TEK INSTRUCTION MANUAL

Part No. 070-6277-00
Product Group No. 42

7F10
OPTICAL-ELECTRICAL CONVERTER

CAUTION

The following service instructions are for use by qualified personnel only. To avoid personal injury, do not perform any service other than that contained in operating instructions unless you are qualified to do so. Refer to Operator's Safety Summary and Service Summary prior to performing any service.

Please Check for CHANGE INFORMATION at the Rear of This Manual

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Tektronix®
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Serial Number_____

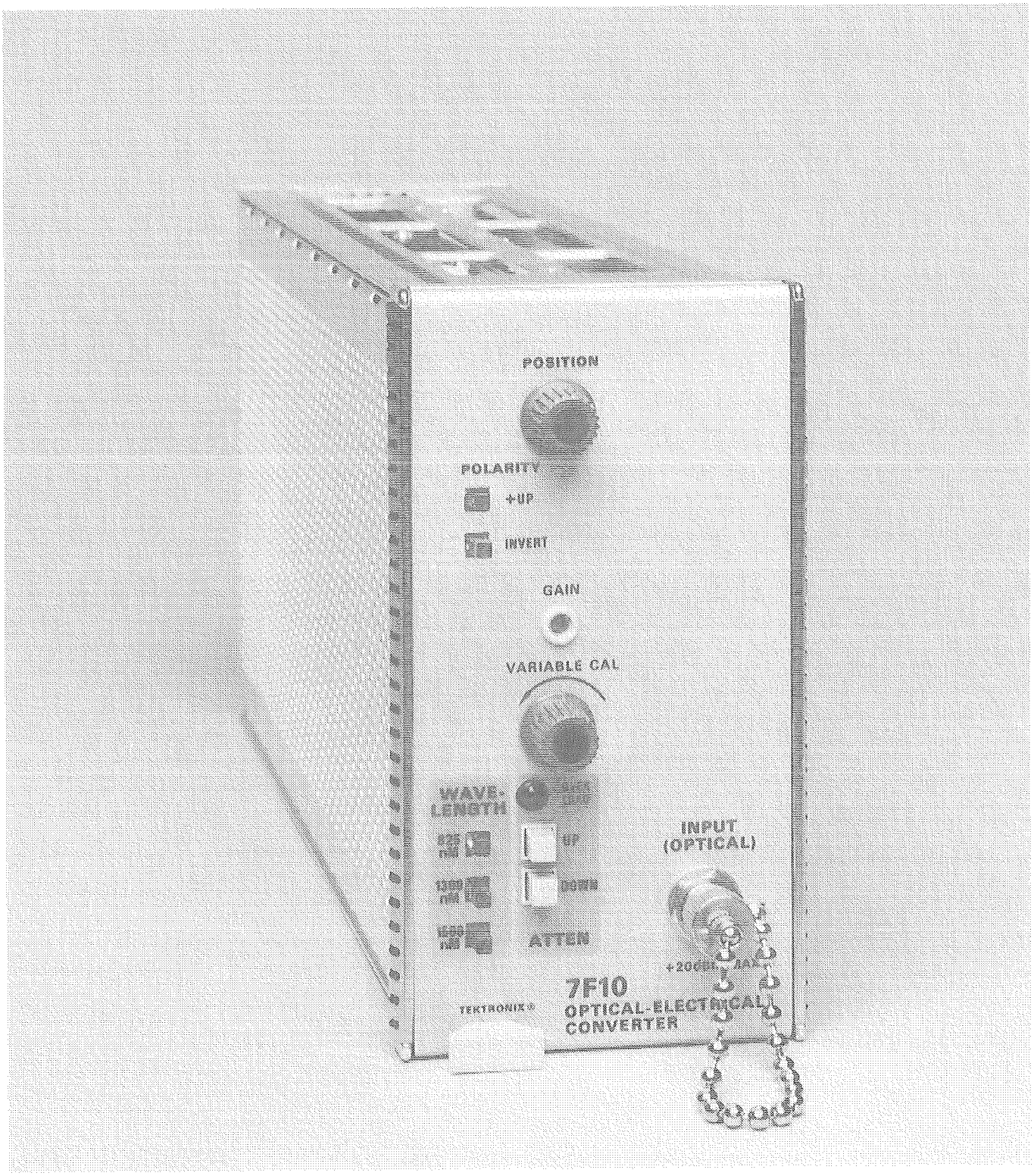
TABLE OF CONTENTS

TABLE OF CONTENTS (cont)

LIST OF ILLUSTRATIONS

NOTE: ILLUSTRATIONS IN SECTION 8 ARE LOCATED ON THE BACK OF THE ASSOCIATED DIAGRAM.

LIST OF TABLES



The Tektronix 7F10 is an optical-to-electrical converter plug-in unit designed primarily for use in vertical compartments of Tektronix 7000-Series Oscilloscopes. The input is optically coupled to the amplifier. Sixteen calibrated deflection factors, VARIABLE deflection factor, and polarity INVERT selections are provided. Readout encoding provides deflection factor, uncalibrated indication, and polarity INVERT information on the CRT of the 7000-Series Oscilloscope.

GENERAL INFORMATION

INTRODUCTION

This Instruction Manual is divided into the following main sections:

Section 1—General Information contains instrument description, electrical specifications, environmental characteristics, standard and recommended accessories, installation, and instructions for packaging for shipment.

Section 2—Operating Instructions contains information relative to operating this instrument and checking instrument operation.

WARNING

The remaining portions of this Instruction Manual contain servicing instructions. These servicing instructions are for use by qualified service personnel only. To avoid electric shock or other personal injury, do not perform any servicing other than that described in the operating instructions unless you are qualified to do so.

Section 3—Theory of Operation contains basic and general circuit analysis to help in understanding the operation of the instrument and that may be useful for servicing the instrument.

Section 4—Maintenance describes routine and corrective maintenance procedures with detailed instructions for replacing assemblies, subassemblies, and individual components.

Section 5—Checks and Adjustments contains procedures to check the operational performance and electrical characteristics of the instrument. Procedures also include methods for adjustment of the instrument to meet specifications.

Section 6—Instrument Options. No options are available for the 7F10.

Section 7—Replaceable Electrical Parts contains information necessary to order replaceable parts and assemblies related to the electrical functions of the instrument.

Section 8—Diagrams and Circuit Board Illustrations includes detailed circuit schematics, locations of assembled boards within the instrument, voltage and waveform information, circuit board and schematic component locators, and locations of adjustments to aid in performing the adjustment procedure.

Section 9—Replaceable Mechanical Parts includes information necessary to order replaceable mechanical parts and shows exploded drawings which identify assemblies.

INSTALLATION

Initial Inspection

WARNING

Dangerous voltages exist inside the instrument. To avoid electrical-shock hazards, operating personnel must not remove protective instrument covers. Component replacement and internal adjustments must be made by qualified service personnel only.

This instrument was inspected both mechanically and electrically before shipment. It should be free of mars or scratches and should meet or exceed all electrical specifications. To confirm this, inspect the instrument for physical damage incurred in transit. Test the electrical performance by following the Operator's Checkout Procedure in Section 2; qualified service personnel may refer to the Performance Check given in Checks and Adjustments, Section 6 of this Instruction Manual. If there is damage or deficiency, contact your local Tektronix Field Office or representative.

Operating Information

CAUTION

To prevent instrument damage, plug-in units should not be installed or removed without first turning off the mainframe power.

The 7F10 is calibrated and ready for use as received. It can be installed in any compartment of Tektronix 7000-Series oscilloscopes, but is intended principally for use in vertical plug-in compartments. To install, align the upper and lower rails of the 7F10 with the oscilloscope tracks and insert. The 7F10 front panel will be flush with the front of the oscilloscope and the latch at the bottom left corner of the 7F10 will be in place against the front panel when the 7F10 is fully installed.

To remove the 7F10, pull on the release latch and the 7F10 will unlatch from the mainframe. Continue pulling to slide the 7F10 out of the oscilloscope.

Operating Temperature

The 7F10 can be operated where the ambient air temperature is between 0 and +50 degrees Celsius and can be stored in ambient temperatures from −55 to +75 degrees Celsius. After storage at temperatures outside the operating limits, allow the chassis temperature to reach a safe operating limit before applying power.

PACKAGING FOR SHIPMENT

If this instrument is to be shipped for long distances by commercial transportation, it is recommended that the instrument be repackaged in the original manner. The carton and packaging material in which your instrument was shipped should be saved and used for this purpose.

Also, if this instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag to the instrument showing the following: Owner of the instrument (with address), name of a person at your firm who can be contacted if required, complete instrument type and serial number, and a detailed description of the service required.

If the original packaging is unfit for use or is not available, package the instrument as follows:

1. Obtain a corrugated cardboard carton with at least a 200-pound test strength and dimensions at least six inches larger than the instrument's dimensions.

2. Surround the instrument with polyethylene sheeting, or equivalent, to protect the instrument.

3. Allow a 3-inch cushion on all sides by tightly packing dunnage or urethane foam between the carton and the instrument.

4. Seal the carton with shipping tape or with an industrial stapler.

5. Mark the address of the Tektronix Service Center and your return address in one or more prominent locations on the exterior of the shipping carton.

SPECIFICATION

The electrical characteristics listed in Table 1-1 apply at ambient temperatures between 0 and +50 degrees Celsius, unless otherwise stated, when the following conditions are met: 1) The instrument was adjusted at an ambient temperature between +20 and +30 degrees Celsius; 2) The instrument is allowed a 30-minute warm-up period; 3) The instrument is operated in an environment that meets the limits described in Table 1-2.

Table 1-1
Electrical/Optical Characteristics

Characteristic	Performance Requirement
Optical Input	Diamond 3.5 millimeter connector. 50/125 micrometer multimode fiber.
Wavelength	Selectable to 825, 1300, and 1500 nanometer.
Photo Element	Germanium avalanche photo diode (APD).
Maximum Linear Input	+10 milliwatt optical carrier, 70% modulation.
Frequency Response	
10 kHz to 750 MHz	±3dB in 7104 Oscilloscope.
Optical Attenuator	
Nominal	2.5 dB/step.
Maximum Attenuation	37.5 dB.
Deflection Factor	Upper readout is corrected for filters and wavelength selected.
Calibrated Range	Selectable in sixteen 2.5 dB steps.
1500 nanometers	2.5 microwatts/division ±30%.
1300 nanometers	2 microwatts/division ±30%.
825 nanometers	4 microwatts/division to ±30%.
VARIABLE Range	At least 4 dB.
POSITION Range	9 division each direction from graticule center within 1.0 division.

Table 1-2
Environmental Characteristics

Characteristic	Performance Requirement
Temperature	
Calibration	+20 to +30 degrees Celsius (+68 to +86 degrees Fahrenheit).
Operating	0 to +50 degrees Celsius (+32 to +112 degrees Fahrenheit).
Nonoperating	−55 to +75 degrees Celsius (−67 to +167 degrees Fahrenheit).
Humidity	0 to 95%.
Altitude	
Operating	4.5 kilometers (15,000 feet).
Nonoperating	Test limit 15 kilometers (50,000 feet).
Transportation	Qualified under National Safe Transit Committee Test Procedure 1A, Category II.

Table 1-3
Physical Characteristics

Characteristic	Performance Requirement
Overall Dimensions	Compatible with all 7000-series plug-in compartments; see Figure 1-1, for dimensional drawing.
Net Weight	Approximately 1.1 kilograms (2 lbs. 7 oz.).

STANDARD ACCESSORIES

Instruction Manual	1 each	070-6277-00

RECOMMENDED ACCESSORIES
(not included)

The following accessories have been selected from our catalog specifically for your instrument. They are listed as a convenience to help you meet your measurement needs. For detailed information and prices, refer to a Tektronix Products Catalog or contact your local Tektronix Field Representative.

174-0045-00	3 meter fiber-optic cable, Diamond 3.5 to Diamond 3.5 connectors.
174-0045-01	1 meter fiber-optic cable, Diamond 3.5 to Diamond 3.5 connectors.
174-0524-00	3 meter fiber-optic cable, Diamond 3.5 to SMA connectors.
174-0524-01	1 meter fiber-optic cable, Diamond 3.5 to SMA connectors.
174-0527-00	3 meter fiber-optic cable, Diamond 3.5 to FC connectors.
174-0527-01	1 meter fiber-optic cable, Diamond 3.5 to FC connectors.
174-0528-00	3 meter fiber-optic cable, Diamond 3.5 to D4 connectors.
174-0528-01	1 meter fiber-optic cable, Diamond 3.5 to D4 connectors.
174-0530-00	3 meter fiber-optic cable, Diamond 3.5 to AT&T Biconic connectors.
174-0530-01	1 meter fiber-optic cable, Diamond 3.5 to AT&T Biconic connectors.

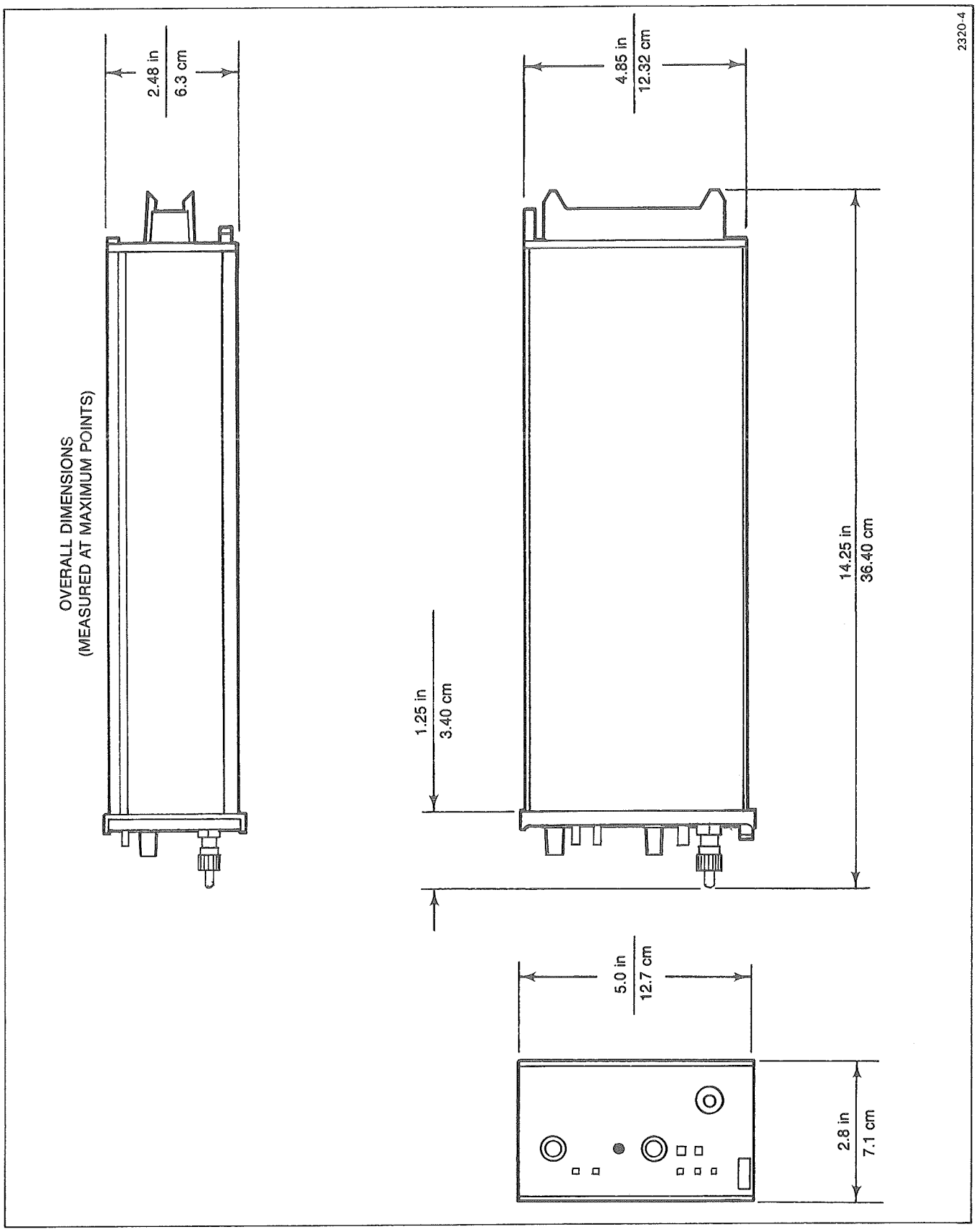


Figure 1-1. 7F10 dimensional drawing.

OPERATING INSTRUCTIONS

To use the 7F10 Optical-Electrical Converter effectively, the user must become familiar with its operation and capabilities. This section describes front-panel control functions, general information on signal input connections, and other subjects that pertain to various measurement applications.

CONTROLS AND CONNECTORS

The 7F10 front panel is shown in Figure 2-1. A brief, functional description of each control and connector is included in this illustration. Refer to Detailed Operating Information for additional information.

OPERATOR'S CHECKOUT PROCEDURE

The following procedure can be used to verify proper operation, and may also be used to get acquainted with the instrument. Only instrument functions (not measurement quantities or specifications) are checked in this procedure; therefore, a minimum amount of test equipment is required. If performing the Operator's Checkout Procedure reveals improper performance or instrument malfunction, first check the operation of associated equipment. Then refer the instrument to qualified service personnel for repair or adjustment if the problem persists.

Before You Begin

Refer to the Change Information at the rear of this manual for any modifications which may affect this procedure.

Test Equipment Required

The following test equipment is required for the Operator's Checkout Procedure. Other test equipment which meets these requirements may be substituted. When other equipment is substituted, the control settings or setup may need to be altered.

1. 7000-Series Oscilloscope Mainframe.

Description: Any Tektronix 7000-Series mainframes such as Tektronix 7104, R7103, 7904, or 7854 Oscilloscope.

NOTE

See Mainframe Compatibility in this section for information on operating the 7F10 in a 7854 Oscilloscope.

2. Time-Base Unit.

Description: Any 7B-series time-base unit compatible with above mainframe such as Tektronix 7B10, 7B15, 7B80, or 7B85 Time-Base Unit.

3. Optical Signal Source.

Description: Tektronix OT501, OT502, or OT503 Transmitter with Option 21 (Diamond 3.5 Connector) and TM500 Power Module Mainframe.

4. Fiber-Optic Cable.

Description: Diamond 3.5 connectors, 1 meter, Tektronix Part 174-0045-01.

Setup Procedure

1. Set the 7000-series oscilloscope power switch to the off position, and connect the oscilloscope to a suitable power source.

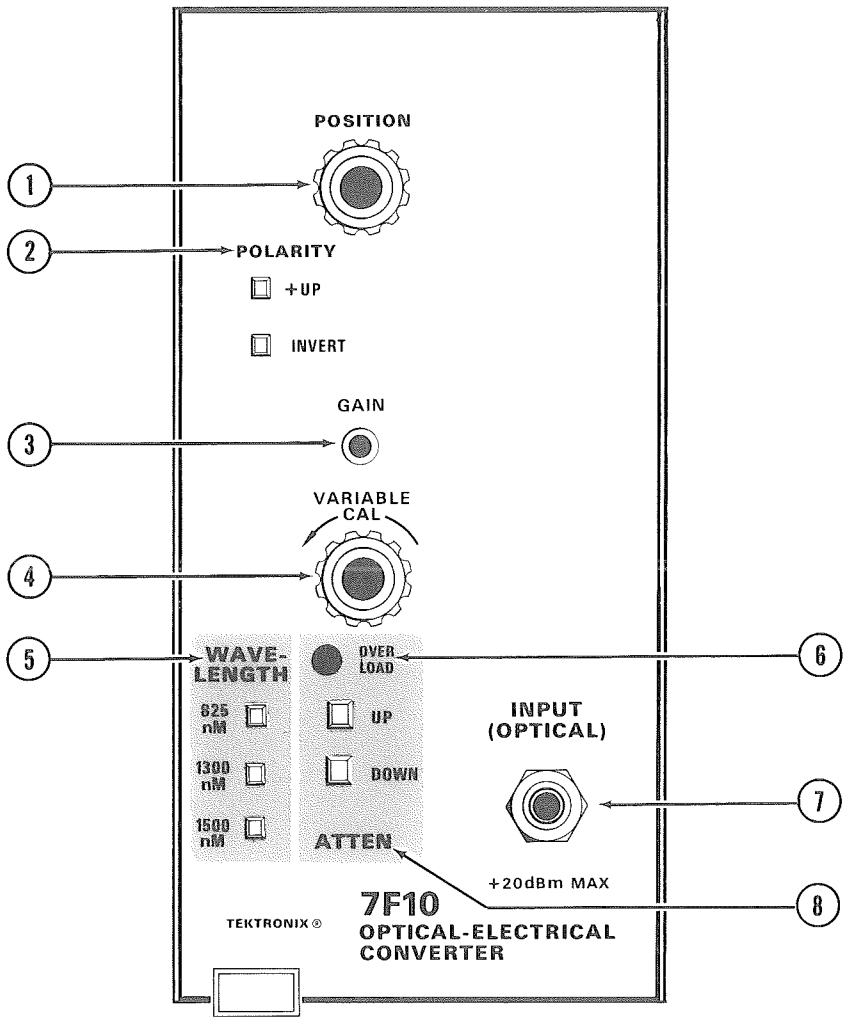
2. Install the 7F10 in the left vertical compartment.

3. Install the 7B-series time-base unit in the B horizontal compartment.

4. Set the front-panel controls as follows:

7F10:	
POLARITY	+UP
VARIABLE	Counterclockwise
WAVELENGTH	825 nM
Time-Base Unit:	
Time/Div	1 ms
Position	Midrange
Magnifier	X1
Triggering	
Mode	Auto
Coupling	AC
Source	Internal
Oscilloscope:	
Vertical Mode	Left
Horizontal Mode	B
B Trigger Source	Vert Mode
Calibrator	4 V
A and B Intensity	Counterclockwise

5. Set the oscilloscope power switch to on and allow the system to warm up before continuing.



(1) **POSITION**— Provides vertical positioning of trace.

(2) **POLARITY**— Inverts display.

+UP: Positive-going signal applied to INPUT connector deflects CRT display upward.

INVERT: Positive-going signal applied to INPUT connector deflects CRT display downward.

(3) **GAIN**— Screwdriver adjustment to set gain of 7F10. (Part of adjustment procedure; see Section 5, Checks and Adjustments.)

(4) **VARIABLE**— Provides continuously variable deflection factors between attenuator settings. Provides calibrated deflection in counterclockwise position.

(5) **WAVELENGTH**— Selects 1 of 3 settings for correct readout deflection factors.

(6) **OVERLOAD**— Indicates excessive input signal which will result in non-linear deflection.

