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**4050E01**

**ROM EXPANDER**

INSTRUCTION MANUAL



*Please Check for  
CHANGE INFORMATION  
at the Rear of this Manual*

**4050E01**  
**ROM EXPANDER**  
INSTRUCTION MANUAL

Tektronix, Inc.  
P.O. Box 500  
Beaverton, Oregon 97077

MANUAL PART NO.  
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**WARNING**

This equipment generates, uses, and can radiate radio  
frequency energy and if not installed and used in accordance  
with the instruction manual, may cause interference to radio  
communications. It has been tested and found to comply with  
the limits for Class A computing devices pursuant to Subpart J  
of Part 15 of FCC Rules, which are designed to provide  
reasonable protection against such interference when  
operated in a commercial environment. Operation of this  
equipment in a residential area is likely to cause interference  
in which case the users at their own expense will be required  
to take whatever measures may be required to correct the  
interference.

# MANUAL REVISION STATUS

## PRODUCT: 4050E01 ROM EXPANDER

This manual supports the following versions of this product: Serial No. B010100 and up.

REV.	DATE	DESCRIPTION
@	JUN 1981	Original Issue



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## WARNING

*The following servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.*

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# OPERATORS SAFETY SUMMARY

*The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary.*

## Terms In This Manual

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

## Terms As Marked on Equipment

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property, including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

## Symbols In This Manual

 This symbol indicates where applicable cautionary or other information is to be found.

## Symbols As Marked on Equipment

 DANGER — High voltage.

 Protective ground (earth) terminal.

 ATTENTION — refer to manual.

## Power Source

This product is intended to operate from a power source that does not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

## Grounding the Product

This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

## Danger Arising From Loss of Ground

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electric shock.

## Use the Proper Power Cord

Use only the power cord and connector specified for your product.

Use only a power cord that is in good condition.

For detailed information on power cords and connectors, see Figure 3-2.

## Use the Proper Fuse

To avoid fire hazard, use only a fuse of the correct type, voltage rating and current rating as specified in the parts list for your product.

## Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate this product in an explosive atmosphere unless it has been specifically certified for such operation.

## Do Not Remove Covers or Panels

To avoid personal injury, do not remove the product covers or panels. Do not operate the product without the covers and panels properly installed.



# **SERVICING SAFETY SUMMARY**

## **FOR QUALIFIED SERVICE PERSONNEL ONLY**

*Refer also to the preceding Operators Safety Summary.*

### **Do Not Service Alone**

Do not perform internal service or adjustment of this product unless another person capable of rendering first aid and resuscitation is present.

### **Use Care When Servicing With Power On**

Dangerous voltages exist at several points in this product. To avoid personal injury, do not touch exposed connections or components while power is on.

Disconnect power before removing protective panels, soldering or replacing components.

### **Power Source**

This product is intended to operate from a power source that does not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.



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**Figure 1-1. The 4050E01 ROM Expander.**

# Section 1

## GENERAL INFORMATION

### ABOUT THIS MANUAL

This manual provides user and service documentation for the 4050E01 ROM Expander, which is shown in Figure 1-1. The first three sections provide information to help the user install and operate it. The remainder of the manual contains information for qualified service personnel.

Before installing the ROM Expander, you should already know how to operate the Graphic System and how to use the ROM Packs or peripheral interfaces which you wish to place in it. Refer to the appropriate operator's and instruction manuals for help with these.

### PRODUCT DESCRIPTION

The 4050E01 ROM Expander is a desk top accessory for a 4050 Series Graphic System. Each ROM Expander provides eight slots in which to install ROM Packs or peripheral interfaces such as the Option 10 Printer Interface.

The ROM Expander consists of two parts: a chassis which holds the ROM Packs and a ROM Expander Interface which plugs into a backpack slot on the Graphic System. The parts are joined by two ribbon cables.

When the ROM Expander is plugged into one of the backpack slots of a Graphic System, all signals required by ROM Packs or peripheral interfaces are available to each of the eight slots. Each slot has its own device address. Turning on the Graphic System causes its processor to memorize the addresses where ROM Packs or peripheral interfaces are located.

A 4051 Graphic System can accommodate a maximum of two ROM Expanders, one in each backpack slot. A 4052 or 4054 Graphic System can accommodate two ROM Expanders in the standard backpack or four in the optional four-slot backpack. The ROM Expanders may be connected only to the backpack slots. One ROM expander may not be connected to another.

The ROM Expander includes two standard accessories: this manual and a power cord. Complete descriptions and part numbers are given at the end of the Replaceable Mechanical Parts section.



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# Section 2

## SPECIFICATIONS

This section gives the specification for the ROM Expander in tabular form. The following definitions explain the column headings.

**Characteristic:** Property of equipment.

**Performance Requirement:** A statement that defines a characteristic in terms of performance. The Performance Check section of this manual describes procedures to verify the performance.

**Supplemental Information:** Statements that explain performance requirements or that provide reference information. These are not supported by performance check procedures in the manual.

The performance requirements are valid only within the following environmental limits:

- The ac line supply meets the requirements given in Table 2-2.
- The unit is operating within the environmental limits given in Table 2-4.
- The unit is connected to a properly functioning 4050 Series Graphic System.

### FUNCTIONAL

Table 2-1 describes the functions which the ROM Expander logic circuits must perform for the unit to be operating properly.

**Table 2-1**  
**FUNCTIONAL CHARACTERISTICS**

<b>Characteristic</b>	<b>Performance Requirement</b>
Initialization	At power up, sets mode to recognize either 4051 or 4052/54 addresses and turns on the corresponding front panel indicator.
ROM Enable	Enables the ROM Pack or peripheral interface in the slot designated by the Graphic System when an appropriate address appears on the system address bus.

## SPECIFICATIONS

### ELECTRICAL

Table 2-2 describes the ac line characteristics under which the ROM Expander is designed to operate. The performance requirements given elsewhere are valid only under these conditions. Table 2-3 gives the specifications for the internal dc supplies.

**Table 2-2**  
**LINE INPUT**

Characteristic	Performance Requirement	Supplemental Information
100, 120, 220, or 240 Vac nominal	± 10%	
Frequency		48 to 66 Hz
Crest factor <sup>a</sup>		1.35 to 1.414
Fuses		100, 120 V: 0.8 A slow blow 220, 240 V: 0.4 A slow blow
Maximum power consumption		90 W (307 BTU/hr)

<sup>a</sup>The crest factor is the ratio of peak to rms voltage. The factor falls below 1.414 as the voltage departs from a sine wave.

**Table 2-3**  
**DC SUPPLIES**

Characteristic	Performance Requirement	Supplemental Information
+ 5 V Supplies <sup>a</sup>	+ 5 V ± 250 mV	Maximum ripple: 50 mV p-p
		Maximum load: 1.5 A at 77°F (25°C) ambient temperature
		Current limit: within regulator I.C.
+ 12 V Supply	+ 12 V ± 600 mV	Maximum ripple: 100 mV p-p
		Maximum load: 1 A at 77°F (25°C) ambient temperature
		Current limit: within regulator I.C.
- 12 V Supply	- 12 V ± 600 mV	Maximum ripple: 100 mV p-p
		Maximum load: 1 A at 77°F (25°C) ambient temperature
		Current Limit: within regulator I.C.

<sup>a</sup>The performance requirements apply separately to each of the two +5 V supplies.

**ENVIRONMENTAL**

Table 2-4 summarizes the environment within which the ROM Expander is intended to operate.

**PHYSICAL**

Table 2-5 describes the physical characteristics of the ROM Expander, excluding the ROM Expander Interface and the ribbon cable which connects it to the main chassis.

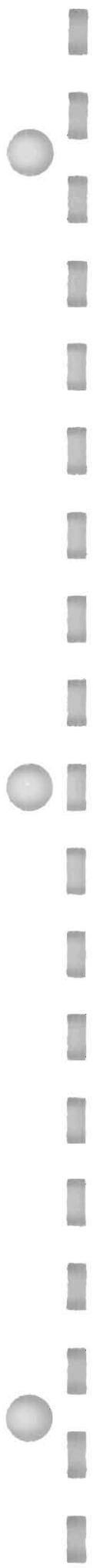
**Table 2-5  
PHYSICAL CHARACTERISTICS**

Characteristic	Information
Length	14.6 in (370 mm)
Width	10.4 in (265 mm)
Depth	6.1 in (155 mm)
Weight	16 lbs (7.3 kg)

**Table 2-4**

**ENVIRONMENTAL CHARACTERISTICS**

Characteristic	Performance Requirement
Temperature	
Operating	+ 50 to + 104°F (+ 10 to + 40°C)
Non-operating	− 40 to + 167°F (− 40 to + 75°C)
Humidity	
Operating	0 to 80% noncondensing
Non-operating	0 to 95% noncondensing
Altitude	
Operating	15,000 ft (4.5 km) maximum
Non-operating	50,000 ft (15 km) maximum
	Reduce maximum operating temperature 1.8°F (1°C) for every 1,000 ft (300 m) above sea level.
Vibration	
Non-operating	0.015 in (0.38 mm) p-p, 10 to 55 Hz (sine wave).
Bench Handling	
Non-operating	Drop from 4 in (102 mm), 45 degrees, or equilibrium on all significant faces.
Shock	
Non-operating	30 g's
Packaged Product Vibration and Shock	The 4050E01 ROM Expander qualifies under the National Safe Transit Association's Pre-shipment Test Procedure, Project 1A-B-1.
Electromagnetic Compatibility	The 4050E01 ROM Expander qualifies under the test limits specified in FCC Rules, Part 15, Subpart J, Class "A."
Line Transients	
Oscillatory surge	The 4050E01 ROM Expander will withstand oscillatory line surges of up to 2.5 kV at 1.5 MHz.
Ride-through	Supplies will remain in regulation for at least 16.67 ms after loss of line voltage.



## Section 3

# OPERATING INSTRUCTIONS

This section provides the following information for the operator:

- Preparation of the ROM Expander for use.
- A description of the front panel indicators.
- A procedure to check that the ROM Expander is operating properly.
- A description of the operation of the ROM Expander.
- Maintenance information for the operator.

A list of standard accessories and part numbers is included at the end of the Replaceable Mechanical Parts section.

## PREPARATION FOR USE

When you install the ROM Expander, you need to check the Line Voltage Selector and fuse, connect the ROM Expander to your Graphic System, and install the ROM Packs or peripheral interfaces. The following paragraphs tell how to do this.

### CAUTION

*Improper line voltage may damage the power supply unit. To avoid damage, be certain to check the setting of the Line Voltage Selector through the following procedure before plugging in the ROM Expander.*

### CHECKING THE VOLTAGE SELECTOR AND FUSE

The Line Voltage Selector allows the selection of four voltage ranges as shown in Table 3-1. Use the following steps to verify that the Line Voltage Selector is set correctly and that the proper fuse is installed.

**Table 3-1**  
**LINE VOLTAGES AND FUSES**

Nominal Voltage	Voltage Range	Fuse
100 V	90 – 110 V	0.8 A slow blow
120 V	108 – 132 V	0.8 A slow blow
220 V	198 – 242 V	0.4 A slow blow
240 V	216 – 250 V	0.4 A slow blow

## OPERATING INSTRUCTIONS

1. On the rear panel of the ROM Expander, remove the power cord and then slide the plastic cover upward over the power cord receptacle (Figure 3-1).
2. Pull out the FUSE PULL handle and remove the fuse.
3. The Line Voltage Selector card is a small circuit card to the left of the fuse holder. The voltage setting is visible through a cutout next to the fuse holder. If this voltage is not correct, remove the selector card by inserting the tip of a ball-point pen or similar instrument into the hole and pulling outward. Turn the selector card over or end-for-end and reinsert it so that the proper voltage shows through the cutout. Push the selector card firmly into its slot.

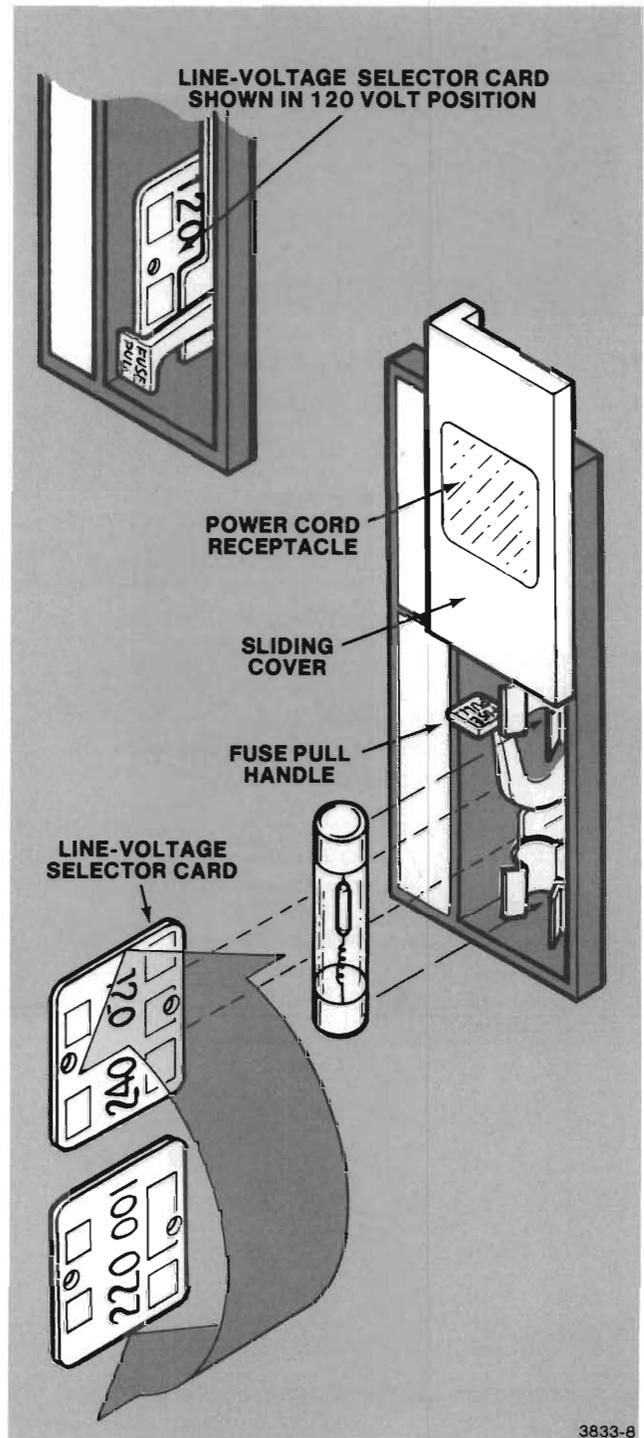
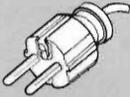
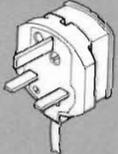


Figure 3-1. Line Voltage Selection.

4. Return FUSE PULL to its normal position. Check fuse size requirements in Table 3-1 and change the fuse if necessary. Reinsert the proper fuse (either end up).
5. Slide the plastic fuse cover downward over the fuse area.
6. Connect the proper power cord to the ROM Expander. See Figure 3-2 for detailed information on power cords and connectors.

Plug Configuration	Usage	Nominal Line Voltage (AC)	Reference Standards	Option Number
	North American	120V, 60Hz	ANSI C73.11 <sup>1</sup> NEMA 5-15-P <sup>2</sup> IEC 83 <sup>3</sup>	STANDARD
	Universal European	220V, 50Hz	CEE (7), II, IV, VII <sup>4</sup> IEC 83 <sup>3</sup>	A1
	United Kingdom	240V, 50Hz	BS 1363 <sup>5</sup> IEC 83 <sup>3</sup>	A2
	Australian	240V, 50Hz	AS C112 <sup>6</sup>	A3
	North American	240V, 60Hz	ANSI C73.20 <sup>1</sup> NEMA 6-15-P <sup>2</sup> IEC 83	A4

<sup>1</sup>ANSI—American National Standards Institute  
<sup>2</sup>NEMA—National Electrical Manufacturer's Association  
<sup>3</sup>IEC—International Electrotechnical Commission  
<sup>4</sup>CEE—National Commission on Rules for the Approval of Electrical Equipment  
<sup>5</sup>BS—British Standards Institution  
<sup>6</sup>AS—Standards Association of Australia

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Figure 3-2. Power Plug Options.

## OPERATING INSTRUCTIONS

### CONNECTION TO THE GRAPHIC SYSTEM

#### WARNING

*This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle BEFORE connecting the ROM Expander to the Graphic System. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.*

1. Place the ROM Expander next to the Graphic System or on top of it using the slide-out support (Figure 3-3A). To use the support, press the release at the bottom of the rear panel (Figure 3-3B), and then pull the support out from the front. Hook it over the top cover of the Graphic System. One ROM Expander can be placed on top of a 4051 or 4052, or two can be placed on top of a 4054. One ROM Expander can be placed on each side of a 4051 or a 4052. Two ROM Expanders can be placed on a table back-to-back with a 4054.
2. Plug the power cord into a suitable grounded power outlet.
3. Verify that the Graphic System power is off.

#### CAUTION

*Inserting or removing a ROM Pack while the power is on may cause damage to the ROM Pack. Graphic System memory contents may also be lost. Always turn off the Graphic System Power switch before inserting or removing any device from a backpack slot.*

4. Insert the ROM Expander Interface (with its instruction label facing the front) into one of the Graphic System backpack slots (Figure 3-4). Press downward while rocking the Interface slightly from side to side until its edge is firmly seated in the slot. (With the optional four-slot backpack, the label should face to the right.)

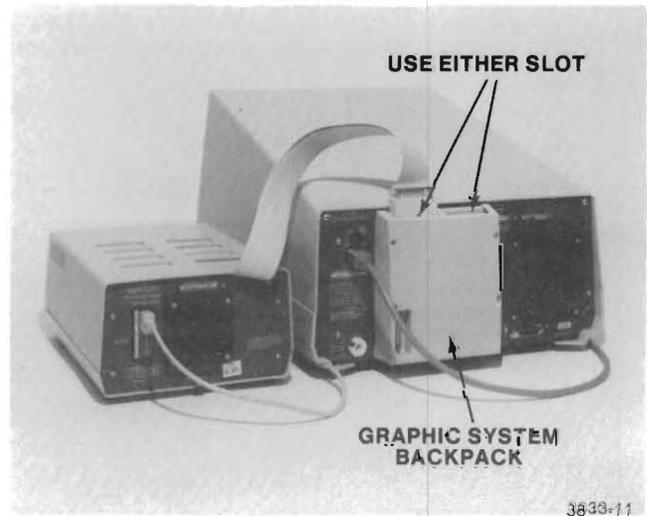


Figure 3-4. Connecting the ROM Expander Interface.

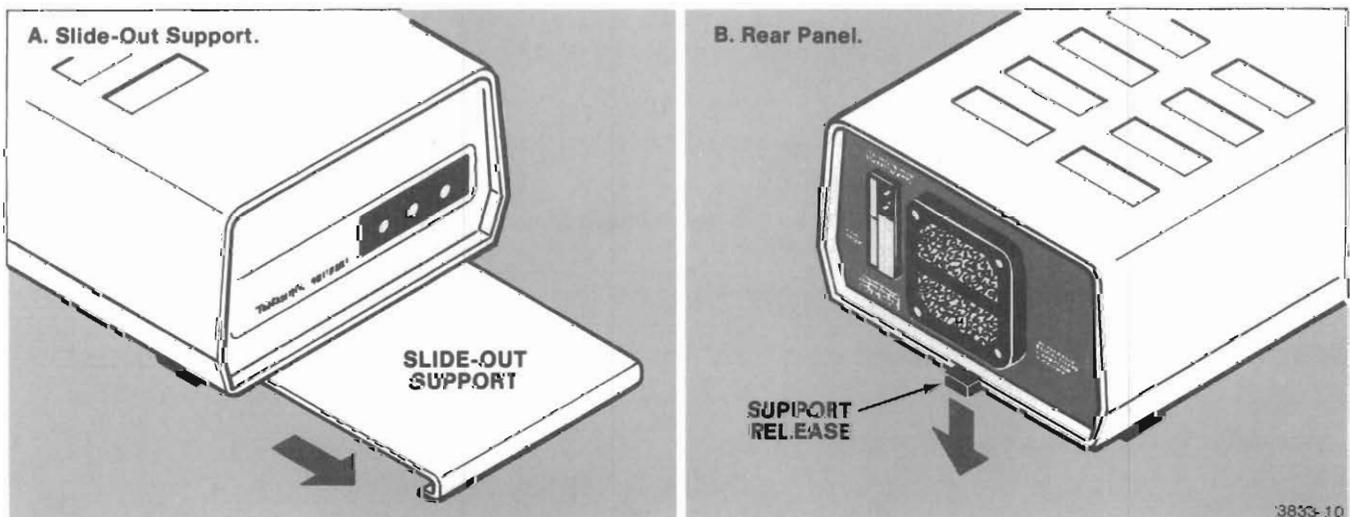


Figure 3-3. ROM Expander Support.

## INSTALLING ROM PACKS AND PERIPHERAL INTERFACES

You may install a ROM Pack in any available slot *unless its instruction manual says otherwise*. (The 4907 File Manager ROM Pack should be placed in a backpack slot.)

### NOTE

*A few 4052/54 ROM Packs execute more rapidly if they are placed directly in a backpack slot. These include the 4052R07 and 4052R08 Signal Processing ROM Packs, the 4052R06 Editor ROM Pack, and the 4907 File Manager ROM Pack. If real-time data processing is a consideration, you may wish to reserve a backpack slot for these ROM Packs.*

Peripheral interfaces such as the Option 10 Printer Interface have special addressing considerations. Read Operator's Familiarization before deciding where to install them.

### CAUTION

*Inserting or removing a ROM Pack while the power is on may cause damage to the ROM Pack. Graphic System memory contents may also be lost. Always turn off the Graphic System Power switch before inserting or removing any device from a backpack slot.*

1. Turn off the power to the Graphic System.
2. Insert the ROM Pack or peripheral interface (with its instruction label facing the front) into one of the eight ROM Expander slots (Figure 3-5A). Press downward while rocking the ROM Pack slightly from side to side until its edge is firmly seated in the slot (Figure 3-5B).

Remove ROM Packs or interfaces from the ROM Expander by turning off the power and pulling upward on the handle.

