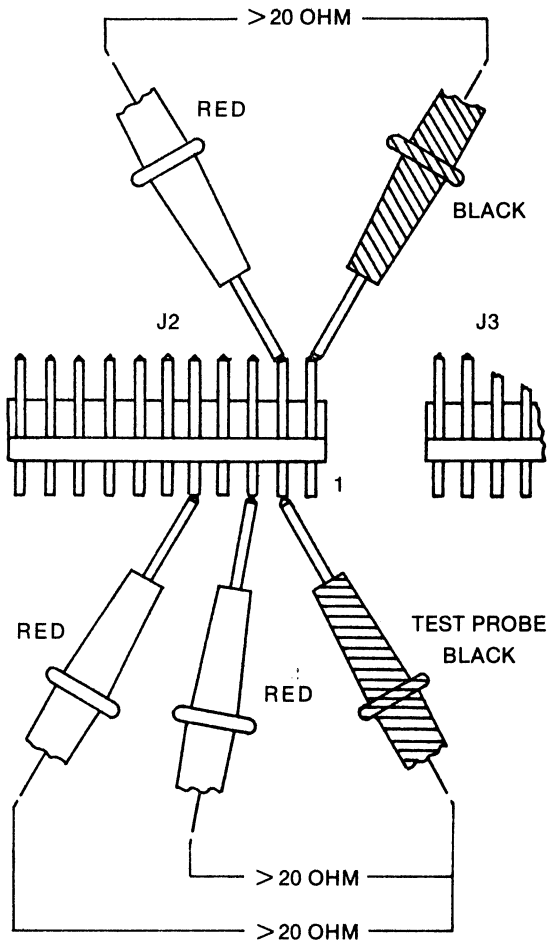
☑ Double check that none of the wires are criss-crossed.

At this time there should be no IC's mounted on the board other than the voltage regulators. If an ohmmeter is available, measure the resistance between the following pins on either connector J2 or J3.

Note: The actual resistance measured is probably **much** greater than that specified.

☐ Connect the remote regulator cable to connector J5.

	Negative probe	Positive probe	Correct resistance
☐	pin 2	pin 3	greater than 20 ohms
☐	pin 2	pin 5	greater than 20 ohms
☐	pin 1	pin 2	greater than 20 ohms



If any reading is less than what is specified check the board for shorts.

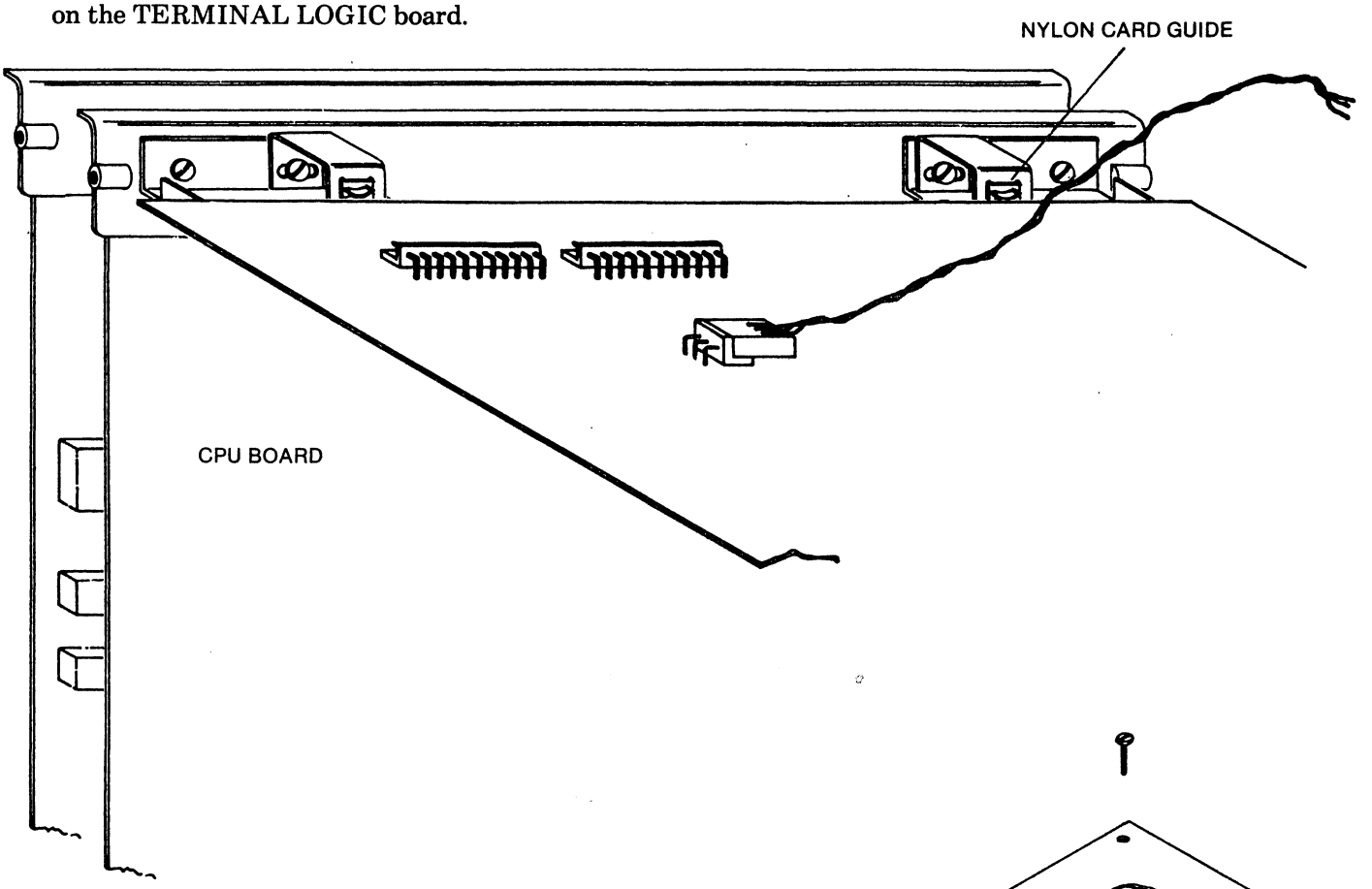
☑ **Make certain the terminal is turned off.** If it was on, wait a few minutes for the capacitors to discharge before proceeding.