(7) **ATTEN UP/DOWN**— Selects 1 of 16 settings for calibrated deflection factors.

(8) **(OPTICAL) INPUT**— Diamond 3.5 millimeter connector for optical input signal.

(9) **Dust Cover**— Provides protection for INPUT connector. Should be installed whenever INPUT connector is not being used.

Figure 2-1. Front-panel controls, connectors, and indicators.

Amplifier Functions

6. Connect the fiber-optic cable from the Optical Signal Source to the (OPTICAL) INPUT connector.

7. Turn the oscilloscope B intensity control clockwise until the trace is just visible.

8. Set the Optical Signal Source for a calibrated optical output amplitude.

9. Press the ATTEN UP or DOWN button to select a deflection factor that should produce four divisions of deflection on the CRT. If optical input cannot produce four divisions of deflection, set ATTEN to produce an even number of divisions (two, three, five, or six) and modify the following procedure accordingly).

10. With the POSITION control, align the trace with the center and top-most graticule lines.

11. Set the POLARITY switch to the INVERT position. Notice that the displayed signal is now inverted and is roughly aligned with the center and bottom graticule lines.

12. Set the POLARITY switch to the +UP position.

13. Rotate the POSITION control fully counterclockwise and notice that the displayed signal can be positioned off the graticule area at the bottom of the CRT.

14. Set the POLARITY switch to INVERT.

15. Rotate the POSITION control fully clockwise and notice that the displayed signal can be positioned off the graticule area at the top of the CRT.

16. Return the POLARITY switch to the +UP position. Position the display to the center four divisions of the graticule area.

17. Rotate the VARIABLE control fully clockwise and notice approximately 1.6 divisions of displayed signal. Return the VARIABLE control to the fully counterclockwise position.

Readout Functions

18. Push the ATTEN UP button and note that the upper readout display indicates deflection factor in microwatts/division. The lower readout indicates attenuation in dB.

19. Change the POLARITY switch to INVERT. Note that a downward-pointing arrow appears within the readout display.

20. Rotate the VARIABLE control clockwise. Note that a ">" symbol appears in the readout display between the downward pointing arrow and the deflection factor information.

21. Change the POLARITY switch to +UP. Note the disappearance of the "down arrow" symbol. Turn the VARIABLE control fully counterclockwise. Note the disappearance of the ">" symbol.

22. Disconnect the fiber-optic cable from the INPUT connector of the 7F10.

23. This completes the Operators Checkout Procedure for the 7F10.

DETAILED OPERATING INFORMATION

Mainframe Compatibility

The 7F10 Optical-Electrical Converter can be used in any 7000-Series mainframe. System bandwidth depends primarily upon bandwidth of the mainframe used.

When used with the 7854 Oscilloscope to acquire (AQR) or average (AVE) a waveform, a warning will be issued because of the 7F10 readout. A default scale factor of "1" will be assigned to the waveform. To provide a scale factor for the stored waveform, use the following sample 7854 program:

```
10 AVE
0 RDOUT      (if 7F10 is in LEFT VERT compartment)
< VSCL
```

NOTE

Even with this program, the readout still has a missing "W" in the scale-factor position.

Optical Input

WARNING

Avoid eye exposure to the output of open-ended fibers by turning off the optical source. If the physical location of the source makes this difficult, avoid eye exposure by covering the end of the fiber or pointing the fiber at a non-reflective surface.

Optical signals for vertical deflection are connected to the (OPTICAL) INPUT connector.

CAUTION

Keep the optical INPUT connector clean at all times. Dust and dirt will degrade performance and may damage the connector. Keep the dust cover on the connector when it is not being used.

Vertical Deflection

The amount of deflection produced by a signal is determined by the optical signal amplitude and the attenuation selected. Calibrated deflection factors apply only when the VARIABLE control is in the CAL (fully counterclockwise) position.

The ATTEN UP and DOWN buttons determine the deflection factor by inserting neutral-density filters into the optical path. Deflection factor in microwatts (μW) is indicated by the upper readout display. Corresponding attenuation in dB is indicated by the lower readout display.

The GAIN adjustment is set to provide calibrated vertical deflection factors as part of the adjustment procedure (see Section 5, Checks and Adjustments). Do not change setting of the GAIN adjustment except as described in the adjustment procedure.

Wavelength

The WAVELENGTH switch corrects the readout for proper indication. Press the WAVELENGTH button that corresponds to the wavelength of the light source.

Polarity Switch

The POLARITY switch provides a means of inverting the displayed signal. With the POLARITY switch set to +UP, a positive-going signal at the INPUT produces an upward deflection on the CRT display. With the POLARITY switch set to INVERT, a positive-going signal produces a downward deflection on the CRT display.

Overload Indicator

The OVERLOAD light on the 7F10 front panel indicates when excessive optical signal amplitude is connected to the (OPTICAL) INPUT connector. This will not damage the 7F10 under normal conditions since internal protection circuitry is provided. However, the optical input amplitude should be reduced as soon as possible since it produces non-linear deflection on the CRT. Either increase the deflection factor by pressing the ATTEN UP button or reduce the optical signal amplitude at the source.

THEORY OF OPERATION

This section describes the circuitry used in the 7F10 Optical-Electrical Converter. The description begins with a discussion of the instrument using the block diagram shown in Figure 3-1. Then, each circuit is described in detail, showing the relationships between the stages in each major circuit. Schematics of all major circuits are given in Section 8, Diagrams and Circuit Board Illustrations. Refer to these schematics throughout the following discussions for specific electrical values and relationships.

BLOCK DIAGRAM DESCRIPTION

The following block diagram discussion is provided to aid in understanding the overall concept of the 7F10 before the individual circuits are discussed in detail. A basic block diagram is shown in Figure 3-1. Each block represents a major circuit in the instrument. Only the basic interconnections between the blocks are shown on the block diagram.

Optical signals to be displayed on the CRT are applied to the (OPTICAL) INPUT connector. The Optical-to-Electrical Converter stage converts this optical signal to an electrical signal which can be amplified and processed by conventional circuitry. The Fast Overload Protection stage protects the Input Amplifier from large signals at the output of the Optical-to-Electrical Converter as a result of excessive optical input.

The front-panel GAIN, POLARITY, and VARIABLE controls determine the signal amplification within the Input Amplifier. The Input Amplifier converts the single-ended input signal to a push-pull signal. The Output Amplifier further amplifies this signal and provides a sample of the signal to the Trigger Amplifier. The Trigger Amplifier supplies the oscilloscope mainframe with a trigger signal, which is a sample of the input signal.

The Readout Encoding stage provides readout information to the mainframe based on input from the Time-Slot Level Shift and Attenuator Clock stages. The Attenuator Driver stage provides signals to the Optical-to-Electrical Converter stage to select neutral-density filters inside this module to determine the optical attenuation and the vertical deflection factor.

DETAILED CIRCUIT OPERATION

This portion of the Theory of Operation section provides a detailed description of the electrical operation and relationship of circuits unique to the 7F10. Circuits commonly used in the electronics industry are not described in detail. If more information is desired on these commonly-used circuits, refer to available textbooks.

FRONT PANEL

Diagram 1

The Front Panel circuit provides the logic signals to drive the mainframe readout system and to provide correct operation of the Optical-to-Electrical Converter module. Figure 3-2 shows a detailed block diagram of the Front Panel circuit. A schematic of the Front Panel circuit is given on diagram 1 at the rear of this manual.

Attenuator Clock

Counter U610 provides a four-bit output to drive the Attenuator Driver and Readout Encoding stages. The clock signal for the counter comes from single-shot multi U620 or U630. If the UP ATTEN button (part of S650) is pressed, U630 clocks Counter U610 up. Likewise, if the DOWN ATTEN button is pressed, U620 clocks the counter down. U640A, U640B, U640C, and U640F provide debouncing for the signal from the ATTEN switch to prevent false triggering of Counter U610. If the UP or DOWN buttons are held depressed, the Attenuator Clock free runs.

Attenuator Driver

The four-bit output from the Attenuator Clock stage is connected to Attenuator Driver U600. This stage buffers the signal and connects it to the Optical-to-Electrical Converter module (diagram 2) to provide the selected amount of attenuation.

Time-Slot Level Shift

Time-slot pulses TS1, TS4, TS5, TS6, and TS7 from the mainframe are connected to the Time-Slot Level Shift Stage. Q571, Q573, Q575, Q577, and Q578 shift the DC level of the time-slot pulses and connects them to the Readout Encoding stage.

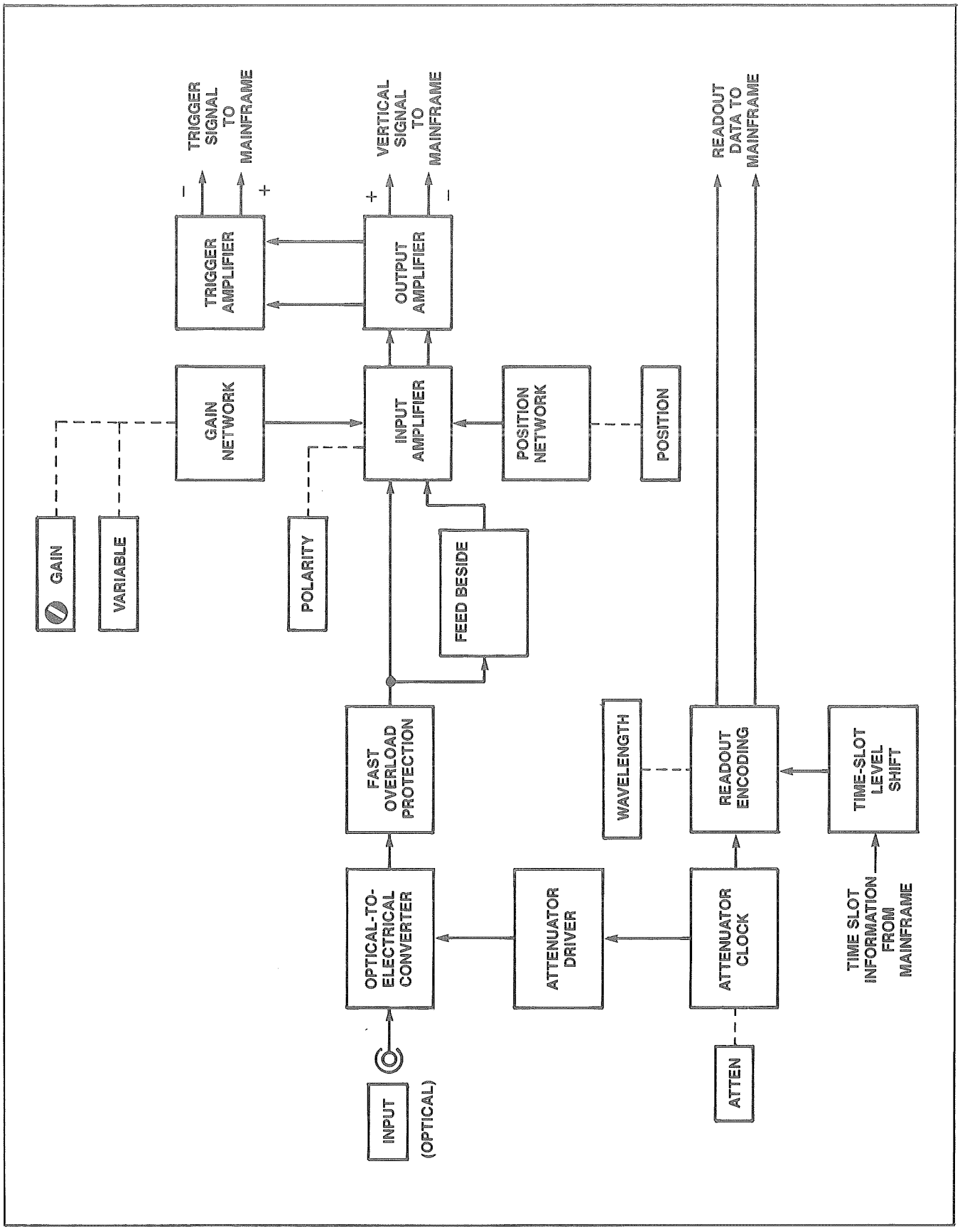


Figure 3-1. Block diagram of the 7F10 Optical-Electrical Converter.

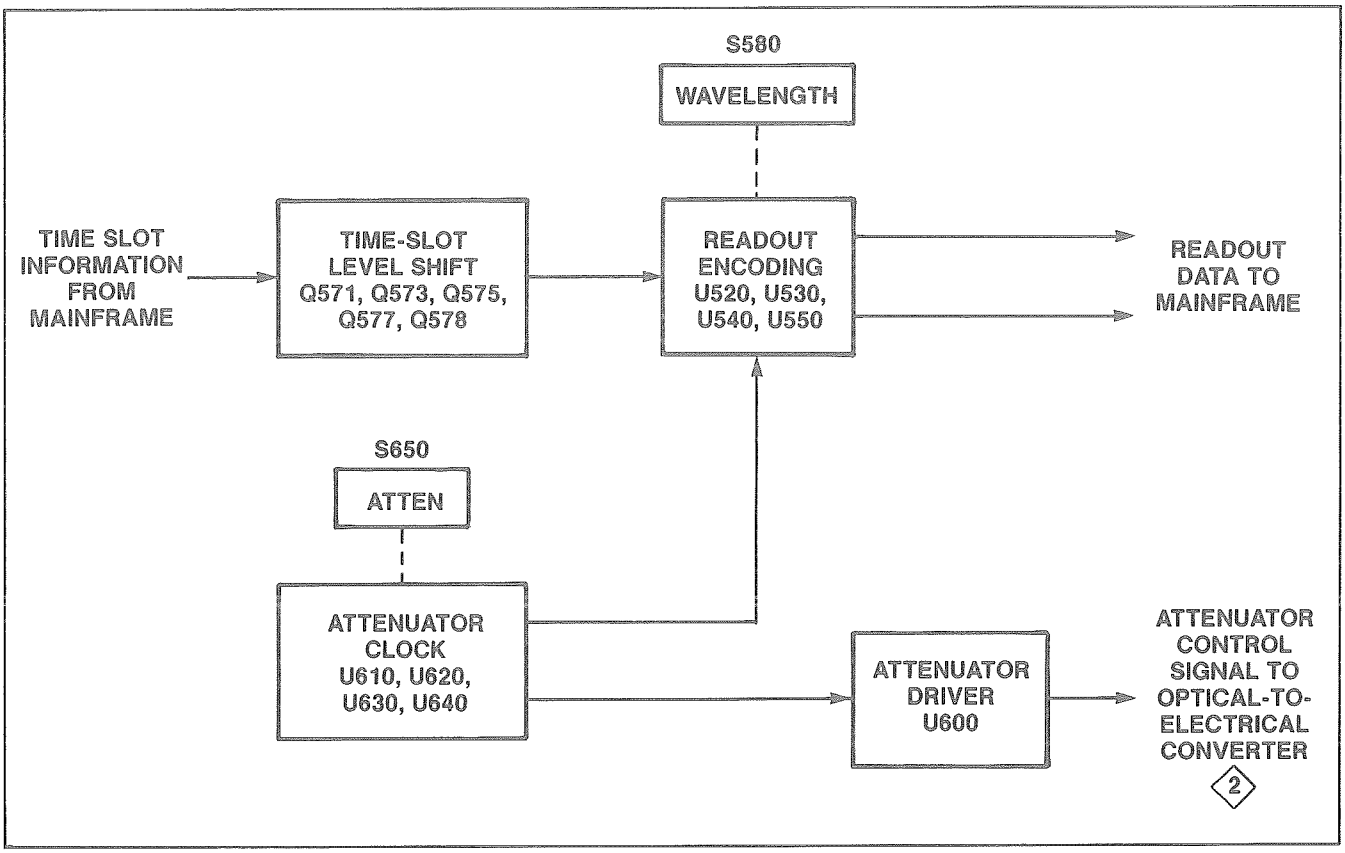


Figure 3-2. Detailed block diagram of Front Panel circuit.

Readout Encoding

The four-bit output from the Attenuator Clock stage is also connected to the Readout Encoding stage U550. Output on pins 14, 15, 16, and 17 provides deflection factor (microwatts/division) readout in the upper mainframe CRT readout location. Output on pins 9, 10, 11, and 13 of U550 provides attenuation (dB) readout in the lower mainframe CRT readout location. U520A and U520B provide digital-to-analog conversion to produce a current output drive to the mainframe readout system.

Output coding to the mainframe is determined by the setting of WAVELENGTH switch S580 and the four-bit code from the Attenuator Clock stage. There are 2000 possible output combinations from the Readout Encoding stage. However, only 240 of these combinations are used. Unused or incorrect output combinations are blocked under the following conditions:

- Invalid address called up.
- Between time slots.
- Fault condition at input (more than one input at ground).
- Incorrect switch settings (such as multiple buttons pressed).

INPUT AMPLIFIER

Diagram 2

The Input Amplifier circuit converts the optical signal at the (OPTICAL) INPUT connector to an electrical signal. It also provides preamplification, positioning, and gain control. Figure 3-3 shows a detailed block diagram of the Input Amplifier circuit. A schematic of the Input Amplifier circuit is given on diagram 2 at the rear of this manual.

Optical-to-Electrical Converter

The Optical-to-Electrical Converter stage converts the optical signal at the (OPTICAL) INPUT connector to an electrical signal. Optical conversion is accomplished by a germanium avalanche photodiode detector (APD).

The attenuator control signal from the Attenuator Driver stage (diagram 1) selects neutral density filters in the Optical-to-Electrical Converter module to provide the selected amount of optical attenuation.

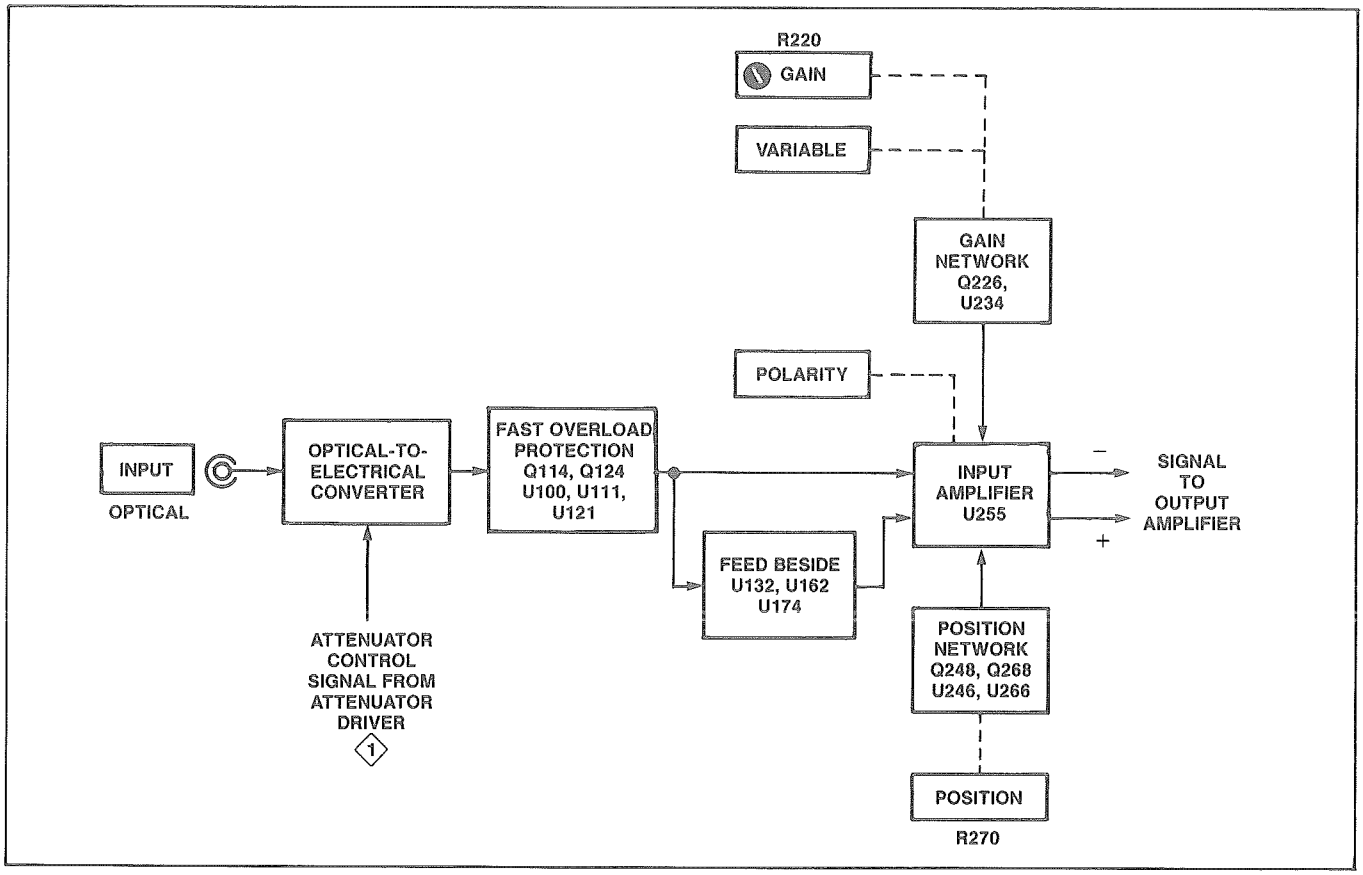


Figure 3-3. Detailed block diagram of Input Amplifier circuit.

Fast Overload Protection

This stage provides protection for the Input Amplifier stage. Without fast overload protection, high-amplitude fast-rise signals could damage U255.

Under normal operating conditions, the four diodes internal to U100 are forward biased. Signals applied to pin 8 pass through U100 to pin 18 with about 15% attenuation. Bias resistors in U100 and these four diodes constitute a matched 50-ohm attenuator. The voltage supplied at pin 3 of U100 is closely regulated by Q114 and U111 and the voltage at pin 13 is closely regulated by Q124 and U121. The current in Q124 is adjusted by Input I adjustment R124 to equal the current supplied to pin 3 of U100 by Q114. This maintains 0 volts at pins 8 and 18 of U100 in the absence of an input signal.

Variable resistor R107 (Z_{IN}) adjusts the voltage at pins 3 and 13 of U100 to set the current in U100. Changing this current affects the dynamic impedance of the four diodes in U100. Because these diodes are in series with the signal, the impedance at pin 8 of U100 and at J120 can be varied over a limited range by R107. The sum of all the currents flowing into pin 8 of U100 is set to equal zero by R124.

Because the dynamic resistance of these diodes varies as a function of both temperature and current, the current at pin 3 and pin 13 is also varied as a function of temperature to hold the diode dynamic resistance constant at all temperatures. Thermistor RT108 senses the ambient temperature and adjusts the voltage at pin 3 of U100 to force the operation of U100 to be independent of temperature.