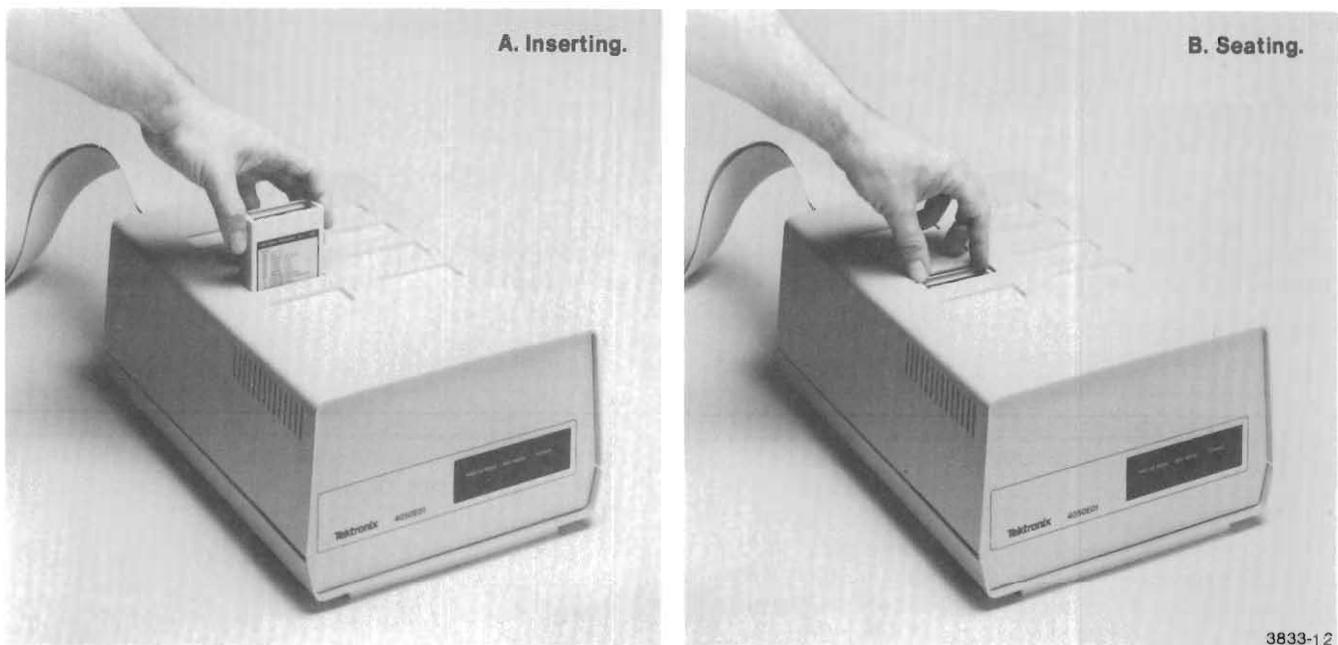


Figure 3-5. Installing ROM Packs.

3833-1.2

## OPERATING INSTRUCTIONS

### INDICATOR LIGHTS

Three indicator lights on the front panel (Figure 3-6) display the internal state of the ROM Expander:

- |              |   |
|--------------|---|
| POWER        | This light comes on when the ROM Expander power supply is operating. Although the ROM Expander has its own power cord, its internal power supply is controlled by the on/off state of the Graphic System to which it is connected. The POWER light should come on when the Graphic System is turned on. |
| 4051 MODE    | This light comes on when the ROM Expander is connected to a 4051 Graphic System.  |
| 4052/54 MODE | This light comes on when the ROM Expander is connected to either a 4052 or a 4054 Graphic System.   |

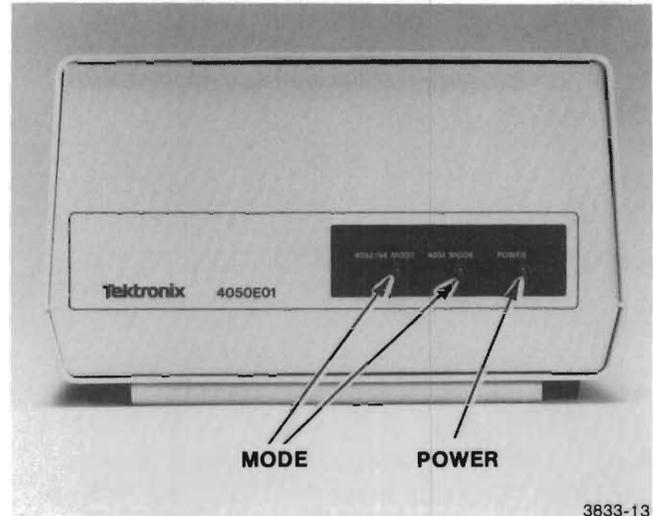


Figure 3-6. Front Panel.

### OPERATOR'S CHECKOUT PROCEDURE

Use these steps to assure yourself that the ROM Expander is operating properly. Steps 4 and 5 require a ROM Pack. While any ROM Pack will do, the Editor ROM Pack is especially easy to use for this purpose. You may also use a peripheral interface such as the Option 10 Printer Interface, but if you do, read the Operator's Familiarization section first.

1. Connect the ROM Expander to your Graphic System as described previously (Connection to the Graphic System).
2. Turn on the Graphic System. The POWER indicator on the front panel of the ROM Expander should come on, and the appropriate MODE indicator (4051 or 4052/54) also should come on. If they do not, turn off the Graphic System. Check that the ROM Expander Interface is properly seated in the Graphic System backpack. If it still doesn't work, check the power cord and fuse as described previously in Preparation for Use.
3. Turn off the Graphic System. The POWER and MODE indicators also should go off.
4. With the power off, plug the ROM Pack into any slot. Turn on the Graphic System.
5. Type in a command to call an appropriate ROM Pack function, for example (using the Editor ROM Pack):

```
CALL "EDITOR"  
I
```

If the Graphic System responds normally (in the example, with the prompt ":") the ROM Expander is operating properly.

If the Graphic System responds with the message CALL NAME INVALID IN IMMEDIATE LINE — MESSAGE NUMBER 32, turn off the power and check that the ROM Pack is properly installed. If this does not help, try the ROM Pack in a backpack slot to verify that the ROM Pack is working properly.

## OPERATOR'S FAMILIARIZATION

This section explains how the ROM Expander operates and how to determine the primary address for peripheral interfaces.

Once the ROM Expander has been connected to a Graphic System backpack, the Graphic System controls its operation. Although the ROM Expander has its own power cord, its power supply is controlled through the switch on the Graphic System.

### ROM PACKS

When the Graphic System is turned on, it checks each ROM Expander slot for a ROM Pack. Wherever the Graphic System finds one installed, it remembers the location and the functions available. Then, when a command such as CALL "EDITOR" calls for a ROM Pack function, the Graphic System automatically connects the appropriate slot. Consequently, most ROM Packs may be installed in any available slot. A few must go in specific locations as described in their instruction manuals.

### PERIPHERAL INTERFACES

Peripheral interfaces such as the Option 10 Printer Interface operate differently. The *user* must refer to these by a two-digit primary address. (The use of these addresses in commands is described in the Graphic System Reference Manual and in the peripheral interface instruction manual.)

- The first digit depends on the *Graphic System backpack slot* to which the ROM Expander is connected. For Graphic Systems with two backpack slots, the first digit is either a 4 (for the left slot) or a 5 (for the right slot). For Graphic Systems with four backpack slots, the first digit is a 4, 5, 6, or 7 (for slots from left to right).
- The second digit depends on the *ROM Expander slot* in which the peripheral interface is placed. The slots are numbered 1 through 8 from left front to right rear.

Figure 3-7 shows the primary addresses for a Graphic System with two ROM Expanders attached. The ROM Expander connected to the backpack left slot has primary addresses of 41 through 48. For the unit connected to the right slot, the primary addresses are 51 through 58. Similarly, ROM Expanders connected to the optional third and fourth slots have primary addresses of 61 through 68 and 71 through 78.

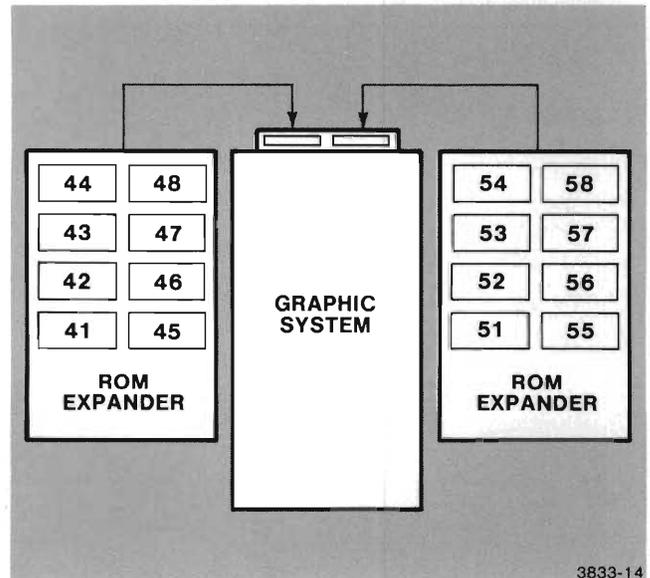


Figure 3-7. Primary Addresses.

When a command includes a primary address in a ROM Expander, the Graphic System enables the interface in the corresponding slot. *The address given in the command must match both the backpack slot to which the ROM Expander is connected and the ROM Expander slot in which the interface is installed.* The following example illustrates this.

1. The ROM Expander is plugged into the left backpack slot of the Graphic System, and the Option 10 Printer Interface is plugged into the left rear slot of the ROM Expander. Therefore, the primary address is 44.

2. The operator enters the following command on the Graphic System keyboard:

**TLIST@44:**

3. The printer lists a tape file directory for the Magnetic Tape Cartridge currently in the Graphic System.

## MAINTENANCE

The rear panel of the ROM Expander unit includes a dust filter which should be cleaned by the following procedure when dust has built up.

1. Turn off the Graphic System and unplug the ROM Expander power cord.
2. Remove the filter by removing the four screws.

### CAUTION

*Water and certain cleaning agents can damage circuits in the ROM Expander. Be sure that the filter is thoroughly dry before reinstalling it. Do not clean the filter with a spray or with a solution other than soap and water.*

3. Clean the filter with soap and water, and then rinse and dry the filter thoroughly.
4. Reinstall the filter by replacing the screws.

## **WARNING**

THE FOLLOWING SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID PERSONAL INJURY, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

## Section 4

# SERVICE INFORMATION

This section contains technical information for qualified service personnel. It describes the theory of operation, the functional check procedure, the performance check procedure, maintenance, and options. There are no adjustments to the ROM Expander.

The sections following this one contain the replaceable electrical parts list, diagrams and schematics, and replaceable mechanical parts. The appendix contains a list of signal definitions and references.

For general information on the addressing and operation of backpack devices, refer to the applicable Graphic System Service Manual.

## THEORY OF OPERATION

Figure 4-1 is a system block diagram of the ROM Expander. The major components are located on a Power Supply board, a Buffer board, and a Control board.

The Power Supply board provides dc to operate the ROM Expander circuits and also provides +5, +12, and -12 V supplies to ROM Packs and peripheral interfaces inserted in ROM Expander slots. Line voltage passes through a relay which is controlled by the +5 V supply from the Graphic System. When the ROM Expander power supply comes up, it asserts a restart signal to initialize the entire system.

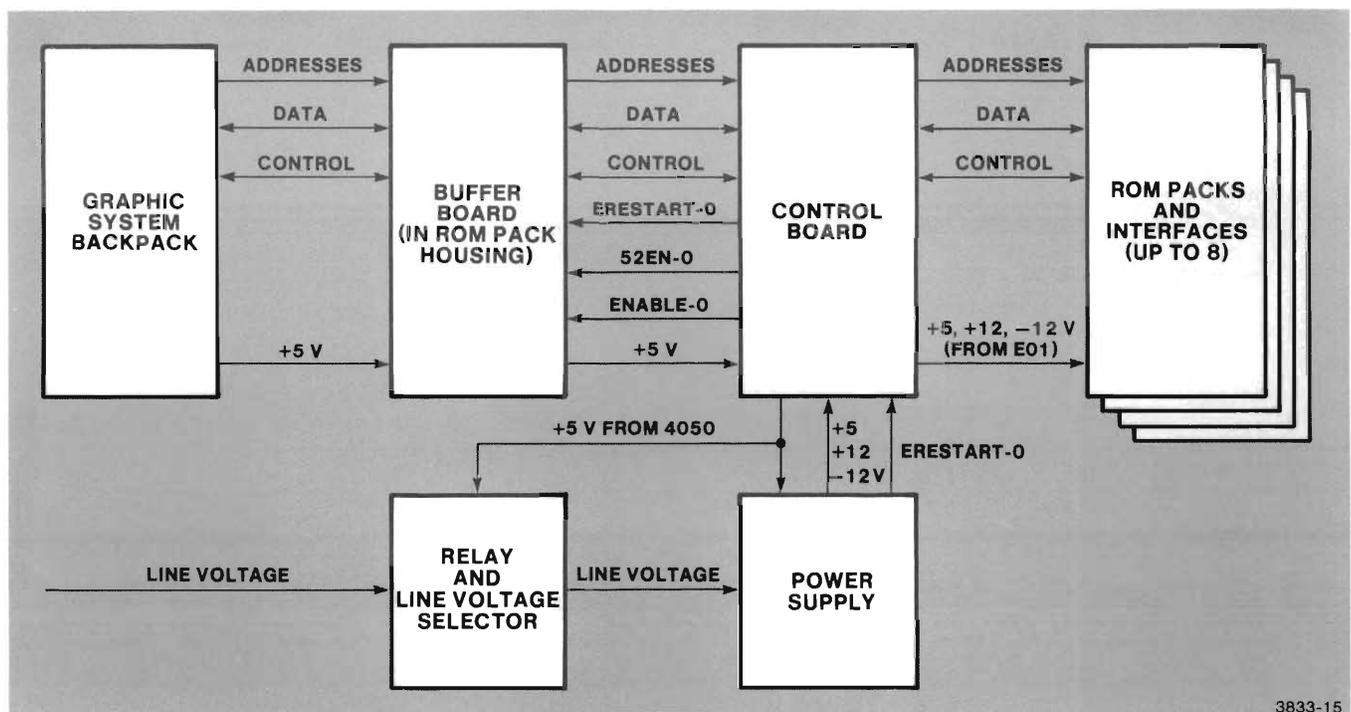


Figure 4-1. System Block Diagram.

## SERVICE INFORMATION

The Buffer board buffers the system data and address buses as well as certain control lines. This board, which is enclosed in a ROM Pack housing, plugs into a backpack slot of a 4050 Series Graphic System.

The Control board contains the eight ROM Pack slots. Logic shown on the Control board block diagram (foldout) performs the following functions:

- At power up, the Mode Selector determines whether the ROM Expander is connected to a 4051 or to a 4052/54 and enables the corresponding portion of the Address Decoder.
- In response to signals from the Graphic System, the Bank Switch latches a three-bit slot code and enables the device in the corresponding slot.
- When the Graphic System addresses a ROM Pack or an interface in the ROM Expander, the Address Decoder enables output onto the System data bus.
- When the Graphic System addresses a peripheral interface, the Peripheral Control Decoder directs control signals to the slot currently designated in the bank switch register.

Each board is described in detail in the following paragraphs.

## POWER SUPPLY

Refer to Schematic A1.

### WARNING

*Line voltage is present at the voltage selector assembly and relay whenever the ROM Expander is plugged in. To avoid electrical shock, always disconnect the power cord before removing the protective panel over the power supply.*

The ROM Expander power supply is a conventional design using I.C. regulators. The power cord receptacle in the rear panel contains a fuse holder, a line voltage selector circuit card, and a line filter.

A relay in the ac line places the ROM Expander under control of the Graphic System to which it is connected. When the Graphic System is turned on, its +5 V supply turns on the relay and closes the primary circuit in the ROM Expander.

The Line Voltage Selector can be set for four nominal voltages: 100, 120, 220, or 240 Vac. The ranges are selected by positioning a removable circuit card.

The cooling fan is connected in such a way that the transformer supplies 110 Vac to it regardless of the line voltage.

## Secondary Circuit

One winding on the transformer steps the ac voltage down to 15 Vac, and another steps it down to 7 Vac. The 15 Vac output is rectified and regulated by separate regulators to provide +12 and -12 Vdc. The 7 Vac output is rectified and regulated to provide two +5 Vdc supplies with a total capacity of 3 A.

All regulators are protected by internal current limiting. They also are protected against extreme heat by automatic downward adjustment of the current limit if the temperature becomes too high.

Restart circuitry asserts ERESTART-0 (Expander RESTART) after the supplies have had time to come up. When the power is turned on, the output of U205B reverse-biases the diode and allows the RC network to charge. When the non-inverting input to U205A passes 2.5 V (about 150 ms), the output goes high.

ERESTART-0 is wire-ORed on the Buffer board with the Graphic System signal RESTART-0. This ensures that the entire system is initialized after power becomes available to the ROM Expander and ROM Packs.

## BUFFER BOARD

Refer to Schematic A2.

The Buffer board physically connects the ROM Expander to the Graphic System. It also buffers the system address and data buses as well as certain control lines. Power is drawn from the Graphic System backpack.

The signals pass from the Graphic System through the edge connector to the Buffer board. There they are buffered and transmitted to the ROM Expander chassis by a pair of ribbon cables.

The data lines are bidirectional. RWOC-1 (read write output command from the Graphic System) controls the transceiver direction, and ENABLE-0 from the Control board enables signals through the transceiver in response to an appropriate address. When RWOC-1 is high, the direction is from the ROM Expander to the Graphic System.

The signals on Pins A10, A13, and A21 differ depending on whether the ROM Expander is connected to a 4051 or to a 4052/54. Refer to Table 4-1. A 4051 places XPC4-0 (external peripheral control line 4), AB14-1, and MCP2-1 (master clock phase 2) on these pins. A 4052/54 places COMCLK (communications clock), SLOW-0 (a ROM Expander output to indicate slow I/O cycles), and EXTEN-0 (external enable) on the corresponding pins.

Table 4-1

**SYSTEM-DEPENDENT BACKPACK SIGNALS**

Pin	4051	4052/54
A10	XPC4-0	COMCLK
A13	AB14-1	SLOW-0
A21	MCP2-1	EXTEN-0

When it is in the 4052/54 mode, the ROM Expander asserts SLOW-0 to the Graphic System for *all* ROM Packs or peripheral interfaces. This increases the execution time for the following 4052/54 ROM Packs (which do not assert SLOW-0 themselves): the 4052R07 and 4052R08 Signal Processing ROM Packs, the 4052R06 Editor ROM Pack, and the 4907 File Manager ROM Pack. ROM Packs placed directly into backpack slots are not affected.

Some other 4051 and 4052/54 signals differ in name but not meaning insofar as backpack devices are concerned. The address buses are AB<sub>nn</sub> and AE<sub>nn</sub> for the 4051 and 4052/54 respectively, and the data buses are DB<sub>nn</sub> and EXD<sub>nn</sub> respectively. RWOC-1 in the 4051 is R-1/W-0 in the 4052/54.

**CONTROL BOARD**

**Mode Selector (Schematic A3-2)**

The Mode Selector looks for a clock signal on Pin A10 of the backpack connector to determine whether the Graphic System is a 4051 or a 4052/54. If it is a 4052/54, this signal is COMCLK, a 2.4576 MHz communications clock. If it is a 4051, the signal is XPC4-0, which does not change state rapidly.

The detector consists of a 4-bit counter, a one-shot (monostable multivibrator), and a flip-flop. At power up, RESTART-0 clears the flip-flop to 4051 mode. It also triggers the one-shot which enables the counter for approximately 10 μs. The input from Pin A10 of the backpack connector (XPC4-0 or COMCLK) clocks the counter. If the counter overflows, the signal is COMCLK and the Graphic System is a 4052/54. An overflow also disables the counter clock.

The flip-flop stores the mode at the end of the counting interval. The mode output enables the appropriate portion of the Address Decoder and turns on an LED on the front panel.

**Bank Switch (Schematic A3-2)**

The ROM Expander contains a Bank Switch register which operates similarly to the one in the Graphic System backpack: it selects the slot to be connected to the ROM Pack address space.

The Graphic System loads the Bank Switch by two signals: LBS-0 (load bank switch) and PIAE-1 (PIA enable). The Graphic System pulls down on LBS-0 and then drives PIAE-1 high when the data is valid. The falling edge of PIAE-1 clocks the three least significant bits of the system data bus (DB2-1 through DB0-1) into the register.

## SERVICE INFORMATION

When the Graphic System requests output from the ROM Expander by pulling down on BSX-0 (bank switch expansion), the contents of the register are decoded to enable the device in the corresponding slot. Table 4-2 gives the connector number and the last digit of the I/O primary address for each Bank Switch value. The primary address of the ROM Expander slot can be found by adding the Bank Switch contents to a base address which depends on the backpack slot to which the ROM Expander is connected. This base address is 41 or 51 for two-slot backpacks, and 41, 51, 61, or 71 for four-slot backpacks.

**Table 4-2**  
**BANK SWITCH SLOT CODES**

DB2 – DB0	Connector Selected	Primary Address <sup>a</sup>
000	J11	x1
001	J13	x2
010	J15	x3
011	J17	x4
100	J27	x5
101	J25	x6
110	J24	x7
111	J23	x8

<sup>a</sup>Where x is 4, 5, 6, or 7 depending on the backpack slot to which the ROM Expander is connected.

### Address Decoder (Schematic A3-2)

The Address Decoder asserts ENABLE-0 to enable the data bus transceiver under three conditions:

- The Graphic System addresses a ROM Pack located in the ROM Expander. The address spaces are X'8800' through X'A7FF' for a 4051 and X'0000' through X'3FFF' for a 4052/54.
- The Graphic System addresses a peripheral interface located in the ROM Expander.
- The Graphic System writes to the ROM Expander (RWOC-1 is low).

The Address Decoder contains two sections: one for use with a 4051, and the other for use with a 4052/54.

The 4051 address decoder responds to a valid ROM Pack address on AB11-1 through AB15-1 or a low active signal on one of the external peripheral control lines, XPC2-0 through XPC4-0. In either case BSX-0 also must be low.