☑ Remove the terminal cover completely.

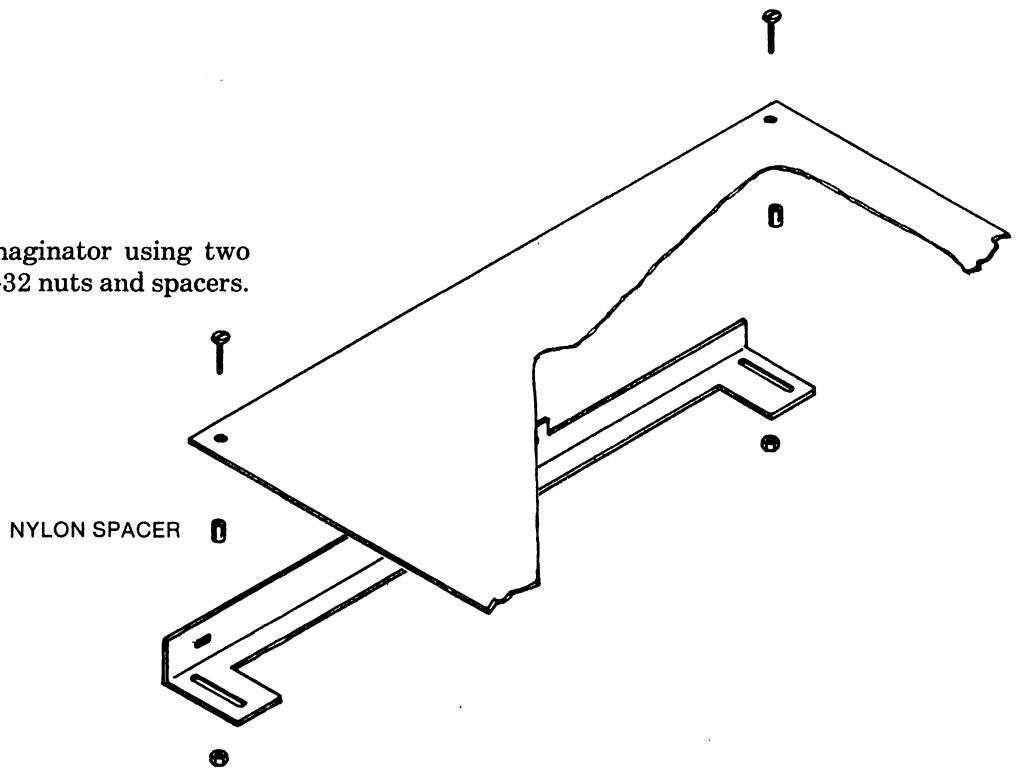
☑ Unplug the power harness from connector P401 on the TERMINAL LOGIC board.

☑ Secure the two rear mounting brackets to the CPU board using 6-32 X 3/8 screws.

☑ Snap the two nylon card guides into the rectangular holes in the two rear mounting brackets.



☐ Temporarily mount the Imaginator using two each of 6-32 X 1/2 screws, 6-32 nuts and spacers.

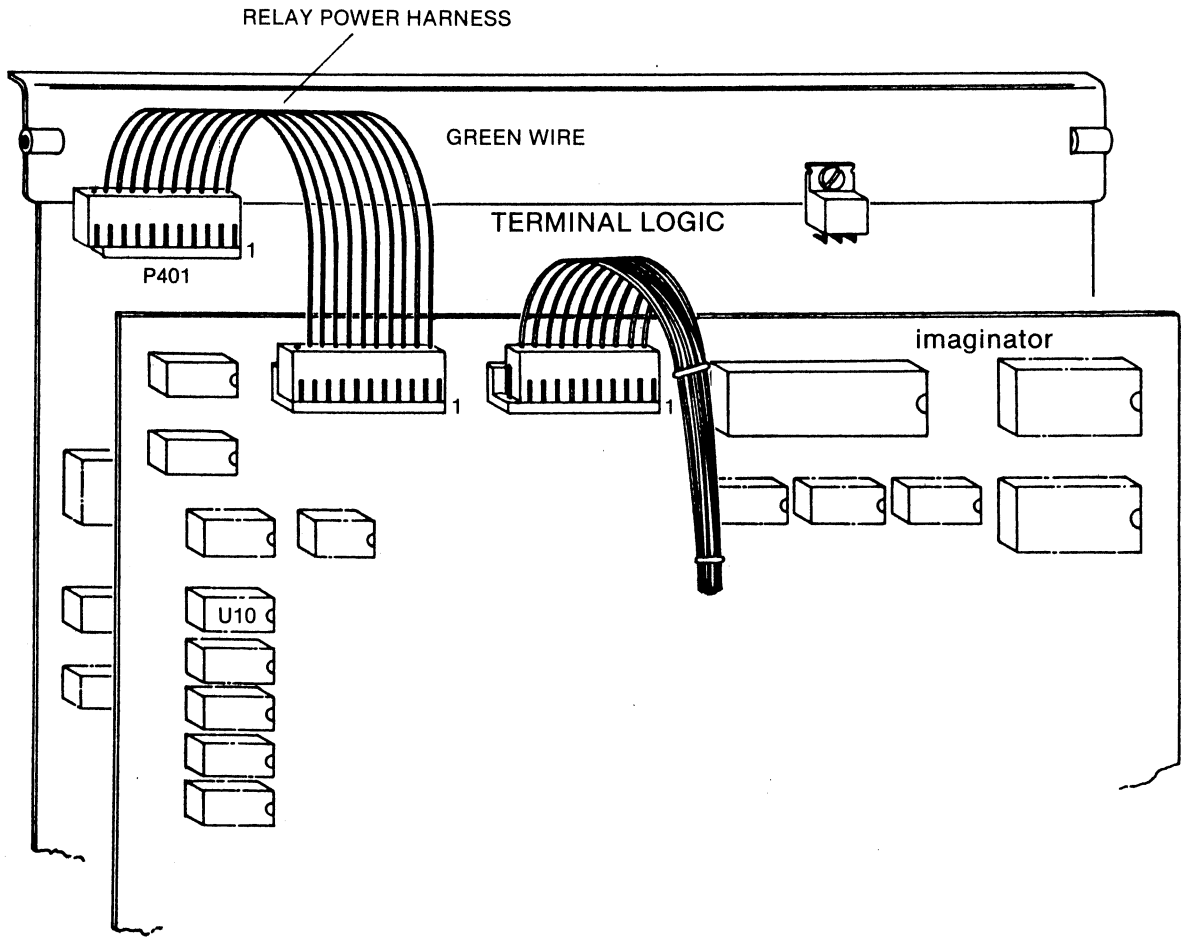


PERFORM ONLY FOR 10 PIN MODELS

1. Plug the power harness that was just unplugged from the TERMINAL LOGIC board onto connector J3 on the Imaginator. The GREEN wire should coincide with pin 1 of the connector (pin 11 is free).