Electrical signals in excess of about 1.0 volt due to high optical input cause one of the two left-hand diodes within U100 to cut off. The upper left diode goes into cutoff for positive signals and the lower left diode goes into cutoff for negative signals. Under cutoff conditions, current from either Q114-U111 or Q124-U121 flows to U255 through one of the two internal resistors of U100. This results in only about 0.9 volt being applied to the input of U255, which it can safely handle.

Feedbeside

The Feedbeside stage compensates for low-frequency imperfections in the frequency response of U255 and U322 (Output Amplifier, diagram 3). Self heating of the transistor base-emitter junction of some transistors within U255 and U322 causes the low-frequency gain to appear slightly

larger than the midband gain. To correct this, a portion of the input signal is picked off by R130, inverted and amplified by U132 which is connected as an operational amplifier, and distributed to four RC (resistive-capacitive) networks. Each network has a different time constant. Components C162, R140, R144, R146, R148, R150, and R152 are adjusted to provide a correction signal. This signal is inverted and amplified by U162, then injected into U255 through pin 12. This signal is subtracted from the signal entering U255 at pin 7. Proper adjustment results in flat frequency response and optimum transient response at the output (pins A11 and B11 on diagram 3). Diode network CR133, CR134, CR135, and CR136 limit the amplitude of the Feedbeside signal to improve overload recovery.

Input Amplifier

The Input Amplifier stage provides gain and polarity control as well as amplification of the vertical signal. The single-ended input signal from the Fast Overload Protection stage is applied to pin 7 of U255, and the correction signal from the Feedbeside network is applied to pin 12.

The current flow through R238 and R239 dictates the proportion of signal current which flows in each pair of common-base transistors within U255. Polarity of the input signal can be inverted within U255 by exchanging the current that flows through R238 with the current that flows through R239. This is done by analog switch U228A, B, C, and D, according to the setting of front-panel POLARITY switch S60. In the +UP position of the POLARITY switch, a HI logic level is applied to pins 5 and 6 of U228. This connects pin 4 to pin 3 of U228B, and pin 9 to pin 8 of U228C. In this condition, Q226A supplies current to pin 13 of U255 through R239, and Q226B supplies current to pin 14 through R238. This same HI level is also applied to pin 6 of U178C, connecting pin 8 to pin 9 and enabling the +UP Var Bal adjustment R170. In this position of the POLARITY switch, transistor Q184 supplies a LO level to the remaining analog switches of U228 and U178.

If the POLARITY switch is now changed to the INVERT position, a LO level is applied to pins 5 and 6 of U228 and pin 6 of U178 causing the switches of U228B-C and U178C to open. A HI level is also supplied by Q184 to close the switches of U228A-D and U178D. This results in the exchange of current through R238 and R239, reversing the polarity of the output signals from U255 and enabling Inverted Var Bal adjustment R175.

The circuitry within U255 is basically a cascode amplifier utilizing a Gilbert multiplier. For ease of discussion, assume that the currents flowing through R238 and R239 are equal, forward-biasing Q3, Q4, Q5, and Q6 of U255 to equal conduction. Also assume the analog switches of U228 and U178 are in the positions shown on the schematic, and that the base of Q2 in U255 is held at a constant level (although in reality the feedbeside signal is injected here). Transistors Q1 and Q2 act as a phase splitter with the signal at the collector of Q2 in phase with the signal applied to the base of Q1, and the signal at the collector of Q1 out of phase with the signal applied to the base of Q1.

Assuming that a positive-going signal is applied to pin 7 of U255, the emitters of Q3 and Q4 are pulled to a more negative voltage level, increasing their conduction. At the same time, the emitters of Q5 and Q6 rise to a more positive level through Q2, decreasing their conduction by an amount equal to the increase in Q3 and Q4. Since the transistor pairs Q4-Q5 and Q3-Q6 are cross-coupled to pins 17 and 19 respectively, and one transistor in each pair increases its conduction by an amount equal to the decrease in conduction of the other, there is no change in current at pins 17 and 19 of U255. This is the zero gain condition for this circuit. (In actual circuit operation, this zero gain condition does not occur since the circuit is designed to operate between full gain and 36% of full gain.)

When the voltage at the base of Q226B goes more negative, due to an increase in the setting of either the GAIN or VARIABLE control, Q226A, Q226B, and U234A increase the current flow through R238 and decrease the current through R239. Integrated circuit U234A ensures that the total current through R238 and R239 does not vary.

The increased current in R238 causes Q3 and Q6 to conduct more, while Q4 and Q5 reduce conduction due to the decrease in current flowing through R239. The summation of currents at the collectors of transistors Q3 and Q5 results in a current at pin 19 of U255 that is out of phase with the input at pin 7. This is due to Q3 conducting more of the out-of-phase signal at its emitter than Q5 is conducting of the in-phase signal at its emitter. Similarly, Q6 conducts more of the in-phase signal at its emitter than Q4 conducts of the out-of-phase signal at its emitter. The increased conduction of Q3 and Q6, together with the decreased conduction of Q4 and Q5, results in a finite gain for U255.

Zener diodes VR254 and VR256 shift the output level of U255 from +6 volts to the −6 volts needed by U322 on diagram 3. Optimum high-frequency response of the output signals is determined by LR240, LR241, LR260, and LR261. Trace drift due to temperature changes in VR254 and VR256 are eliminated by supplying operating current for them and U255 from current sources.

POLARITY switch S60 also provides the invert control signal to the mainframe readout system to add a down-arrow to the CRT readout when in the INVERT position.

Position Network

A constant current flow is maintained through Q248 by U246 and through Q268 by U266. Current in Q248 and Q268 is sensed by current-sampling resistors R248 and R268, respectively. The front-panel POSITION control, R275, injects position signal current into U246 at pin 3 through R276. This alters the current flowing through Q248 and Q268 and positions the trace displayed on the CRT. A small correction signal applied to U255 through R277 and U174 forces the VARIABLE to control the gain of U255 without affecting its DC balance. Without this correction, thermal effects in the four output transistors of U255 would cause a varying trace shift at different POSITION control settings when the VARIABLE control is rotated.

Gain Network

The gain of the Input Amplifier stage is controlled by either front-panel GAIN control R220 or VARIABLE control R222. With the VARIABLE control in the CAL position (fully counterclockwise), the GAIN control determines the biasing current of U255. When the VARIABLE control is out of the CAL position, a control signal is sent to the mainframe readout system to add an uncal symbol to the CRT readout.

TRIGGER AND OUTPUT AMPLIFIER

Diagram 3

The circuitry on this schematic is divided into two major circuits—Output Amplifier and Trigger Amplifier. The Output amplifier stage provides final amplification of the vertical signal. The Trigger Amplifier stage provides final amplification of the trigger signal. Figure 3-4 shows a detailed block diagram of the Trigger and Output Amplifier circuit. A schematic of the Trigger and Output Amplifier circuit is given on diagram 3 at the rear of this manual.

Output Amplifier

The differential signal from the Input Amplifier on diagram 2 is applied to the Output Amplifier. This signal is amplified by U322 and applied to the rear-panel edge connector pins A11 and B11 for use by the oscilloscope mainframe. Biasing for U322 is provided by U314. The average DC level at the input of U322 (pins 7 and 9) is available at pin 12 of U322 and is compared with the DC voltage level at the junction of R312 and R313 by U314 (−6.0 volts). Pin 8 of U322 is held at the voltage required to set the input of U322 at −6.0 volts. Pin 8 of U322 is held at the voltage required to set the input of U322 at −6.0 volts.

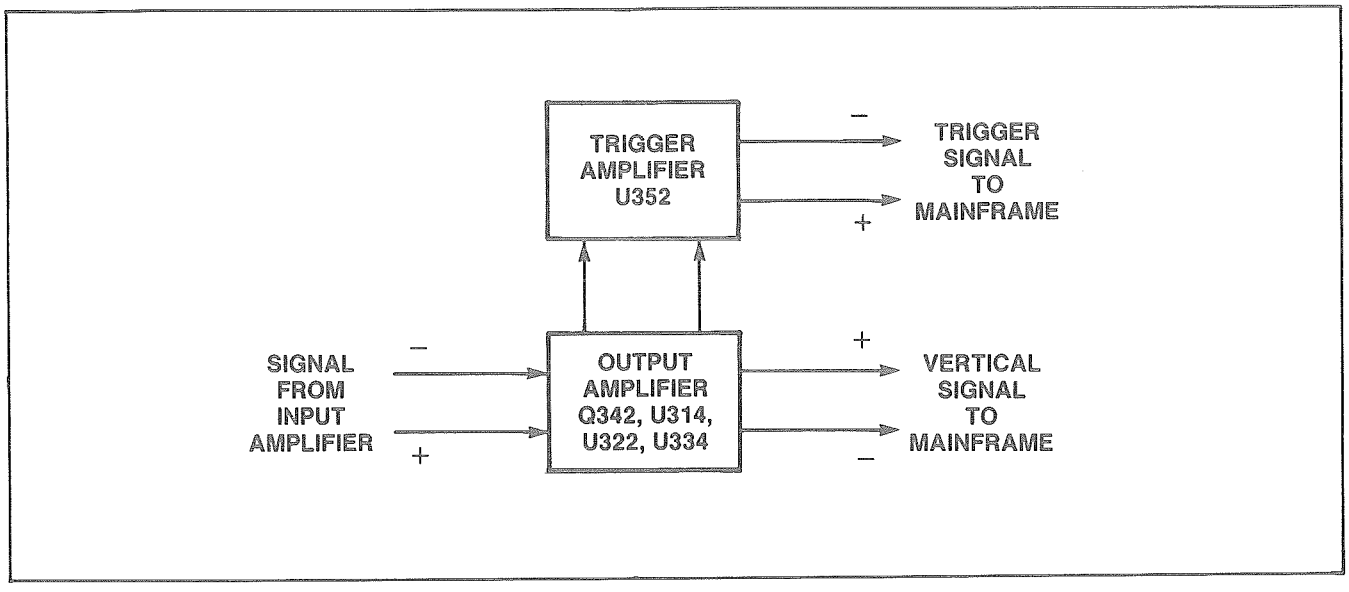


Figure 3-4. Detailed block diagram of the Trigger and Output Amplifier circuit.

In order to balance the overall amplification of U255 and U322 at all temperatures, the DC standing current in U322 is varied from 32 milliamperes to 40 milliamperes over a temperature range of 0 to +50 degrees Celsius by thermistor RT317.

The voltage on pin 18 of U322 varies from 0.775 volt at 0 degrees Celsius to 1.0 volt at +50 degrees Celsius to maintain the average voltage at pins A11 and B11 within 0.15 volt of ground. Thermistor RT345 senses the ambient temperature and, with the voltage regulator consisting of U334B and Q342, sets the correct voltage at pin 18 of U322.

The DC voltage level at pin 14 of U322 and pin 13 of U352 is set by DC voltage regulator U334A. Integrated circuit U334A maintains a voltage on pin 14 of U322 equal to that developed by the resistor divider network of R333 and R334 at pin 3 of U334A. Resistors R335 and R336 bias off transistors not used in U322 and U352.

Trigger Amplifier

A sample of the differential signal applied to U322 is available as a trigger signal at pins 2 and 4. It is connected to pins 7 and 9 of Trigger Amplifier stage U352. This differential signal is amplified by U352 to provide the + and − Trigger signals. It is applied to the rear-panel edge connector on pins A13 and B13. The TRIG BAL adjustment R365 is set to balance the quiescent DC level between A13 and B13 in the absence of an output signal.

MAINTENANCE

This section of the manual contains information for performing preventive maintenance, troubleshooting, and corrective maintenance for the 7F10 Optical-Electrical Converter.

PREVENTIVE MAINTENANCE

Preventive maintenance, when performed on a regular basis, can prevent instrument breakdown and may improve the reliability of the instrument. The severity of the environment to which the instrument is subjected will determine the frequency of maintenance. A convenient time to perform preventive maintenance is just preceding electrical adjustment of the instrument.

Cleaning

The 7F10 should be cleaned as often as operating conditions require. Accumulation of dirt in the instrument can cause overheating and component breakdown. Dirt on components acts as an insulating blanket which prevents efficient heat dissipation. It also provides an electrical conduction path which may result in instrument failure.

CAUTION

Avoid the use of chemical cleaning agents which might damage the plastics used in this instrument. Use a non-residue type of cleaner, preferably isopropyl alcohol, totally denatured ethyl alcohol, or a fluorinated solvent (i.e., trifluorotrichlorothane) such as Freon TF or Spray-On #2002. Before using any other type of cleaner, consult your Tektronix Service Center or representative.

Cleaning the Exterior. Loose dust accumulated on the outside of the instrument can be removed with a soft cloth or small brush. The brush is particularly useful for dislodging dirt on and around the front-panel controls. Dirt which remains can be removed with a soft cloth dampened in a mild detergent and water solution. Abrasive cleaners should not be used.

WARNING

To prevent damage from electrical arcing, circuit boards and components must be dry before applying power to the instrument.

Cleaning the Interior. Cleaning the interior of the instrument should only be necessary occasionally. The best way to clean the interior is to blow off the accumulated dust with dry, low-velocity air (approximately 5 lb/sq in.). Remove any dirt which remains with a soft brush or a cloth dampened with a mild detergent and water solution. A cotton-tipped applicator is useful for cleaning in narrow spaces, or for cleaning more delicate circuit components.

CAUTION

The cleaning process, either hand cleaning with a solvent or machine cleaning in an automatic detergent wash, is not recommended for boards fitted with HYPCON connectors. Contaminants will degrade the conductivity of the contacts. See the information given for HYPCON connectors under Component Removal in Section 4, Maintenance.

Visual Inspection

The 7F10 should be inspected occasionally for such defects as broken connections, improperly seated semiconductors, damaged or improperly installed circuit boards, and heat-damaged parts. The corrective procedure for most visible defects is obvious; however, particular care must be taken if heat-damaged parts are found. Overheating usually indicates other trouble in the instrument; therefore, the cause of overheating must be corrected to prevent recurrence of the damage.

Semiconductor Checks

Periodic checks of semiconductors are not recommended. The best check of semiconductor performance is actual operation in the instrument. More details on semiconductors are given under Troubleshooting later in this section.

Periodic Electrical Adjustment

To ensure accurate measurements, check the electrical adjustment of this instrument after each 1000 hours of operation, or every six months if used infrequently. In addition, replacement of components may necessitate adjustment of the affected circuits. Complete adjustment instructions are given in Section 5, Checks and Adjustments. This procedure can be helpful in localizing certain troubles in the instrument, and in some cases, may correct them.

TROUBLESHOOTING

The following information is provided to facilitate troubleshooting the 7F10. Information contained in other sections of this manual should be used in conjunction with the following data to aid in locating a defective component. An understanding of the circuit operation is helpful in locating troubles. See Section 3, Theory of Operation, for this information.

Troubleshooting Aids

Diagrams. Complete schematic diagrams are given on the foldout pages in Section 8, Diagrams and Circuit Board Illustrations. The component number and electrical value of each component in this instrument are shown on these diagrams. (See the first page of the Diagrams and Circuit Board Illustrations section for definitions of the reference designators and symbols used to identify components in this instrument.) Important voltages and numbered waveform test points are also shown on the diagrams. Important waveforms and the numbered test points where they were obtained are located adjacent to each diagram. Circuitry mounted on circuit boards is enclosed with heavy solid black lines. Each schematic is overlaid by a grid locator with a cross-reference table to facilitate location of components on the schematic or the circuit board.

Circuit Board Illustrations. To aid in locating circuit boards, a circuit board location illustration appears on the back of the foldout page facing each schematic diagram. In addition, an illustration of the circuit board is included here, with the physical location of the components and waveform test points that appear on the schematic diagram identified. Each circuit board illustration is overlaid by a grid locator with a cross-reference table to facilitate rapid location of components contained on the schematic diagram or circuit board.

Test Point And Adjustment Locations. To aid in locating test points and adjustable components called out in the Checks and Adjustments procedure, a Test Point and Adjustment Locations foldout page is provided in Section 8, Diagrams and Circuit Board Illustrations.

Component Color Coding. This instrument contains carbon composition resistors, metal-film resistors, and wire-wound resistors. The resistance of wire-wound resistors is usually printed on the component body. The resistance of composition resistors and metal-film resistors is color coded on the components using the EIA color code (some metal-film resistors may have the resistance printed on the body). The color code is read starting with the stripe nearest the end of the resistor. Composition resistors have four stripes, which consist of two significant figures, a multiplier, and a tolerance value (see Fig. 4-1). Metal-film resistors have five stripes consisting of three significant figures, a multiplier, and a tolerance value.

The values of common disc capacitors, silver mica capacitors, and small electrolytics are marked on the side of the component body.

The cathode end of glass-encased diodes is indicated by a stripe, a series of stripes, or a dot. The cathode and anode ends of metal-encased diodes can be identified by the diode symbol marked on the body.

Semiconductor Lead Configurations. Figure 4-2 illustrates the basing configuration for semiconductors used in this instrument. Some plastic-case transistors have lead configurations that do not agree with those shown here. If a replacement transistor is made by a different manufacturer than the original, check the manufacturer's basing diagram. All transistor sockets in this instrument are wired for the standard basing used for metal-case transistors.

Wiring Color Code. Insulated wire and cable used in this instrument is color coded to facilitate circuit tracing.

Multi-Pin Connector Identification. The multi-pin connectors are keyed with two triangles. Pin number 1 is indexed with a triangular mark on the circuit board and molded on the holder of the multi-pin connector, as shown in Figure 4-3. Each group of pins is identified by its corresponding P-number etched on the circuit board. The J and P numbers on the circuit boards correlate to the J and P component numbers on the schematic diagrams.

Interface Connector Pin Locations. The Main Amplifier circuit board couples the plug-in unit to the associated mainframe (oscilloscope). Figure 4-4 identifies the pins on the interface connector as shown in Section 8, Diagrams and Circuit Board Illustrations.

Troubleshooting Equipment

The following equipment is useful for troubleshooting the 7F10:

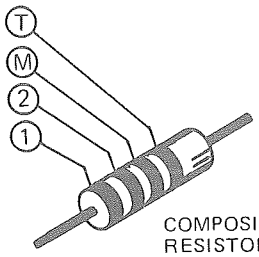
1. Semiconductor Tester

Description: Dynamic-type tester.

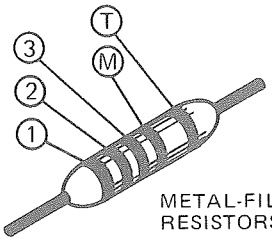
Purpose: To test the semiconductors used in this instrument.

Recommended type: Tektronix Type 576 Curve Tracer, Tektronix 577/177 Curve Tracer, or a Tektronix 7CT1N Curve Tracer plug-in unit in a 7000-series oscilloscope system.

COLOR CODE



COMPOSITION RESISTORS



METAL-FILM RESISTORS

(1) (2) and (3) - 1ST, 2ND, AND 3RD SIGNIFICANT FIGS.
(M) - MULTIPLIER (T) - TOLERANCE;
(TC) - TEMPERATURE COEFFICIENT.

COLOR	SIGNIFICANT FIGURES	RESISTORS	
		MULTIPLIER (OHMS)	TOLERANCE
BLACK	0	1	---
BROWN	1	10	±1%
RED	2	10^2 or 100	±2%
ORANGE	3	10^3or 1 K	±3%
YELLOW	4	10^4 or 10K	±4%
GREEN	5	10^5 or 100 K	±1/2%
BLUE	6	10^6 or 1 M	±1/4%
VIOLET	7	---	±1/10%
GRAY	8	---	---
WHITE	9	---	---
GOLD	---	10^{-1} or 0.1	±5%
SILVER	---	10^{-2} or 0.01	±10%
NONE	---	---	±20%

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Figure 4-1. Color code for resistors.

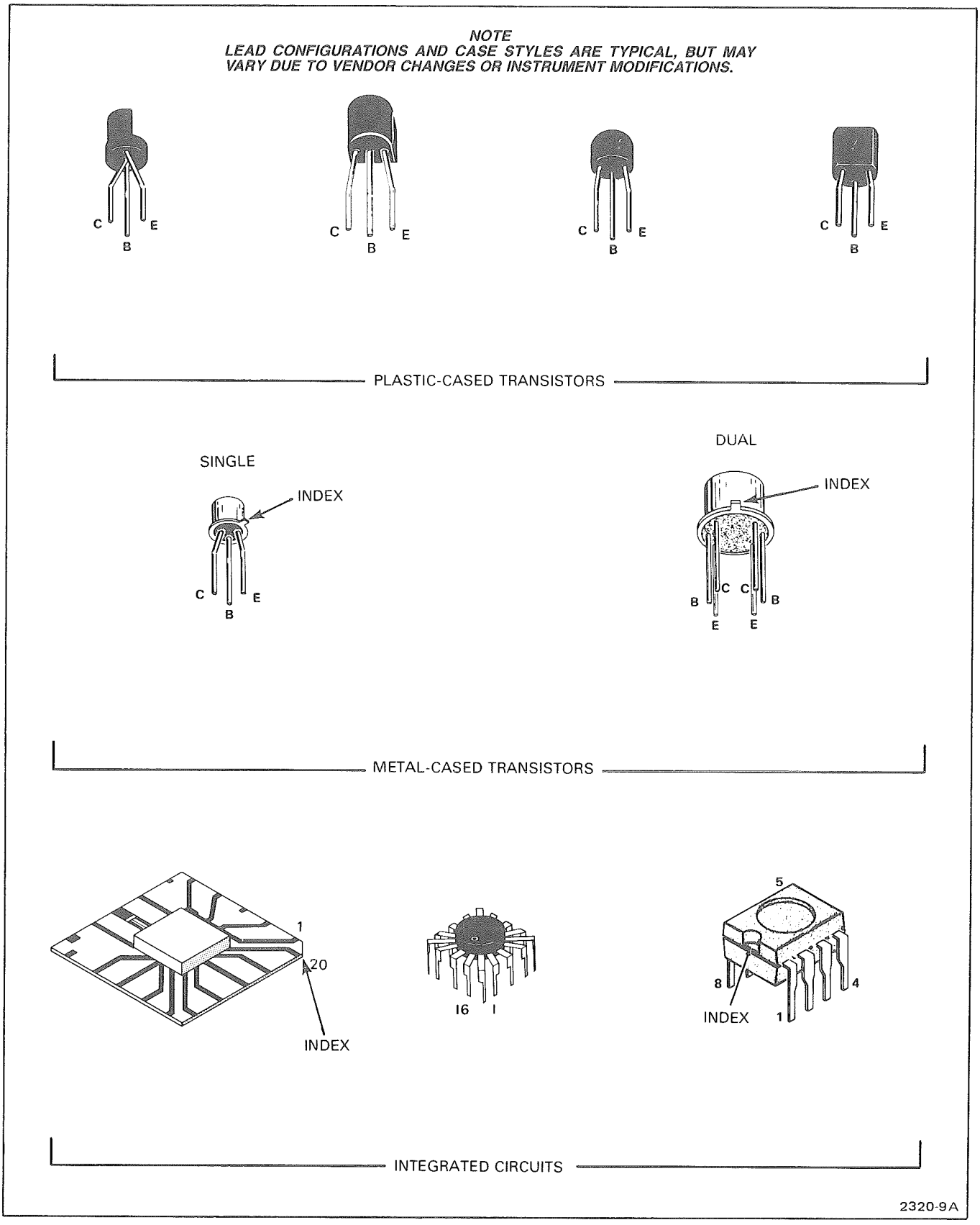


Figure 4-2. Semiconductor lead configurations.