The 4052/54 address decoder uses two input signals which are not used by the 4051 address decoder. EPIAS-0 marks a valid external peripheral address. EXTEN-0 is low when the processor communicates with the ROM Expander. A valid ROM Pack address is indicated by a decoder input of 6: 4052/54 mode is high, EPIAS-0 is high, and AB15-1 is low. Interface operations are indicated by a decoder input of 5: 4052/54 mode is high, EPIAS-0 is low, and AB15-1 is high. In either case BSX-0 also must be low.

### Peripheral Control Decoder (Schematic A3-1)

The external peripheral control lines give the Graphic System an additional way to control devices in ROM Pack slots. The 4051 backpack uses three such signals (XPC2-0 through XPC4-0). The 4052/54 uses only two (XPC2-0 and XPC3-0). A set of gates AND each signal with one of the bank switch decoder outputs and send the result to the appropriate slot. When the ROM Expander is in 4052/54 mode, COMCLK (which is on the same backpack pin as XPC4-0) is available at all slots.

## FUNCTIONAL CHECK PROCEDURE

The Functional Check Procedure verifies that all major sections of the product function as defined in the service manual. These tests can be used to determine whether adjustment and/or repair is necessary. This is the level of testing that is recommended by Tektronix for testing the instrument after repair or for initial acceptance testing. A detailed check of internal and external product characteristics is provided in the Performance Check Procedure section. These checks are extensive and time-consuming. Under normal circumstances, the Functional Check Procedure will provide an adequate test of product performance in a less costly manner.

This procedure requires a 4050-Series Graphic System, an Option 10 Printer Interface, and a printer. If a printer and interface are not available, a ROM Pack may be substituted. The printer is preferred because it checks additional signals.

1. Connect the ROM Expander to a 4050-Series Graphic System as described in Preparation for Use.
2. Check the baud rate setting on the printer and Option 10 Printer Interface as described in the applicable manuals. Turn on the printer.
3. Turn on the Graphic System. Verify on the ROM Expander that the correct front panel mode indicator (4051 or 4052/54) is illuminated.

### CAUTION

*Turn off the Graphic System before inserting or removing devices from either the backpack or the ROM Expander.*

4. Turn off the Graphic System.
5. Connect the ROM Expander Interface to Slot 51 in the Graphic System backpack. This is the right-hand slot in the standard backpack as viewed from the front of the Graphic System.

### NOTE

*The following steps are repeated for each slot.*

6. With the Graphic System turned off, place the Option 10 Printer Interface in Slot 1 of the ROM Expander (Figure 4-2). ROM Packs may be used if a Printer Interface is not available, but do not use more than one ROM Pack of the same type.

7. Turn on the Graphic System.
8. Enter the following command on the Graphic System keyboard and press RETURN:

```
PRINT@51: "SLOT 1"
```

If a ROM Pack is used in place of a Printer Interface, enter a command which calls for a ROM Pack function (refer to the Operator's Checkout section).

9. Repeat Steps 6 through 8, turning off the Graphic System and moving the Printer Interface to successive slots until all slots are tested. Alter Step 8 accordingly:

```
PRINT@52: "SLOT 2"
PRINT@53: "SLOT 3"
PRINT@54: "SLOT 4"
PRINT@55: "SLOT 5"
PRINT@56: "SLOT 6"
PRINT@57: "SLOT 7"
PRINT@58: "SLOT 8"
```

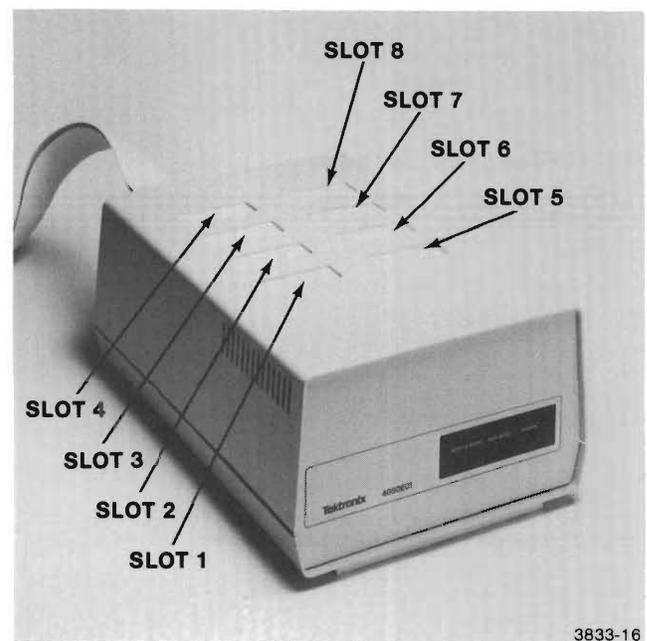


Figure 4-2. Slot Numbers.

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## SERVICE INFORMATION

10. Verify that the printer output is correct for each slot. The output should be a column of slot numbers from 1 through 8:

SLOT 1  
SLOT 2  
SLOT 3  
SLOT 4  
SLOT 5  
SLOT 6  
SLOT 7  
SLOT 8

The message INVALID I/O OPERATION IN IMMEDIATE LINE — MESSAGE NUMBER 67 indicates that the slot is not operating properly. Check to see that the interface is fully seated in the connector.

## PERFORMANCE CHECK PROCEDURE

The Performance Check Procedure provides a detailed check of internal and external product characteristics. These checks are extensive and time-consuming. Under normal circumstances, the Functional Check Procedure will provide an adequate test of product performance in a less costly manner.

This procedure compares the performance of a 4050E01 ROM Expander with the functional and electrical requirements given in the Specifications section. Units which do not meet these requirements are not operating acceptably and should be repaired. This procedure does not check environmental requirements because of the special equipment required to do so.

The performance check consists of two parts: a check of the power supply operation and a check of the functional performance.

### EQUIPMENT REQUIRED

- TEKTRONIX DM501 Digital Multimeter (or equivalent).
- 4051, 4052, or 4054 Graphic System.
- An Option 10 Printer Interface and printer. If these are not available, a ROM Pack may be substituted.

### POWER SUPPLY

This portion of the procedure verifies that the power supply is working properly. Table 4-3 summarizes the test points and performance requirements. It may be copied to use as a work sheet.

The procedure begins with the ROM Expander disconnected from the power line and the Graphic System.

1. Remove any ROM Packs or interfaces from ROM Expander slots.
2. Remove the cover by removing the four screws shown in Figure 4-3.

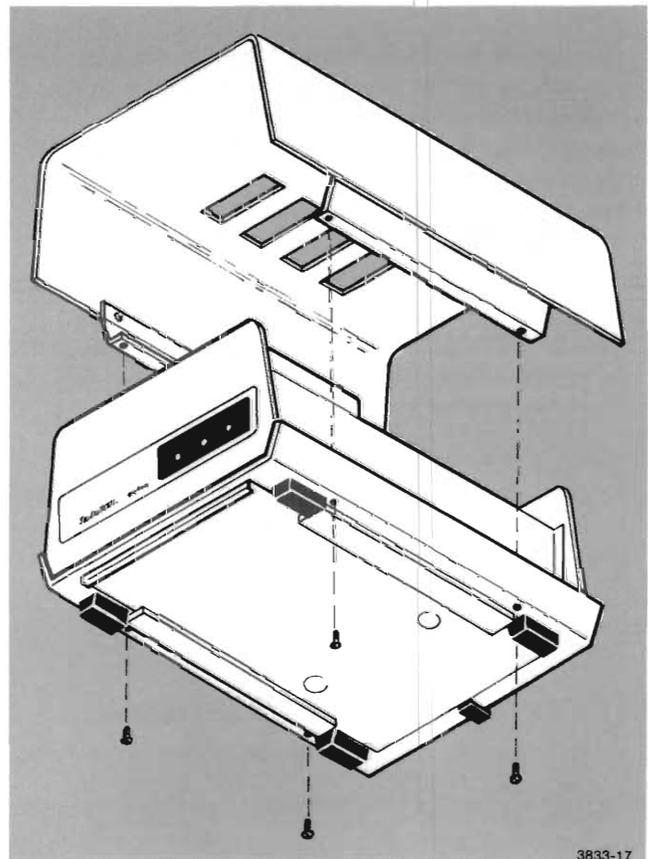


Figure 4-3. Removing the Cover.

3. Connect the ROM Expander power cord.
4. Verify that the power to the Graphic System is turned off.
5. Plug the ROM Expander Interface into an available backpack slot on the Graphic System.
6. Verify that the POWER LED is off (Figure 4-4A).
7. Turn on the Graphic System.
8. Verify the following:
  - a. The front panel POWER LED is on.
  - b. The three LEDs on the Control board are on (Figure 4-4B).
9. Connect the reference lead of the multimeter to the chassis.

**NOTE**

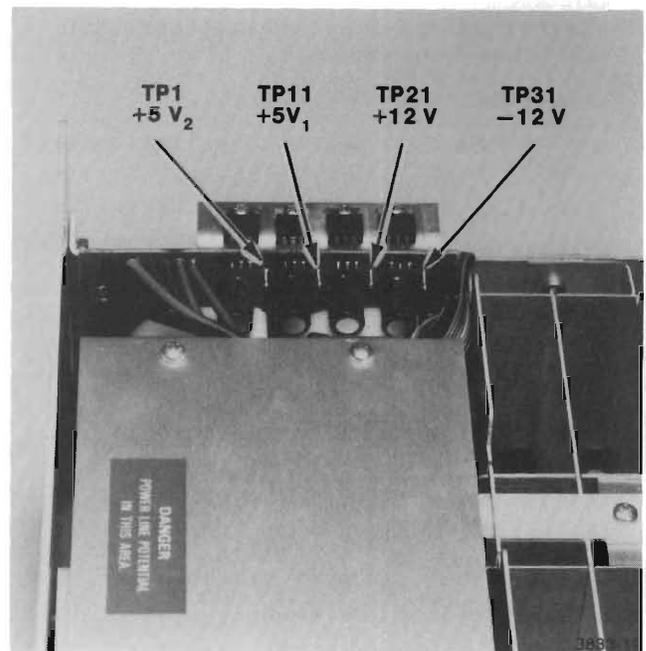
*The following steps are repeated for each supply.*

10. Measure the + 5 V output at TP1 (Figure 4-5). Record the reading in the "Measured" column of Table 4-3 (or on a copy).
11. Verify that the measured voltage falls within the minimum and maximum values given in Table 4-3.
12. Repeat Steps 10 and 11 for each supply listed in Table 4-3. (Both + 5 V supplies must be checked.)

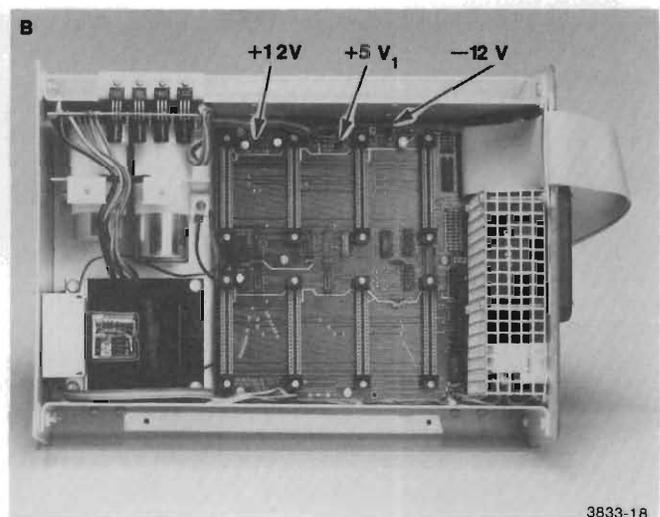
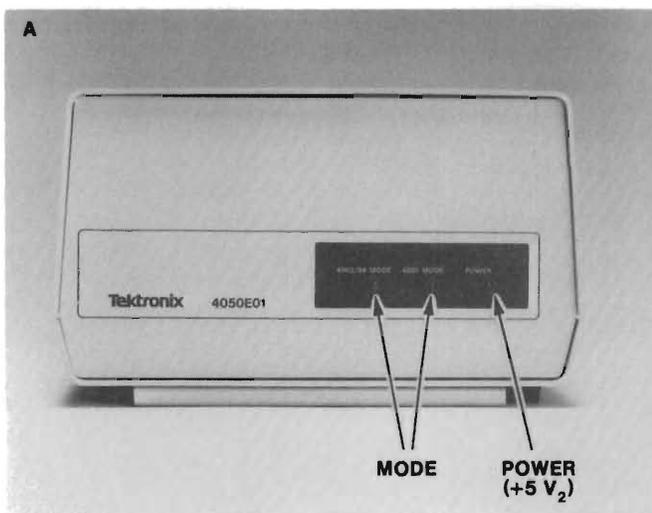
**Table 4-3**

**PERFORMANCE CHECK WORK SHEET**

Test Point	Voltage (nominal)	Minimum	Measured	Maximum
TP1	+ 5 Vdc	4.75 V		5.25 V
TP11	+ 5 Vdc	4.75 V		5.25 V
TP21	+ 12 Vdc	11.4 V		12.6 V
TP31	-12 Vdc	-11.4 V		-12.6V



**Figure 4-5. Power Supply Test Points.**



**Figure 4-4. Indicator Lights.**

## SERVICE INFORMATION

### FUNCTIONAL PERFORMANCE

Use the Functional Check Procedure (earlier in this section) to verify operation of the initialization and ROM enable functions. Although ROM Packs may be

inserted into slots for the test, an Option 10 Printer Interface is preferred because it checks additional signals.

This completes the performance check procedure.

## MAINTENANCE INFORMATION

### REPLACING THE POWER SUPPLY BOARD

Refer to Figure 4-6.

1. Remove the four screws holding the protective cover over the power supply.
2. Disconnect P1.
3. Unfasten the four voltage regulators from the heat sink.
4. Unsolder the transformer leads from the circuit board.
5. Remove the two screws which fasten the capacitor support and transformer shield lead to the chassis.
6. Remove the four screws holding the Power Supply board in place.

Reverse the procedure to replace the supply:

7. Place the support over the capacitors, and then mount the Power Supply board to the side of the chassis.
8. Fasten the capacitor support and transformer shield lead to the bottom of the chassis.
9. Solder the remaining transformer leads to the circuit board. They connect in the same order as they come out of the transformer (see Figure 4-6).
10. Mount new regulators on the heat sink. The  $-12\text{ V}$  regulator (U31) requires a mica insulator and plastic washer.

11. Solder the regulators to the Power Supply board.
12. Reconnect P1.
13. Replace the protective cover over the Power Supply.

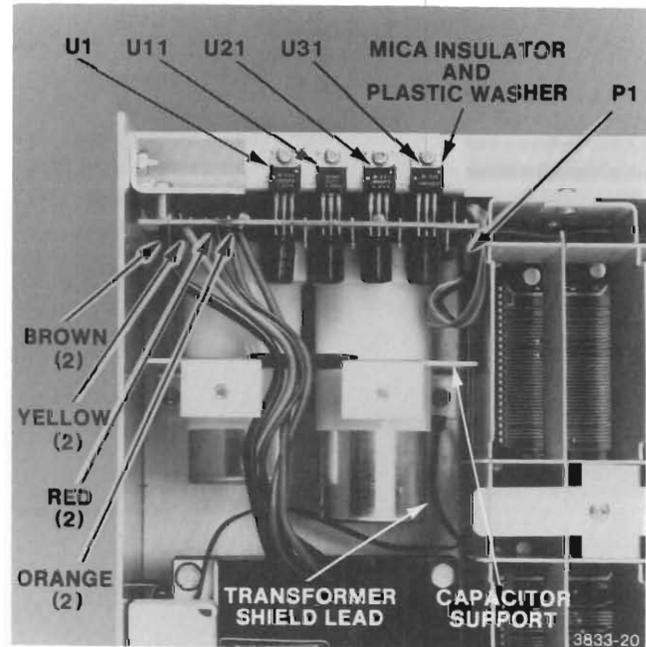


Figure 4-6. Replacing the Power Supply Board.

## REPLACING THE CONTROL BOARD

1. Remove any ROM Packs or interfaces from the slots.

**NOTE**

*The ROM Pack guides should be removed as a unit. Do not remove the two screws through the bar which holds the guides together.*

2. Remove the ROM Pack guides by removing four screws through each side of the chassis (Figure 4-7).
3. Remove the rear panel by removing the four screws which fasten it to the chassis (Figure 4-7).
4. Disconnect P14, P19, P21, P26, and P28 from the Control board (Figure 4-8).
5. Remove the eight screws which hold the circuit board in place.

Reverse the procedure to replace the board:

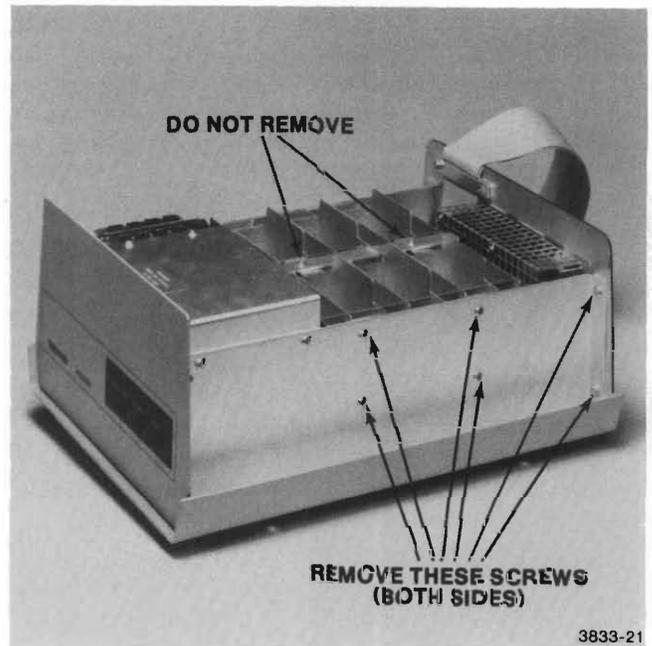


Figure 4-7. Access to the Control Board.

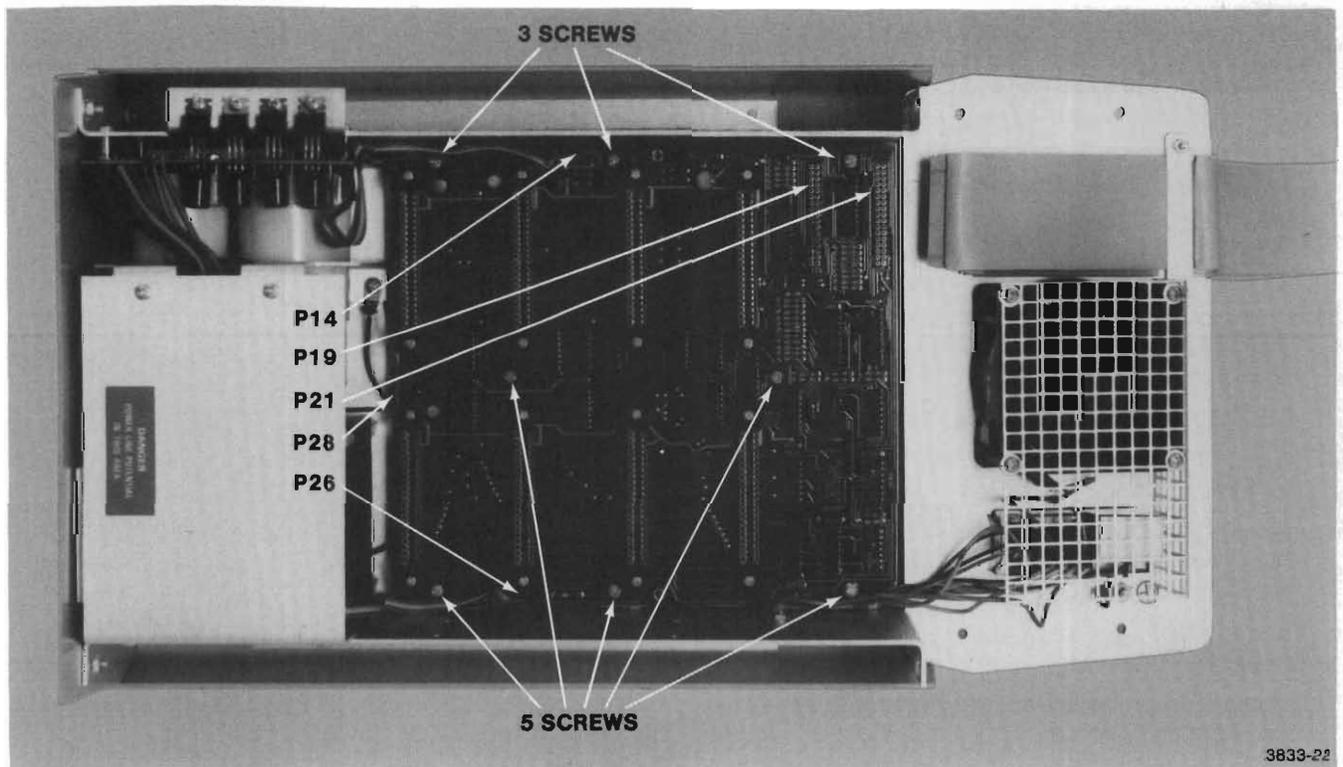


Figure 4-8. Replacing the Control Board.

## SERVICE INFORMATION

### CAUTION

Wires carrying line voltage lie under one side of the Control board. Before replacing the board verify that heavy paper insulation covers component leads in this area.