2. Plug either end of the relay power harness onto connector J2 on the imaginator. The GREEN wire should coincide with pin 1.

3. Plug the other end of the relay power harness onto connector P401 on the TERMINAL LOGIC board. The GREEN wire should coincide with pin 1, (hole 11 is free).

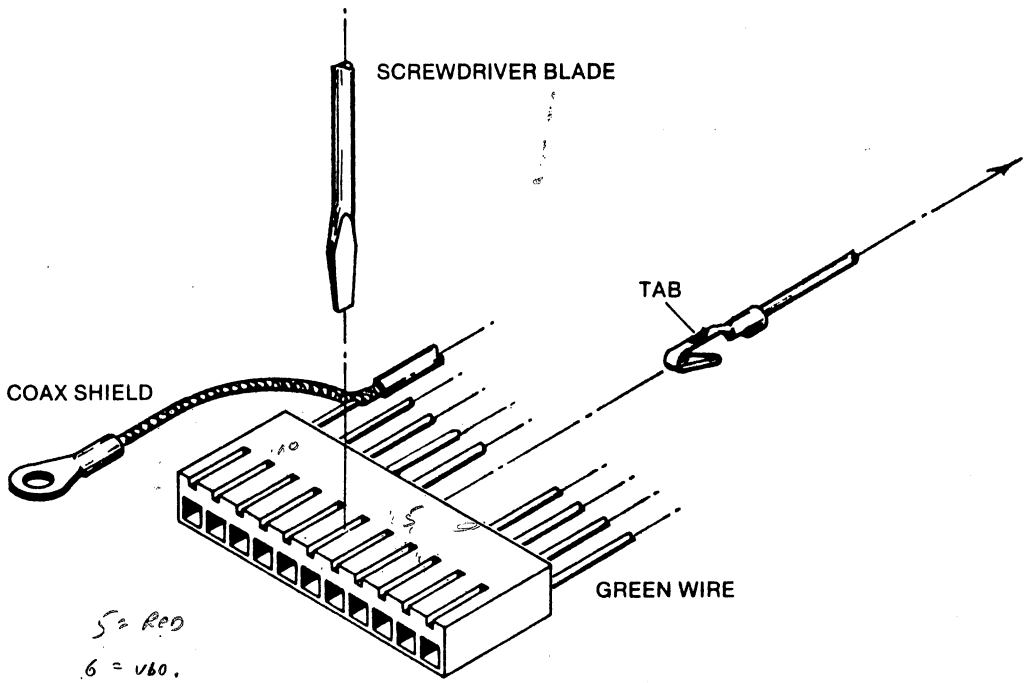


ILLUSTRATED SYMBOLICALLY

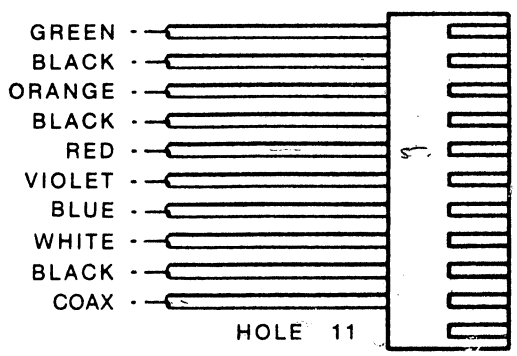
PERFORM ONLY FOR 11 PIN MODELS

The power harness that was just unplugged from the TERMINAL LOGIC board needs to be slightly modified.

☐ Using a small, flat-blade screwdriver, depress the crimp terminal's locking tab to release the RED wire from connector shell hole 6.



☐ Insert this RED wire into connector shell hole 5. Tug on the wire to be certain it is properly engaged.



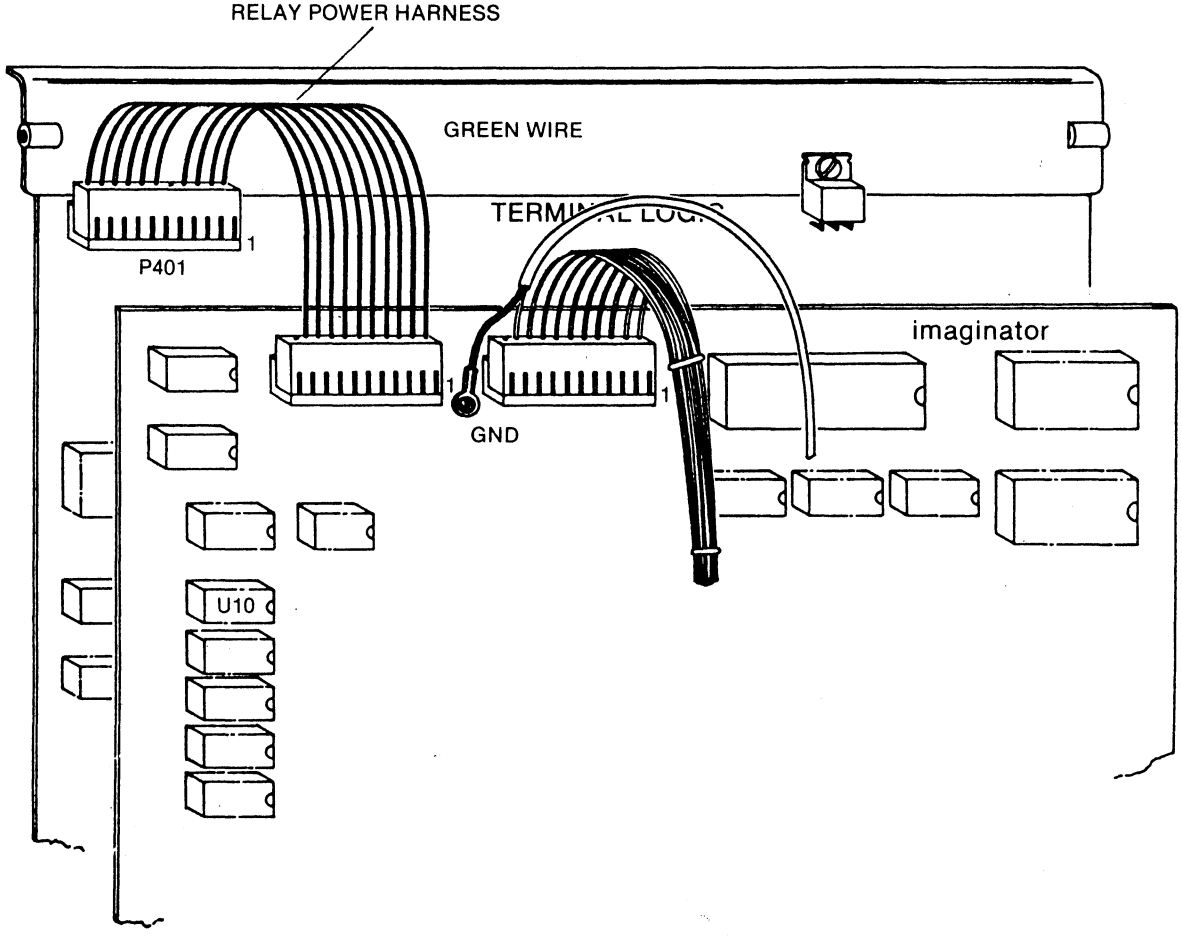
☐ Similarly, remove the VIOLET wire from hole 7 and insert it into hole 6.
☐ Remove the BLUE wire from hole 8 and insert it into hole 7. (If BLUE wire is present, otherwise skip this step).
☐ Remove the WHITE wire from hole 9 and insert it into hole 8.
☐ ~~Remove the BLACK wire from hole 10 and insert it into hole 9.~~
☐ Remove the COAX wire from hole 11 and insert it into hole 9
☐ Connector shell hole 11 is left empty.