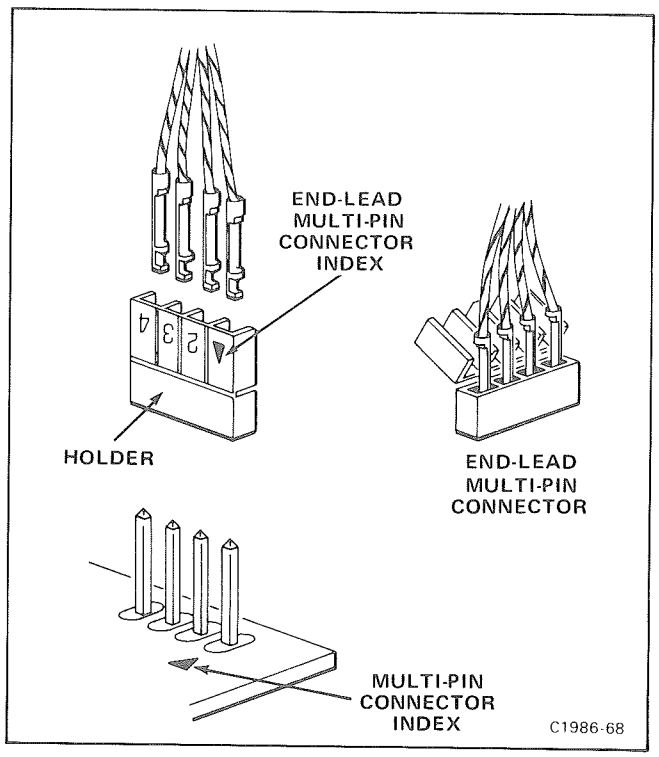


Figure 4-3. Orientation of multi-connector holders.

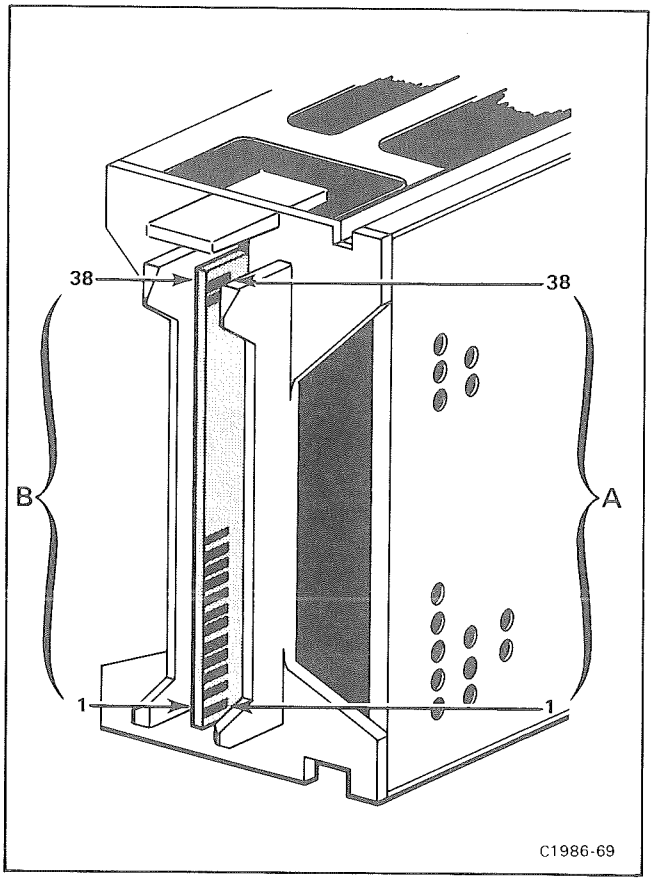


Figure 4-4. Location of pin numbers on interface connector.

2. Test Oscilloscope

Description: Frequency response, DC to 10 megahertz minimum; deflection factor, 5 millivolts/division to 5 volts/division.

Purpose: To check operating waveforms.

Recommended type: Refer to the Tektronix Products Catalog for applicable oscilloscope system.

Troubleshooting Techniques

This troubleshooting procedure is arranged to check the simple trouble possibilities before proceeding with extensive troubleshooting. The first few checks assure proper connection, operation, and adjustment. If the trouble is not located by these checks, the remaining steps aid in locating the defective component. When the defective component is located, replace it using the replacement procedure given under Corrective Maintenance in this section.

1. Check Control Settings

Incorrect control settings can simulate a trouble that does not exist. If there is any question about the correct function or operation of any control on the 7F10, refer to Section 2, Operating Instructions.

2. Check Associated Equipment

Before proceeding with troubleshooting, check that the equipment used with this instrument is operating correctly. Also, check that the optical input signal is properly connected and that the fiber-optic interconnecting cables are not defective.

3. Visual Check

Visually check that portion of the instrument in which the trouble is located. Many troubles can be found by visible indications, such as unsoldered connections, broken wires, damaged circuit boards, and damaged components.

4. Check Instrument Adjustment

Check the electrical adjustment of this instrument, or of the affected circuit if the trouble appears in one circuit. The apparent trouble may only be a result of misadjustment. Complete adjustment instructions are given in Section 5, Checks and Adjustments.

5. Isolate Trouble To A Circuit

To isolate trouble to a particular circuit, note the trouble symptom. The symptom often identifies the circuit in which the trouble is located. When trouble symptoms appear in more than one circuit, check the affected circuits by taking voltage and waveform readings.

After the defective circuit has been located, proceed with steps 6 and 7 of Troubleshooting Techniques to isolate the defective component.

6. Check Voltages And Waveforms

Often the defective component can be located by checking for the correct voltages or waveforms in the circuit. Typical voltages and waveforms are given in Section 8, Diagrams and Circuit Board Illustrations.

NOTE

Voltages and waveforms given in Section 8, Diagrams and Circuit Board Illustrations, are not absolute and may vary slightly between 7F10 Amplifier units. To obtain operating conditions similar to those used to make these readings, see the appropriate schematic.

7. Check Individual Components

The following procedures describe methods of checking individual components in the 7F10. Components which are soldered in place are best checked by first disconnecting one end. This isolates the measurement from the effects of surrounding circuitry.

TRANSISTORS. A good check of transistor operation is actual performance under operating conditions. A transistor can most effectively be checked by substituting a new component for it (or one which has been checked previously). However, be sure that circuit conditions are not such that a replacement transistor might also be damaged. If substitute transistors are not available, use a dynamic tester. Static-type testers are not recommended, since they do not check operation under simulated operating conditions.

INTEGRATED CIRCUITS. Integrated circuits can be checked with a voltmeter, test oscilloscope, or by direct substitution. A good understanding of the circuit operation is essential when troubleshooting circuits using integrated circuits. In addition, operating waveforms, logic levels, and other operating information for the integrated circuits are given in Section 3, Theory of Operation, and Section 8, Diagrams and Circuit Board Illustrations. Use care when checking voltages and waveforms around the integrated circuits so that adjacent leads are not shorted together. A convenient means of clipping a test probe to the in-line, multi-pin integrated circuits is with an integrated-circuit test clip. This device also doubles as an integrated-circuit extraction tool.

DIODES. A diode can be checked for an open or shorted condition by measuring the resistance between terminals with an ohmmeter. Use an ohmmeter scale having a low internal source current. The resistance should be very high in one direction and very low when the meter leads are reversed.

NOTE

When checking diodes, do not use an ohmmeter scale that has a high internal current since high currents may damage the diodes under test.

RESISTORS. Check the resistors with an ohmmeter. Resistor tolerance is given in Section 7, Replaceable Electrical Parts. Normally, resistors do not need to be replaced unless the measured value varies widely from the specified value.

CAPACITORS. A leaky or shorted capacitor can best be detected by checking resistance with an ohmmeter on the highest scale. Do not exceed the voltage rating of the capacitor. The resistance reading should be high after initial charge of the capacitor. An open capacitor can best be detected with a capacitance meter or by checking if the capacitor passes AC signals.

Intermittent components can sometimes be located by freezing one small area at a time with refrigerant spray. However, moisture condensing on U246 and U266 will normally cause the trace position to deviate significantly from its normal position.

8. Repair And Adjust The Circuit

If any defective parts are located, follow the replacement procedures given under Component Replacement in this section. Check the performance of any circuit that has been repaired or that has had any electrical components replaced. Adjustment of the circuit may be necessary. See Section 5, Checks and Adjustments, for performance check and adjustment procedures.

CORRECTIVE MAINTENANCE

Corrective maintenance consists of component replacement and instrument repair. Special techniques required to replace components in the 7F10 are given here.

Obtaining Replacement Parts

All electrical and mechanical part replacements for the 7F10 can be obtained through your local Tektronix Field Office or representative. However, many of the standard electronic components can be obtained locally in less time than is required to order them from Tektronix, Inc. Before ordering or purchasing replacement parts, check the parts list for value, tolerance, rating, and description.

NOTE

When selecting replacement parts, remember that the physical size and shape of a component may affect its performance in the instrument, particularly at high frequencies. All replacement parts should be direct replacements unless you know that a different component will not adversely affect instrument performance.

Special Parts. Some components of the 7F10 are manufactured or selected by Tektronix, Inc. to meet specific performance requirements. Most of the mechanical parts used in this instrument have been manufactured by Tektronix, Inc. To determine the manufacturer of parts, refer to Cross Index to Manufacturers in the parts list. Order all special parts directly from your local Tektronix Field Office or representative.

Ordering Parts. When ordering replacement parts from Tektronix, Inc., include the following information:

1. Instrument type.

2. Instrument serial number.

3. A description of the part (if electrical, include the circuit number).

4. Tektronix part number.

NOTE

If U550 is replaced, serial number of the Optical-to-Electrical Converter module must be included with order. If the Optical-to-Electrical Converter module is replaced, U550 must be replaced also.

Soldering Techniques

WARNING

To avoid electric shock and possible damage to the instrument, remove the 7F10 from the mainframe before soldering.

The reliability and accuracy of this instrument can be maintained only if proper soldering techniques are used when repairing or replacing parts. General soldering techniques which apply to maintenance of any precision electronic equipment should be used when working on this instrument. Use only 60/40 rosin-core, electronic-grade solder. The choice of soldering iron is determined by the repair to be made.

When soldering on circuit boards or small wiring, use only a 15 to 20 watt, pencil-type soldering iron. A higher wattage soldering iron can cause the etched circuit wiring to separate from the board base material and melt the insulation from small wiring. Always keep the soldering-iron tip properly tinned to ensure the best heat transfer to the solder joint. Apply only enough heat to remove the component or to make a good solder joint. To protect heat-sensitive components, hold the component lead with a pair of long-nose pliers between the component body and the solder joint. Use a solder-removing wick to remove excess solder from connections or to clean circuit board pads.

The following technique should be used to replace a component soldered to a circuit board in this instrument. Most components can be replaced without removing the board(s) from the instrument.

CAUTION

To prevent damage to the HYPCON connectors, follow the procedure given under Component Removal—HYPCON Connectors, later in this section when removing or installing components near the Hypcon board.

1. Touch the soldering iron to the lead at the solder connection. Never place the iron directly on the board, as this may damage the board.

2. Melt a small amount of solder onto the component lead connection. This replaces the flux, which may have been removed during instrument cleaning, and facilitates removal of the component.

3. Grip the component lead with a pair of long-nose pliers. When the solder begins to flow, gently pull the component lead from the board. If unable to separate the lead from the board, try removing the other end of the component.

NOTE

Some components are difficult to remove from the circuit board due to a bend placed in each lead during machine insertion of the component. The purpose of the bent leads is to hold the component in position during a flow-solder manufacturing process which solders all components at once. To make removal of machine inserted components easier, straighten the leads of the component on the back of the circuit board using a small screwdriver or pliers, while heating the soldered connection. If the component is known to be defective or if a replacement is readily available, the component may be cut from the circuit board. The leads remaining in the board can then be removed with a suction-type desoldering tool or long-nose pliers.

4. Bend the leads of the replacement component to fit the holes in the circuit board. If the component is replaced while the board is mounted in the instrument, cut the leads so they will just protrude through the board. Insert the leads into the holes in the board so that the component is firmly seated against the board, or as originally positioned.

5. Touch the iron to the connection and apply enough solder to make a firm solder joint.

6. Cut off any excess lead protruding through the board (if not clipped in step 4).

7. Clean the area around the solder connection with a flux-removing solvent. Be careful not to remove information printed on the circuit board.

COMPONENT REMOVAL AND REPLACEMENT

WARNING

To avoid electric shock and possible damage to the instrument, always remove the 7F10 from the mainframe before replacing components.

The exploded-view drawings associated with the Replaceable Mechanical Parts list (located at the rear of this manual) may be helpful in the removal or disassembly of individual components or sub-assemblies. Circuit board locations are shown in the diagrams section.

Optical-to-Electrical Converter Module

The Optical-to-Electrical Converter module is not serviceable and must be replaced as a unit. Refer Optical-to-Electrical Converter module service to your local Tektronix Service Center.

NOTE

If U550 is replaced, serial number of the Optical-to-Electrical Converter module must be included with order. If the Optical-to-Electrical Converter module is replaced, U550 must be replaced also.

Remove and replace the Optical-to-Electrical Converter module as follows:

1. Remove the Front Panel board using the procedure given under Circuit Boards—Front Panel Circuit Board.

2. Remove the securing nut from the input connector.

3. Disconnect all cables from the Optical-to-Electrical Converter module. Note the location so they can be correctly replaced.

4. Remove the three screws and the standoff securing the Optical-to-Electrical Converter module to the chassis.

5. Remove the Optical-to-Electrical Converter module.

6. Replace the Optical-to-Electrical Converter module by reversing the order of removal.

Circuit Boards

If a circuit board is damaged beyond repair, replace the entire assembly, including all soldered-on components. Part numbers for the completely wired boards are given in Section 7, Replaceable Electrical Parts.

Front Panel Circuit Board. Remove and replace the Front Panel circuit board as follows:

NOTE

U550 is not included with the replacement board. Remove from the damaged board and install in the new board. If U550 must be replaced, provide serial number of the Optical-to-Electrical Converter module with the order.

1. Remove the knobs and securing nuts from the POSITION and VARIABLE controls.

2. Disconnect all multi-pin connectors from the Front Panel board. Note the location so they can be correctly replaced.

3. Remove the screw securing the Front Panel board in place.

4. Lift the Front Panel board from the instrument.

5. Replace the Front Panel board by reversing the order of removal. Match the index arrows on the pin connectors to the corresponding arrow on the board. Correct location of the pin connectors is shown on the circuit board illustration in Section 8, Diagrams and Circuit Board Illustrations.

Main Amplifier Circuit Board. Remove and replace the Main Amplifier circuit board as follows:

1. Remove the Front Panel board and the Optical-to-Electrical Converter module as described previously.

2. Remove the four screws that secure the plastic rear panel to the instrument frame.

3. Remove the six screws that secure the perimeter of the board to the instrument frame.

4. Remove the Main Amplifier board through the rear of the instrument.

5. Replace the Main Amplifier circuit board by reversing the order of removal.

Semiconductors

Semiconductors should not be replaced unless actually defective. If removed from their sockets during routine maintenance, return them to their original sockets. Unnecessary replacement of semiconductors may affect the adjustment of the instrument. When semiconductors are replaced, check the operation of circuits which may be affected.

WARNING

To avoid electric-shock hazard, always remove the 7F10 from the mainframe before replacing components.

Replacement semiconductors should be of the original type or a direct replacement. Lead configurations of the semiconductors used in this instrument are shown in Figure 4-2. Some plastic-cased transistors have lead configurations which do not agree with those shown. If a replacement transistor is made by a different manufacturer than the original, check the manufacturer's basing diagram for correct basing. All transistor sockets in the 7F10 are wired for the standard basing as used for metal-cased transistors.

HYPCON Connectors

The HYPCON connector is a precision-made connector designed to provide low-loss electrical connection between the printed circuit board and hybrid integrated circuit. An exploded view of the HYPCON connector is shown in Figure 4-5. Care must be taken when replacing the hybrid ICs not to touch the elastomer gold-plated contacts with your fingers or to use a cleaner which will degrade contact reliability. The HYPCON connector and hybrid IC should be removed if it becomes necessary to use a cleaning solvent near the connector when replacing adjacent circuit board components (within 1/2 inch).

NOTE

IMPORTANT: Remove all traces of solder flux or foreign material contamination from the circuit board contact area before replacing the connector. Contamination usually occurs during the soldering and cleaning process. Even when soldering is done carefully, flux, oil or other contaminants can be carried under the connector during the cleaning operation. When the solvent evaporates, nonconductive contaminants may remain on or near the contact interfaces.

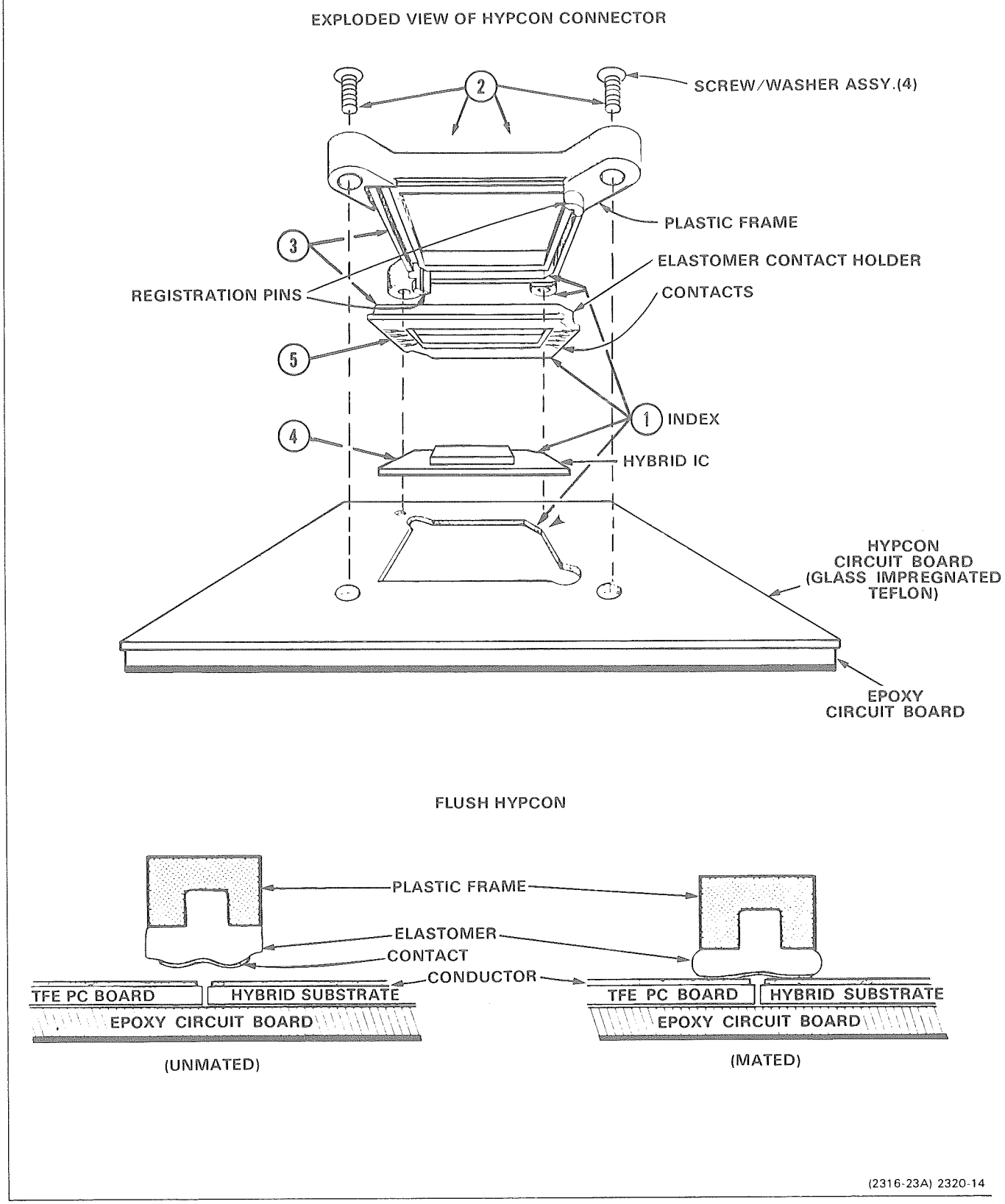


Figure 4-5. HYPCON connector assembly.

DISASSEMBLY AND REMOVAL

(1) Note index on circuit board (arrow) and Hypcon plastic frame (pointed mounting ear).

(2) Unscrew and remove the 4 screw/washer assemblies.

(3) Lift Hypcon connector from board.

(4) Note index location of hybrid and remove from board with tweezers.

(5) Note index location of elastomer contact holder and remove by grasping a corner of the contact holder with tweezers and lifting up. Do not touch the gold-plated contacts with your fingers.

REASSEMBLY AND REPLACEMENT

Grasp corner of elastomer contact holder with tweezers and place in plastic frame slot being careful to match the flat contact holder with the flat frame corner. Place a clean plastic envelope over finger and press with finger to seat contact holder into the frame. The contact holder must be evenly seated on all four sides.

Match hybrid flat corner with board receptacle flat corner and place hybrid in receptacle. Match pointed mounting ear of Hypcon connector with flat corner of receptacle and guide registration pins into the board holes.

Insert mounting hardware and apply 2 inch-poinds of torque to secure the connector assembly.

(2316-23B) 2320-14

Figure 4-5. HYPCON connector assembly (continued).

The cleaning process, either hand cleaning with a solvent or machine cleaning in an automatic detergent wash, is not recommended for boards fitted with HYPCON connectors.

If a component adjacent to a HYPCON connector must be replaced, the following steps are recommended:

1. Remove the hybrid IC and HYPCON connector (see Disassembly and Removal instructions in Figure 4-5) before any soldering or cleaning, and store in a dirt-free covered container.