6. Replace the Control board.
7. Connect P19 and P21. The shorter cable goes next to the chassis.

### CAUTION

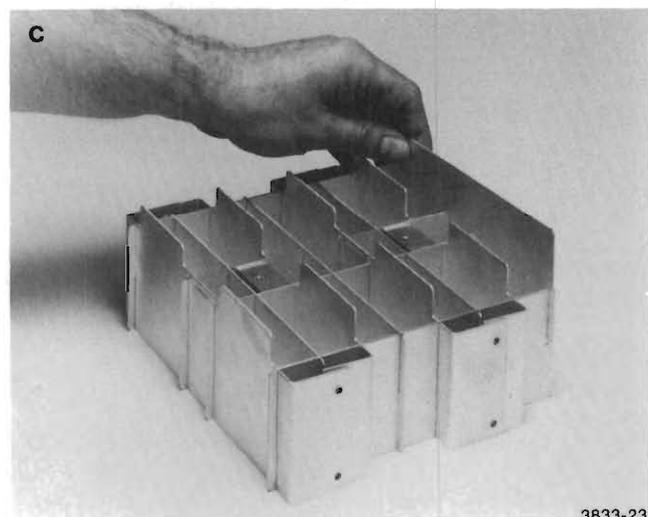
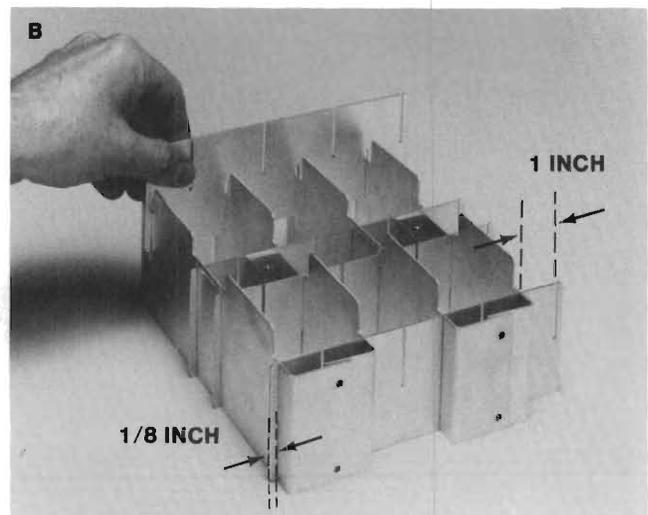
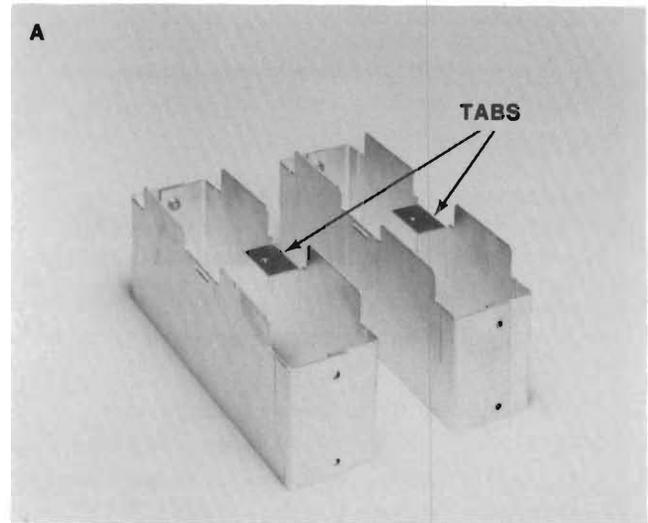
The wires from the Line Voltage Selector on the rear panel carry line voltage. To avoid personal injury or damage to the product, be careful not to pinch the wires when replacing the rear panel.

8. Replace the rear panel.
9. Replace P14, P26, and P28.
10. Replace the ROM Pack guides. Check the fit by inserting ROM Packs in the slots.

## ASSEMBLING THE ROM PACK GUIDES

Ordinarily it is not necessary to disassemble the ROM Pack guides because they can be removed as a unit while servicing the Control board. However, Figure 4-9 shows the assembly procedure should this become necessary.

1. Assemble the two groups shown in Figure 4-9A. If necessary, temporarily insert screws in each side. Orient the tabs as shown in the figure.
2. Add the four cross pieces as shown in Figure 4-9B. These pieces should extend about 1/8 in beyond the side facing you, but about 1 inch in the other direction.
3. Add the four dividers as shown in Figure 4-9C.
4. Insert the bar and the two screws which secure it to the tabs, but do not tighten the screws yet.
5. Place the guides in the chassis and fasten with four screws through each side. Do not tighten the screws yet.
6. Place ROM Packs in two diagonally opposite slots (1 and 8 or 4 and 5).
7. Tighten all screws. Check the fit of the ROM Packs and adjust if necessary.



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Figure 4-9. Assembly of ROM Pack Guides.

## OPTION INFORMATION

Options are available to convert the 4050E01 ROM Expander to operate from either 220 or 240 V sources which are used in various countries. To order kits for field installation, see the accessories list in the Replaceable Mechanical Parts section. Installation instructions are provided with each kit. Brief descriptions of the options are given below and in Figure 3-2.

Option A1 — 220 V, 50 Hz operation, Universal European plug.

Option A2 — 240 V, 50 Hz operation, United Kingdom plug.

Option A3 — 240 V, 50 Hz operation, Australian plug.

Option A4 — 240 V, 60 Hz operation, North American plug.

A rental tag, Option 49, also is available.



# Section 5 REPLACEABLE ELECTRICAL PARTS

## PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

### LIST OF ASSEMBLIES

A list of assemblies can be found at the beginning of the Electrical Parts List. The assemblies are listed in numerical order. When the complete component number of a part is known, this list will identify the assembly in which the part is located.

### CROSS INDEX-MFR. CODE NUMBER TO MANUFACTURER

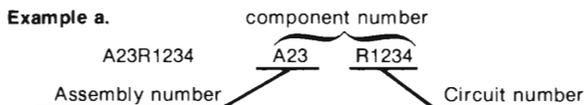
The Mfr Code Number to Manufacturer index for the Electrical Parts List is located immediately after this page. The Cross Index provides codes, names and addresses of manufacturers of components listed in the Electrical Parts List.

### ABBREVIATIONS

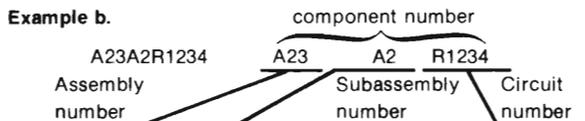
Abbreviations conform to American National Standard Y1 1

### COMPONENT NUMBER (column one of the Electrical Parts List)

A numbering method has been used to identify assemblies, subassemblies and parts. Examples of this numbering method and typical expansions are illustrated by the following:



Read: Resistor 1234 of Assembly 23



Read: Resistor 1234 of Subassembly 2 of Assembly 23

Only the circuit number will appear on the diagrams and circuit board illustrations. Each diagram and circuit board illustration is clearly marked with the assembly number. Assembly numbers are also marked on the mechanical exploded views located in the Mechanical Parts List. The component number is obtained by adding the assembly number prefix to the circuit number.

The Electrical Parts List is divided and arranged by assemblies in numerical sequence (e.g., assembly A1 with its subassemblies and parts, precedes assembly A2 with its subassemblies and parts).

Chassis-mounted parts have no assembly number prefix and are located at the end of the Electrical Parts List.

### TEKTRONIX PART NO. (column two of the Electrical Parts List)

Indicates part number to be used when ordering replacement part from Tektronix.

### SERIAL/MODEL NO. (columns three and four of the Electrical Parts List)

Column three (3) indicates the serial number at which the part was first used. Column four (4) indicates the serial number at which the part was removed. No serial number entered indicates part is good for all serial numbers.

### NAME & DESCRIPTION (column five of the Electrical Parts List)

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

### MFR. CODE (column six of the Electrical Parts List)

Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)

### MFR. PART NUMBER (column seven of the Electrical Parts List)

Indicates actual manufacturers part number.

**REPLACEABLE ELECTRICAL PARTS**

**CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER**

Mfr. Code	Manufacturer	Address	City, State, Zip
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
02777	HOPKINS ENGINEERING COMPANY	12900 FOOTHILL BLVD.	SAN FERNANDO, CA 91342
03508	GENERAL ELECTRIC COMPANY, SEMI-CONDUCTOR PRODUCTS DEPARTMENT	ELECTRONICS PARK	SYRACUSE, NY 13201
04222	AVX CERAMICS, DIVISION OF AVX CORP.	P O BOX 867, 19TH AVE. SOUTH	MYRTLE BEACH, SC 29577
04713	MOTOROLA, INC., SEMICONDUCTOR PROD. DIV.	5005 E MCDOWELL RD, PO BOX 20923	PHOENIX, AZ 85036
05574	VIKING INDUSTRIES, INC.	21001 NORDHOFF STREET	CHATSWORTH, CA 91311
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042
14433	ITT SEMICONDUCTORS	3301 ELECTRONICS WAY P O BOX 3049	WEST PALM BEACH, FL 33402
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
27014	NATIONAL SEMICONDUCTOR CORP.	2900 SEMICONDUCTOR DR.	SANTA CLARA, CA 95051
55680	NICHICON/AMERICA/CORP.	6435 N PROESEL AVENUE	CHICAGO, IL 60645
56289	SPRAGUE ELECTRIC CO.	87 MARSHALL ST.	NORTH ADAMS, MA 01247
71400	BUSSMAN MFG., DIVISION OF MCGRAW-EDISON CO.	2536 W. UNIVERSITY ST.	ST. LOUIS, MO 63107
72619	DIALIGHT, DIV. AMPEREX ELECTRONIC	203 HARRISON PLACE	BROOKLYN, NY 11237
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
77342	AMF INC., POTTER AND BRUMFIELD DIV.	200 RICHLAND CREEK DRIVE	PRINCETON, IN 47670
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
82877	ROTRON, INC.	7-9 HASBROUCK LANE	WOODSTOCK, NY 12498
90201	MALLORY CAPACITOR CO., DIV. OF P. R. MALLORY AND CO., INC.	3029 E. WASHINGTON STREET P. O. BOX 372	INDIANAPOLIS, IN 46206
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NE 68601

REPLACEABLE ELECTRICAL PARTS

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
ASSEMBLIES					
A1	670-7210-00		CKT BOARD ASSY:POWER SUPPLY	80009	670-7210-00
A2	670-7209-00		CKT BOARD ASSY:BUFFER	80009	670-7209-00
A3	670-7211-00		CKT BOARD ASSY:CONTROL	80009	670-7211-00
A1 POWER SUPPLY					
A1	670-7210-00		CKT BOARD ASSY:POWER SUPPLY	80009	670-7210-00
A1C1	290-0770-00		CAP.,FXD,ELCTLT:100UF,+50-10%,25V	56289	502D230
A1C11	290-0770-00		CAP.,FXD,ELCTLT:100UF,+50-10%,25V	56289	502D230
A1C21	290-0770-00		CAP.,FXD,ELCTLT:100UF,+50-10%,25V	56289	502D230
A1C31	290-0770-00		CAP.,FXD,ELCTLT:100UF,+50-10%,25V	56289	502D230
A1C101	290-0508-00		CAP.,FXD,ELCTLT:18,000UF,+100-10%,15V	56289	68D10444
A1C131	290-0753-00		CAP.,FXD,ELCTLT:4500UF,+75-10%,30V	90201	20-30431
A1C202	283-0177-00		CAP.,FXD,CER DI:1UF,+80-20%,25V	56289	273C5
A1C203	290-0745-00		CAP.,FXD,ELCTLT:22UF,+50-10%,25V	56289	502D225
A1C210	283-0190-00		CAP.,FXD,CER DI:0.47UF,5%,50V	72982	8141N077X7R0474J
A1C231	290-0753-00		CAP.,FXD,ELCTLT:4500UF,+75-10%,30V	90201	20-30431
A1CR201	152-0198-00		SEMICONV DEVICE:SILICON,200V,3A	03508	1N5624
A1CR202	152-0198-00		SEMICONV DEVICE:SILICON,200V,3A	03508	1N5624
A1CR205	152-0141-02		SEMICONV DEVICE:SILICON,30V,150MA	01295	1N4152R
A1CR206	152-0066-00		SEMICONV DEVICE:SILICON,400V,750MA	14433	LG4016
A1CR207	152-0066-00		SEMICONV DEVICE:SILICON,400V,750MA	14433	LG4016
A1CR209	152-0406-00		SEMICONV DEVICE:SILICON,200V,3A	80009	152-0406-00
A1J1	131-0608-00		TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
	-----		(QUANTITY OF 8)		
A1R201	315-0105-00		RES.,FXD,CMPSN:1M OHM,5%,0.25W	01121	CB1055
A1R202	315-0184-00		RES.,FXD,CMPSN:180K OHM,5%,0.25W	01121	CB1845
A1R203	321-0277-00		RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
A1R204	321-0277-00		RES.,FXD,FILM:7.5K OHM,1%,0.125W	91637	MFF1816G75000F
A1R207	315-0182-00		RES.,FXD,CMPSN:1.8K OHM,5%,0.25W	01121	CB1825
A1R208	315-0304-00		RES.,FXD,CMPSN:300K OHM,5%,0.25W	01121	CB3045
A1R209	321-0322-00		RES.,FXD,FILM:22.1K OHM,1%,0.125W	91637	MFF1816G22101F
A1R210	321-0382-00		RES.,FXD,FILM:93.1K OHM,1%,0.125W	91637	MFF1816G93101F
A1TP1	214-0579-00		TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A1TP11	214-0579-00		TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A1TP21	214-0579-00		TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A1TP31	214-0579-00		TERM,TEST POINT:BRS CD PL	80009	214-0579-00
A1U205	156-0853-00		MICROCIRCUIT,LI:OPERATIONAL AMPLIFIER,DUAL	27014	LM358N
A1VR208	152-0166-00		SEMICONV DEVICE:ZENER,0.4W,6.2V,5%	04713	SZ11738

# REPLACEABLE ELECTRICAL PARTS

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A2 BUFFER					
A2	670-7209-00		CKT BOARD ASSY:BUFFER	80009	670-7209-00
A2C125	283-0422-00		CAP., FXD, CER DI:0.047UF, +80-20%, 50V	04222	DG015E473Z
A2C225	283-0422-00		CAP., FXD, CER DI:0.047UF, +80-20%, 50V	04222	DG015E473Z
A2C323	290-0943-00		CAP., FXD, ELCTLT:47UF, +50-10%, 25V	55680	25ULB47V8T
A2C325	283-0422-00		CAP., FXD, CER DI:0.047UF, +80-20%, 50V	04222	DG015E473Z
A2C334	283-0422-00		CAP., FXD, CER DI:0.047UF, +80-20%, 50V	04222	DG015E473Z
A2C421	283-0107-00		CAP., FXD, CER DI:51PF, 5%, 200V	72982	8121B232COG0510J
A2C425	283-0422-00		CAP., FXD, CER DI:0.047UF, +80-20%, 50V	04222	DG015E473Z
A2J31	131-0608-00		TERMINAL, PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
	-----		(QUANTITY OF 34)		
A2J32	131-0608-00		TERMINAL, PIN:0.365 L X 0.025 PH BRZ GOLD	22526	47357
	-----		(QUANTITY OF 34)		
A2R111	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A2R112	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A2R113	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A2R115	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A2R121	307-0445-00		RES, NTWK, FXD, FI:4.7K OHM, 20%, (9) RES	91637	MSP10A01-472M
A2R211	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A2R212	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A2R227	315-0102-00		RES., FXD, CMPSN:1K OHM, 5%, 0.25W	01121	CB1025
A2R231	315-0472-00		RES., FXD, CMPSN:4.7K OHM, 5%, 0.25W	01121	CB4725
A2R233	315-0222-00		RES., FXD, CMPSN:2.2K OHM, 5%, 0.25W	01121	CB2225
A2R235	315-0102-00		RES., FXD, CMPSN:1K OHM, 5%, 0.25W	01121	CB1025
A2R321	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A2R322	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A2R421	315-0101-00		RES., FXD, CMPSN:100 OHM, 5%, 0.25W	01121	CB1015
A2R427	315-0102-00		RES., FXD, CMPSN:1K OHM, 5%, 0.25W	01121	CB1025
A2R431	315-0102-00		RES., FXD, CMPSN:1K OHM, 5%, 0.25W	01121	CB1025
A2U121	156-1111-02		MICROCIRCUIT, DI:OCTAL BUS TRANSCEIVERS	80009	156-1111-02
A2U131	156-0852-02		MICROCIRCUIT, DI:HEX DRVR W/3 STATE INP	80009	156-0852-02
A2U221	156-1179-01		MICROCIRCUIT, DI:OCTAL BFR W/3 STATE OUT	01295	SN745241 JP4
A2U321	156-1179-01		MICROCIRCUIT, DI:OCTAL BFR W/3 STATE OUT	01295	SN745241 JP4
A2U331	156-0341-02		MICROCIRCUIT, DI:DUAL 2-INP DRIVER, SCRN	01295	SN75453
A2U421	156-1179-01		MICROCIRCUIT, DI:OCTAL BFR W/3 STATE OUT	01295	SN745241 JP4

REPLACEABLE ELECTRICAL PARTS

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A3 CONTROL					
A3	670-7211-00		CKT BOARD ASSY:CONTROL	80009	670-7211-00
A3C130	290-0745-00		CAP., FXD, ELCTLT: 22UF, +50-10%, 25V	56289	502D225
A3C131	290-0745-00		CAP., FXD, ELCTLT: 22UF, +50-10%, 25V	56289	502D225
A3C150	283-0422-00		CAP., FXD, CER DI: 0.047UF, +80-20%, 50V	04222	DG015E473Z
A3C154	290-0745-00		CAP., FXD, ELCTLT: 22UF, +50-10%, 25V	56289	502D225
A3C251	283-0422-00		CAP., FXD, CER DI: 0.047UF, +80-20%, 50V	04222	DG015E473Z
A3C252	283-0422-00		CAP., FXD, CER DI: 0.047UF, +80-20%, 50V	04222	DG015E473Z
A3C351	283-0422-00		CAP., FXD, CER DI: 0.047UF, +80-20%, 50V	04222	DG015E473Z
A3C353	283-0422-00		CAP., FXD, CER DI: 0.047UF, +80-20%, 50V	04222	DG015E473Z
A3C415	283-0422-00		CAP., FXD, CER DI: 0.047UF, +80-20%, 50V	04222	DG015E473Z
A3C433	290-0745-00		CAP., FXD, ELCTLT: 22UF, +50-10%, 25V	56289	502D225
A3C465	283-0422-00		CAP., FXD, CER DI: 0.047UF, +80-20%, 50V	04222	DG015E473Z
A3C475	283-0422-00		CAP., FXD, CER DI: 0.047UF, +80-20%, 50V	04222	DG015E473Z
A3C485	283-0065-00		CAP., FXD, CER DI: 0.001UF, 5%, 100V	72982	805-518-Z5DQ102J
A3C547	283-0422-00		CAP., FXD, CER DI: 0.047UF, +80-20%, 50V	04222	DG015E473Z
A3C549	283-0422-00		CAP., FXD, CER DI: 0.047UF, +80-20%, 50V	04222	DG015E473Z
A3C567	283-0422-00		CAP., FXD, CER DI: 0.047UF, +80-20%, 50V	04222	DG015E473Z
A3C569	283-0422-00		CAP., FXD, CER DI: 0.047UF, +80-20%, 50V	04222	DG015E473Z
A3C577	283-0422-00		CAP., FXD, CER DI: 0.047UF, +80-20%, 50V	04222	DG015E473Z
A3C578	283-0422-00		CAP., FXD, CER DI: 0.047UF, +80-20%, 50V	04222	DG015E473Z
A3DS130	150-1001-02		LT EMITTING DIO: RED, 660NM, 50MA MAX	80009	150-1001-02
A3DS231	150-1001-02		LT EMITTING DIO: RED, 660NM, 50MA MAX	80009	150-1001-02
A3DS333	150-1001-02		LT EMITTING DIO: RED, 660NM, 50MA MAX	80009	150-1001-02
A3J11	131-1962-00		CONN, RCPT, ELEC: CKT CARD, 22/44 CONT	05574	600201-3241
A3J13	131-1962-00		CONN, RCPT, ELEC: CKT CARD, 22/44 CONT	05574	600201-3241
A3J14	131-0608-00		TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD (QUANTITY OF 8)	22526	47357
A3J15	131-1962-00		CONN, RCPT, ELEC: CKT CARD, 22/44 CONT	05574	600201-3241
A3J17	131-1962-00		CONN, RCPT, ELEC: CKT CARD, 22/44 CONT	05574	600201-3241
A3J19	131-0608-00		TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD (QUANTITY OF 34)	22526	47357
A3J21	131-0608-00		TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD (QUANTITY OF 34)	22526	47357
A3J22	131-0608-00		TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD (QUANTITY OF 2)	22526	47357
A3J23	131-1962-00		CONN, RCPT, ELEC: CKT CARD, 22/44 CONT	05574	600201-3241
A3J24	131-1962-00		CONN, RCPT, ELEC: CKT CARD, 22/44 CONT	05574	600201-3241
A3J25	131-1962-00		CONN, RCPT, ELEC: CKT CARD, 22/44 CONT	05574	600201-3241
A3J26	131-0608-00		TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD (QUANTITY OF 6)	22526	47357
A3J27	131-1962-00		CONN, RCPT, ELEC: CKT CARD, 22/44 CONT	05574	600201-3241
A3J28	131-0608-00		TERMINAL, PIN: 0.365 L X 0.025 PH BRZ GOLD (QUANTITY OF 2)	22526	47357
A3R110	301-0331-00		RES., FXD, CMPSN: 330 OHM, 5%, 0.50W	01121	EB3315
A3R231	301-0680-00		RES., FXD, CMPSN: 68 OHM, 5%, 0.50W	01121	EB6805
A3R332	315-0751-00		RES., FXD, CMPSN: 750 OHM, 5%, 0.25W	01121	CB7515
A3R333	315-0102-00		RES., FXD, CMPSN: 1K OHM, 5%, 0.25W	01121	CB1025
A3R354	315-0472-00		RES., FXD, CMPSN: 4.7K OHM, 5%, 0.25W	01121	CB4725
A3R410	315-0102-00		RES., FXD, CMPSN: 1K OHM, 5%, 0.25W	01121	CB1025
A3R411	315-0470-00		RES., FXD, CMPSN: 47 OHM, 5%, 0.25W	01121	CB4705
A3R412	315-0470-00		RES., FXD, CMPSN: 47 OHM, 5%, 0.25W	01121	CB4705
A3R413	315-0470-00		RES., FXD, CMPSN: 47 OHM, 5%, 0.25W	01121	CB4705
A3R414	315-0470-00		RES., FXD, CMPSN: 47 OHM, 5%, 0.25W	01121	CB4705
A3R435	301-0331-00		RES., FXD, CMPSN: 330 OHM, 5%, 0.50W	01121	EB3315
A3R444	315-0470-00		RES., FXD, CMPSN: 47 OHM, 5%, 0.25W	01121	CB4705