- [ ] Plug this power harness onto connector J3 on the Imaginator board. The green wire should coincide with pin 1 of the connector.

- [ ] Secure the coax shield's terminal to the ground (GND) on the Imaginator with a 6-32 X 3/8 screw, 6-32 nut and #6 lockwasher. The nut and lockwasher should be on the circuit side of the board.

- [ ] Plug the Imaginator end of the relay power harness onto connector J2 on the Imaginator. The green wire should coincide with pin 1.

- [ ] Plug the other end of the relay power harness onto connector P401 on the TERMINAL LOGIC board. The green wire should coincide with pin 1.



ILLUSTRATED SYMBOLICALLY

PERFORM ON ALL MODELS

IMPORTANT

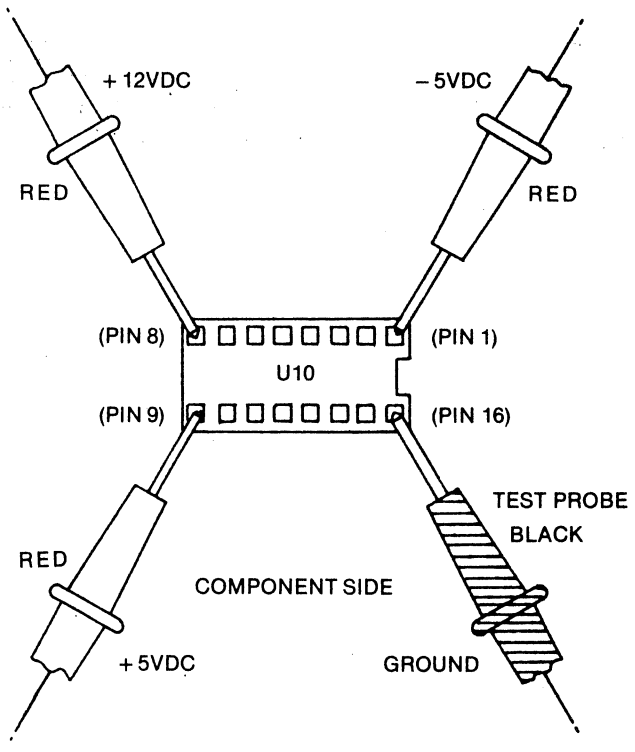
It is very important that the power harnesses are wired correctly for your type terminal. Applying power with a miswired harness can cause considerable damage to both the terminal and the Imaginator. Unless you are confident you wired the harnesses correctly, double check them against the proper diagram (10 or 11 pin model).

WARNING

When power is applied to the terminal, do not touch the flyback transformer, the high voltage lead, or the anode socket. An electrical shock hazard exists in these areas.

☐ Turn the terminal on.

☐ With the voltmeter, measure the voltage between the following pins of IC socket U10.



Negative probe	Positive probe	Correct Voltage (+/–5%)
☐ pin 16	pin 9	+5 volts
☐ pin 16	pin 1	–5
☐ pin 16	pin 8	+12

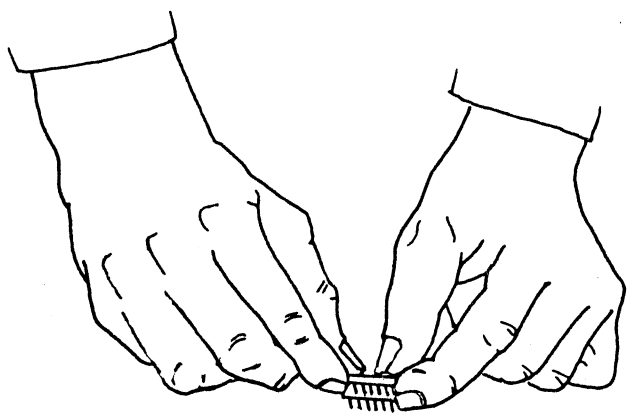
If these criteria are not met double check for cold solder joints and solder bridges. Make certain that all polarity sensitive components are mounted correctly.

☐ **Turn the terminal off.** Allow the capacitors to discharge a couple of minutes before proceeding.

☐ Unplug the harnesses from both J2 and J3.

☐ Remove the Imaginator from the terminal.