2. When hand soldering:

   a. Use small-diameter solder (0.030 to 0.040 inch).

   b. Use low-wattage soldering iron (15 to 20 watts).

   c. Use care with solder amount and placement.

3. Remove solder flux and contact contamination with isopropyl alcohol.

4. Flush the hybrid and HYPCON connector mounting area with isopropyl alcohol. Do not scrub with a cotton-tipped applicator as cotton fibers may adhere to edges and surfaces of contact areas and cause open or intermittent connections. The elastomer should be examined under light for dust, hair, etc., before it is re-installed. If the etched circuit board surfaces require more cleaning, scrub with a soft rubber eraser and blow or vacuum clean while dusting the surface with a small cleaning brush.

5. If the hybrid IC and elastomer contact holder are contaminated, clean the contact holder and hybrid by flushing or spraying with alcohol and oven dry at 50 degrees Celsius. Do not scrub with a cotton-tipped applicator or similar device. If the contact holder is excessively contaminated, replace it with a new one.

Two inch-pounds of torque should be applied to the mounting screws to secure the HYPCON to the circuit board.

Make sure that the elastomer is properly seated in the contact holder before remounting the assembly to the circuit board. The elastomer is keyed to fit snugly in the plastic holder in only one orientation. Exercise care when mounting the frame, elastomer contact holder, and hybrid IC assembly to the circuit board to prevent misalignment between the connector and board.

CAUTION

Because of the close tolerances involved, special care must be taken to ensure correct index alignment of each HYPCON part during reassembly. Failure to do so can result in a cracked hybrid substrate. See Figure 4-5 for index locations.

When replacing the hybrid, insert it into the board opening and then position the HYPCON connector in the board registration holes for perfect alignment. The outer portion of the HYPCON frame should be flush with the circuit board before the four mounting screws are tightened. Avoid touching the hybrid and elastomer contact holder with your fingers; finger oils can degrade reliability.

A procedure for removal and replacement of the HYPCON assembly is included in Figure 4-5.

Hybrid substrate contact numbers 1 and 20 are printed on the substrate at the index corner. See Figure 4-2, Semiconductor Lead Configurations.

Circuit-Board Pins

A circuit-board pin replacement kit (including necessary tools, instructions, and replacement pins with attached ferrules) is available from Tektronix, Inc. Order Tektronix Part 040-0542-00. Replacing circuit-board pins on multi-layer boards is not recommended; refer such repairs to your local Tektronix Field Office or representative.

CAUTION

The Main Amplifier circuit board in this instrument is a multilayer type board with two identical conductive paths laminated between the top and bottom board layers. All soldering on this board should be done with care to prevent breaking the connection to the center conductors. Only experienced maintenance personnel should attempt repair of the board.

To replace a damaged pin which is mounted on a single-layer circuit board, first disconnect any pin connectors. Then unsolder the damaged pin (using Soldering Techniques given earlier in this section) and pull it from the board with a pair of pliers, leaving the ferrule (see Figure 4-6) in the hole if possible. If the ferrule remains in the circuit board, remove the spare ferrule from the replacement pin and press the

new pin into the hole in the circuit board. If the ferrule is removed with the damaged pin, clean out the hole using a solder-removing wick and a scribe. Then, press the replacement pin, with attached spare ferrule, into the circuit board. Position the replacement pin in the same manner as the original. Solder the pin to the circuit board on each side of the board. If the original pin was bent at an angle to mate with a connector, carefully bend the new pin to the same angle. Replace the multi-pin connector.

Pushbutton Switches

The pushbutton switches used in the 7F10 are mounted on the Front Panel circuit board. To repair these switches, first remove the Front Panel board using the procedure given under Circuit Boards—Front Panel Circuit Board. Then remove the pushbutton switch following the procedure given in Figure 4-7.

ADJUSTMENT AFTER REPAIR

After any electrical component has been replaced, the adjustment of that particular circuit should be checked, as well as the adjustment of any closely related circuits. See Section 5, Checks and Adjustments, in this manual for a complete adjustment procedure.

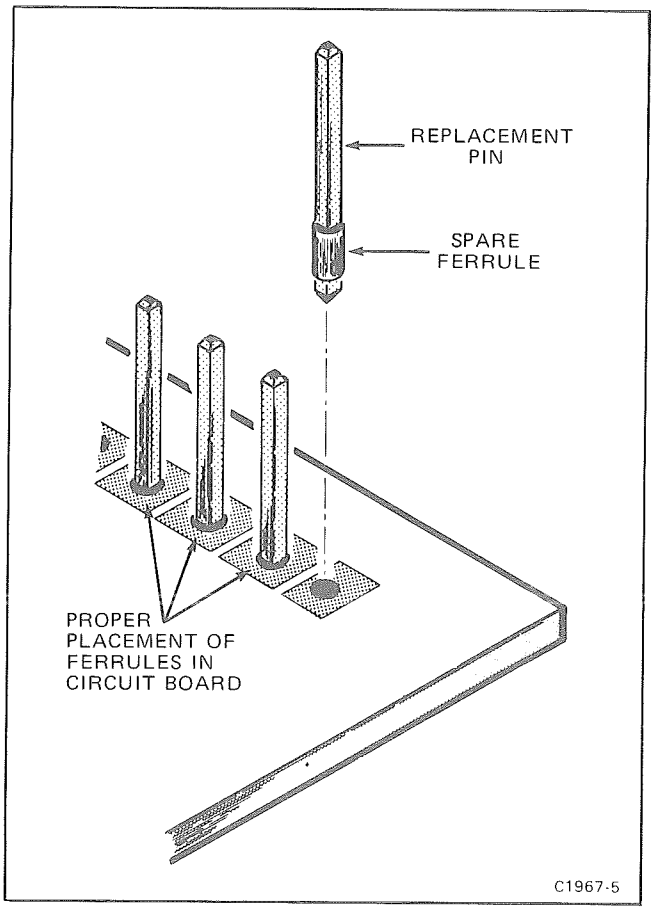
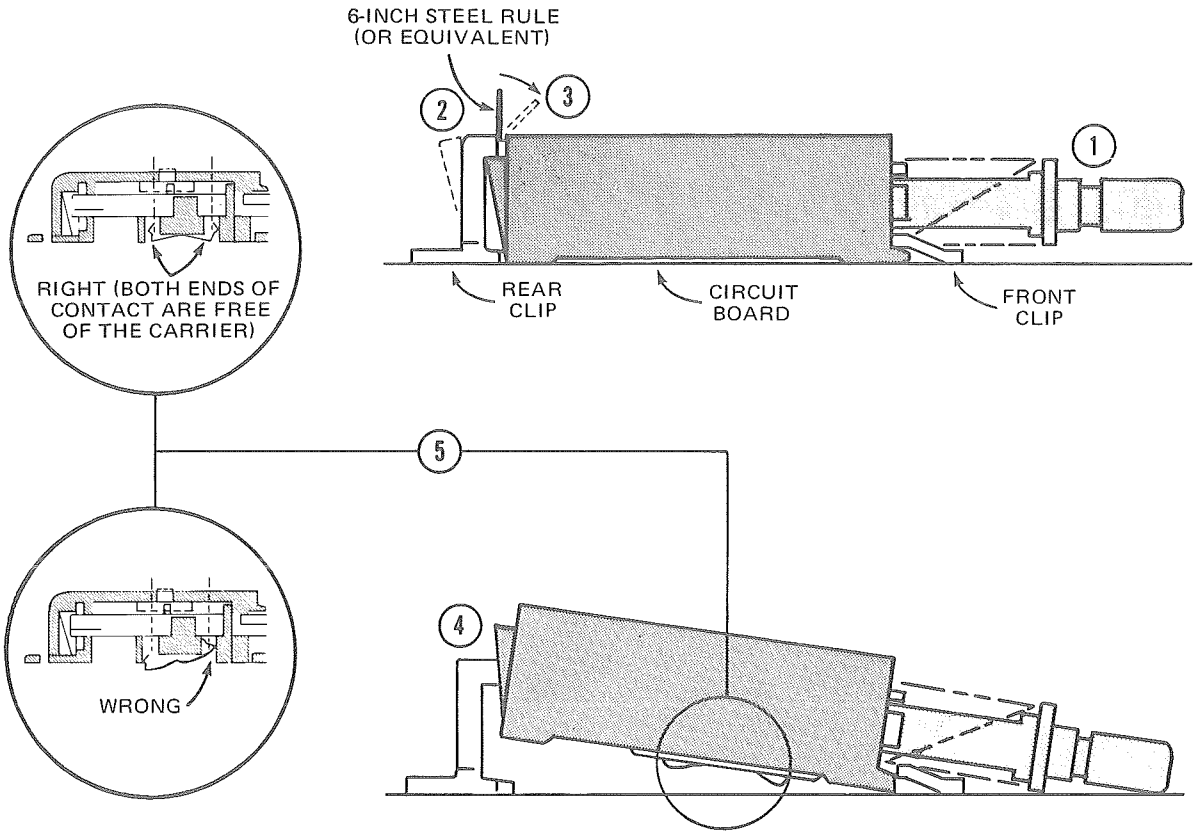


Figure 4-6. Detailed view of circuit-board pin and ferrule.



(1) Make sure that all switch shafts are in the OUT position to clear the rear clip.

(2) Place the long edge of a six-inch rule or similar thin straight edge between the top edge of the rear clip and the switch body.

(3) Carefully pry the rear clip back just far enough to push the steel rule down between the clip and switch body.

CAUTION

When the switch is removed, the contacts may drop free and be damaged or lost. Body salts or acids can contaminate the switch contacts. Wear cotton gloves to prevent touching the contacts in the switch or on the board with bare hands.

(4) Pull the rear of the switch up, remove the steel rule, and pull the switch out of the front clip.

(5) To replace the switch, first check that the slide contacts are properly installed in the carrier. Then, place the front of the switch into the front clip and push the rear of the switch down until the rear clip catches and holds the switch in place.

1967-3

Figure 4-7. Removal procedure for pushbutton switches.

SECTION 5
CHECKS AND ADJUSTMENTS

This section contains information necessary to perform a complete instrument check and adjustment. Limits given in this procedure are adjustment guides and should not be interpreted as performance requirements unless preceded by a check mark (✓). Where possible, instrument performance is checked before an adjustment is made.

PRELIMINARY INFORMATION

Adjustment Interval

To maintain instrument accuracy, check the performance of the 7F10 every 1000 hours of operation, or every 6 months if used infrequently. Before complete adjustment, thoroughly clean and inspect this instrument as outlined in Section 4, Maintenance.

Tektronix Field Service

Tektronix Field Service Centers and the Tektronix Factory Service Center provide instrument repair and adjustment services. Contact your local Tektronix Field Office or representative for further information.

Using This Procedure

This Checks and Adjustments procedure can be used for a complete adjustment procedure or as a check of the instrument's performance. Completion of each step in the procedure ensures that the instrument is correctly adjusted and operating within specified limits. Refer to the following discussion for instructions on a complete or partial check and adjustment.

Index. An index precedes the procedure to aid in locating individual steps in the Checks and Adjustments procedure.

Performance Check. Instrument performance can be checked by performing the complete Optical Checks procedure only. A check mark (✓) preceding a CHECK step indicates that the limit given is a performance requirement specified in the Specification tables in Section 1.

To check operation of this instrument without the use of special test equipment, refer to the Operator's Checkout Procedure in Section 2.

Adjustment. Completion of each step in the Checks and Adjustments procedure ensures that the instrument is correctly adjusted and performing within specified limits. Where possible, instrument performance is checked before an adjustment is made. For best overall performance when performing the complete adjustment procedure, make each adjustment to the exact setting indicated.

Partial Procedures. This procedure is written to completely check and adjust the instrument to the Performance Requirements listed in the Specification tables, Section 1. If the application for which this instrument is used does not require the full available performance, the procedures and the required equipment list can be shortened accordingly.

A partial performance check and adjustment may be desirable after replacing components, or to touch up the adjustment of a portion of the instrument. To check or adjust only part of the instrument, refer to the Equipment Required list which precedes the portion of the procedure you want to perform. To avoid unnecessary adjustment of other parts of the instrument, adjust only if the tolerance given in the CHECK step is not met.

TEST EQUIPMENT REQUIRED

The test equipment listed in Table 5-1 is required for a complete check and adjustment of this instrument. The test equipment specifications given in Table 5-1 are the minimum required to meet the Performance Requirements listed in the Specification tables, Section 1. Detailed operating instructions for test equipment are not given in this procedure. Refer to the test equipment instruction manual if more information is needed.

Special Fixtures

Special fixtures are used only where they facilitate instrument adjustment. These fixtures are available from Tektronix, Inc. Order by part number from your local Tektronix Field Office or representative.

Test Equipment Alternatives

The test equipment listed in the Examples of Applicable Test Equipment column in Table 5-1 is required to check

and adjust this instrument. The Checks and Adjustments procedure is based on the first item of equipment given as an example. If other equipment is substituted, control settings or setups may need to be altered. If the exact item of equipment given as an example is not available, refer to the Minimum Specifications column to determine if other equipment may be substituted. Then check the Purpose column. If you determine that your measurement requirements will not be affected, the item and corresponding step(s) can be deleted.

Table 5-1
Test Equipment

Description	Minimum Specifications	Purpose	Examples of Applicable Test Equipment
1. Oscilloscope Mainframe	Tektronix 7000-series. 1 GHz bandwidth required for complete procedure.	Used throughout procedure to provide display.	a. Tektronix 7104 Oscilloscope.
2. Time Base	Tektronix 7B-series time-base plug-in unit.	Used throughout procedure to provide sweep.	a. Tektronix 7B10 or 7B15 Time Base. b. Tektronix 7B80 or 7B85 Time Base.
3. Differential Amplifier*	Tektronix 7A-series differential plug-in unit. Dual input with 1 mV per division sensitivity required.	Check/adjust input impedance.	a. Tektronix 7A22 Differential Amplifier.
4. Dual-Trace Amplifier	Tektronix 7A-series dual-trace amplifier.	Check optical deflection.	a. Tektronix 7A26 Dual-Trace Amplifier.
5. Digital Voltmeter (DVM)*	0.1 mV sensitivity.	Check/adjust input current.	a. Tektronix DM 501 Digital Multimeter with TM 500-Series Power Module. b. Tektronix 7D13 Digital Multimeter.
6. Pulse Generator*	Amplitude accuracy within 0.25%; range, 60 mV to 5 V into 50 ohms; frequency, 1 kHz square wave.	Check/adjust gain and low-frequency step response.	a. Tektronix PG 506 Pulse Generator with TM 500-Series Power Module.
7. Leveled Sine-Wave Generator	Reference frequency, 10 MHz or less; amplitude accuracy, within 2% of reference frequency; amplitude, 1 V to at least 4 V into 50 ohms; frequency, 1 GHz.	Check optical deflection and bandwidth.	a. Tektronix SG 504 Leveled Sine Wave Generator with TM 500-Series Power Module.
8. Optical Pulser	Wavelength, 1300 nM; connectors, Diamond 3.5.	Check optical gain and bandwidth.	a. Tektronix OT 503 Electrical/Optical Converter, Option 21 and Option 95, with TM 500-Series Power Module.
9. 50-ohm Bridge*	1/4 percent 50-ohm bridge.	Check/adjust input impedance.	a. Tektronix 067-0875-00 Calibration Fixture.
10. BNC Coaxial Cable (3 required)	Impedance, 50 ohms; connectors, BNC; length, 18-inches.	Provide signal connection.	a. Tektronix Part 012-0057-01.

Table 5-1 (cont)

Description	Minimum Specifications	Purpose	Examples of Applicable Test Equipment
11. Fiber Optic Cable	Connectors, Diamond 3.5; length, 1 meter.	Provide optical connection.	a. Tektronix Part 174-0045-01 with interlock.
12. Adapter*	Connectors, SMA male-to-BNC female.	Used to connect signals to amplifier section.	a. Tektronix Part 015-1018-00.
13. Adapter*	Connectors, SMA female-to-SMA female.	Used to connect signals to amplifier section.	a. Tektronix part 015-1012-00.
14. Attenuator*	Attenuation, 2X; impedance, 50-ohms; connectors, BNC.	Signal attenuation.	a. Tektronix part 011-0069-02.
15. Attenuator	Attenuation, 5X; impedance, 50-ohms; connectors, BNC.	Signal attenuation.	a. Tektronix part 011-0060-02.
16. Attenuator*	Attenuation, 10X; impedance, 50-ohms; connectors, BNC.	Signal attenuation.	a. Tektronix part 011-0059-02.
17. Terminator	Impedance, 50-ohms; connectors, BNC.	Signal termination.	a. Tektronix part 015-0049-01.
18. Adapter	Connectors, BNC female-to-N male.	Connect to OT503 input.	a. Tektronix part 103-0045-00.
19. Srewdriver *	Three-inch shaft, 3/32-inch bit.	Used throughout adjustment procedure.	a. Xcelite R3323.

* Required for adjustment only, not used for performance check.

CHECKS AND ADJUSTMENTS PROCEDURE

Introduction

The following procedure checks and adjusts the 7F10 to meet the performance requirements given in the Specifications section.

Index to Checks and Adjustments Procedure

(✓)Performance requirement check; see introductory information.

Setup Procedure for Performance Check

NOTE

The performance of this instrument can be checked at any ambient temperature from 0 to +50 degrees C unless otherwise stated. Adjustments must be performed at an ambient temperature between +20 and +30 degrees C for specified accuracies.

CAUTION

To avoid instrument damage, it is recommended that the Oscilloscope Mainframe power switch be turned off before removing or replacing plug-in units.

1. Install the 7F10 in the left vertical compartment of the Oscilloscope Mainframe.

2. Install a 7000-Series Time Base in the Oscilloscope Mainframe B horizontal compartment.

3. Install the Dual-Trace Amplifier in the right vertical compartment.

4. Connect the Oscilloscope Mainframe to a suitable power source and turn it on. Allow at least 20 minutes warmup before beginning the procedure.

A. OPTICAL CHECKS

Equipment Required (numbers correspond to those listed in Table 5-1, Test Equipment)

1. Oscilloscope Mainframe
2. Time Base
4. Dual-Trace Amplifier
7. Leveled Sine Wave Generator
8. Optical Pulser
10. BNC Coaxial Cable
11. Fiber Optic Cable
15. Attenuator, 5X
17. 50-Ohm Termination
18. BNC-to-N Adapter

Control Settings

7F10 Control Settings

POSITION	Midrange
POLARITY	+UP
VARIABLE	Counterclockwise
WAVELENGTH	1300 nM

Oscilloscope Mainframe Control Settings

Power	On
Vertical Mode	Right
Horizontal Mode	B
Intensity	Visible display
Focus	Well-defined display
Trigger Source	Vertical Mode

Time Base Control Settings

Time/Division	50 ms
Triggering	Auto, AC, Internal

(✓)A1. Check Optical Deflection

a. Connect the Sine Wave Generator to the Dual-Trace Amplifier input through a BNC cable, 5X attenuator, and a 50-ohm termination.

b. Connect the Optical Pulser output connector to the 7F10 INPUT with the fiber optic cable.

c. Refer to the Optical Pulser data sheet (provided as part of Option 95) and note the modulation amplitude required to achieve a 50% modulation level.

d. Set the Sine Wave Generator for 6 MHz output and adjust to an output amplitude (as measured on the display) equal to the level that will produce a 50% modulation level for the Optical Pulser.

e. Without changing either the frequency or the output amplitude of the Sine Wave Generator, disconnect the output of the 5X attenuator from the Dual-Trace Amplifier and connect it to the Optical Pulser modulation input through the BNC-to-N Adapter.

f. Turn the Optical Pulser on.

g. Press the ATTEN UP or DOWN buttons until the lower readout shows 15.0 dB.

h. Set Mainframe Vertical Mode to Left.

i. CHECK—Display resulting from the optical signal is correct within 30%. Expected output from the Optical Pulser can be determined from the Option 95 data sheet. Actual deflection can be determined by multiplying the number of divisions of deflection times the scale factor shown by the upper readout.

(✓)A2. Check Optical Bandwidth

a. Set the Sine Wave Generator for exactly six divisions of deflection from the Optical Pulser at 6 MHz.

b. Set the Sine Wave Generator to the 495 to 1050 MHz range.

c. CHECK—Displayed amplitude from the Optical Pulse 7 does not drop below three divisions as the Sine Wave Generator output frequency is varied from 495 MHz to 750 MHz.

(✓)A3. Check Variable Control Range

a. Set the Sine Wave Generator for exactly six divisions of deflection at 5 MHz.

b. Rotate the VARIABLE control fully counterclockwise (not in detent).

c. CHECK—Displayed signal amplitude 2 divisions or less.

d. Set the VARIABLE control to the calibrated position.

(✓)A4. Check Overload Indicator

a. Press the ATTEN UP or DOWN buttons until the upper readout shows 5.0 dB.

b. CHECK—7F10 OVERLOAD light is on.

c. Turn off the Optical Pulser.

d. Disconnect all test equipment.

This completes the Optical Checks procedure. If all checks were within tolerance, the instrument will perform to the specifications stated in Section 1. If any checks are out of tolerance, proceed with the Amplifier Adjustments procedure.

(✓)Performance requirement check; see introductory information.

Setup Procedure for Adjustments

NOTE

The performance of this instrument can be checked at any ambient temperature from 0 to +50 degrees C unless otherwise stated. Adjustments must be performed at an ambient temperature between +20 and +30 degrees C for specified accuracies.

1. Remove the side covers from the 7F10.

2. Remove the left side panel and bottom panel from the Oscilloscope Mainframe to allow access to the 7F10 internal adjustments and test points.

CAUTION

To avoid instrument damage, it is recommended that the Oscilloscope Mainframe power switch be turned off before removing or replacing plug-in units.

3. Install a 7000-Series Time Base in the Oscilloscope Mainframe B horizontal compartment.

4. Install the Differential Amplifier in the right vertical compartment.

5. Connect the Oscilloscope Mainframe to a suitable power source and turn it on. Allow at least 20 minutes warmup before beginning the procedure.

B. AMPLIFIER ADJUSTMENTS

Equipment Required (numbers correspond to those listed in Table 5-1, Test Equipment)

1. Oscilloscope Mainframe
2. Time Base
3. Differential Amplifier
5. Digital Voltmeter (DVM)
6. Pulse Generator
9. 50-Ohm Bridge
10. BNC Coaxial Cable (3 required)
12. BNC-to-SMA Adapter
13. Female-to-Female SMA Adapter
14. Attenuator, 2X
16. Attenuator, 10X
19. Screwdriver

Control Settings

7F10 Control Settings

POSITION	Midrange
POLARITY	+UP
VARIABLE	Counterclockwise
WAVELENGTH	1300 nM

Oscilloscope Mainframe Control Settings

Power	On
Vertical Mode	Left
Horizontal Mode	B
Intensity	Visible display
Focus	Well-defined display
Trigger Source	Vertical Mode

Time Base Control Settings

Time/Division	1 ms
Triggering	Auto, AC, Internal

See Adjustments pullout in the Diagrams section for location of adjustments and test points.