# REPLACEABLE ELECTRICAL PARTS

## A3 CONTROL (CONT)

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A3R445	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R446	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R447	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R448	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R449	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R450	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R451	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R452	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R453	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R454	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R455	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R457	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R458	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R486	315-0153-00		RES., FXD, CMPSN:15K OHM, 5%, 0.25W	01121	CB1535
A3R487	301-0680-00		RES., FXD, CMPSN:68 OHM, 5%, 0.50W	01121	EB6805
A3R517	307-0445-00		RES, NTWK, FXD, FI:4.7K OHM, 20%, (9) RES	91637	MSP10A01-472M
A3R521	307-0445-00		RES, NTWK, FXD, FI:4.7K OHM, 20%, (9) RES	91637	MSP10A01-472M
A3R529	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R530	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R531	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R532	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R533	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R534	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R535	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R536	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R559	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R560	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R561	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R562	315-0470-00		RES., FXD, CMPSN:47 OHM, 5%, 0.25W	01121	CB4705
A3R569	315-0102-00		RES., FXD, CMPSN:1K OHM, 5%, 0.25W	01121	CB1025
A3R577	315-0102-00		RES., FXD, CMPSN:1K OHM, 5%, 0.25W	01121	CB1025
A3R578	315-0471-00		RES., FXD, CMPSN:470 OHM, 5%, 0.25W	01121	CB4715
A3R579	315-0471-00		RES., FXD, CMPSN:470 OHM, 5%, 0.25W	01121	CB4715
A3U130	156-0479-02		MICROCIRCUIT, DI:QUAD 2-INP ORGATE	01295	SN74LS32NP3
A3U150	156-0479-02		MICROCIRCUIT, DI:QUAD 2-INP ORGATE	01295	SN74LS32NP3
A3U231	156-0480-02		MICROCIRCUIT, DI:QUAD 2 INP & GATE	01295	SN74LS08NP3
A3U233	156-0479-02		MICROCIRCUIT, DI:QUAD 2-INP ORGATE	01295	SN74LS32NP3
A3U235	156-0479-02		MICROCIRCUIT, DI:QUAD 2-INP ORGATE	01295	SN74LS32NP3
A3U252	156-0479-02		MICROCIRCUIT, DI:QUAD 2-INP ORGATE	01295	SN74LS32NP3
A3U337	156-0480-02		MICROCIRCUIT, DI:QUAD 2 INP & GATE	01295	SN74LS08NP3
A3U339	156-0469-02		MICROCIRCUIT, DI:3/8 LINE DCDR	01295	SN74LS138NP3
A3U353	156-0479-02		MICROCIRCUIT, DI:QUAD 2-INP ORGATE	01295	SN74LS32NP3
A3U415	156-1179-01		MICROCIRCUIT, DI:OCTAL BFR W/3 STATE OUT	01295	SN745241 JP4
A3U441	156-0469-02		MICROCIRCUIT, DI:3/8 LINE DCDR	01295	SN74LS138NP3
A3U455	156-0392-03		MICROCIRCUIT, DI:QUAD LATCH W/CLEAR	01295	SN74LS175NP3
A3U475	156-0718-03		MICROCIRCUIT, DI:TRIPLE 3-INP NOR GATE	80009	156-0718-03
A3U485	156-0072-02		MICROCIRCUIT, DI:MONOSTABLE MV, BURN-IN	27014	DM8852
A3U519	156-1111-02		MICROCIRCUIT, DI:OCTAL BUS TRANSCEIVERS	80009	156-1111-02
A3U547	156-1179-01		MICROCIRCUIT, DI:OCTAL BFR W/3 STATE OUT	01295	SN745241 JP4
A3U549	156-1179-01		MICROCIRCUIT, DI:OCTAL BFR W/3 STATE OUT	01295	SN745241 JP4
A3U557	156-0464-02		MICROCIRCUIT, DI:DUAL 4 INP NAND GATE	80009	156-0464-02
A3U559	156-0469-02		MICROCIRCUIT, DI:3/8 LINE DCDR	01295	SN74LS138NP3
A3U577	156-0180-04		MICROCIRCUIT, DI:QUAD 2 INP NAND GATE	01295	SN74S00NP3
A3U579	156-0645-02		MICROCIRCUIT, DI:SCHMITT-TRIG POS-NAND	01295	SN74LS14
A3U587	156-0844-02		MICROCIRCUIT, DI:SYN 4 BIT CNTR, SCRN	01295	SN74LS161A
A3U589	156-0388-03		MICROCIRCUIT, DI:DUAL D FLIP-FLOP	07263	74LS74D
A3VR130	152-0306-00		SEMICONV DEVICE:ZENER, 0.4W, 9.1V, 5%	14433	1N960B

**REPLACEABLE ELECTRICAL PARTS**

A3 CONTROL (CONT)

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
A3VR231	152-0278-00		SEMICOND DEVICE:ZENER,0.4W,3V,5%	04713	SZG35009K20
A3VR242	152-0278-00		SEMICOND DEVICE:ZENER,0.4W,3V,5%	04713	SZG35009K20
A3VR433	152-0306-00		SEMICOND DEVICE:ZENER,0.4W,9.1V,5%	14433	1N960B

## REPLACEABLE ELECTRICAL PARTS

Component No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Name & Description	Mfr Code	Mfr Part Number
CHASSIS PARTS					
A5001	119-1330-00		POWER LINE MDL:CONN W/LINE V SEL & RFI FLTR	02777	F65004
B5001	119-0492-00		FAN,AXIAL:MUFFIN TYPE,3 INCH DIA,115V	82877	SU2C5
DS5001	150-1052-00		LT EMITTING DIO:RED,655NM,50MA	72619	559-0101-001
DS5003	150-1052-00		LT EMITTING DIO:RED,655NM,50MA	72619	559-0101-001
DS5005	150-1052-00		LT EMITTING DIO:RED,655NM,50MA	72619	559-0101-001
F5001	159-0018-00		FUSE,CARTRIDGE:3AG,0.8A,250V,SLOW-BLOW	71400	MDL 8/10
F5001	159-0031-00		FUSE,CARTRIDGE:3AG,0.4A,250V,SLOW-BLOW	71400	MDL 4/10
	-----		(OPTION A1,A2,A3,A4 ONLY)		
K5001	148-0091-00		RELAY,ARMATURE:4 FORM C,6VDC,2A,125VAC	77342	R10-E1-Y4-V52
T5001	120-1098-00		XFMR,PWR,STPDN:	80009	120-1098-00
U1	156-0277-00		MICROCIRCUIT,LI:VOLTAGE REGULATOR	07263	MICROA7805UC
U11	156-0277-00		MICROCIRCUIT,LI:VOLTAGE REGULATOR	07263	MICROA7805UC
U21	156-0285-00		MICROCIRCUIT,LI:VOLTAGE REGULATOR	27014	LM340T-12
U31	156-0872-00		MICROCIRCUIT,LI:VOLTAGE REGULATOR	04713	MC7912C

# Section 6

## DIAGRAMS AND SCHEMATICS

### Symbols and Reference Designators

Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors = Values one or greater are in picofarads (pF).  
 Values less than one are in microfarads ( $\mu$ F).

Resistors = Ohms ( $\Omega$ ).

Graphic symbols and class designation letters are based on ANSI Standard Y32.2-1975.

Logic symbology is based on ANSI Y32.14-1973 in terms of positive logic. Logic symbols depict the logic function performed and **may** differ from the manufacturer's data.

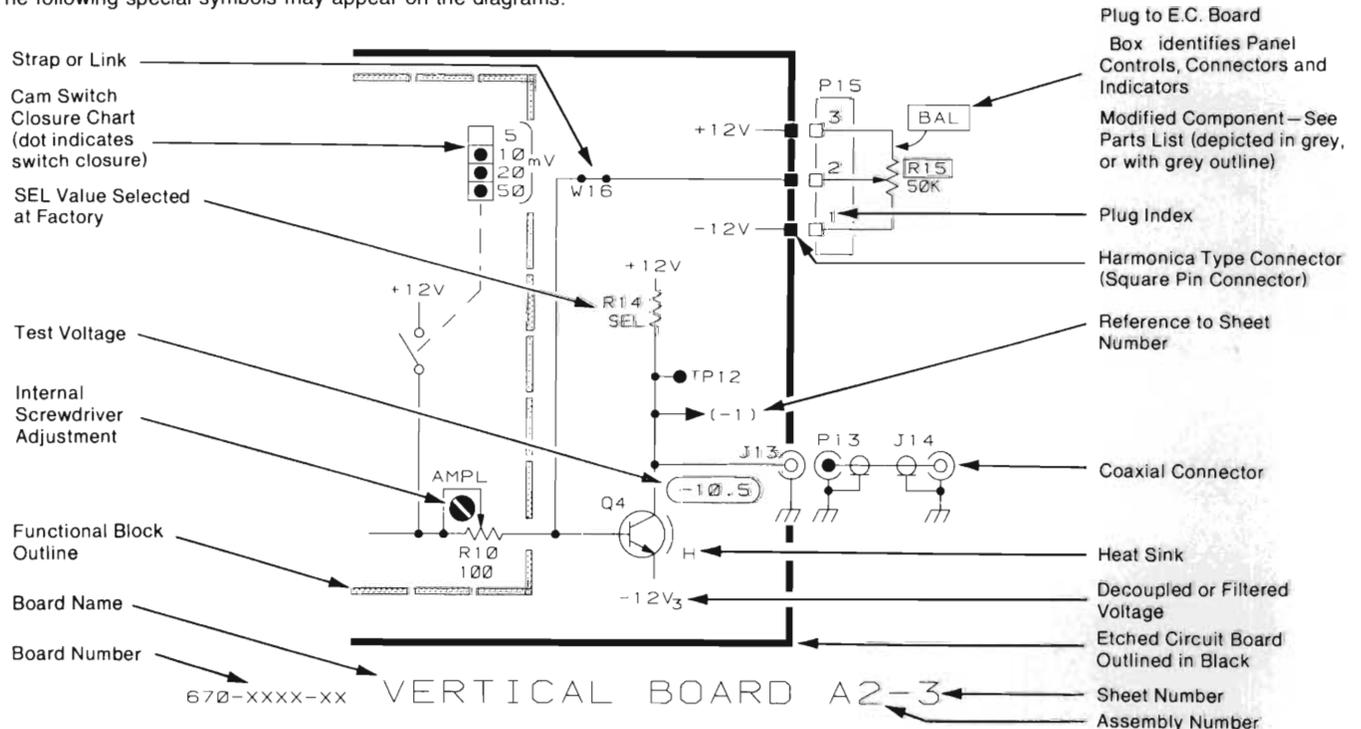
Abbreviations are based on ANSI Y1.1-1972. Other ANSI standards that are used in the preparation of diagrams by Tektronix, Inc., are:

Y14.15, 1966	Drafting Practices.
Y14.2, 1973	Line Conventions and Lettering.
Y10.5, 1968	Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.

The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

A	Assembly, separable or repairable (circuit board, etc.)	H	Heat dissipating device (heat sink, heat radiator, etc.)	S	Switch or contactor
AT	Attenuator, fixed or variable	HR	Heater	T	Transformer
B	Motor	HY	Hybrid circuit	TC	Thermocouple
BT	Battery	J	Connector, stationary portion	TP	Test point
C	Capacitor, fixed or variable	K	Relay	U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
CB	Circuit breaker	L	Inductor, fixed or variable	V	Electron tube
CR	Diode, signal or rectifier	M	Meter	VR	Voltage regulator (zener diode, etc.)
DL	Delay line	P	Connector, movable portion	W	Wirestrap or cable
DS	Indicating device (lamp)	Q	Transistor or silicon-controlled rectifier	Y	Crystal
E	Spark Gap, Ferrite bead	R	Resistor, fixed or variable	Z	Phase shifter
F	Fuse	RT	Thermistor		
FL	Filter				

The following special symbols may appear on the diagrams:



## DIAGRAMS AND SCHEMATICS

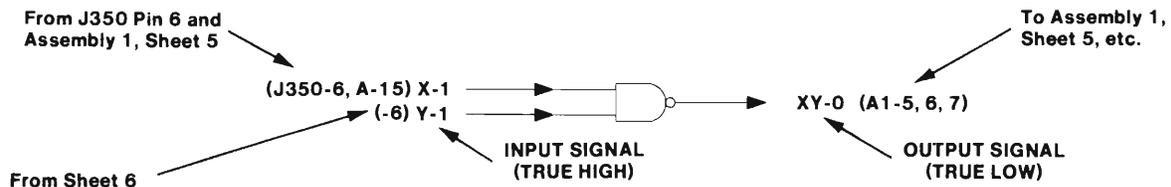
### 1. True High and True Low Signals

Signal names on the schematics are followed by -1 or a -0. A TRUE HIGH signal is indicated by -1, and a TRUE LOW signal is indicated by -0.

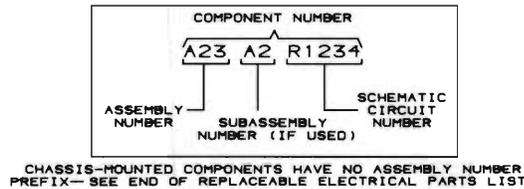
SIGNAL -1 = TRUE HIGH  
SIGNAL -0 = TRUE LOW

### 2. Cross-References

Schematic cross-references (from/to information) are included on the schematics. The "from" reference only indicates the signal "source," and the "to" reference lists all loads where the signal is used. All from/to information will be enclosed in parentheses.

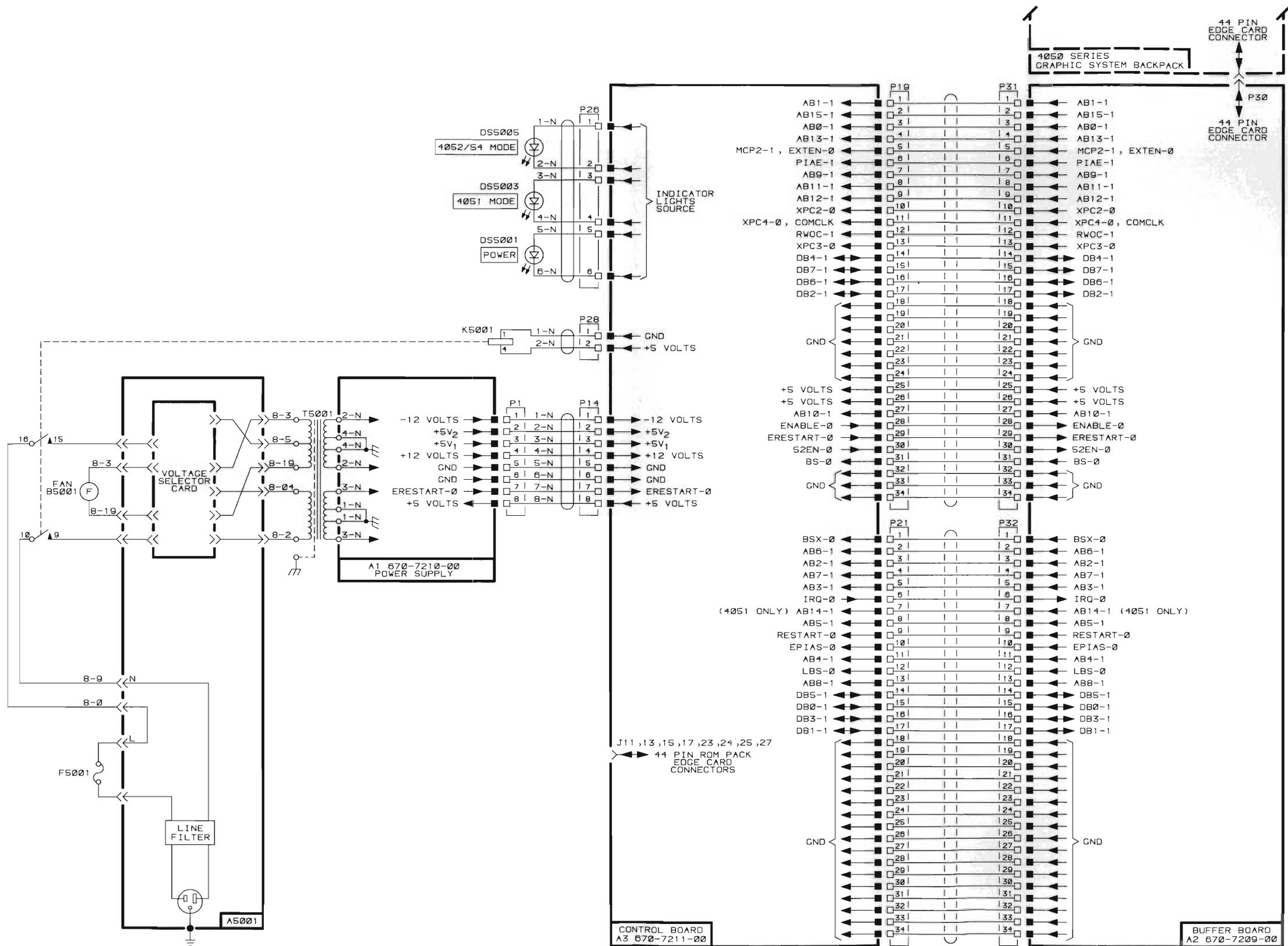


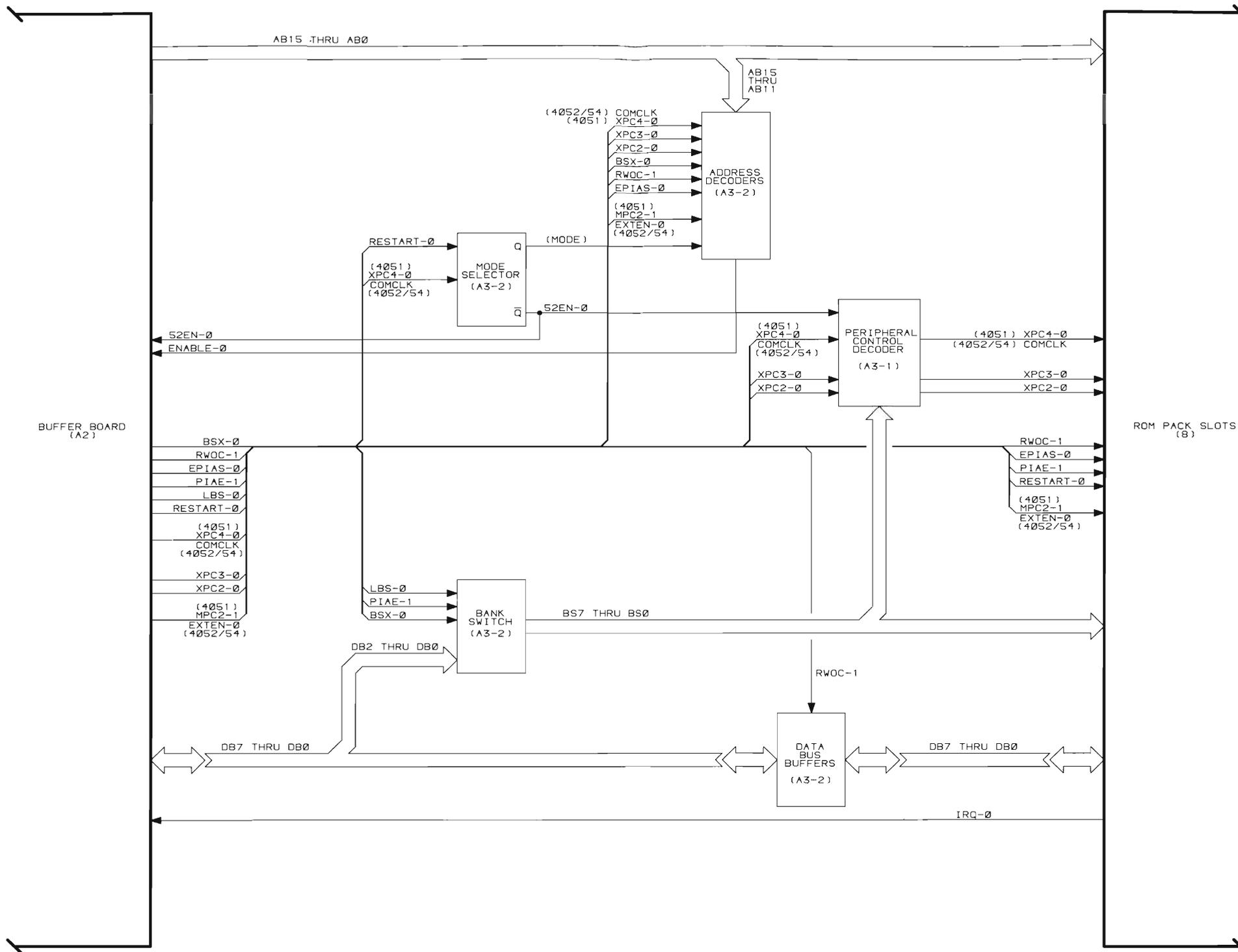
### 3. Component Number Example



## EDGE CONNECTOR PIN ASSIGNMENTS

Pin	Buffer Board P30	Control Board J11, J13, J15, J17, J23, J24, J25, and J27	Pin	Buffer Board P30	Control Board J11, J13, J15, J17, J23, J24, J25, and J27
A1	GND	GND	A22	(BS-0 — not used)	BSn-0 (n = 0-7)
A2	+ 5 V (from 4050)	+ 5 V (from ROM Expander)	B1	GND	GND
A3	(-12 V — not used)	-12 V	B2	+ 5 V (from 4050)	+ 5 V (from ROM Expander)
A4	(-12 V — not used)	-12 V	B3	AB10-1	AB10-1
A5	AB9-1	AB9-1	B4	(+ 12 V — not used)	+ 12 V
A6	PIAE-1	PIAE-1	B5	(+ 12 V — not used)	+ 12 V
A7	EPIAS-0	EPIAS-0	B6	DB0-1	DB0-1
A8	XPC3-0	XPC3-0	B7	AB8-1	AB8-1
A9	LBS-0	(no connection)	B8	DB1-1	DB1-1
A10	4051: XPC4-0 4052/4: COMCLK	4051: XPC4-0 4052/4: COMCLK	B9	AB7-1	AB7-1
A11	RESTART-0 (input) ERESTART-0 (output)	RESTART-0	B10	DB2-1	DB2-1
A12	XPC2-0	XPC2-0	B11	DB4-1	DB4-1
A13	4051: AB14-1 4052/4: SLOW-0	4051: AB14-1 4052/4: (not used)	B12	DB3-1	DB3-1
A14	IRQ-0	IRQ-0	B13	DB5-1	DB5-1
A15	AB15-1	AB15-1	B14	AB0-1	AB0-1
A16	AB13-1	AB13-1	B15	DB6-1	DB6-1
A17	AB12-1	AB12-1	B16	AB1-1	AB1-1
A18	AB11-1	AB11-1	B17	DB7-1	DB7-1
A19	RWOC-1	RWOC-1	B18	AB2-1	AB2-1
A20	BSX-0	(no connection)	B19	AB6-1	AB6-1
A21	4051: MCP2-1 4052/4: EXTEN-0	4051: MCP2-1 4052/4: EXTEN-0	B20	AB3-1	AB3-1
			B21	AB5-1	AB5-1
			B22	AB4-1	AB4-1