Integrated circuits are fragile and care must be used when handling them. The pins of an IC are often spread at an angle which makes it difficult to insert them into a socket. Place the pins on a flat surface and rock the IC a slight amount to straighten the pins. Every IC has some kind of notch or dot at one end. Orient the IC so that this marking will correspond to the marking on the IC socket and the marking on the circuit board. Place the IC on the socket and push straight down with even, gentle pressure over its entire length. Check to see that all of the pins went into the socket and that none accidentally folded under the IC. If you need to remove an IC from its socket, **do not** use your hands alone. The IC may suddenly dislodge and stab your finger. Use a tool.



Remember the orientation.

- ☐ Insert IC 74LS166 into socket U1
- ☐ Skip U2
- ☐ Insert IC 74S32 (Not 74LS32) into socket U3
- ☐ Insert IC 74LS367 into socket U4
- ☐ Insert IC 74LS367 into socket U5
- ☐ Insert IC 74LS367 into socket U6
- ☐ Skip U7
- ☐ Insert IC 74LS153 into socket U18
- ☐ Insert IC 74LS163 into socket U19
- ☐ Insert IC 74LS163 into socket U20
- ☐ Insert IC 74LS04 into socket U21
- ☐ Insert IC 74LS138 into socket U22
- ☐ Insert IC 74LS74 into socket U23
- ☐ Insert IC 74LS153 into socket U24
- ☐ Insert IC 74LS163 into socket U25
- ☐ Insert IC 74LS163 into socket U26
- ☐ Insert IC 74LS74 into socket U27
- ☐ Insert IC 74LS11 into socket U28
- ☐ Insert IC 74LS08 into socket U29
- ☐ Insert IC 74LS153 into socket U30
- ☐ Insert IC 74LS163 into socket U31
- ☐ Insert IC 74LS74 into socket U32
- ☐ Insert IC 74LS163 into socket U33
- ☐ Insert IC 74LS32 into socket U34
- ☐ Insert IC 74LS367 into socket U35
- ☐ Insert IC 74LS153 into socket U36
- ☐ Insert IC 74LS245 into socket U37
- ☐ Insert IC 74LS51 into socket U38
- ☐ Insert IC 74LS74 into socket U39
- ☐ Insert IC 74LS74 into socket U40
- ☐ Insert IC 74LS367 into socket U41

CAUTION

The metal-oxide-semiconductors (MOS) supplied with this kit are highly susceptible to destruction by static discharge. Place your free hand on the exposed metal traces of the circuit board before inserting a MOS IC in its socket. We recommend touching the power connectors J2 or J3. This will help eliminate the voltage differential between the IC and the circuit. Keep these IC's away from static collectors (e.g., plastic containers, styrofoam cups). All of the remaining IC's are MOS devices.

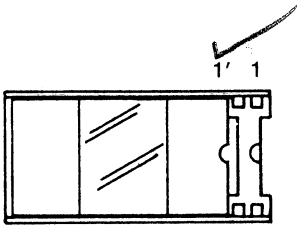
- ☐ Insert IC 4116 into socket U10
- ☐ Insert IC 4116 into socket U11
- ☐ Insert IC 4116 into socket U12
- ☐ Insert IC 4116 into socket U13
- ☐ Insert IC 4116 into socket U14
- ☐ Insert IC 4116 into socket U15
- ☐ Insert IC 4116 into socket U16
- ☐ Insert IC 4116 into socket U17

Large IC's are fragile. When inserting them in a socket, press gently and evenly over their surface.

- ☐ Insert IC 6810 into socket U8.

Do not remove the opaque sticker or filter covering the window of the EPROM. Ultraviolet light, such as from the sun and even roomlight, can erase them.

- ☐ Insert IC 9000-000X into socket U9A (not U9B). Note that the IC socket has 28 pins while the IC has only 24. Align pin 1 of the IC with 1' of the IC socket.



Two additional IC's are required to complete this kit. They are presently mounted on the TERMINAL LOGIC board. When removing IC's **don't** use your hands alone. The IC may suddenly dislodge from the socket and stab your finger.

PERFORM ONLY FOR 10 PIN MODELS

☐ **Make sure the terminal is turned off.** With an IC extrator or small, flat-blade screwdriver, carefully remove U474 (74LS166) from the TERMINAL LOGIC board.

☐ Insert this IC into socket U2 on the Imaginator.

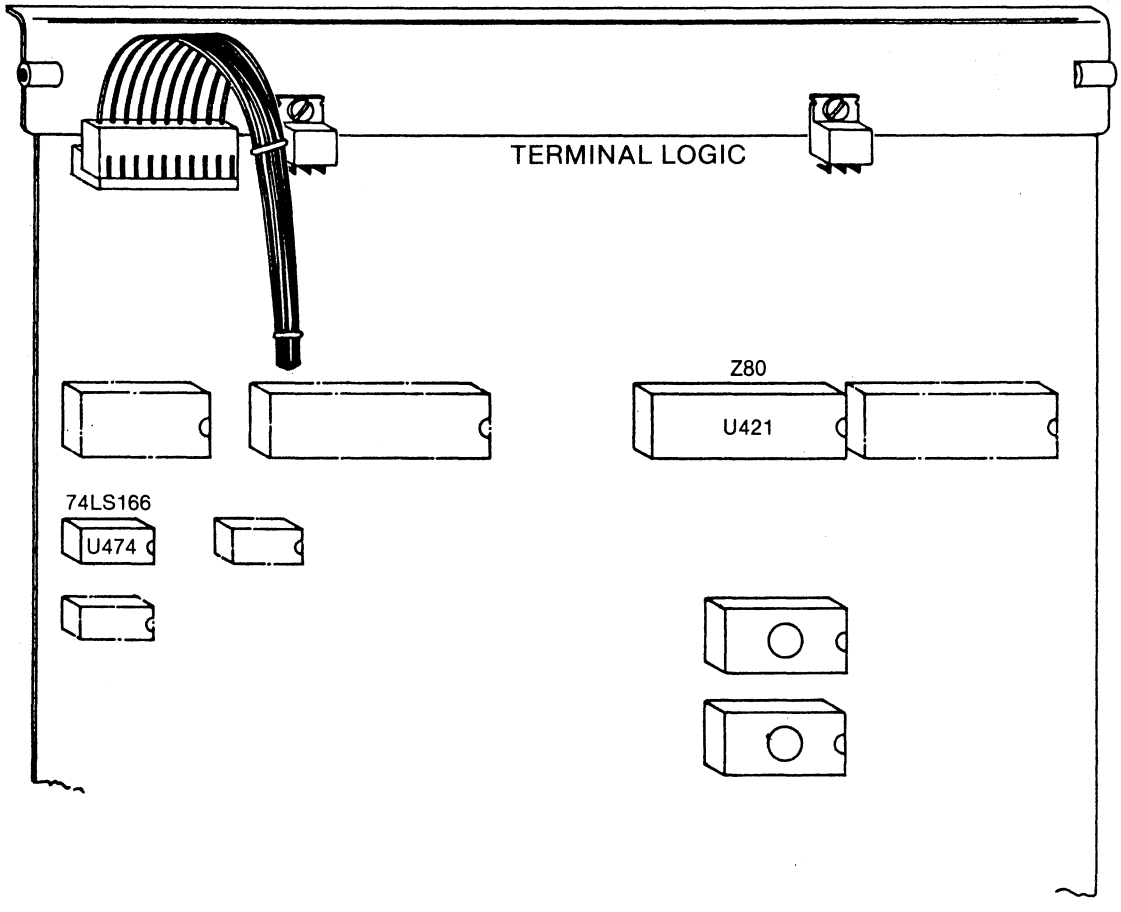
☐ **Read** the next two steps before performing them.