NOTE

All tolerances given in the following steps are indications of correct adjustment only and are not performance specifications.

B1. Check/Adjust Input Current (R124)

a. Temporarily turn off the Mainframe power. Remove the Dual-Trace Amplifier and install the Differential Amplifier in the right vertical compartment.

b. Remove the 7F10 and disconnect the SMA cable from the back of the Optical-to-Electrical Converter. Connect the female-to-female SMA adapter and the BNC-to-SMA adapter to the SMA cable.

c. Replace the 7F10 in the left vertical compartment. Feed the input cable through the bottom of the Mainframe.

d. Turn on the Mainframe power and allow all instruments to return to operating temperature before continuing with adjustments.

e. Connect the DVM (Digital Voltmeter) between the outer conductor and the inner conductor of the BNC connector.

f. CHECK—DVM for a reading of zero volts, within 2.5 millivolts.

g. ADJUST—Input I adjustment R124 (see Figure 8-9) for a DVM reading of less than 2.5 millivolts.

h. Disconnect the DVM.

B2. Check/Adjust Position Centering (R270)

a. Connect the DVM between TP249 (see Figure 8-9) and ground.

b. Set the POSITION control for a reading of less than 50 millivolts.

c. Connect the DVM between solder points M and K on the Main Amplifier board (see Figure 8-9).

d. CHECK—DVM for a reading of less than 25 millivolts.

e. ADJUST—Pos Center adjustment R270 (see Figure 8-9) for a DVM reading of less than 25 millivolts.

f. Disconnect the DVM.

B3. Check/Adjust +Up Variable Balance (R170)

a. Position the trace to the center horizontal graticule line.

b. CHECK—Display for less than 0.2 division vertical trace shift while rotating the VARIABLE control throughout its range.

c. ADJUST—+Up Var Bal adjustment R170 (see Figure 8-9) for vertical trace shift (less than 0.2 division) while rotating the VARIABLE control throughout its range.

d. Repeat step b with the trace positioned at the top and then at the bottom of the graticule. If necessary, readjust R170 for the best compromise at all positions.

B4. Check/Adjust Inverted Variable Balance (R175)

a. Set the POLARITY switch to INVERT.

b. Position the trace to the center horizontal graticule line.

c. CHECK—Display for less than 0.2 division vertical trace shift while rotating the VARIABLE control throughout its range.

d. ADJUST—Inverted Variable Balance adjustment R175 (see Figure 8-9) for minimum vertical trace shift (less than 0.2 division) while rotating the VARIABLE control throughout its range.

e. Repeat step c with the trace positioned at the top and then at the bottom of the graticule. If necessary, readjust R175 for the best compromise at all positions.

f. INTERACTION—Position Centering, +Up Variable Balance, and Inverted Variable Balance interact. Repeat steps B2, B3, and B4 until all settings remain within tolerance.

B5. Check/Adjust Trigger Balance (R365)

a. Connect the DVM between TP249 (see Figure 8-9) and ground.

b. Set the POSITION control for a reading of less than 50 millivolts.

c. Connect the DVM between solder points D and E on the Main Amplifier board (see Figure 8-9).

d. CHECK—DVM for a reading of less than 25 millivolts.

e. ADJUST—Trigger Bal adjustment R365 (see Figure 8-9) for a DVM reading of less than 25 millivolts.

f. Disconnect the DVM.

B6. Check/Adjust Input Impedance (R107)

a. Connect the 50-Ohm Bridge to the BNC-to-SMA adapter.

b. Connect the Mainframe calibrator out to the 50-Ohm Bridge input connector with an 18-inch BNC cable and 2X attenuator.

c. Connect the 50-Ohm Bridge + and − outputs to the Differential Amplifier + and − inputs, respectively, with two 18-inch BNC cables.

d. Set the Differential Amplifier for DC input coupling, 1 millivolt/division, 100 kHz HF −3 dB point, and DC LF −3 dB point.

e. Set the Time Base time/division for 500 microseconds.

f. Set the Mainframe Vertical Mode to Right.

g. CHECK—Displayed square-wave amplitude is less than one division.

h. ADJUST—Z In adjustment R107 (see Figure 8-9) for minimum amplitude of the displayed square wave (less than one division).

i. Disconnect the 50-Ohm Bridge.

B7. Check/Adjust Gain

NOTE

It is essential that the Mainframe sensitivity be properly adjusted prior to performing this step. Check the Mainframe Instruction Manual for adjustment procedure.

a. Connect the Pulse Generator Std Ampl Output to the BNC-to-SMA adapter through a BNC coaxial cable.

b. Set the Mainframe Vertical Mode to Left.

c. Set the Pulse Generator for std ampl output at an amplitude of 0.1 volt.

d. CHECK—Five-division display within 0.15 division.

e. ADJUST—Front-panel GAIN adjustment for exactly five divisions of vertical deflection.

f. Rotate the VARIABLE control fully counterclockwise (not in detent).

g. CHECK—1.8 divisions or less of displayed square wave.

h. ADJUST—Min Gain adjustment R212 (see Figure 8-9) for 1.8 divisions of vertical deflection.

i. INTERACTION—Recheck parts d through h and readjust as necessary.

j. Return the VARIABLE control to the calibrated position.

k. Disconnect the Pulse Generator.

B8. Check/Adjust Low-Frequency Step Response (C162, R140, R144, R146, R148, R150, R152)

a. Connect the Pulse Generator Fast Rise Output to the BNC-to-SMA adapter through a BNC coaxial cable and a 10X attenuator.

b. Set the Pulse Generator for fast rise output with a period of 10 milliseconds.

c. Set the Pulse Generator output amplitude for an eight-division display.

d. Position the top of the signal about one division below the top of the graticule.

e. CHECK—Displayed pulse for aberrations and tilt within 0.8 divisions (disregard first 10 nanoseconds) with the Pulse Generator period and Time Base time/division settings shown in Table 5-2.

Table 5-2
Low-Frequency Step Response

Adjustment	Pulse Generator Period	Time Base Time/Div
R150, R152	10 ms	2 ms/div
R146, R148	1 ms	0.2 ms/div
R140, R144	0.1 ms	20 us/div
C162, R140	10 μs	2 us/div

f. ADJUST—Compensation adjustments for minimum aberrations and tilt (disregard the first 10 nanoseconds) with the Pulse Generator period and Time Base time/division settings shown in Table 5-2. See Figure 8-9 for adjustment locations.

g. INTERACTION—All adjustments in this step interact. If any changes were made, repeat the checks and adjustments until all are within tolerance.

h. Disconnect the Pulse Generator.

i. Turn off the Mainframe power.

j. Remove the 7F10 from the Mainframe.

This completes the 7F10 Checks and Adjustments procedure. Reconnect the SMA connector to the Optical-to-Electrical Converter. Replace the side covers on the 7F10 and the side and bottom panels on the Mainframe. Then perform the Optical Checks in part A.

SECTION 6
INSTRUMENT OPTIONS

There were no options available for the 7F10 at the time this manual was printed.

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.

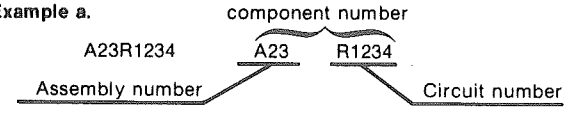
ABBREVIATIONS

Abbreviations conform to American National Standard Y1.1.

COMPONENT NUMBER (column one of the Electrical Parts List)

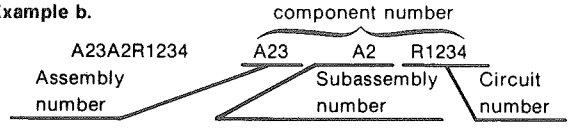
A numbering method has been used to identify assemblies, subassemblies and parts. Examples of this numbering method and typical expansions are illustrated by the following:

Example a.



Read: Resistor 1234 of Assembly 23

Example b.



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.

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00853	SANGAMO WESTON INC SANGAMO CAPACITOR DIV	SANGAMO RD P O BOX 128	PICKENS SC 29671
01121	ALLEN-BRADLEY CO	1201 SOUTH 2ND ST	MILWAUKEE WI 53204
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP	13500 N CENTRAL EXPRESSWAY P O BOX 225012 M/S 49	DALLAS TX 75265
01686	RCL ELECTRONICS INC	195 MCGREGOR ST	MANCHESTER NH 03102
02735	RCA CORP SOLID STATE DIVISION	ROUTE 202	SOMERVILLE NJ 08876
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT	W GENESEE ST	AUBURN NY 13021
04222	AVX CERAMICS DIV OF AVX CORP	19TH AVE SOUTH P O BOX 867	MYRTLE BEACH SC 29577
04713	MOTOROLA INC SEMICONDUCTOR GROUP	5005 E MCDOWELL RD	PHOENIX AZ 85008
05828	GENERAL INSTRUMENT CORP GOVERNMENT SYSTEMS DIV	600 W JOHN ST	HICKSVILLE NY 11802
07263	FAIRCHILD CAMERA AND INSTRUMENT CORP SEMICONDUCTOR DIV	464 ELLIS ST	MOUNTAIN VIEW CA 94042
07716	TRW INC TRW ELECTRONICS COMPONENTS TRW IRC FIXED RESISTORS/BURLINGTON	2850 MT PLEASANT AVE	BURLINGTON IA 52601
09922	BURNDY CORP	RICHARDS AVE	NORWALK CT 06852
12697	CLAROSTAT MFG CO INC	LOWER WASHINGTON ST	DOVER NH 03820
14193	CAL-R INC	1601 OLYMPIC BLVD	SANTA MONICA CA 90404
15513	DATA DISPLAY PRODUCTS	303 N OAK ST	LOS ANGELES CA 90302
19701	MEPCO/ELECTRA INC A NORTH AMERICAN PHILIPS CO	P O BOX 760	MINERAL WELLS TX 76067
22526	DU PONT E I DE NEMOURS AND CO INC DU PONT CONNECTOR SYSTEMS	30 HUNTER LANE	CAMP HILL PA 17011
24546	CORNING GLASS WORKS	550 HIGH ST	BRADFORD PA 16701
27014	NATIONAL SEMICONDUCTOR CORP	2900 SEMICONDUCTOR DR	SANTA CLARA CA 95051
32293	INTERSIL INC	10900 N TANTAU AVE	CUPERTINO CA 95014
32997	BOURNS INC TRIMPOT DIV	1200 COLUMBIA AVE	RIVERSIDE CA 92507
34649	INTEL CORP	3065 BOWERS AVE	SANTA CLARA CA 95051
50434	HEWLETT-PACKARD CO OPTOELECTRONICS DIV	640 PAGE MILL RD	PALO ALTO CA 94304
50579	LITRONIX INC	19000 HOMESTEAD RD	CUPERTINO CA 95014
51406	MURATA ERIE NORTH AMERICA INC GEORGIA OPERATIONS	1148 FRANKLIN RD SE	MARIETTA GA 30067
53387	MINNESOTA MINING AND MFG CO ELECTRONIC PRODUCTS DIV	3M CENTER	ST PAUL MN 55101
54473	MATSUSHITA ELECTRIC CORP OF AMERICA	ONE PANASONIC WAY	SECAUCUS NJ 07094
55680	NICHICON /AMERICA/ CORP	927 E STATE PKY	SCHAUMBURG IL 60195
57668	ROHM CORP	16931 MILLIKEN AVE	IRVINE CA 92713
59660	TUSONIX INC	2155 N FORBES BLVD	TUCSON, ARIZONA 85705
75042	TRW INC TRW ELECTRONIC COMPONENTS IRC FIXED RESISTORS PHILADELPHIA DIV	401 N BROAD ST	PHILADELPHIA PA 19108
76493	BELL INDUSTRIES INC MILLER J W DIV	19070 REYES AVE P O BOX 5825	COMPTON CA 90224
80009	TEKTRONIX INC	4900 S W GRIFFITH DR P O BOX 500	BEAVERTON OR 97077
91293	JOHANSON MFG CO	P O BOX 329	BOONTON NJ 07005
91637	DALE ELECTRONICS INC	P O BOX 609	COLUMBUS NE 68601
TK1345	ZMAN AND ASSOCIATES	7633 S 180TH	KENT WA 98032
TK1483	TEKA PRODUCTS INC	45 SALEM ST	PROVIDENCE RI 02907

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1	670-9808-00			CIRCUIT BD ASSY:AMPLIFIER	80009	670-9808-00
A2	670-9809-00			CIRCUIT BD ASSY:FRONT PANEL	80009	670-9809-00
A1	670-9808-00			CIRCUIT BD ASSY:AMPLIFIER	80009	670-9808-00
A1C33	290-0745-00			CAP,FXD,ELCTLT:22UF,+50-10%,25V	54473	ECE-A25V22L
A1C35	290-0782-00			CAP,FXD,ELCTLT:4.7UF,+75-10%,35VDC	55680	ULB1V4R7TAAANA
A1C42	290-0745-00			CAP,FXD,ELCTLT:22UF,+50-10%,25V	54473	ECE-A25V22L
A1C43	290-0745-00			CAP,FXD,ELCTLT:22UF,+50-10%,25V	54473	ECE-A25V22L
A1C44	290-0745-00			CAP,FXD,ELCTLT:22UF,+50-10%,25V	54473	ECE-A25V22L
A1C46	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-610-Y5U0102P
A1C108	290-0745-00			CAP,FXD,ELCTLT:22UF,+50-10%,25V	54473	ECE-A25V22L
A1C115	290-0745-00			CAP,FXD,ELCTLT:22UF,+50-10%,25V	54473	ECE-A25V22L
A1C118	290-0745-00			CAP,FXD,ELCTLT:22UF,+50-10%,25V	54473	ECE-A25V22L
A1C144	283-0666-00			CAP,FXD,MICA DI:890PF,2%,100V	00853	D151F891G0
A1C148	283-0100-00			CAP,FXD,CER DI:0.0047UF,10%,200V	04222	SR306A472KAA
A1C150	283-0268-00			CAP,FXD,CER DI:0.015UF,20%,50V	04222	3439-050C-153K
A1C152	283-0249-00			CAP,FXD,CER DI:0.068PF,10%,50V	04222	SR305C683KAA
A1C162	281-0123-00			CAP,VAR,CER DI:5-25PF,100V	59660	518-000A5-25
A1C239	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR302E105ZAATR
A1C240	283-0249-00			CAP,FXD,CER DI:0.068PF,10%,50V	04222	SR305C683KAA
A1C254	283-0408-00			CAP,FXD,CER DI:0.68UF,+100-0%,12V	91293	12OS41Y684PP2S
A1C256	283-0408-00			CAP,FXD,CER DI:0.68UF,+100-0%,12V	91293	12OS41Y684PP2S
A1C260	283-0249-00			CAP,FXD,CER DI:0.068PF,10%,50V	04222	SR305C683KAA
A1C356	283-0326-00			CAP,FXD,CER DI:0.082UF,10%,50V	51406	RPE111X7R823K50V
A1CR42	152-0066-00			SEMICOND DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
A1CR43	152-0066-00			SEMICOND DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
A1CR44	152-0066-00			SEMICOND DVC,DI:RECT,SI,400V,1A,DO-41	05828	GP10G-020
A1CR114	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V	03508	DA2527 (1N4152)
A1CR124	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V	03508	DA2527 (1N4152)
A1CR133	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V	03508	DA2527 (1N4152)
A1CR134	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V	03508	DA2527 (1N4152)
A1CR135	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V	03508	DA2527 (1N4152)
A1CR136	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V	03508	DA2527 (1N4152)
A1CR229	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V	03508	DA2527 (1N4152)
A1CR230	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V	03508	DA2527 (1N4152)
A1CR234	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V	03508	DA2527 (1N4152)
A1J70	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY OF 3)	22526	48283-036
A1J184	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY OF 5)	22526	48283-036
A1J501	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY OF 5)	22526	48283-036
A1J502	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY OF 5)	22526	48283-036
A1J503	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY OF 2)	22526	48283-036
A1J504	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY OF 2)	22526	48283-036
A1L42	108-0538-00			COIL,RF:FIXED,2.7UH	76493	JWM#B7059
A1L43	108-0538-00			COIL,RF:FIXED,2.7UH	76493	JWM#B7059
A1L44	108-0538-00			COIL,RF:FIXED,2.7UH	76493	JWM#B7059
A1L166	108-0245-00			CHOKE,RF:FIXED,3.9UH	76493	B6310-1
A1L245	108-0212-00			COIL,RF:FIXED,495NH	80009	108-0212-00
A1L245	108-0595-00			COIL,RF:FIXED,49NH (L245,SELECTED)	TK1345	108-0595-00
A1L362	108-0436-00			COIL,RF:FIXED,240NH	80009	108-0436-00
A1L363	108-0436-00			COIL,RF:FIXED,240NH	80009	108-0436-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1LR240	108-0924-00			COIL,RF:FIXED,1.9UH	TK1345	108-0924-00
A1LR240	108-0924-01			COIL,RF:FIXED,1.7UH	TK1345	108-0924-01
A1LR240	108-0924-02			COIL,RF:FIXED,1.7UH (LR240,SELECTED)	TK1345	108-0924-02
A1LR241	108-0271-00			COIL,RF:FIXED,235NH	80009	108-0271-00
A1LR241	108-0468-00			COIL,RF:FIXED,120NH (LR241,SELECTED)	TK1345	108-0468-00
A1LR260	108-0924-00			COIL,RF:FIXED,1.9UH	TK1345	108-0924-00
A1LR260	108-0924-01			COIL,RF:FIXED,1.7UH	TK1345	108-0924-01
A1LR260	108-0924-02			COIL,RF:FIXED,1.7UH (LR260,SELECTED)	TK1345	108-0924-02
A1LR261	108-0271-00			COIL,RF:FIXED,235NH	80009	108-0271-00
A1LR261	108-0468-00			COIL,RF:FIXED,120NH (LR261,SELECTED)	TK1345	108-0468-00
A1Q32	151-0301-00			TRANSISTOR:PNP,SI,TO-18	04713	ST898
A1Q114	151-0301-00			TRANSISTOR:PNP,SI,TO-18	04713	ST898
A1Q124	151-0302-00			TRANSISTOR:NPN,SI,TO-18	04713	ST899
A1Q184	151-0302-00			TRANSISTOR:NPN,SI,TO-18	04713	ST899
A1Q226	151-0261-00			TRANSISTOR:PNP,SI,TO-77	04713	SD441
A1Q248	151-0301-00			TRANSISTOR:PNP,SI,TO-18	04713	ST898
A1Q268	151-0301-00			TRANSISTOR:PNP,SI,TO-18	04713	ST898
A1Q342	151-0302-00			TRANSISTOR:NPN,SI,TO-18	04713	ST899
A1R31	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R32	308-0231-00			RES,FXD,WW:220 OHM,5%,3W	01686	T28-79-220-5
A1R33	315-0153-00			RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15K00J
A1R36	321-0356-00			RES,FXD,FILM:49.9K OHM,1%,0.125W,TC=T0	19701	5033ED49K90F
A1R37	321-0327-00			RES,FXD,FILM:24.9K OHM,1%,0.125W,TC=T0	07716	CEAD24901F
A1R41	315-0510-00			RES,FXD,FILM:51 OHM,5%,0.25W	19701	5043CX51R00J
A1R42	315-0510-00			RES,FXD,FILM:51 OHM,5%,0.25W	19701	5043CX51R00J
A1R46	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A1R107	311-1227-00			RES,VAR,NONWW:TRMR,5K OHM,0.5W	32997	3386F-T04-502
A1R109	313-1202-00			RES,FXD,FILM:2K OHM,5%,0.2W	57668	TR20JE02K0
A1R110	315-0682-00			RES,FXD,FILM:6.8K OHM,5%,0.25W	57668	NTR25J-E06K8
A1R111	315-0151-00			RES,FXD,FILM:150 OHM,5%,0.25W	57668	NTR25J-E150E
A1R112	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R113	321-0315-00			RES,FXD,FILM:18.7K OHM,1%,0.125W,TC=T0	19701	5043ED18K70F
A1R115	315-0200-00			RES,FXD,FILM:20 OHM,5%,0.25W	19701	5043CX20R00J
A1R120	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A1R121	315-0151-00			RES,FXD,FILM:150 OHM,5%,0.25W	57668	NTR25J-E150E
A1R122	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R123	321-1289-07			RES,FXD,FILM:10.1K OHM,0.1%,0.125W,TC=T9	19701	5033RE10K108
A1R124	311-1223-00			RES,VAR,NONWW:TRMR,250 OHM,0.5W	32997	3386F-T04-251
A1R125	321-0289-06			RES,FXD,FILM:10.0K OHM,0.25%,0.125W,TC=T9	19701	5033RE10K00C
A1R130	313-1682-00			RES,FXD,FILM:6.8K OHM,5%,0.2W	57668	TR20JE 06K8
A1R131	313-1821-00			RES,FXD,FILM:820 OHM,5%,0.2W	57668	TR20JE 820E
A1R132	315-0303-00			RES,FXD,FILM:30K OHM,5%,0.25W	19701	5043CX30K00J
A1R133	321-0260-00			RES,FXD,FILM:4.99K OHM,1%,0.125W,TC=T0	19701	5033ED4K990F
A1R134	321-0260-00			RES,FXD,FILM:4.99K OHM,1%,0.125W,TC=T0	19701	5033ED4K990F
A1R135	321-0190-00			RES,FXD,FILM:931 OHM,1%,0.125W,TC=T2	19701	5043ED931R0F
A1R140	311-1228-00			RES,VAR,NONWW:TRMR,10K OHM,0.5W	32997	3386F-T04-103
A1R141	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	57668	NTR25J-E47K0
A1R142	315-0392-00			RES,FXD,FILM:3.9K OHM,5%,0.25W	57668	NTR25J-E03K9
A1R143	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	57668	NTR25J-E47K0
A1R144	311-1228-00			RES,VAR,NONWW:TRMR,10K OHM,0.5W	32997	3386F-T04-103
A1R145	321-0222-00			RES,FXD,FILM:2.00K OHM,1%,0.125W,TC=T0	19701	5033ED2K00F
A1R146	311-1226-00			RES,VAR,NONWW:TRMR,2.5K OHM,0.5W	32997	3386F-T04-252
A1R147	321-0289-00			RES,FXD,FILM:10.0K OHM,1%,0.125W,TC=T0	19701	5033ED10K0F
A1R148	311-1230-00			RES,VAR,NONWW:TRMR,20K OHM,0.5W	32997	3386F-T04-203
A1R149	315-0823-00			RES,FXD,FILM:82K OHM,5%,0.25W	57668	NTR25J-E82K
A1R150	311-1232-00			RES,VAR,NONWW:TRMR,50K OHM,0.5W	32997	3386F-T04-503