INSTRUMENT:

4050E01  
ROM EXPANDER

NOTES:

@

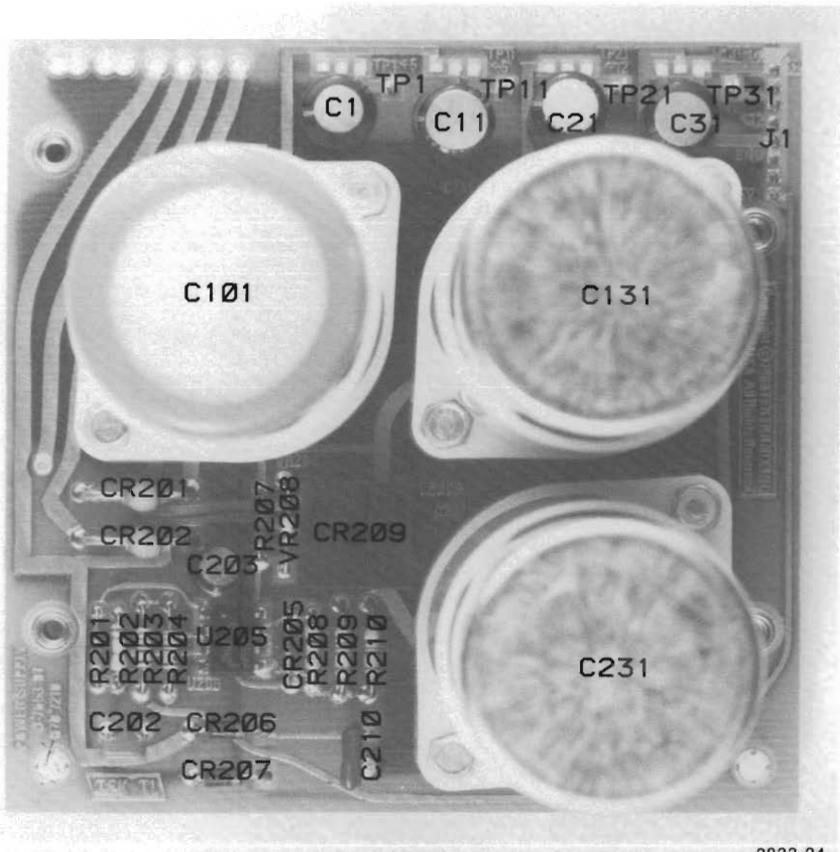
3833-31

DIAGRAM:

CONTROL BOARD  
BLOCK DIAGRAM

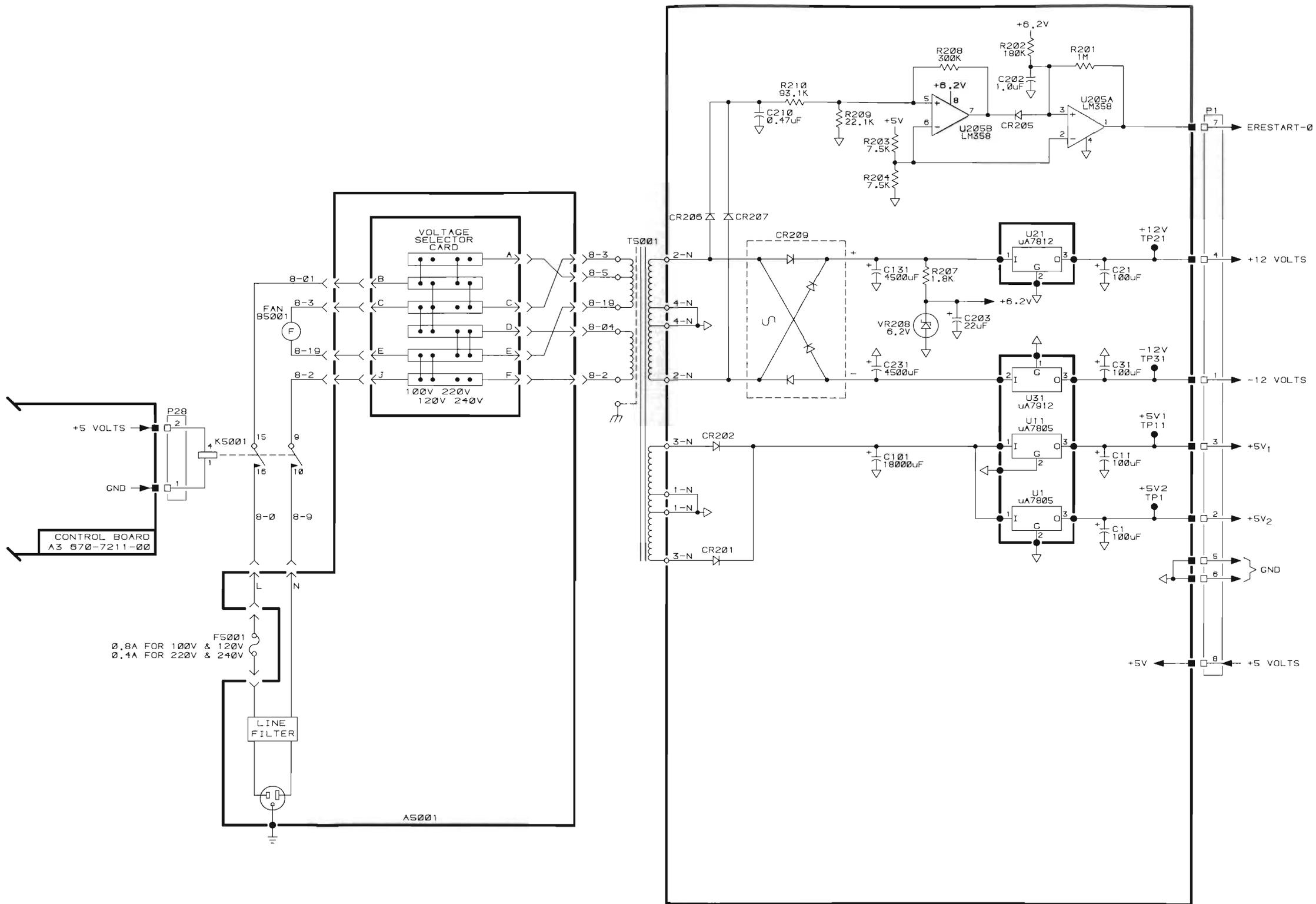
SHEET:

1 OF 1



3833-24

**Power Supply (670-7210-00) Component Locations.**



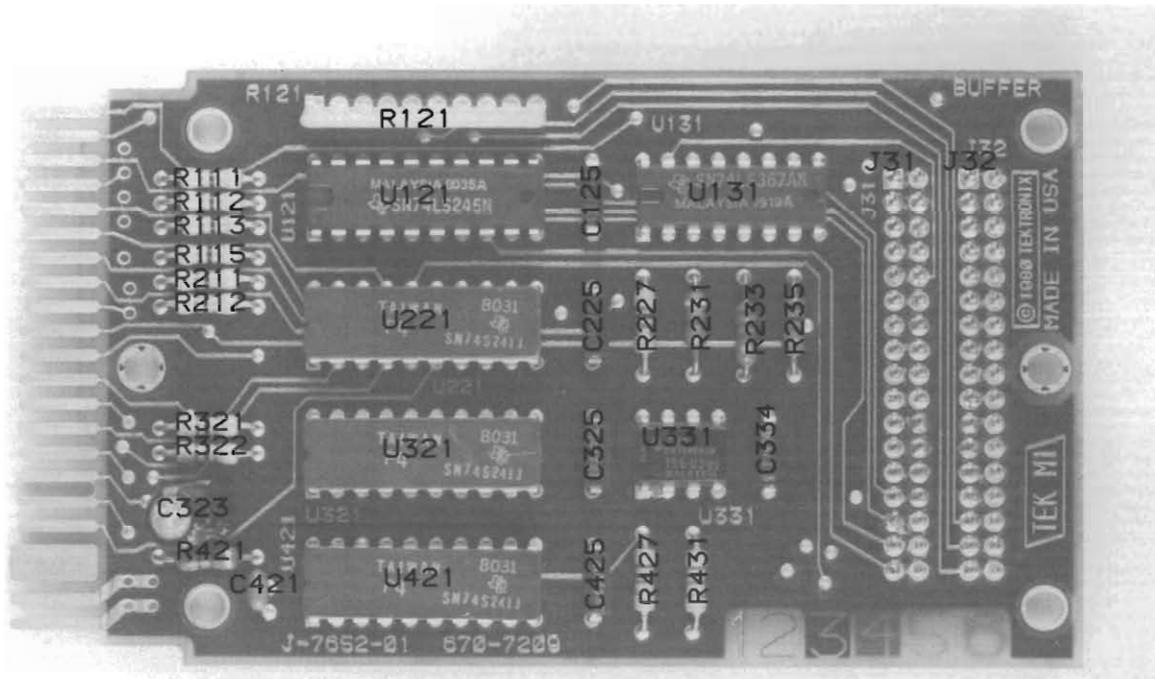
INSTRUMENT :  
4050E01  
ROM EXPANDER

NOTES :

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3833-2

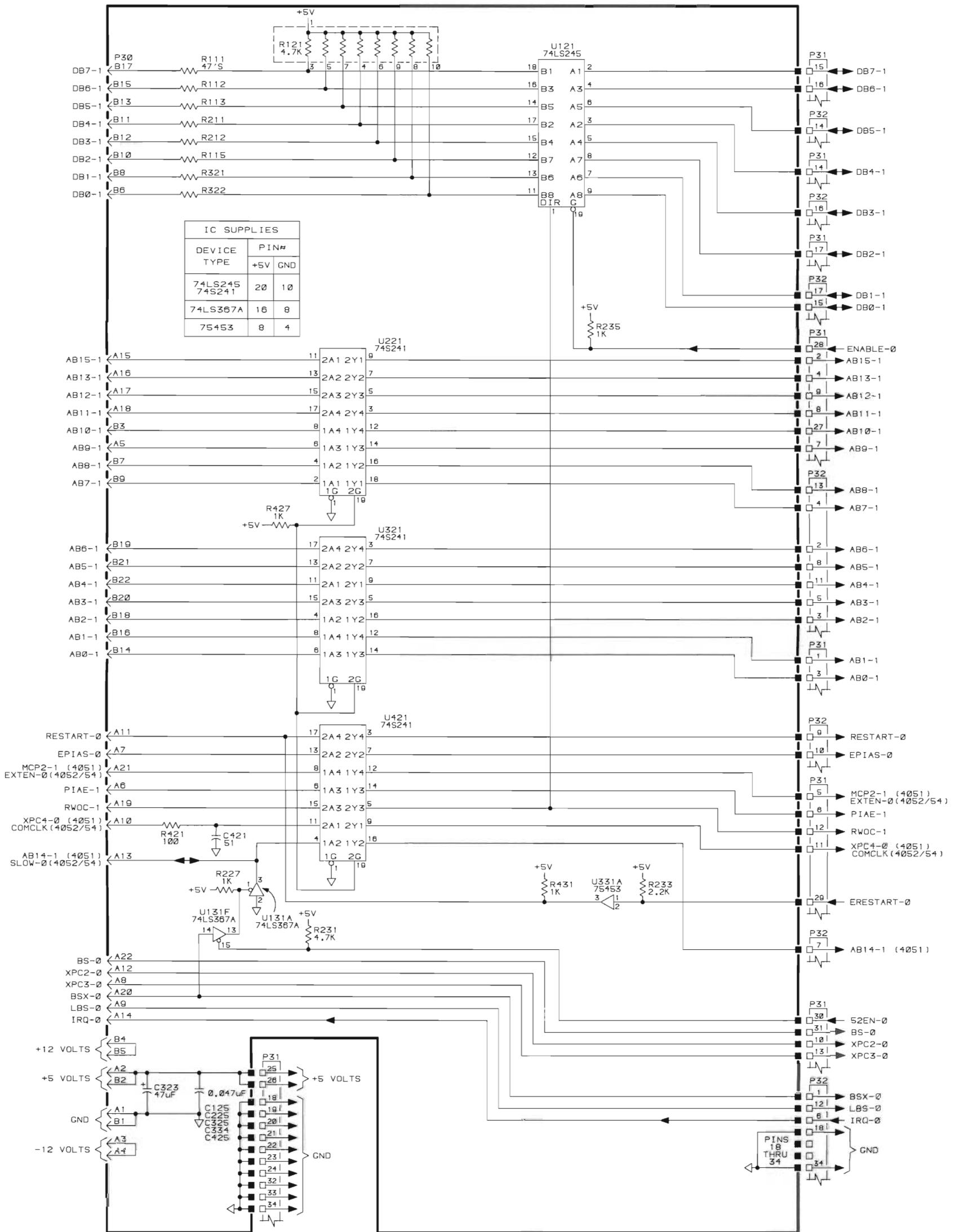
BOARD : 670-7210-00  
POWER SUPPLY BOARD

ASSEMBLY-SHEET :  
A1-1  
(1 OF 1)



3833-27

Buffer Board (670-7209-00) Component Locations.



INSTRUMENT:

4050E01  
ROM EXPANDER

NOTES: ALL EDGE CONNECTOR SIGNALS  
CONNECT TO 4050 SERIES INSTRUMENTS

3833-3

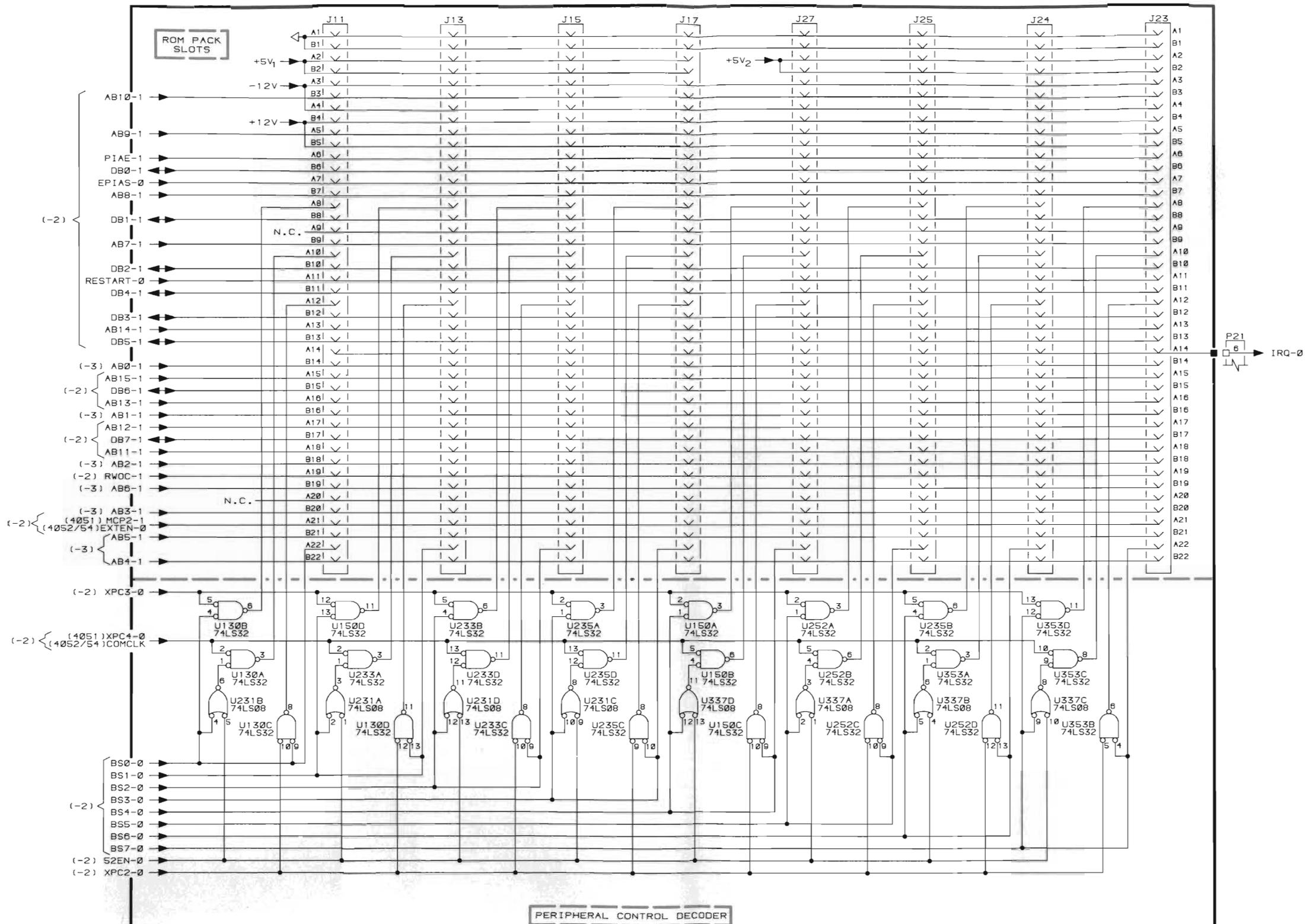
BOARD: 670-7209-00

BUFFER BOARD

ASSEMBLY-SHEET:

A2-1  
(1 OF 1)





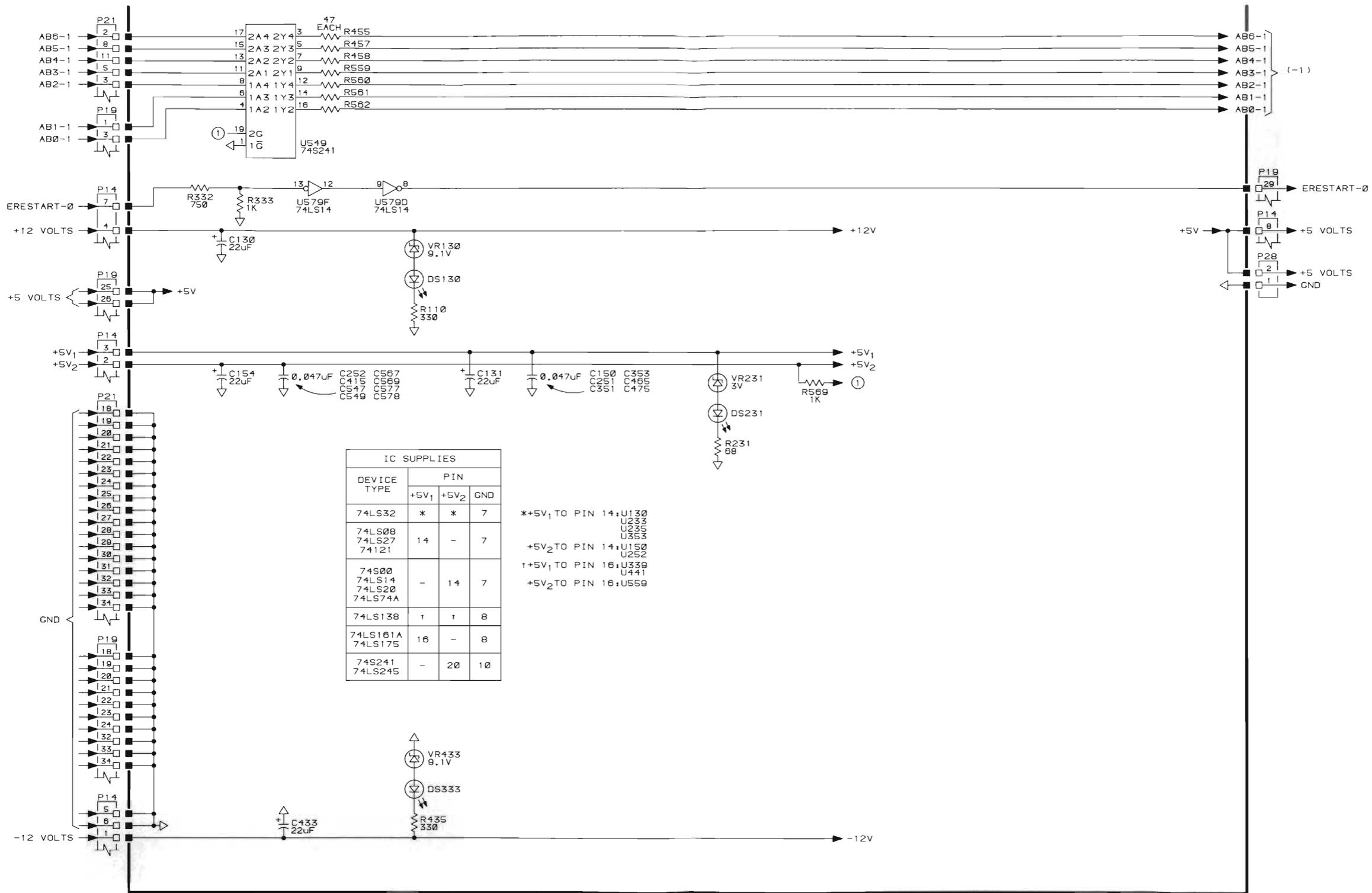
INSTRUMENT:  
4050E01  
ROM EXPANDER

NOTES:  
  
@  
3833-4

BOARD: 670-7211-00  
CONTROL BOARD

ASSEMBLY-SHEET:  
A3-1  
(1 OF 3)





INSTRUMENT :  
4050E01  
ROM EXPANDER

NOTES :

@  
3833-6

BOARD : 670-7211-00  
CONTROL BOARD

ASSEMBLY-SHEET :  
A3-3  
(3 OF 3)

# Section 7 REPLACEABLE MECHANICAL PARTS

## PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

## SPECIAL NOTES AND SYMBOLS

X000 Part first added at this serial number  
00X Part removed after this serial number

## FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

## INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column

```

1 2 3 4 5           Name & Description
Assembly and/or Component
Attaching parts for Assembly and/or Component
    --- * ---
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
    --- * ---
Parts of Detail Part
Attaching parts for Parts of Detail Part
    --- * ---
    
```

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol --- \* --- indicates the end of attaching parts.