☐ Similarly, remove U421 (Z-80) from the TERMINAL LOGIC board. **Be careful.** This IC is a MOS device and is fragile. Place your free hand temporarily on the large aluminum heatsink on the TERMINAL LOGIC board before removing this device.

☐ Insert this IC into socket U7 on the Imaginator. Place your free hand on the circuit board traces as you did earlier before inserting this MOS device in its socket.

☐ Plug the indicated end of the 16 conductor ribbon cable assembly into socket U474 on the TERMINAL LOGIC board. Pin 1 of the cable's header must be aligned with pin 1 of the socket

☐ Plug the indicated end of the 40 conductor ribbon cable assembly into socket U421 on the TERMINAL LOGIC board. Pin 1 of the cable's header must be aligned with pin 1 of the socket.



PERFORM ONLY FOR 11 PIN MODELS

☑ **Make sure the terminal is turned off.** With an IC extractor or small, flat-blade screwdriver, carefully remove U421 (74LS166) from the TERMINAL LOGIC board.

☑ Insert this IC into socket U2 on the Imaginator.

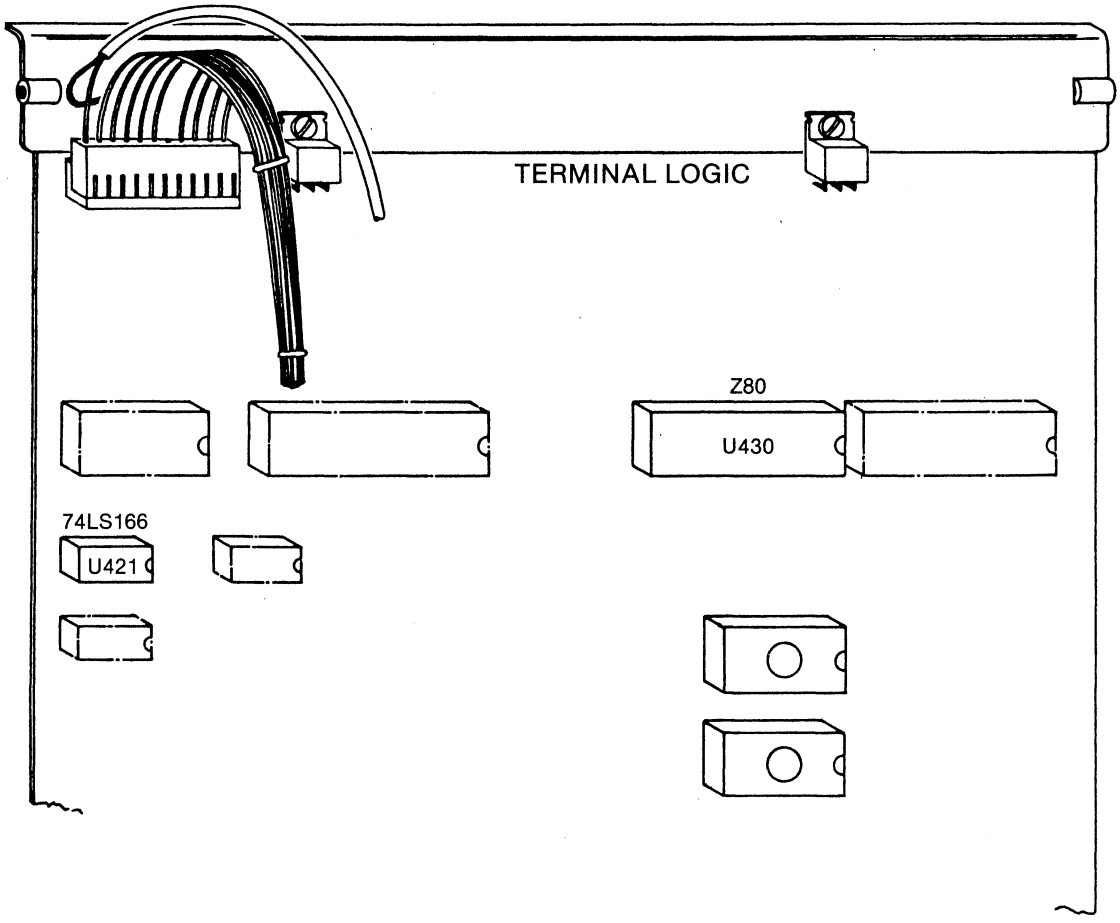
☑ **Read** the next two steps before performing them.

☑ Similarly, remove U430 (Z-80) from the TERMINAL LOGIC board. **Be careful.** this IC is a MOS device and is fragile. Place your free hand temporarily on the large aluminum heatsink on the TERMINAL LOGIC board before removing this device.

☑ Insert this IC into socket U7 on the Imaginator. Place your free hand on the circuit board traces as you did earlier before inserting this MOS device in its socket.

☐ Plug the indicated end of the 16 conductor ribbon cable assembly into socket U421 on the TERMINAL LOGIC board. Pin 1 of the cable's header must be aligned with pin 1 of the socket.