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1R151	315-0822-00			RES,FXD,FILM:8.2K OHM,5%,0.25W	19701	5043CX8K200J
A1R152	311-1235-00			RES,VAR,NONWW:100K OHM,0.5W	32997	3386F-T04-104
A1R153	315-0303-00			RES,FXD,FILM:30K OHM,5%,0.25W	19701	5043CX30K00J
A1R154	315-0204-00			RES,FXD,FILM:200K OHM,5%,0.25W	19701	5043CX200K0J
A1R155	321-0314-00			RES,FXD,FILM:18.2K OHM,1%,0.125W,TC=T0	19701	5043ED18K20F
A1R162	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	57668	NTR25J-E 20K
A1R163	313-1151-00			RES,FXD,FILM:150 OHM,5%,0.2W	57668	TR20JE150E
A1R164	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
A1R166	321-0133-00			RES,FXD,FILM:237 OHM,1%,0.125W,TC=T0	07716	CEAD237R0F
A1R170	311-1235-00			RES,VAR,NONWW:100K OHM,0.5W	32997	3386F-T04-104
A1R171	315-0474-00			RES,FXD,FILM:470K OHM,5%,0.25W	19701	5043CX470K0J92U
A1R172	315-0204-00			RES,FXD,FILM:200K OHM,5%,0.25W	19701	5043CX200K0J
A1R173	315-0124-00			RES,FXD,FILM:120K OHM,5%,0.25W	19701	5043CX120K0J
A1R174	315-0683-00			RES,FXD,FILM:68K OHM,5%,0.25W	57668	NTR25J-E68K0
A1R175	311-1235-00			RES,VAR,NONWW:100K OHM,0.5W	32997	3386F-T04-104
A1R176	315-0474-00			RES,FXD,FILM:470K OHM,5%,0.25W	19701	5043CX470K0J92U
A1R177	315-0204-00			RES,FXD,FILM:200K OHM,5%,0.25W	19701	5043CX200K0J
A1R178	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
A1R179	315-0394-00			RES,FXD,FILM:390K OHM,5%,0.25W	57668	NTR25J-E390K
A1R182	315-0513-00			RES,FXD,FILM:51K OHM,5%,0.25W	57668	NTR25J-E51K0
A1R183	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
A1R184	315-0333-00			RES,FXD,FILM:33K OHM,5%,0.25W	57668	NTR25J-E33K0
A1R185	315-0272-00			RES,FXD,FILM:2.7K OHM,5%,0.25W	57668	NTR25J-E02K7
A1R186	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	57668	NTR25J-E47K0
A1R187	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
A1R212	311-1466-00			RES,VAR,NONWW:TRMR,2K OHM,0.5W	32997	3386F-T04-202
A1R219	321-0202-00			RES,FXD,FILM:1.24K OHM,1%,0.125W,TC=T0	24546	NA55D1241F
A1R221	321-0257-00			RES,FXD,FILM:4.64K OHM,1%,0.125W,TC=T0	19701	5043ED4K640F
A1R223	321-0286-00			RES,FXD,FILM:9.31K OHM,1%,0.125W,TC=T0	19701	5033ED9K310F
A1R224	321-0400-00			RES,FXD,FILM:143K OHM,1%,0.125W,TC=T0	19701	5043ED143K0F
A1R225	321-0162-00			RES,FXD,FILM:475 OHM,1%,0.125W,TC=T0	19701	5033ED475R0F
A1R226	321-0223-00			RES,FXD,FILM:2.05K OHM,1%,0.125W,TC=T0	80009	321-0223-00
A1R227	321-0223-00			RES,FXD,FILM:2.05K OHM,1%,0.125W,TC=T0	80009	321-0223-00
A1R228	321-0428-00			RES,FXD,FILM:280K OHM,1%,0.125W,TC=T0	24546	NA55D2803F
A1R229	323-0310-00			RES,FXD,FILM:16.5K OHM,1%,0.5W,TC=T0	75042	CECT0-1652F
A1R230	321-0295-00			RES,FXD,FILM:11.5K OHM,1%,0.125W,TC=T0	07716	CEAD11501F
A1R231	321-0281-00			RES,FXD,FILM:8.25K OHM,1%,0.125W,TC=T0	19701	5043ED8K250F
A1R232	321-0289-03			RES,FXD,FILM:10.0K OHM,0.25%,0.125W,TC=T2	07716	CEAC10001C
A1R233	321-0612-03			RES,FXD,FILM:500 OHM,0.25%,0.125W,TC=T2	19701	5033RC500R0C
A1R234	321-0289-03			RES,FXD,FILM:10.0K OHM,0.25%,0.125W,TC=T2	07716	CEAC10001C
A1R235	321-0363-00			RES,FXD,FILM:59.0K OHM,1%,0.125W,TC=T0	07716	CEAD59001F
A1R236	321-0289-00			RES,FXD,FILM:10.0K OHM,1%,0.125W,TC=T0	19701	5033ED10K0F
A1R237	313-1510-00			RES,FXD,FILM:51 OHM,5%,0.2W	80009	313-1510-00
A1R238	313-1510-00			RES,FXD,FILM:51 OHM,5%,0.2W	80009	313-1510-00
A1R239	313-1510-00			RES,FXD,FILM:51 OHM,5%,0.2W	80009	313-1510-00
A1R240	315-0150-00			RES,FXD,FILM:15 OHM,5%,0.25W	19701	5043CX15R00J
A1R241	321-0318-00			RES,FXD,FILM:20.0K OHM,1%,0.125W,TC=T0	19701	5033ED20K00F
A1R242	321-0318-00			RES,FXD,FILM:20.0K OHM,1%,0.125W,TC=T0	19701	5033ED20K00F
A1R243	313-1391-00			RES,FXD,FILM:390 OHM,5%,0.2W	57668	TR20JE 390E
A1R244	321-1313-07			RES,FXD,FILM:18.0K OHM,0.1%,0.125W	24546	NE55E 1802B
A1R245	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
A1R246	315-0511-00			RES,FXD,FILM:510 OHM,5%,0.25W	19701	5043CX510R0J
A1R247	313-1391-00			RES,FXD,FILM:390 OHM,5%,0.2W	57668	TR20JE 390E
A1R248	321-0059-00			RES,FXD,FILM:40.2 OHM,0.5%,0.125W,TC=T0	91637	CMF55116G40R20F
A1R249	321-0318-00			RES,FXD,FILM:20.0K OHM,1%,0.125W,TC=T0	19701	5033ED20K00F
A1R261	321-0289-07			RES,FXD,FILM:10.0K OHM,0.1%,0.125W,TC=T9	19701	5033RE10K00B
A1R262	321-0289-07			RES,FXD,FILM:10.0K OHM,0.1%,0.125W,TC=T9	19701	5033RE10K00B
A1R263	321-0314-00			RES,FXD,FILM:18.2K OHM,1%,0.125W,TC=T0	19701	5043ED18K20F
A1R264	321-1313-07			RES,FXD,FILM:18.0K OHM,0.1%,0.125W	24546	NE55E 1802B

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1R265	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
A1R266	315-0511-00			RES,FXD,FILM:510 OHM,5%,0.25W	19701	5043CX510R0J
A1R267	321-1313-07			RES,FXD,FILM:18.0K OHM,0.1%,0.125W	24546	NE55E 18020
A1R268	321-0059-00			RES,FXD,FILM:40.2 OHM,0.5%,0.125W,TC=T0	91637	CMF55116G40R20F
A1R269	321-0289-07			RES,FXD,FILM:10.0K OHM,0.1%,0.125W,TC=T9	19701	5033RE10K00B
A1R270	311-1235-00			RES,VAR,NONWW:100K OHM,0.5W	32997	3386F-T04-104
A1R271	315-0245-00			RES,FXD,FILM:2.4M OHM,5%,0.25W	01121	CB2455
A1R276	315-0245-00			RES,FXD,FILM:2.4M OHM,5%,0.25W	01121	CB2455
A1R277	315-0105-00			RES,FXD,FILM:1M OHM,5%,0.25W	19701	5043CX1M000J
A1R306	313-1101-00			RES,FXD,FILM:100 OHM,5%,0.2W	57668	TR20JE100E
A1R307	313-1101-00			RES,FXD,FILM:100 OHM,5%,0.2W	57668	TR20JE100E
A1R312	321-0280-00			RES,FXD,FILM:8.06K OHM,1%,0.125W,TC=T0	19701	5033ED8K060F
A1R313	321-1296-03			RES,FXD,FILM:12.0K OHM,0.25%,0.125W,TC=T2	07716	CEAC12001C
A1R314	301-0201-00			RES,FXD,FILM:200 OHM,5%,0.5W	19701	5053CX200R0J
A1R315	323-0116-00			RES,FXD,FILM:158 OHM,1%,0.5W,TC=T0	19701	5053RD158R0F
A1R316	315-0131-00			RES,FXD,FILM:130 OHM,5%,0.25W	19701	5043CX130R0J
A1R318	323-0120-00			RES,FXD,FILM:174 OHM,1%,0.5W,TC=T0	24546	NA65D 1740F
A1R333	321-0231-00			RES,FXD,FILM:2.49K OHM,1%,0.125W,TC=T0	19701	5033ED2K49F
A1R334	321-0298-09			RES,FXD,FILM:12.4K OHM,1%,0.125W,TC=T9	01121	ORDER BY DESCR
A1R335	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R336	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A1R337	313-1510-00			RES,FXD,FILM:51 OHM,5%,0.2W	80009	313-1510-00
A1R338	313-1510-00			RES,FXD,FILM:51 OHM,5%,0.2W	80009	313-1510-00
A1R342	315-0510-00			RES,FXD,FILM:51 OHM,5%,0.25W	19701	5043CX51R00J
A1R343	321-0286-00			RES,FXD,FILM:9.31K OHM,1%,0.125W,TC=T0	19701	5033ED9K310F
A1R344	321-0126-00			RES,FXD,FILM:200 OHM,1%,0.125W,TC=T0	19701	5033ED200R0F
A1R352	313-1510-00			RES,FXD,FILM:51 OHM,5%,0.2W	80009	313-1510-00
A1R353	313-1510-00			RES,FXD,FILM:51 OHM,5%,0.2W	80009	313-1510-00
A1R354	313-1510-00			RES,FXD,FILM:51 OHM,5%,0.2W	80009	313-1510-00
A1R355	313-1510-00			RES,FXD,FILM:51 OHM,5%,0.2W	80009	313-1510-00
A1R356	313-1121-00			RES,FXD,FILM:120 OHM,5%,0.2W	80009	313-1121-00
A1R357	313-1121-00			RES,FXD,FILM:120 OHM,5%,0.2W	80009	313-1121-00
A1R362	323-0184-00			RES,FXD,FILM:806 OHM,1%,0.5W,TC=T0	24546	NA65D806F
A1R363	323-0184-00			RES,FXD,FILM:806 OHM,1%,0.5W,TC=T0	24546	NA65D806F
A1R365	311-1221-00			RES,VAR,NONWW:TRMR,50 OHM,0.5W	32997	3386F-T04-500
A1RT108	307-0642-00			RES,THERMAL:10K OHM,5%,25 DEG C	01295	TG1/8 103J
A1RT129	307-0477-00			RES,THERMAL:1K OHM,10%,6MW/DEG C	14193	2J21
A1RT317	307-0126-00			RES,THERMAL:100 OHM,10%,NTC	14193	2D21-101-D
A1RT345	307-0250-00			RES,THERMAL:390 OHM,10%,0.125W	01295	TG1/8 391K
A1TP0	214-0579-00			TERM,TEST POINT:BRS CD PL (QUANTITY OF 4)	80009	214-0579-00
A1U36	156-0067-00			MICROCKT,LINEAR:OPNL AMPL,SEL	04713	MC1741CP1
A1U100	155-0180-00			MICROCKT,LINEAR:FAST INPUT PROTECTION	80009	155-0180-00
A1U111	156-0067-00			MICROCKT,LINEAR:OPNL AMPL,SEL	04713	MC1741CP1
A1U121	156-0067-00			MICROCKT,LINEAR:OPNL AMPL,SEL	04713	MC1741CP1
A1U132	156-0770-00			MICROCKT,LINEAR:OPNL AMPL	27014	LF356H
A1U162	156-0770-00			MICROCKT,LINEAR:OPNL AMPL	27014	LF356H
A1U174	156-0067-00			MICROCKT,LINEAR:OPNL AMPL,SEL	04713	MC1741CP1
A1U178	156-0644-00			MICROCKT,DGTL:CMOS,QUAD BILATERAL SW,CHK	04713	MC14066BCL
A1U228	156-0644-00			MICROCKT,DGTL:CMOS,QUAD BILATERAL SW,CHK	04713	MC14066BCL
A1U234	156-0158-04			MICROCKT,LINEAR:DUAL OPNL AMPL	01295	MC1458JG
A1U246	156-0067-00			MICROCKT,LINEAR:OPNL AMPL,SEL	04713	MC1741CP1
A1U255	155-0181-00			MICROCKT,LINEAR:INPUT AMPLIFIER	80009	155-0181-00
A1U266	156-0067-00			MICROCKT,LINEAR:OPNL AMPL,SEL	04713	MC1741CP1
A1U314	156-0067-00			MICROCKT,LINEAR:OPNL AMPL,SEL	04713	MC1741CP1
A1U322	155-0175-00			MICROCKT,LINEAR:TRIGGER AMPLIFIER	80009	155-0175-00
A1U334	156-0158-04			MICROCKT,LINEAR:DUAL OPNL AMPL	01295	MC1458JG
A1U352	155-0175-00			MICROCKT,LINEAR:TRIGGER AMPLIFIER	80009	155-0175-00
A1VR254	153-0069-00			SEMICOND DVC SE:1N4742A FAMILY,MATCHED PAIR	80009	153-0069-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1VR256	153-0069-00			SEMICOND DVC SE:1N4742A FAMILY,MATCHED PAIR	80009	153-0069-00
A2	670-9809-00			CIRCUIT BD ASSY:FRONT PANEL	80009	670-9809-00
A2C550	283-0167-00			CAP,FXD,CER DI:0.1UF,10%,100V	04222	3430-100C-104K
A2C611	283-0005-00			CAP,FXD,CER DI:0.01UF,+100-0%,250V	04222	SR303E103ZAA
A2C621	283-0203-00			CAP,FXD,CER DI:0.47UF,20%,50V	04222	SR305SC474MAA
A2C631	283-0203-00			CAP,FXD,CER DI:0.47UF,20%,50V	04222	SR305SC474MAA
A2CR66	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V	03508	DA2527 (1N4152)
A2CR501	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V	03508	DA2527 (1N4152)
A2CR507	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V	03508	DA2527 (1N4152)
A2CR509	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V	03508	DA2527 (1N4152)
A2CR511	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V	03508	DA2527 (1N4152)
A2CR513	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V	03508	DA2527 (1N4152)
A2CR515	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V	03508	DA2527 (1N4152)
A2CR517	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V	03508	DA2527 (1N4152)
A2CR519	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V	03508	DA2527 (1N4152)
A2CR579	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V	03508	DA2527 (1N4152)
A2CR611	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V	03508	DA2527 (1N4152)
A2CR613	152-0322-00			SEMICOND DVC,DI:SCHOTTKY BARRIER,SI,15V	50434	5082-2672
A2DS60	150-1000-00			LT EMITTING DIO:RED,650NM,40MA MAX	50579	RL-50
A2DS65	150-1000-00			LT EMITTING DIO:RED,650NM,40MA MAX	50579	RL-50
A2DS581	150-1000-00			LT EMITTING DIO:RED,650NM,40MA MAX	50579	RL-50
A2DS583	150-1000-00			LT EMITTING DIO:RED,650NM,40MA MAX	50579	RL-50
A2DS585	150-1000-00			LT EMITTING DIO:RED,650NM,40MA MAX	50579	RL-50
A2DS590	150-1090-00			LT EMITTING DIO:RED,660NM,30MA	15513	SP850211
A2J70	131-2222-00			CONN,RCPT,ELEC:CKT BD,34 CONT,MALE	TK1483	08-1743-RD01
A2J184	131-2222-00			CONN,RCPT,ELEC:CKT BD,34 CONT,MALE	TK1483	08-1743-RD01
A2J501	131-2222-00			CONN,RCPT,ELEC:CKT BD,34 CONT,MALE	TK1483	08-1743-RD01
A2J502	131-2222-00			CONN,RCPT,ELEC:CKT BD,34 CONT,MALE	TK1483	08-1743-RD01
A2J503	131-2222-00			CONN,RCPT,ELEC:CKT BD,34 CONT,MALE	TK1483	08-1743-RD01
A2J504	131-2222-00			CONN,RCPT,ELEC:CKT BD,34 CONT,MALE	TK1483	08-1743-RD01
A2J601	131-1426-00			CONN,RCPT,ELEC:RTANGLE HEADER,1 X 36	22526	65524-136
A2P603	131-3358-00			CONN,RCPT,ELEC:HEADER,RTANG,10 PIN	53387	3591-5002
A2Q571	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A2Q573	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A2Q575	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A2Q577	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A2Q578	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A2R65	315-0154-00			RES,FXD,FILM:150K OHM,5%,0.25W	57668	NTR25J-E150K
A2R66	315-0133-00			RES,FXD,FILM:13K OHM,5%,0.25W	19701	5043CX13K00J
A2R67	315-0151-00			RES,FXD,FILM:150 OHM,5%,0.25W	57668	NTR25J-E150E
A2R221	311-2373-00			RES,VAR,NONWW:PNL,5K OHM,0.25W	12697	CM45239
A2R222	311-2372-00			RES,VAR,NONWW:PNL,5K OHM,0.25W & 0.5W,2 SPDT SW	12697	CM45238
A2R275	311-2373-00			RES,VAR,NONWW:PNL,5K OHM,0.25W	12697	CM45239
A2R501	321-0325-00			RES,FXD,FILM:23.7K OHM,1%,0.125W,TC=TO	07716	CEAD23701F
A2R507	321-0319-00			RES,FXD,FILM:20.5K OHM,1%,0.125W,TC=TO	19701	5033ED20K50F
A2R509	321-0342-00			RES,FXD,FILM:35.7K OHM,1%,0.125W,TC=TO	07716	CEAD35701F
A2R511	321-0342-00			RES,FXD,FILM:35.7K OHM,1%,0.125W,TC=TO	07716	CEAD35701F
A2R513	321-0325-00			RES,FXD,FILM:23.7K OHM,1%,0.125W,TC=TO	07716	CEAD23701F
A2R515	321-0342-00			RES,FXD,FILM:35.7K OHM,1%,0.125W,TC=TO	07716	CEAD35701F
A2R517	321-0354-00			RES,FXD,FILM:47.5K OHM,1%,0.125W,TC=TO	19701	5043ED47K50F
A2R519	321-0342-00			RES,FXD,FILM:35.7K OHM,1%,0.125W,TC=TO	07716	CEAD35701F
A2R521	315-0154-00			RES,FXD,FILM:150K OHM,5%,0.25W	57668	NTR25J-E150K
A2R523	315-0154-00			RES,FXD,FILM:150K OHM,5%,0.25W	57668	NTR25J-E150K
A2R525	321-0289-00			RES,FXD,FILM:10.0K OHM,1%,0.125W,TC=TO	19701	5033ED10K0F
A2R527	321-0318-00			RES,FXD,FILM:20.0K OHM,1%,0.125W,TC=TO	19701	5033ED20K00F
A2R529	321-0631-00			RES,FXD,FILM:12.5K OHM,1%,0.125W,TC=TO	91637	MFF1816G12501F

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A2R531	321-0327-00			RES,FXD,FILM:24.9K OHM,1%,0.125W,TC=T0	07716	CEA024901F
A2R533	321-0356-00			RES,FXD,FILM:49.9K OHM,1%,0.125W,TC=T0	19701	5033ED49K90F
A2R535	321-0385-00			RES,FXD,FILM:100K OHM,1%,0.125W,TC=T0	19701	5033ED100K0F
A2R537	321-0289-00			RES,FXD,FILM:10.0K OHM,1%,0.125W,TC=T0	19701	5033ED10K0F
A2R539	321-0318-00			RES,FXD,FILM:20.0K OHM,1%,0.125W,TC=T0	19701	5033ED20K00F
A2R541	321-0631-00			RES,FXD,FILM:12.5K OHM,1%,0.125W,TC=T0	91637	MFF1816G12501F
A2R543	321-0327-00			RES,FXD,FILM:24.9K OHM,1%,0.125W,TC=T0	07716	CEA024901F
A2R545	321-0356-00			RES,FXD,FILM:49.9K OHM,1%,0.125W,TC=T0	19701	5033ED49K90F
A2R547	321-0385-00			RES,FXD,FILM:100K OHM,1%,0.125W,TC=T0	19701	5033ED100K0F
A2R557	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A2R559	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A2R561	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A2R563	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A2R565	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A2R571	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	57668	NTR25J-E 20K
A2R573	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	57668	NTR25J-E 20K
A2R575	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	57668	NTR25J-E 20K
A2R577	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	57668	NTR25J-E 20K
A2R578	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	57668	NTR25J-E 20K
A2R579	315-0302-00			RES,FXD,FILM:3K OHM,5%,0.25W	57668	NTR25J-E03K0
A2R581	315-0151-00			RES,FXD,FILM:150 OHM,5%,0.25W	57668	NTR25J-E150E
A2R590	315-0151-00			RES,FXD,FILM:150 OHM,5%,0.25W	57668	NTR25J-E150E
A2R611	315-0105-00			RES,FXD,FILM:1M OHM,5%,0.25W	19701	5043CX1M000J
A2R621	315-0105-00			RES,FXD,FILM:1M OHM,5%,0.25W	19701	5043CX1M000J
A2R623	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
A2R631	315-0105-00			RES,FXD,FILM:1M OHM,5%,0.25W	19701	5043CX1M000J
A2R633	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
A2R641	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A2R643	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A2R645	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A2R647	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A2S60	263-0031-00			SWITCH PB ASSY:2 LATCH,7.5MM,4 CONTACTS	80009	263-0031-00
A2S580	263-0015-02			SWITCH PB ASSY:3 LCH,7.5MM,6 CONTACTS	80009	263-0015-02
A2S650	263-0033-00			SWITCH PB ASSY:1 MOMENTARY,7.5MM,2 CONTACT (QUANTITY OF 2)	80009	263-0033-00
A2U520	156-1191-00			MICROCKT,LINEAR:DUAL BI-FET OPNL AMPL	01295	TL072CP
A2U530	156-0330-02			MICROCKT,DGTL:HEX BUFFER,SCREENED	02735	CD40508FX
A2U540	156-0330-02			MICROCKT,DGTL:HEX BUFFER,SCREENED	02735	CD40508FX
A2U550	156-1417-00			MICROCKT,DGTL:NMOS,2048 X 8 EPROM	34649	D2716-1/S6623
A2U600	156-2957-00			MICROCKT,DGTL:TTL,QUAD HIGH CURRENT PERIPHERAL DRIVER	80009	156-2957-00
A2U610	156-2958-00			MICROCKT,DGTL:HCMOS,SYNC,4 BIT UP/DOWN COUNTER	80009	156-2958-00
A2U620	156-1408-00			MICROCKT,LINEAR:TIMER,LOW POWER	32293	ITS9217
A2U630	156-1508-00			MICROCKT,DGTL:ECL,FAST 6-BIT ADDER	07263	F10018DDC
A2U640	156-0494-02			MICROCKT,DGTL:HEX INV/BUFF,SELECTED	02735	CD4049UBFX
A2W523	131-0566-00			BUS,COND:DUMMY RES,0.094 OD X 0.225L	24546	OMA 07
A2X550	136-0751-00			SKT,PL-IN ELEK:MICROCKT,24 PIN	09922	DILB24P108
U550	160-4269-00			MICROCKT,DGTL:NMOS,2048 X 8 EPROM,PRGM (REPLACEMENT OF U550 MUST BE MATCHED TO OPTICAL MODULE)	80009	160-4269-00

DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols

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.