**Attaching parts must be purchased separately, unless otherwise specified.**

## ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

## ABBREVIATIONS

"	INCH	ELCTRN	ELECTRON	IN	INCH	SE	SINGLE END
#	NUMBER SIZE	ELEC	ELECTRICAL	INCAND	INCANDESCENT	SECT	SECTION
ACTR	ACTUATOR	ELCTLT	ELECTROLYTIC	INSUL	INSULATOR	SEMICON	SEMICONDUCTOR
ADPTR	ADAPTER	ELEM	ELEMENT	INTL	INTERNAL	SHLD	SHIELD
ALIGN	ALIGNMENT	EPL	ELECTRICAL PARTS LIST	LPHLDR	LAMPHOLDER	SHLDR	SHOULDERED
AL	ALUMINUM	EOPT	EQUIPMENT	MACH	MACHINE	SKT	SOCKET
ASSEM	ASSEMBLED	EXT	EXTERNAL	MECH	MECHANICAL	SL	SLIDE
ASSY	ASSEMBLY	FIL	FILLISTER HEAD	MTG	MOUNTING	SLFLKG	SELF-LOCKING
ATTEN	ATTENUATOR	FLEX	FLEXIBLE	NIP	NIPPLE	SLVG	SLEEVING
AWG	AMERICAN WIRE GAGE	FLH	FLAT HEAD	NON WIRE	NOT WIRE WOUND	SPR	SPRING
BD	BOARD	FLTR	FILTER	OBD	ORDER BY DESCRIPTION	SQ	SQUARE
BRKT	BRACKET	FR	FRAME or FRONT	OD	OUTSIDE DIAMETER	SST	STAINLESS STEEL
BRS	BRASS	FSTNR	FASTENER	OVH	OVAL HEAD	STL	STEEL
BRZ	BRONZE	FT	FOOT	PH BRZ	PHOSPHOR BRONZE	SW	SWITCH
BSHG	BUSHING	FXD	FIXED	PL	PLAIN or PLATE	T	TUBE
CAB	CABINET	GSKT	GASKET	PLSTC	PLASTIC	TERM	TERMINAL
CAP	CAPACITOR	HDL	HANDLE	PN	PART NUMBER	THD	THREAD
CER	CERAMIC	HEX	HEXAGON	PNH	PAN HEAD	THK	THICK
CHAS	CHASSIS	HEX HD	HEXAGONAL HEAD	PWR	POWER	TNSN	TENSION
CKT	CIRCUIT	HEX SOC	HEXAGONAL SOCKET	RCP	RECEPTACLE	TPG	TAPPING
COMP	COMPOSITION	HLCPS	HELICAL COMPRESSION	RES	RESISTOR	TRH	TRUSS HEAD
CONN	CONNECTOR	HLXT	HELICAL EXTENSION	RGD	RIGID	V	VOLTAGE
COV	COVER	HV	HIGH VOLTAGE	RLF	RELIEF	VAR	VARIABLE
CPLG	COUPLING	IC	INTEGRATED CIRCUIT	RTNR	RETAINER	W/	WITH
CRT	CATHODE RAY TUBE	ID	INSIDE DIAMETER	SCH	SOCKET HEAD	WSHR	WASHER
DEG	DEGREE	IDNT	IDENTIFICATION	SCOPE	OSCILLOSCOPE	XFMR	TRANSFORMER
DWR	DRAWER	IMPLR	IMPELLER	SCR	SCREW	XSTR	TRANSISTOR

# REPLACEABLE MECHANICAL PARTS

## CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
000E0	ZEPHER ELECTRONIC SALES CORP.	647 INDUSTRY DRIVE	SEATTLE, WA 98188
00779	AMP, INC.	P O BOX 3608	HARRISBURG, PA 17105
02288	GOULD INC., ALLIED CONTROL DIVISION	100 RELAY ROAD	PLANTSVILLE, CT 06479
04963	MINNESOTA MINING AND MFG. CO., ADHESIVES COATINGS AND SEALERS DIVISION	3M CENTER	ST. PAUL, MN 55101
05574	VIKING INDUSTRIES, INC.	21001 NORDHOFF STREET	CHATSWORTH, CA 91311
08261	SPECTRA-STRIP CORP.	7100 LAMPSON AVE.	GARDEN GROVE, CA 92642
12327	FREEWAY CORPORATION	9301 ALLEN DRIVE	CLEVELAND, OH 44125
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
52905	SIMPLEX MFG. COMPANY	5224 NE 42ND AVENUE	PORTLAND, OREGON 97218
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
77250	PHEOLL MANUFACTURING CO., DIVISION OF ALLIED PRODUCTS CORP.	5700 W. ROOSEVELT RD.	CHICAGO, IL 60650
77342	AMF INC., POTTER AND BRUMFIELD DIV.	200 RICHLAND CREEK DRIVE	PRINCETON, IN 47670
77969	RUBBERCRAFT CORP. OF CALIF., LTD.	1800 W. 220TH ST.	TORRANCE, CA 90507
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
80126	PACIFIC ELECTRICORD CO.	747 W. REDONDO BEACH, P O BOX 10	GARDENA, CA 90247
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
86445	PENN FIBRE AND SPECIALTY CO., INC.	2032 E. WESTMORELAND ST.	PHILADELPHIA, PA 19134
91886	MALCO A MICRODOT CO.	12 PROGRESS DRIVE	MONTGOMERYVILLE, PA 18936
98627	UNIVERSAL OIL PRODUCTS CO., MORPLEX DIV.	1300 MORPLEX DRIVE	LACROSSE, WI 54601

REPLACEABLE MECHANICAL PARTS

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
1-	644-0105-00			1						CAB. TOP ASSY: (ATTACHING PARTS)	80009	644-0105-00
-1	211-0559-00			4						SCREW,MACHINE:6-32 X 0.375"100 DEG,FLH STL - - - * - - -	83385	OBD
-2	407-1892-00			2						. BRACKET,CAB.TOP:HOLD DOWN,ALUMINUM	80009	407-1892-00
-3	390-0557-00			1						. CABINET TOP: (ATTACHING PARTS)	80009	390-0557-00
-4	210-0457-00			4						. NUT,PL,ASSEM WA:6-32 X 0.312 INCH,STL - - - * - - -	83385	OBD
-5	407-1363-00			8						. BRACKET,HINGE:ALUMINUM (ATTACHING PARTS)	80009	407-1363-00
-6	210-0586-00			16						. NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL - - - * - - -	83385	OBD
-7	200-1575-00			8						. LID,ROM HOUSING:PLASTIC	80009	200-1575-00
-8	214-1906-00			8						. SPR,HLCL,TRSN:0.108 DIA X 1.250 INCH LONG	80009	214-1906-00
-9	214-1905-00			8						. PIN,HINGE:0.062 DIA X 2.850" L,SST	80009	214-1905-00
-10	334-3003-00			1						MARKER,IDENT:MKD DANGER PWR LINE POT	80009	334-3003-00
-11	200-2041-00			1						COVER,PWR SPLY: (ATTACHING PARTS)	80009	200-2041-00
-12	211-0504-00			4						SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL - - - * - - -	83385	OBD
	-----									ROM GUIDE ASSY: (ATTACHING PARTS)		
-13	211-0504-00			8						SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL - - - * - - -	83385	OBD
-14	381-0428-00			1						BAR,TIE:7.0 X 0.625,ALUMINUM (ATTACHING PARTS)	80009	381-0428-00
-15	211-0504-00			2						SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL - - - * - - -	83385	OBD
-16	386-4754-00			4						PLATE,DIVIDER:TRANSVERSE,ALUMINUM	80009	386-4754-00
-17	386-4753-00			4						PLATE,DIVIDER:LONGITUDINAL,ALUMINUM	80009	386-4753-00
-18	407-2862-00			2						BRACKET,SUPPORT:ROM HOUSING,ALUMINUM	80009	407-2862-00
-19	407-2861-00			2						BRACKET,SUPPORT:ROM HOUSING,ALUMINUM	80009	407-2861-00
-20	343-1028-00			2						CLAMP,CABLE:GROUNDING,3.0 X 0.438,AL (ATTACHING PARTS)	80009	343-1028-00
-21	211-0198-00			2						SCREW,MACHINE:4-40 X 0.438 PNH,STL,POZ	77250	OBD
-22	210-0586-00			2						NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL - - - * - - -	83385	OBD
-23	252-0571-00			AR						NEOPRENE EXTR:CHAN,0.234 X 0.156	77969	1353
-24	175-4120-00			1						CA ASSY,SP,ELEC:28 AWG,25.5 L,RIBBON (A2J31 TO A3J19)	000E0	OBD
-25	175-4121-00			1						CA ASSY,SP,ELEC:28 AWG,24.5 L,RIBBON (A2J32 TO A3J21)	000E0	OBD
-26	343-0998-00			1						CLAMP,CABLE:ALUMINUM	80009	343-0998-00
-27	386-4708-00			1						PLATE,GROUND:ALUMINUM	80009	386-4708-00
-28	361-1155-00			1						SPACER,PLATE:0.062 X 2.55 X 0.5,ALUMINUM	80009	361-1155-00
-29	131-2698-00			1						CONTACT,ELEC:GROUNDING,PH BRZ (ATTACHING PARTS)	80009	131-2698-00
-30	211-0578-00			2						SCREW,MACHINE:6-32 X 0.438 INCH,PNH STL	83385	OBD
-31	210-0457-00			2						NUT,PL,ASSEM WA:6-32 X 0.312 INCH,STL - - - * - - -	83385	OBD
-32	380-0384-01			1						HSG HALF,ROM PK:LID,ABS (ATTACHING PARTS)	80009	380-0384-01
-33	211-0102-00			2						SCREW,MACHINE:4-40 X 0.500",FLH,STL - - - * - - -	83385	OBD
-34	-----									CKT BOARD ASSY:BUFFER(SEE A2 REPL)		
-35	380-0343-01			1						HSG HALF,PTR:INNER,ABS	80009	380-0343-01
	334-4431-00			1						MARKER,IDENT:MKD ROM EXPANDER PRODUCT NO	80009	334-4431-00
-36	333-2819-00			1						PANEL,FRONT: (ATTACHING PARTS)	80009	333-2819-00
-37	210-0457-00			4						NUT,PL,ASSEM WA:6-32 X 0.312 INCH,STL - - - * - - -	83385	OBD
-38	210-1281-00			3						WASHER,RECESSED:0.25 ID X 0.059 THK,PLSTC	80009	210-1281-00
-39	175-4089-00			1						CA ASSY,SP,ELEC:6,26 AWG,14.0 L,RIBBON (DS5001-5/6;DS5002-3/4;DS5003-1/2 TO A3J26)	80009	175-4089-00

REPLACEABLE MECHANICAL PARTS

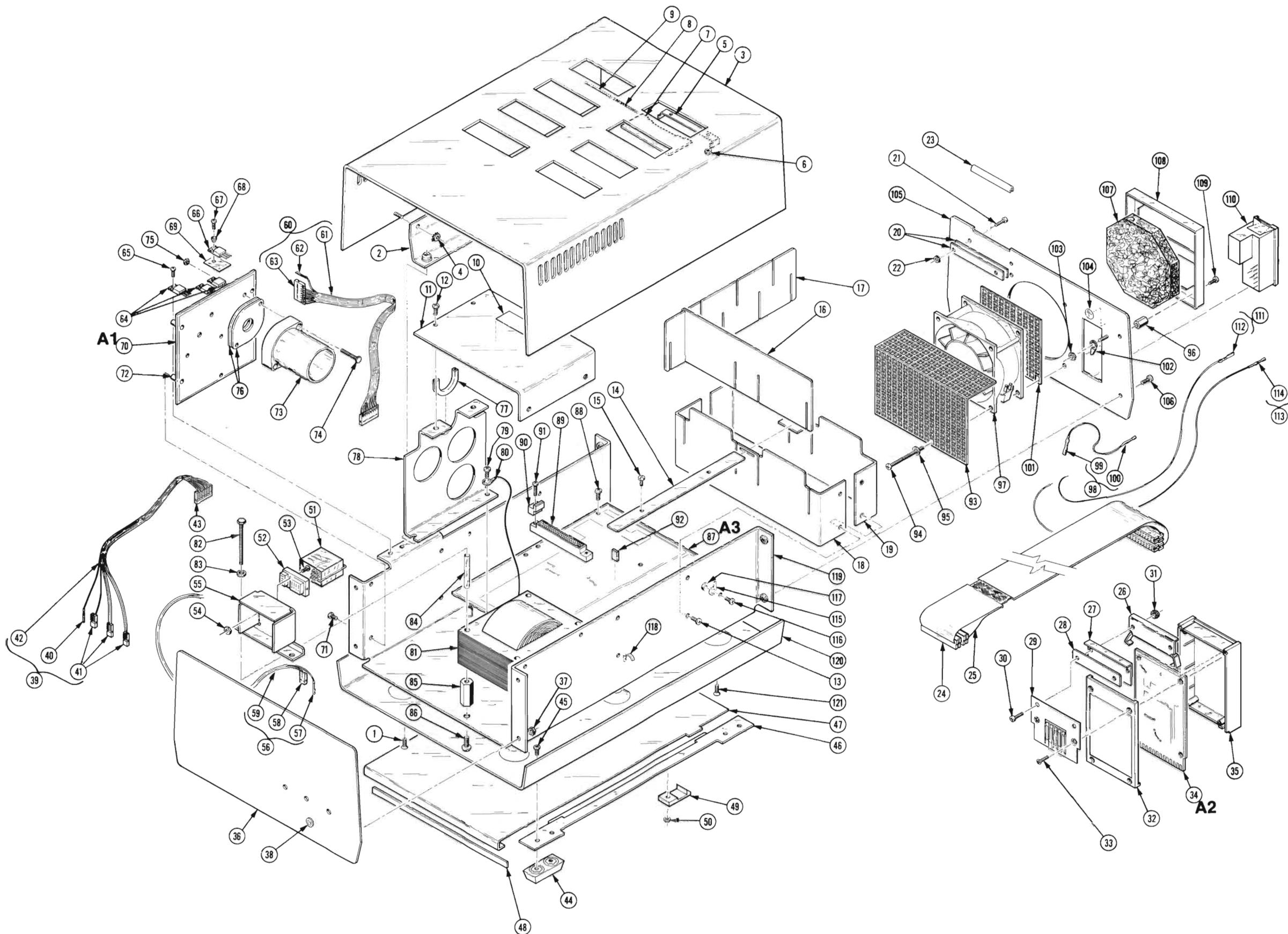
Fig. & Index No.	Tektronix Part No	Serial/Model No. Eff Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-40	131-0707-00		12	.	CONNECTOR,TERM.:22-26 AWG,BRS& CU BE GOLD	22526	47439
-41	352-0169-00		3	.	HLDR,TERM CONN:2 WIRE BLACK	80009	352-0169-00
-42	175-0829-00		AR	.	WIRE,ELECTRICAL:6 WIRE RIBBON	08261	SS-0626-710610C
-43	352-0164-00		1	.	CONN BODY,PL,EL:6 WIRE BLACK	80009	352-0164-00
-44	348-0419-00		4	.	FOOT,CABINET:FRONT	80009	348-0419-00
					(ATTACHING PARTS)		
-45	211-0507-00		8	.	SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL	83385	OBD
					- - - * - - -		
-46	351-0681-00		2	.	GUIDE,INSTR SUP:ALUMINUM	80009	351-0681-00
-47	386-4756-00		1	.	SUPPORT,INSTR:ALUMINUM	80009	386-4756-00
-48	253-0160-00		AR	.	TAPE,PRESS.SENS:ADHESIVE,2.124 FT LONG	04963	4116 TYPE A
-49	105-0153-00		1	.	CATCH,THUMB:ACETAL	80009	105-0153-00
					(ATTACHING PARTS)		
-50	210-0551-00		1	.	NUT,PLAIN,HEX.:4-40 X 0.25 INCH,STL	83385	OBD
					- - - * - - -		
-51	214-0539-00		1	.	RTNR,ELEC RELAY:	02288	30040-2
-52	136-0215-00		1	.	SKT,PL-IN ELEK:RELAY,4 POLE,CHASSIS MOUNT	77342	27E702
					(ATTACHING PARTS)		
-53	211-0008-00		1	.	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
-54	210-0586-00		1	.	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	83385	OBD
					- - - * - - -		
-55	407-1906-01		1	.	BRACKET,RELAY:ALUMINUM	80009	407-1906-01
-56	175-4090-00		1	.	CA ASSY,SP,ELEC:2,26 AWG,11.0 L,RIBBON	80009	175-4090-00
					(K5001 TO A3J28)		
-57	131-0707-00		2	.	CONNECTOR,TERM.:22-26 AWG,BRS& CU BE GOLD	22526	47439
-58	352-0169-00		1	.	HLDR,TERM CONN:2 WIRE BLACK	80009	352-0169-00
-59	175-0825-00		AR	.	WIRE,ELECTRICAL:2 WIRE RIBBON	80009	175-0825-00
-60	175-2056-00		1	.	CA ASSY,SP,ELEC:8,26 AWG,10.0 L	80009	175-2056-00
					(A1J1 TO A3J14)		
-61	175-0831-00		AR	.	WIRE,ELECTRICAL:8 WIRE RIBBON	08261	SS-0826-710610C
-62	131-0707-00		16	.	CONNECTOR,TERM.:22-26 AWG,BRS& CU BE GOLD	22526	47439
-63	352-0166-00		2	.	CONN BODY,PL,EL:8 WIRE BLACK	80009	352-0166-00
-64	-----		3	.	MICROCIRCUIT:(SEE U1,U11,U21 REPL)		
					(ATTACHING PARTS)		
-65	211-0008-00		3	.	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-66	-----		1	.	MICROCIRCUIT:(SEE U31 REPL)		
					(ATTACHING PARTS)		
-67	211-0008-00		1	.	SCREW,MACHINE:4-40 X 0.25 INCH,PNH STL	83385	OBD
-68	210-1171-00		1	.	WSHR,SHOULDERED:0.116 ID X 0.138 INCH OD	52905	A7148516P2
-69	342-0163-00		1	.	INSULATOR,PLATE:XSTR,0.675 X 0.625 X 0.001"	80009	342-0163-00
					- - - * - - -		
-70	-----		1	.	CKT BOARD ASSY:POWER SUPPLY(SEE A1 REPL)		
					(ATTACHING PARTS)		
-71	211-0504-00		4	.	SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
					. POWER SUPPLY BOARD ASSY INCLUDES:		
-72	129-0209-00		4	.	SPACER,POST:0.375 L,W/6-32 THD THRU	80009	129-0209-00
-73	432-0048-04		3	.	BASE,CAP.MTG:1.365 H,PLASTIC	80009	432-0048-04
					(ATTACHING PARTS)		
-74	211-0588-00		6	.	SCREW,MACHINE:6-32 X 0.75 INCH,HEX.HD STL	83385	OBD
-75	210-0407-00		6	.	NUT,PLAIN,HEX.:6-32 X 0.25 INCH,BRS	73743	3038-0228-402
					- - - * - - -		
-76	386-0254-00		6	.	RETAINER,CAP.:LARGE FIBER	98627	OBD
-77	252-0571-00		AR	.	NEOPRENE EXTR:CHAN,0.234 X 0.156	77969	1353
-78	386-3665-00		1	.	SUPPORT,CAP.:	80009	386-3665-00
					(ATTACHING PARTS)		
-79	211-0504-00		2	.	SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL	83385	OBD
					- - - * - - -		
-80	210-0202-00		1	.	TERMINAL,LUG:0.146 ID,LOCKING,BRZ TINNED	78189	2104-06-00-2520N
-81	-----		1	.	TRANSFORMER:(SEE T5001 REPL)		
					(ATTACHING PARTS)		
-82	212-0516-00		4	.	SCREW,MACHINE:10-32 X 2 INCH,HEX HD STL	77250	OBD
-83	210-0812-00		4	.	WASHER,NONMETAL:#10,FIBER	86445	OBD
					- - - * - - -		