☑ Plug the indicated end of the 40 conductor ribbon cable assembly into socket U430 on the TERMINAL LOGIC board. Pin 1 of the cable's header must be aligned with pin 1 of the socket.



PERFORM ON ALL MODELS

☐ Triple check the orientation of every IC. **An improperly oriented IC will not work and will probably be damaged when power is applied.** Also verify that every pin is indeed in the socket and not folded under the IC.

☐ While holding the ribbon cables up and out of the way, remount the Imaginator as you have done previously.

☐ Plug the free end of the 16 conductor ribbon cable assembly into socket J1 on the Imaginator. Pin 1 of the cable's header must be aligned with pin 1 of the socket.

☐ Plug the free end of the 40 conductor ribbon cable assembly into socket J4 on the Imaginator. Pin 1 of the cable's header must be aligned with pin 1 of the socket.

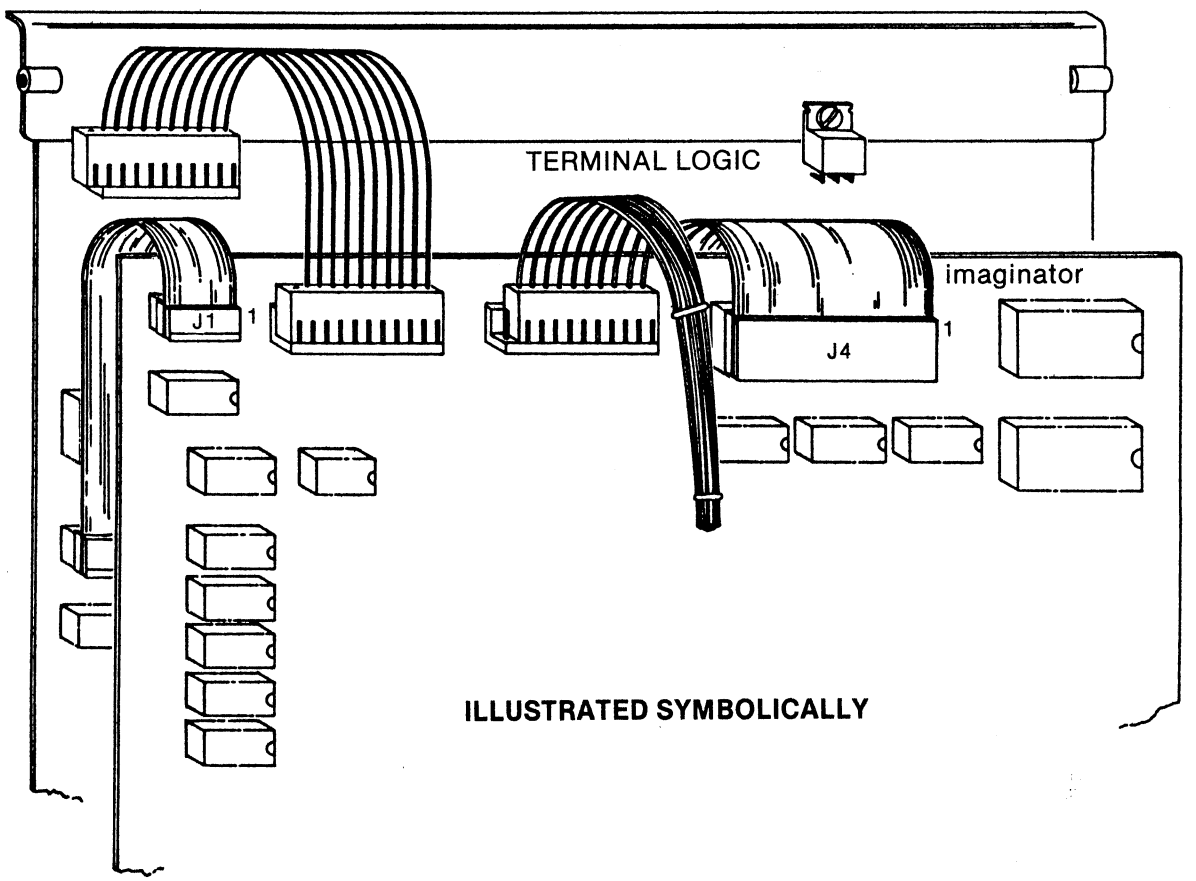
PERFORM ONLY FOR 10 PIN MODELS

☐ Plug the power harness that was originally plugged onto the TERMINAL LOGIC board onto connector J3 on the Imaginator. The GREEN wire should coincide with pin 1 of the connector (pin 11 is free).

☐ Plug the free end of the relay power harness onto connector J2 on the Imaginator. The GREEN wire should coincide with pin 1.

☐ The other end of the relay power harness should still be plugged onto connector P401 on the TERMINAL LOGIC board.

☐ Connect the remote regulator's cable to J5 if it was disconnected.