REPLACEABLE MECHANICAL PARTS

Fig & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-84	166-0227-00		4		INS SLV,ELEC:0.187 ID X 1.50 INCH LONG	80009	166-0227-00
-85	384-0632-00		4		POST,ELEC-MECH:0.375 X 1.109" LONG,10-32 (ATTACHING PARTS)	80009	384-0632-00
-86	212-0507-00		4		SCREW,MACHINE:10-32 X 0.375 INCH,PNH STL - - - * - - -	83385	OBD
-87	-----		1		CKT BOARD ASSY:CONTROL(SEE A3 REPL) (ATTACHING PARTS)		
-88	211-0504-00		8		SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL - - - * - - -	83385	OBD
	-----		-		. CONTROL BOARD ASSY INCLUDES:		
	-----		2		. FIBER SHEETS AND FOAM ADHESIVE		
	-----		-		. AVAILABLE ONLY AS PART OF A3		
-89	131-1962-00		8		. CONN,RCPT,ELEC:CKT CARD,22/44 CONT	05574	600201-3241
-90	351-0500-00		16		. GUIDE,CKT CARD: (ATTACHING PARTS)	80009	351-0500-00
-91	211-0198-00		16		. SCREW,MACHINE:4-40 X 0.438 PNH,STL,POZ - - - * - - -	77250	OBD
-92	131-0993-00		1		. BUS,CONDUCTOR:2 WIRE BLACK	00779	530153-2
-93	378-0866-00		1		SCREEN,FAN:3.2 X 1.625 L,ALUMINUM (ATTACHING PARTS)	80009	378-0866-00
-94	211-0552-00		4		SCREW,MACHINE:6-32 X 2 INCH,PNH STL	83385	OBD
-95	210-0803-00		4		WASHER,FLAT:0.15 ID X 0.032 THK,STL CD PL	12327	OBD
-96	385-0080-00		4		SPACER,POST:0.437 L W/6-32 THD THRU,AL - - - * - - -	80009	385-0080-00
-97	-----		1		FAN:(SEE B5001 REPL)		
-98	195-2432-00		1		LEAD,ELECTRICAL:22 AWG,5.0 L,8-3 (B5001 TO A5001)	80009	195-2432-00
	195-2433-00		1		LEAD,ELECTRICAL:22 AWG,5.0 L,8-19 (B5001 TO A5001)	80009	195-2433-00
	-----		-		. EACH ELECTRICAL LEAD INCLUDES:		
-99	131-2436-00		1		. TERM,QIK DISC:18-22 AWG,FEMALE	00779	2-520083-2
-100	131-0677-00		1		. CONNECTOR,TERM:18 AWG	91886	122-0192-019
-101	378-0865-00		1		FLTR,SCRN MESH:3.2 SQUARE,ALUMINUM	80009	378-0865-00
-102	210-0202-00		1		TERMINAL,LUG:0.146 ID,LOCKING,BRZ TINNED (ATTACHING PARTS)	78189	2104-06-00-2520N
-103	210-0408-00		1		NUT,PLAIN,HEX.:6-32 X 0.312 INCH,BRS - - - * - - -	73743	3040-402
	334-3995-00		1		MARKER,IDENT:MARKED CAUTION (OPTION A3 ONLY)	80009	334-3995-00
-104	334-3379-02		1		MARKER,IDENT:MARKED GROUND SYMBOL	80009	334-3379-02
-105	333-2255-01		1		PANEL,FRONT: (ATTACHING PARTS)	80009	333-2255-01
-106	211-0504-00		4		SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL - - - * - - -	83385	OBD
-107	378-0053-00		1		FIL ELEM,AIR CO:AIR	80009	378-0053-00
-108	380-0410-00		1		RTNR,AIR FILTER:ABS (ATTACHING PARTS)	80009	380-0410-00
-109	211-0504-00		4		SCREW,MACHINE:6-32 X 0.25 INCH,PNH STL - - - * - - -	83385	OBD
-110	-----		1		LINE VOLTAGE SEL AND FILTER:(SEE A5001 REPL)		
-111	195-2428-00		1		LEAD,ELECTRICAL:22 AWG,19.0 L,8-0 (A5001 TO K5001)	80009	195-2428-00
	195-2429-00		1		LEAD,ELECTRICAL:22 AWG,19.0 L,8-9 (A5001 TO K5001)	80009	195-2429-00
	-----		-		. EACH ELECTRICAL LEAD INCLUDES:		
-112	131-2436-00		1		. TERM,QIK DISC:18-22 AWG,FEMALE	00779	2-520083-2
-113	195-2430-00		1		LEAD,ELECTRICAL:22 AWG,21.0 L,8-2 (A5001 TO K5001)	80009	195-2430-00
	195-2431-00		1		LEAD,ELECTRICAL:22 AWG,20.0 L,8-01 (A5001 TO K5001)	80009	195-2431-00
	-----		-		. EACH ELECTRICAL LEAD INCLUDES:		
-114	131-0677-00		1		. CONNECTOR,TERM:18 AWG	91886	122-0192-019

## REPLACEABLE MECHANICAL PARTS

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff Dscont	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
1-115	210-0202-00		1						TERMINAL,LUG:0.146 ID,LOCKING,BRZ TINNED (ATTACHING PARTS)	78189	2104-06-00-2520N
-116	211-0504-00		1						SCREW,MACHINE:6-32 X 0.250,PNH,STL,CD PL	83385	OBD
-117	210-0408-00		1						NUT,PLAIN,HEX:6-32 X 0.312,BRS CD PL - - - * - - -	73743	OBD
-118	343-0213-00		3						CLAMP,LOOP:0.2 ID,PLASTIC	80009	343-0213-00
-119	441-1357-00		1						CHAS,EXPANDER:MAIN	80009	441-1357-00
-120	390-0556-00		1						CABINET BOTTOM: (ATTACHING PARTS)	80009	390-0556-00
-121	211-0507-00		6						SCREW,MACHINE:6-32 X 0.312 INCH,PNH STL - - - * - - -	83385	OBD



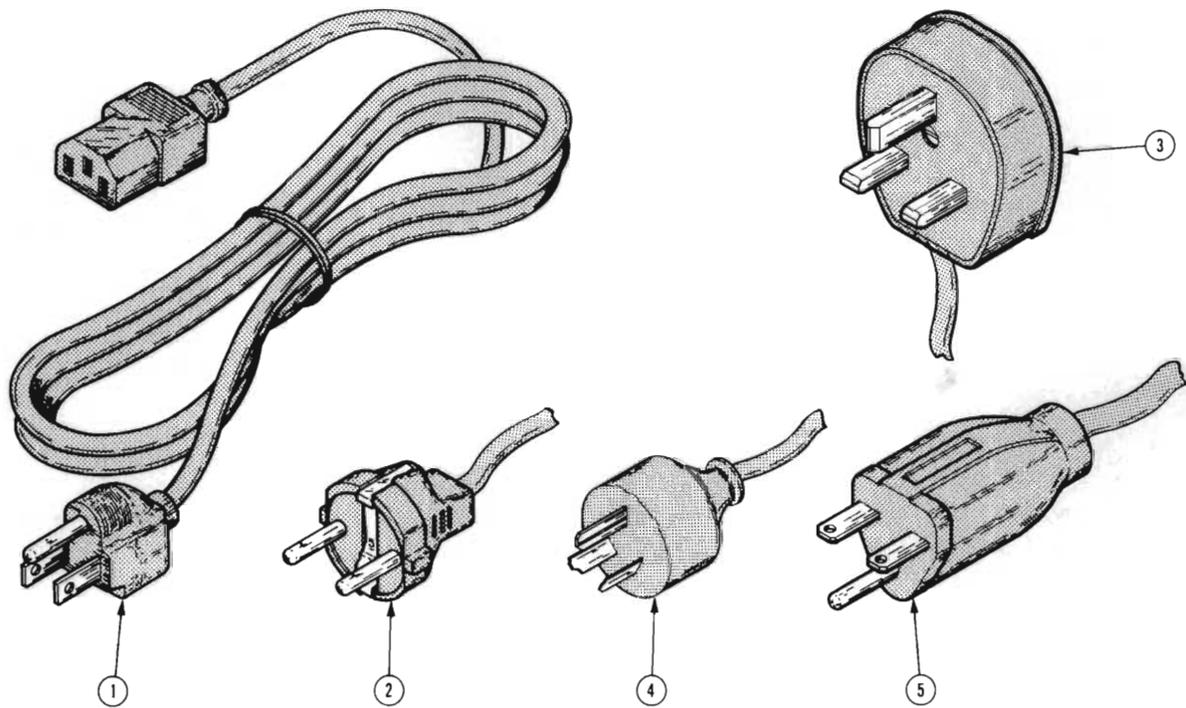


Fig. & Index No.

Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1	2	3	4	5	Name & Description	Mfr Code	Mfr Part Number
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STANDARD ACCESSORIES

-1	161-0066-00		1						CABLE ASSY,PWR:3,18 AWG,115V,98.0 L	80009	161-0066-00
-2	161-0066-09		1						CABLE ASSY,PWR:3,0.75MM SQ,220V,96.0 L	80126	OBD
	-----		-						(OPTION A1 ONLY)		
-3	161-0066-10		1						CABLE ASSY,PWR:3,0.75MM SQ,240V,96.0 L	80126	OBD
	-----		-						(OPTION A2 ONLY)		
-4	161-0066-11		1						CABLE ASSY,PWR:3,0.75MM,240V,96.0L	80126	OBD
	-----		-						(OPTION A3 ONLY)		
-5	161-0066-12		1						CABLE ASSY,PWR:3,18 AWG,240V,96.0 L	80126	OBD
	-----		-						(OPTION A4 ONLY)		
	070-3833-00		1						MANUAL,TECH:INSTRUCTION	80009	070-3833-00

# Appendix A

## SIGNAL DEFINITIONS AND REFERENCES

Signal	Source	Destination	Description
52EN-0	A3-2	A2	Low when the ROM Expander is connected to a 4052/54. Used with BSX-0 to generate SLOW-0 in 4052/54 mode.
AB0-1 thru AB15-1	4050 A2	A2 A3-2	System address bus.
BSn-0 (n = 0-7)	A3-2	A3-3	Individual bank select lines for the eight Expander slots.
BSX-0	4050 A2	A2 A3-2	Bank Switch Expansion. Generated by the backpack bank decoder to enable a ROM which resides in any of the eight slots. The particular slot is determined by three bits loaded into the bank switch register on the Expander Control board.
COMCLK	4052 A2	A2 A3-2	A 2.4576 MHz communications clock from the 4052/54 processor. This signal is available to all slots at all times when the ROM Expander is in 4052/54 mode.
DB0-1 thru DB7-1	4050 A2	A2 A3-2	Bidirectional system data bus.
ENABLE-0	A3-2	A2	Enables the transceiver to the system data bus.
EPIAS-0	4050 A2	A2 A3-2	External PIA select. Goes true whenever the address bus contains an address reserved for an external PIA. These addresses are X'87Cx' through X'87Fx' for the 4051, and X'FF4x' through X'FF7x' for the 4052/54.
ERESTART-0	A1 A3-3 A2	A3-3 A2 4050	Expander Restart, asserted when the ROM Expander power supply comes up. It ensures that the entire system is initialized after power becomes available to the ROM Expander and to devices connected through it.
EXTEN-0	4052 A2	A2 A3-2	External Enable (4052/54). Goes low when the processor requests data from a ROM Pack.
IRQ-0	A3-1 A2	A2 4050	Interrupt request, a maskable interrupt request line to the system processor.
LBS-0	4050 A2	A2 A3-2	Load Bank Switch. This signal is generated whenever the processor addresses the Bank Switch memory location.
MCP2-1	4051 A2	A2 A3-2	Master Clock Phase 2, a 4051 system clock.
PIAE-1	4050 A2	A2 A3-2	Peripheral Interface Adapter Enable.
RESTART-0	4050 A2	A2 A3-2	This signal is generated by the Graphic System during power up. It sets the entire system to an initial state.

## SIGNALS

Signal	Source	Destination	Description
RWOC-1	4050 A2	A2 A3-2	Read/Write Output Command, a signal generated by the processor to control the direction of flow on the System data bus. It is high when the processor reads data placed on the bus by a ROM Pack or a peripheral interface. It is low when the processor places data on the bus for a peripheral or ROM Pack.
SLOW-0	A2	4052	The ROM Expander asserts this input to the 4052/54 whenever a ROM Pack or peripheral interface in the ROM Expander is addressed. It provides for slow I/O cycles by forcing the processor to hold PIAE-1 high for a longer interval.
XPC2-0 thru XPC4-0	4050 A2	A2 A3-1 A3-2	External Peripheral Control Lines. The 4051 Graphic System decodes these signals from the system peripheral control addresses. They can be used to control special interfaces in Expander slots. The ROM Expander gates the signals to the slot which is currently enabled. The 4052/54 Graphic System uses only XPC2-0 and XPC3-0.

## MANUAL CHANGE INFORMATION

PRODUCT 4051E01 ROM EXPANDER INSTRUCTION MANUAL CHANGE REFERENCE C1/182  
MANUAL PART NO. 070-3833-00 DATE 1-12-82

EFFECTIVE SERIAL NUMBER:

TEXT CHANGE

Pages 4-9 and 4-10

REPLACE ABOVE PAGES WITH ATTACHED PAGES

### **THIS IS A PAGE REPLACEMENT PACKAGE.**

The area of change is marked  
by a change bar in the margin.

1. Remove the appropriate pages from your manual and insert the attached pages.
2. Update Manual Revision Status page i in the front of your manual to indicate the new revision letter, date revised, and which pages were revised. You will find this information, centered, at the bottom of each replacement page. (This update is for your information only.)
3. Keep this cover sheet in the Change Information section at the very back of your manual for a permanent record.

## REPLACING THE CONTROL BOARD

1. Remove any ROM Packs or interfaces from the slots.

**NOTE**

*The ROM Pack guides should be removed as a unit. Do not remove the two screws through the bar which holds the guides together.*

2. Remove the ROM Pack guides by removing four screws through each side of the chassis (Figure 4-7).
3. Remove the rear panel by removing the four screws which fasten it to the chassis (Figure 4-7).
4. Disconnect P14, P19, P21, P26, and P28 from the Control board (Figure 4-8).
5. Remove the eight screws which hold the circuit board in place.

Reverse the procedure to replace the board:

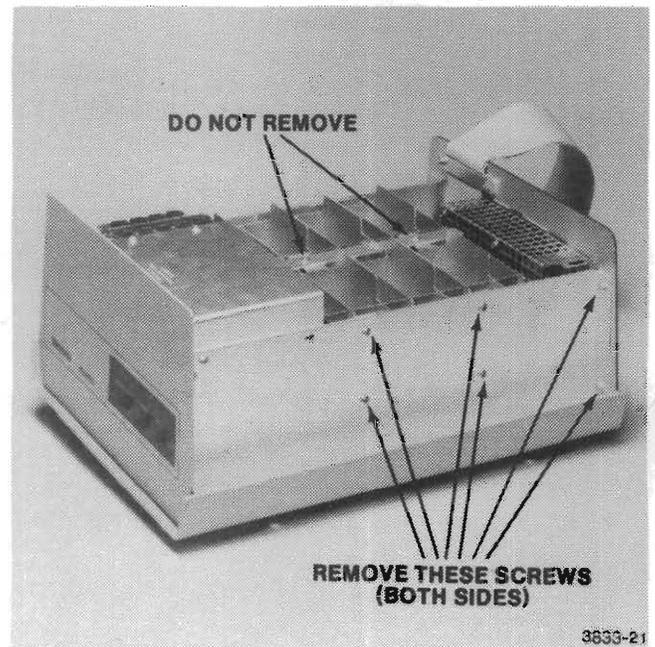


Figure 4-7. Access to the Control Board.

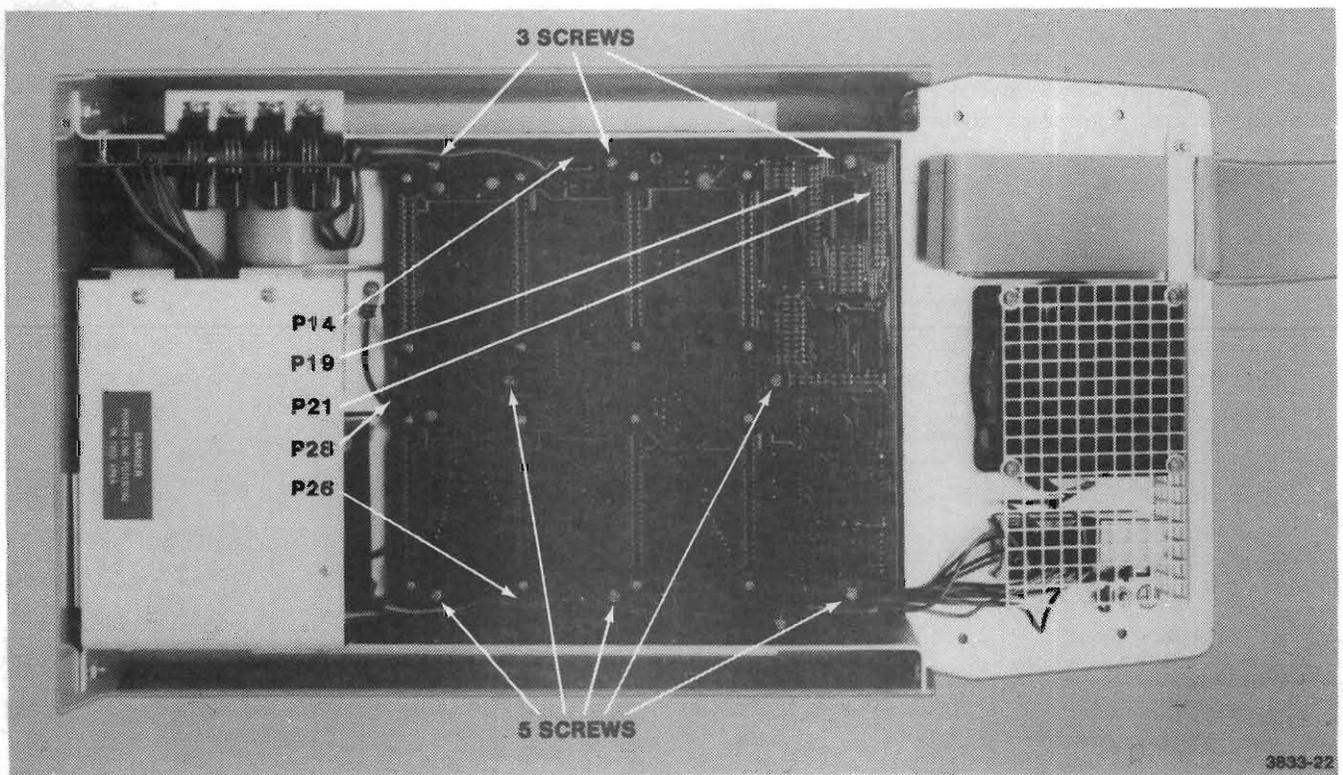


Figure 4-8. Replacing the Control Board.

## SERVICE INFORMATION

### CAUTION

Wires carrying line voltage lie under one side of the Control Board. Before replacing the board verify that cable clamps protect these wires from damage by component leads.

6. Replace the Control board.
7. Connect P19 and P21. The shorter cable goes next to the chassis.

### CAUTION

The wires from the Line Voltage Selector on the rear panel carry line voltage. To avoid personal injury or damage to the product, be careful not to pinch the wires when replacing the rear panel.

8. Replace the rear panel.
9. Replace P14, P26, and P28.
10. Replace the ROM Pack guides. Check the fit by inserting ROM Packs in the slots.

## ASSEMBLING THE ROM PACK GUIDES

Ordinarily it is not necessary to disassemble the ROM Pack guides because they can be removed as a unit while servicing the Control board. However, Figure 4-9 shows the assembly procedure should this become necessary.

1. Assemble the two groups shown in Figure 4-9A. If necessary, temporarily insert screws in each side. Orient the tabs as shown in the figure.
2. Add the four cross pieces as shown in Figure 4-9B. These pieces should extend about 1/8 in beyond the side facing you, but about 1 inch in the other direction.
3. Add the four dividers as shown in Figure 4-9C.
4. Insert the bar and the two screws which secure it to the tabs, but do not tighten the screws yet.
5. Place the guides in the chassis and fasten with four screws through each side. Do not tighten the screws yet.
6. Place ROM Packs in two diagonally opposite slots (1 and 8 or 4 and 5).
7. Tighten all screws. Check the fit of the ROM Packs and adjust if necessary.

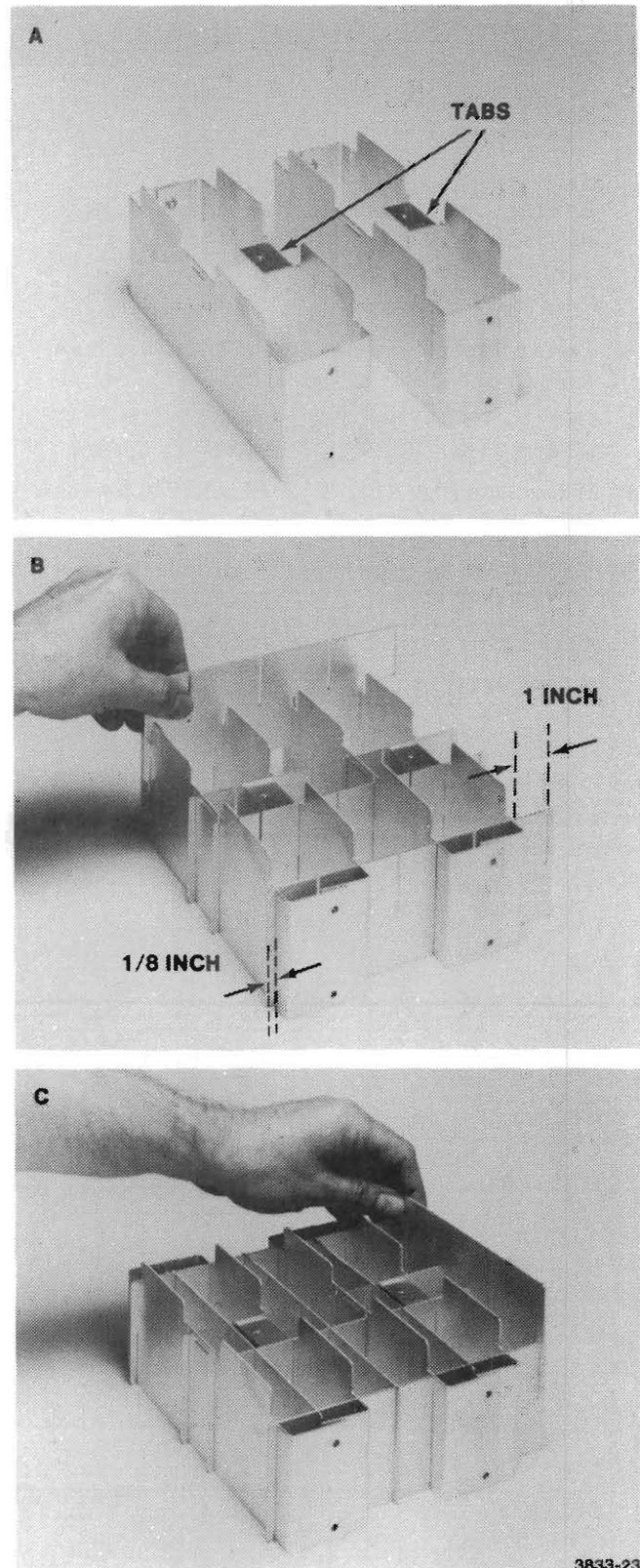


Figure 4-9. Assembly of ROM Pack Guides.

PRODUCT 4050E01 ROM EXPANDER INSTRUCTION MANUAL

CHANGE REFERENCE M48904

MANUAL PART NO. 070-3833-00

DATE 4-7-83

EFFECTIVE SERIAL NUMBER: B010398

PARTS AND SCHEMATIC CHANGES

Replaceable Electrical Parts

ADD:	A1CR203	152-0141-02	SEMICOND DEVICE:SILICON,30V,150MA
CHANGE TO:	A1	670-7210-02	CKT BOARD ASSY:POWER SUPPLY
	A1R201	315-0334-00	RES.,FXD,CMPSN:330K OHM,5%,0.25W

Schematic A1 POWER SUPPLY

CHANGE AS INDICATED BELOW