ILLUSTRATED SYMBOLICALLY

PERFORM ONLY FOR 11 PIN MODELS

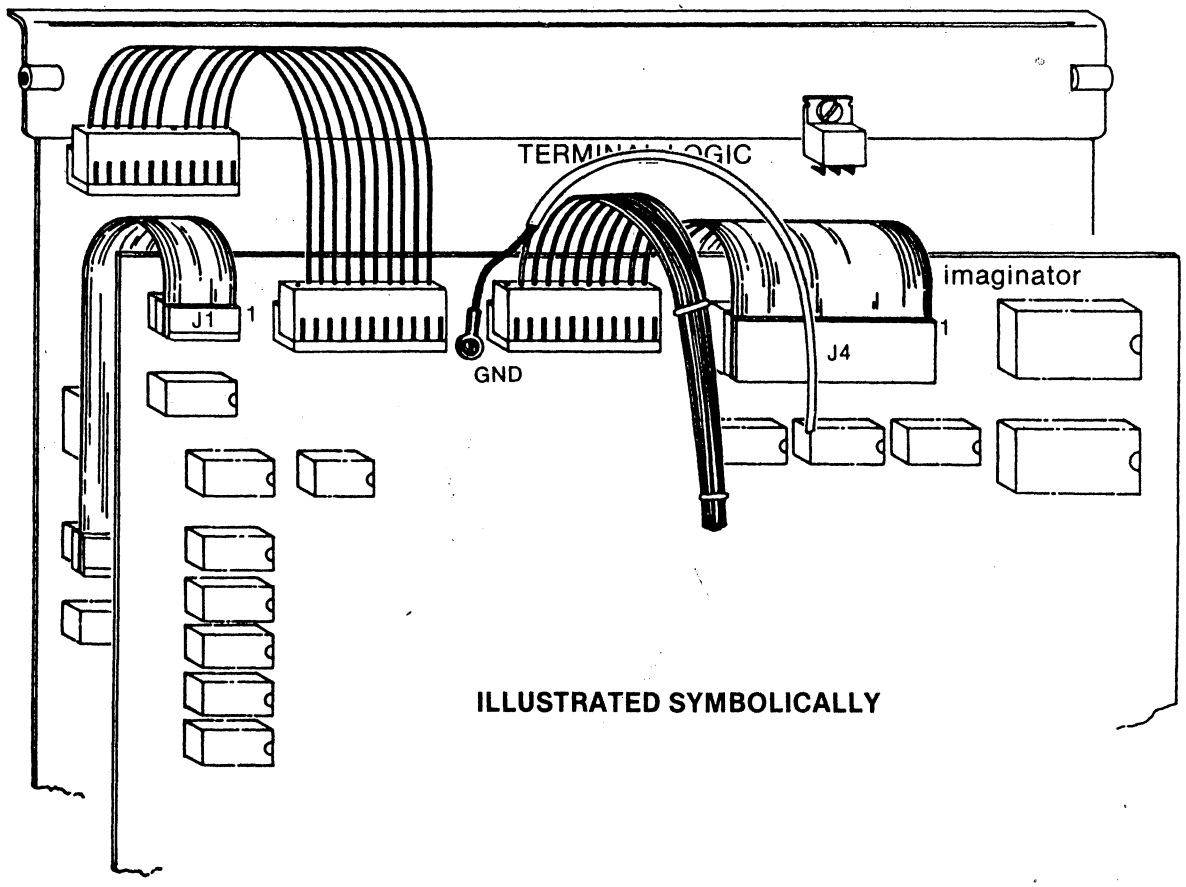
☑ Plug the power harness that was originally plugged onto the TERMINAL LOGIC board onto connector J3 on the Imaginator. The GREEN wire should coincide with pin 1 of the connector.

☑ Secure the coax shield's terminal to the ground (GND) on the Imaginator with a 6-32 X 3/8 screw, 6-32 nut and #6 lockwasher. The nut and lockwasher should be on the circuit side of the board.

☑ Plug the Imaginator end of the relay power harness onto connector J2 on the Imaginator. The green wire should coincide with pin 1.

☑ The other end of the relay power harness should still be plugged onto connector P401 on the TERMINAL LOGIC board.

☑ Connect the remote regulator's cable to J5 if it was disconnected.



ILLUSTRATED SYMBOLICALLY

CHECKOUT

PERFORM ON ALL MODELS

☐ Double check to see that everything is secure.

☐ Turn the terminal on.

☐ In about a minute the cursor should appear in the upper left hand corner of the screen.

☐ Turn the terminal off-line (depress the OFF-LINE key).

☐ Type your name on the keyboard. The characters should appear on the screen just as they did before adding the Imaginator.

The following steps require you to type in graphic commands. Do not type a carriage return, a line feed, or anything else unless you are asked to. The graphics command processor (GCP) expects commands in specific formats and may become confused if presented with extraneous characters.

Once a command sequence is started, there is no good way to abort in the middle (a DELETE or BACKSPACE will not erase an incorrect command). Normally, one could either complete the incorrect sequence or give the terminal a hardware reset (right-SHIFT,RESET). However, in this section of the manual, we recommend a hardware reset and then a restart of this section beginning with the step that asked you to type your name.

A brief *description* accompanys each of the following commands but it is not necessary to understand them to proceed with this section. Each command is described in detail in the **User's Guide.**

(Note that you are asked to type a slash occasionally, don't let this confuse you, it's only purpose is to serve as a delimiter. Actually any character could be used except the numerals 0,1,2,3,4,5,6,7,8,9.)

☐ The terminal should be set up in Heath/Zenith mode not ANSI mode.

☐ Type **ESC x 1** Note that x is lower case.
Enable the 25th line.

☐ Lock down the CAPS-LOCK key.

☐ Type **ESC 1**
EnterGraphicsMode, ASCII.

☐ Type **D 6 /**
DisplayToggle command, Graphics and Alphanumerics enabled.

☐ Your name should still be the only display on the screen.

☐ Type **P 2 0 0 1 0 /**
PointAt (200,10) command.

☐ Type **L 3 0 0 2 4 0**
LineTo (300,240) command.

☐ A diagonal line should appear along with your name.

☐ Type **D 2 /**
DisplayToggle command, enable graphics only.

☐ Only the diagonal line should appear.

☐ Type **D 0 /**
DisplayToggle command, enable neither graphics nor alphanumerics.

☐ The screen should be blank.

☐ Type **D 3 /**
DisplayToggle command, enable graphics and erase graphics.

☐ Type **M 1 2 8 0 /**
MoveTo (128,0) command.

☐ Type **A 3 7 4 2 4 6**
AreaTo (374,246) command

☐ A large filled rectangle should appear.

This rectangle represents a square with the dimensions of 247 horizontal points and 247 vertical points. However, the rectangle displayed may not appear to have equal length sides. If correction is required, proceed with the following adjustments. Refer to the **Adjustment** section of your terminal's **Operators Manual** for details.

WARNING

When power is applied to the terminal, do not touch the flyback transformer, the high voltage lead, or the anode socket. An electrical shock hazard exists in these areas.

- ☐ Using a flat blade screwdriver adjust the VERT SIZE control on the VIDEO CIRCUIT board to produce a square. Be careful not to let the end of the screwdriver touch any other component or lead.

- ☐ At this time you may also wish to adjust the FOCUS and the BRIGHTNESS controls on the VIDEO CIRCUIT board to suit your personal conditions.

- ☐ Turn the terminal off.

- ☐ Put the terminal's cover back in place.

- ☐ Proceed to the **User's Guide.**

WE WOULD LIKE YOUR COMMENTS ON THIS MANUAL

Did you find any errors in this manual? Where?

Was it complete? Should some areas be covered in greater detail?

Was it the right level? Too simple? Too difficult?

Was it clearly written?

Please rate this document with respect to similar ones.

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