The overline on a signal name indicates that the signal performs its intended function when it is in the low state.

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.

American National Standard Institute
1430 Broadway
New York, New York 10018

Component Values

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

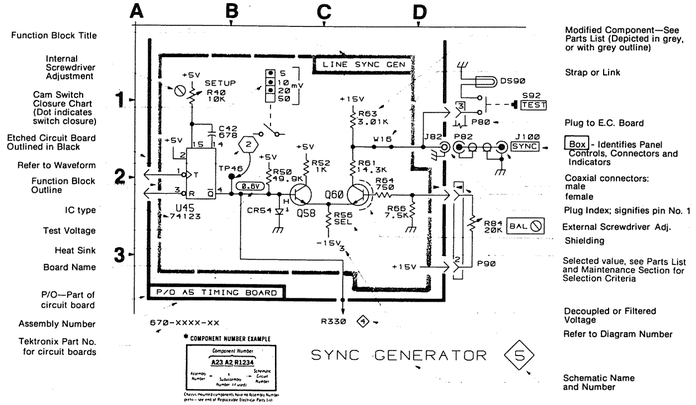
Capacitors = Values one or greater are in picofarads (pF). Values less than one are in microfarads (μF).
Resistors = Ohms (Ω).

The information and special symbols below may appear in this manual.

Assembly Numbers and Grid Coordinates

Each assembly in the instrument is assigned an assembly number (e.g., A20). The assembly number appears on the circuit board outline on the diagram, in the title for the circuit board component location illustration, and in the lookup table for the schematic diagram and corresponding component locator illustration. The Replaceable Electrical Parts list is arranged by assemblies in numerical sequence; the components are listed by component number *(see following illustration for constructing a component number).

The schematic diagram and circuit board component location illustration have grids. A lookup table with the grid coordinates is provided for ease of locating the component. Only the components illustrated on the facing diagram are listed in the lookup table. When more than one schematic diagram is used to illustrate the circuitry on a circuit board, the circuit board illustration may only appear opposite the first diagram on which it was illustrated; the lookup table will list the diagram number of other diagrams that the circuitry of the circuit board appears on.



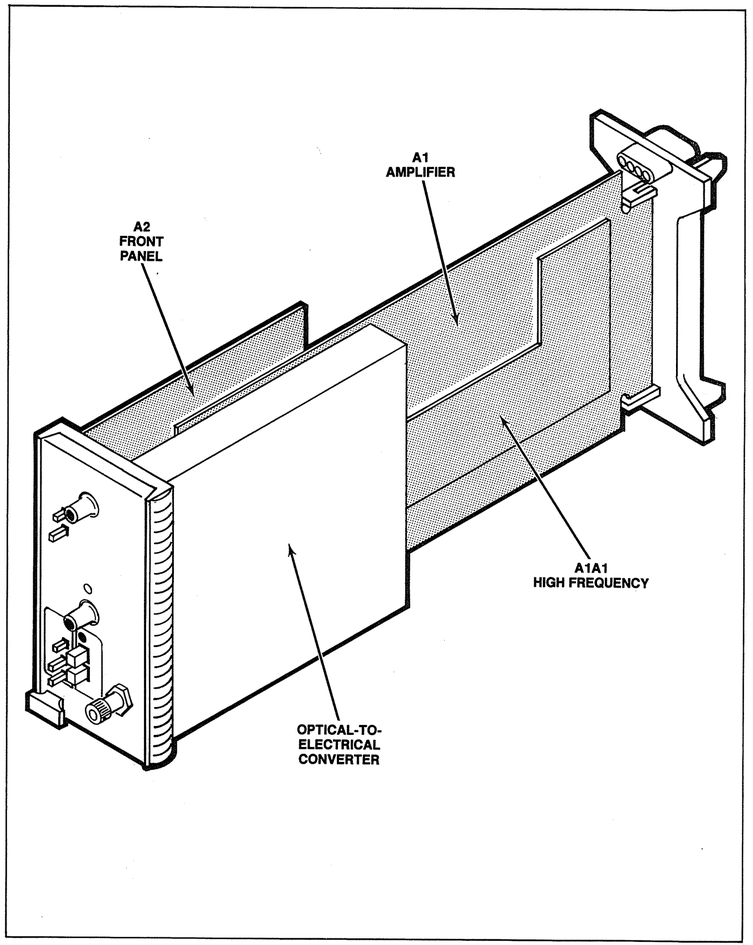


Figure 8-1. Location of circuit boards in the 7F10.

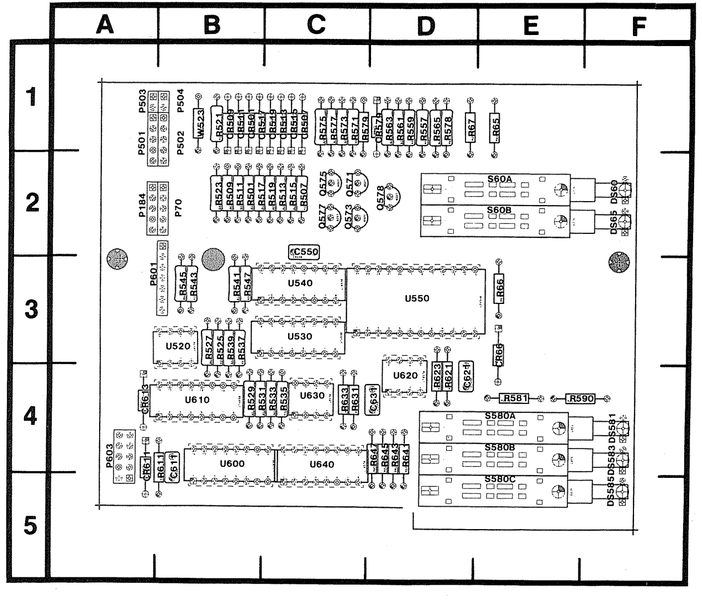


Figure 8-2. A2—Front Panel circuit board assembly (front).

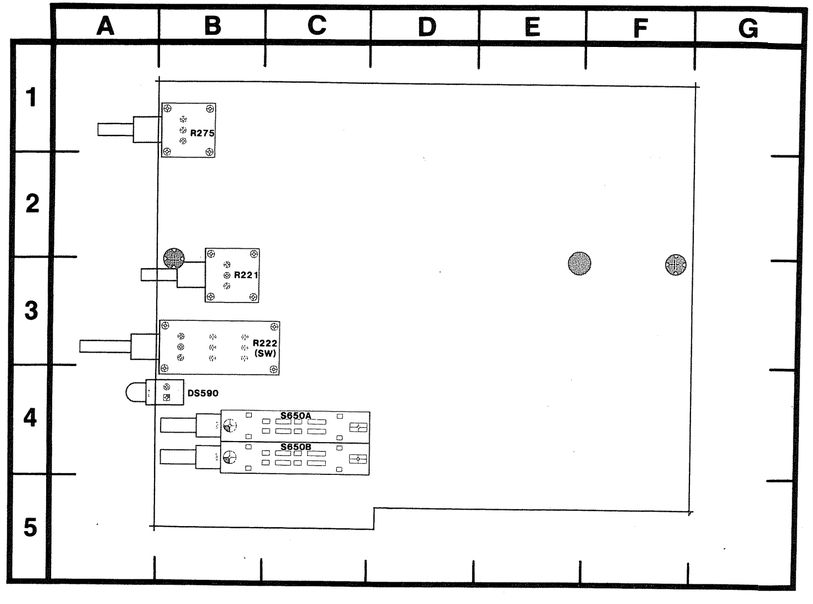
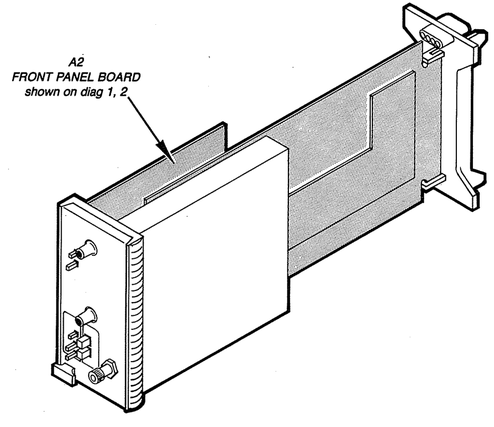


Figure 8-3. A2—Front Panel circuit board assembly (back).



FRONT →

← FRONT

Circuit Number	Schematic Location	Board Location
C550	G5	C2
C611	D3	B4
C621	C4	D4
C631	C4	D4
CR66	G3	E3
CR501	F1	B1
CR507	F1	C1
CR509	G1	B1
CR511	G1	B1
CR513	G2	C1
CR515	G2	C1
CR517	G2	B1
CR519	G2	C1
CR579	C2	D1
CR611	D3	A4
CR613	D4	A4

Circuit Number	Schematic Location	Board Location
DS60	F3	F2
DS65	F3	F2
DS581	D2	F4
DS583	D2	F4
DS585	E2	F5
DS590	G4	B4 (back)
P70	H4	B2
P184	H3	A2
P501	A2	A1
P502	A2	B1
P503	H1	A1
P504	H1	B1
P601	H5	B3
P603	H4	A4
Q571	B2	C2
Q573	B2	C2

Circuit Number	Schematic Location	Board Location
Q575	C2	C2
Q577	C2	C2
Q578	C2	D2
R65	F3	E1
R66	G3	E3
R67	F3	D1
R221	G3	B3 (back)
R222	G4	B3 (back)
R275	G3	B1 (back)
R501	F1	B2
R507	F1	C2
R509	G1	B2
R511	G1	B2
R513	G2	C2
R515	G2	C2
R517	G2	B2
R519	G2	C2

Circuit Number	Schematic Location	Board Location
R521	G2	B1
R523	G2	B2
R525	F1	B3
R527	F1	B3
R529	E1	B4
R531	E1	B4
R533	E1	C4
R535	E1	C4
R537	F1	B3
R539	F2	B3
R541	E2	B3
R543	E2	B3
R545	E2	B3
R547	E1	B3
R557	B1	D1
R559	B1	D1
R561	C1	D1
R563	C1	D1

Circuit Number	Schematic Location	Board Location
R565	C1	D1
R571	B2	C1
R573	B2	C1
R575	B2	C1
R577	B2	C1
R578	C2	D1
R579	C2	C1
R581	D2	E4
R590	G4	E4
R611	D3	B4
R621	C4	D4
R623	C4	D4
R631	C4	C4
R633	C4	C4
R641	B4	D4
R643	B4	D4
R645	B4	D4
R647	B4	D4

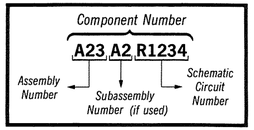
Circuit Number	Schematic Location	Board Location
S60A	F3	E2
S60B	E3	E2
S580A	D2	E4
S580B	D2	E4
S580C	E2	E5
S650A	B3	B4
S650B	B3	B4
U520A	F1	B3
U520B	F1	B3
U530	E1	C3
U540	E2	C3
U550	E1	D3
U600	E4	B4
U610	D4	B4
U620	C4	D4
U630	C4	C4
U640A	B4	C4

Circuit Number	Schematic Location	Board Location
U640B	B4	C4
U640C	B4	C4
U640D	D4	C4
U640F	B3	C4
W523	G3	B1

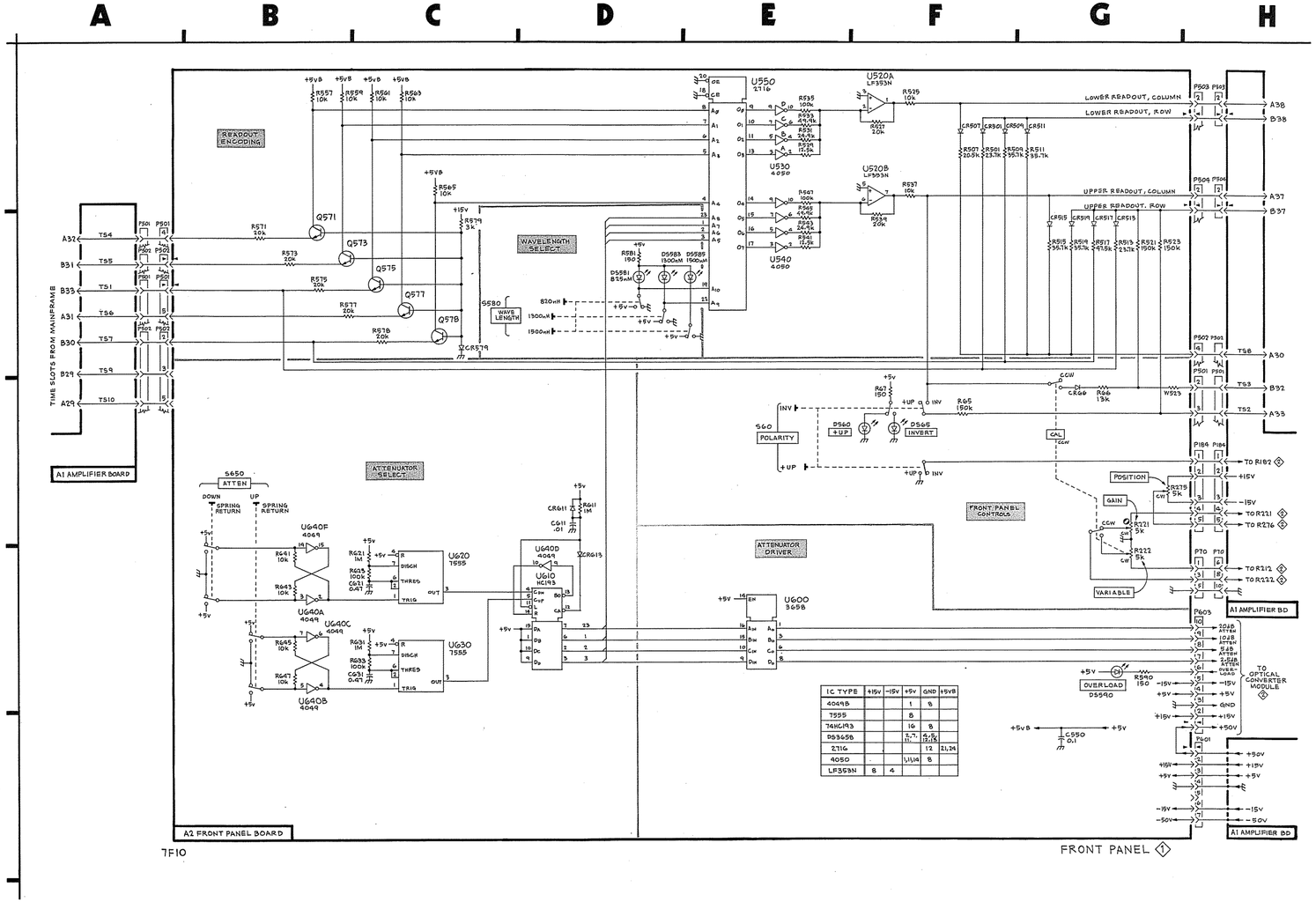
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

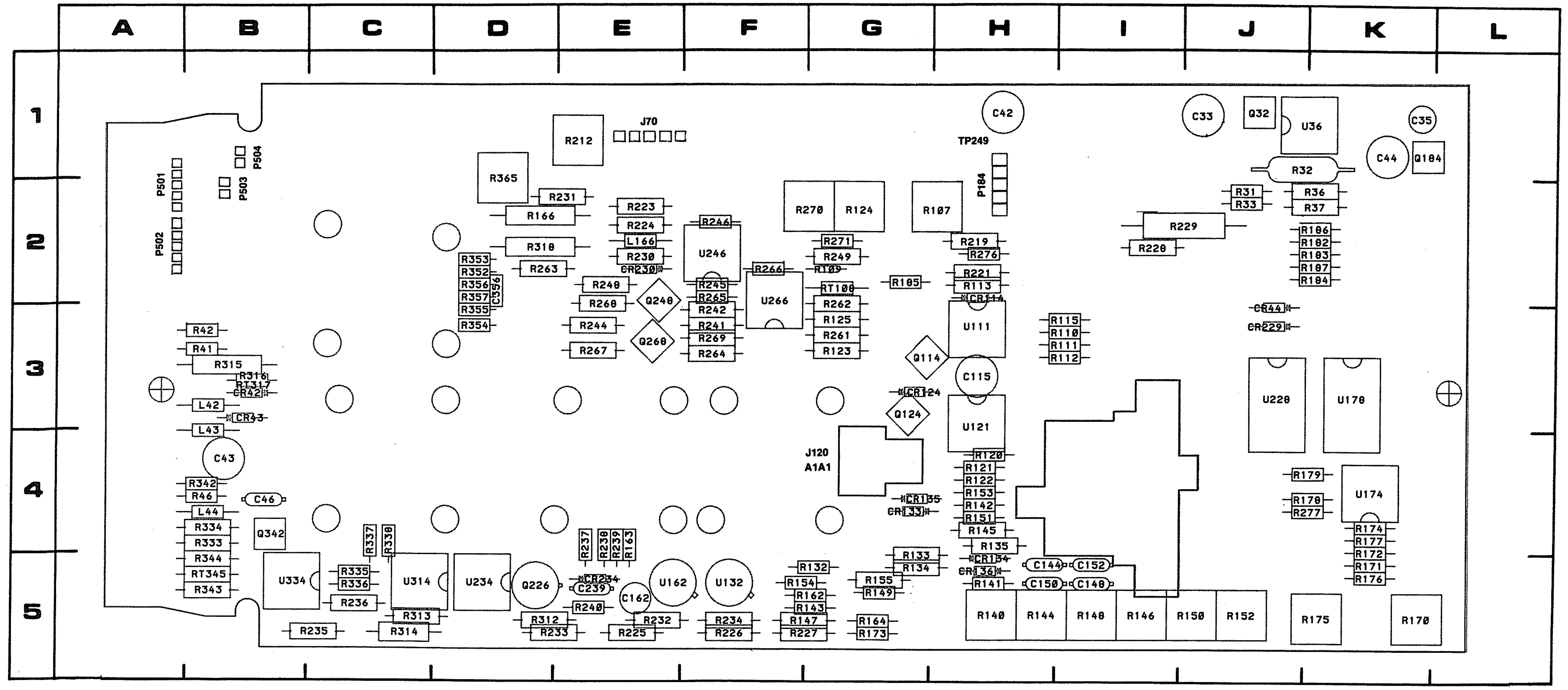
Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE



Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.





FRONT →

Figure 8-4. A1—Amplifier circuit board assembly.

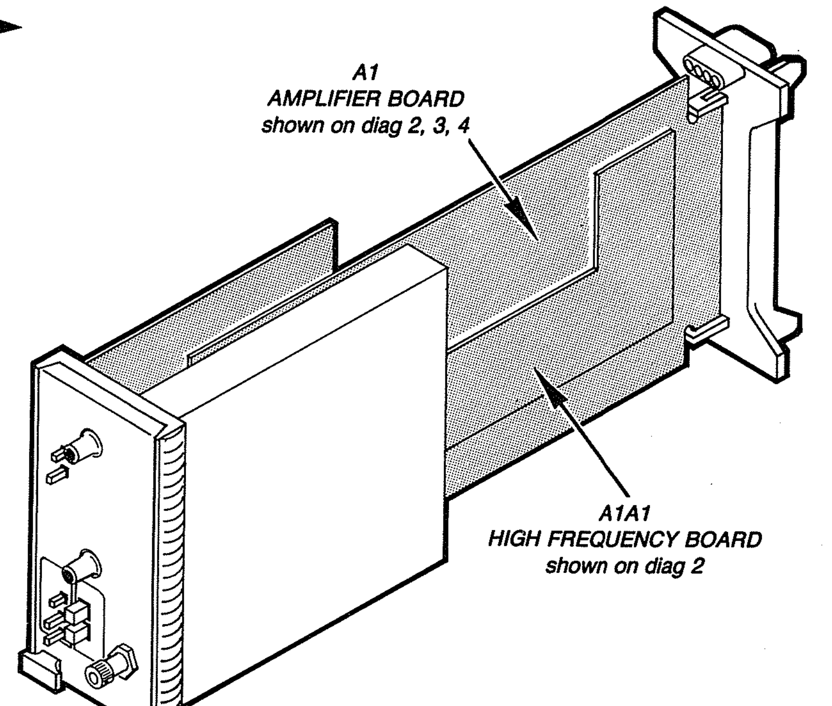
Circuit Number	Schematic Location	Board Location
C115	C2	H3
C144	D3	I 5
C148	D4	I 5
C150	D3	I 5
C152	D4	I 5
C162	E4	E5
C239	E2	E5
CR114	B2	H2
CR124	B4	G3
CR133	C3	G4
CR134	C3	H5
CR135	C3	G4
CR136	C3	H5
CR229	F1	J3
CR230	F1	E2
CR234	E2	E5
L166	E3	E2
P70	D1	E1
P184	C1	H1
P184	C5	H1
P184	H2	H1
P603	A3	Optical Module
Q114	B1	G3
Q124	B4	G3
Q184	D5	L1
Q226A	F1	D5
Q226B	E1	D5

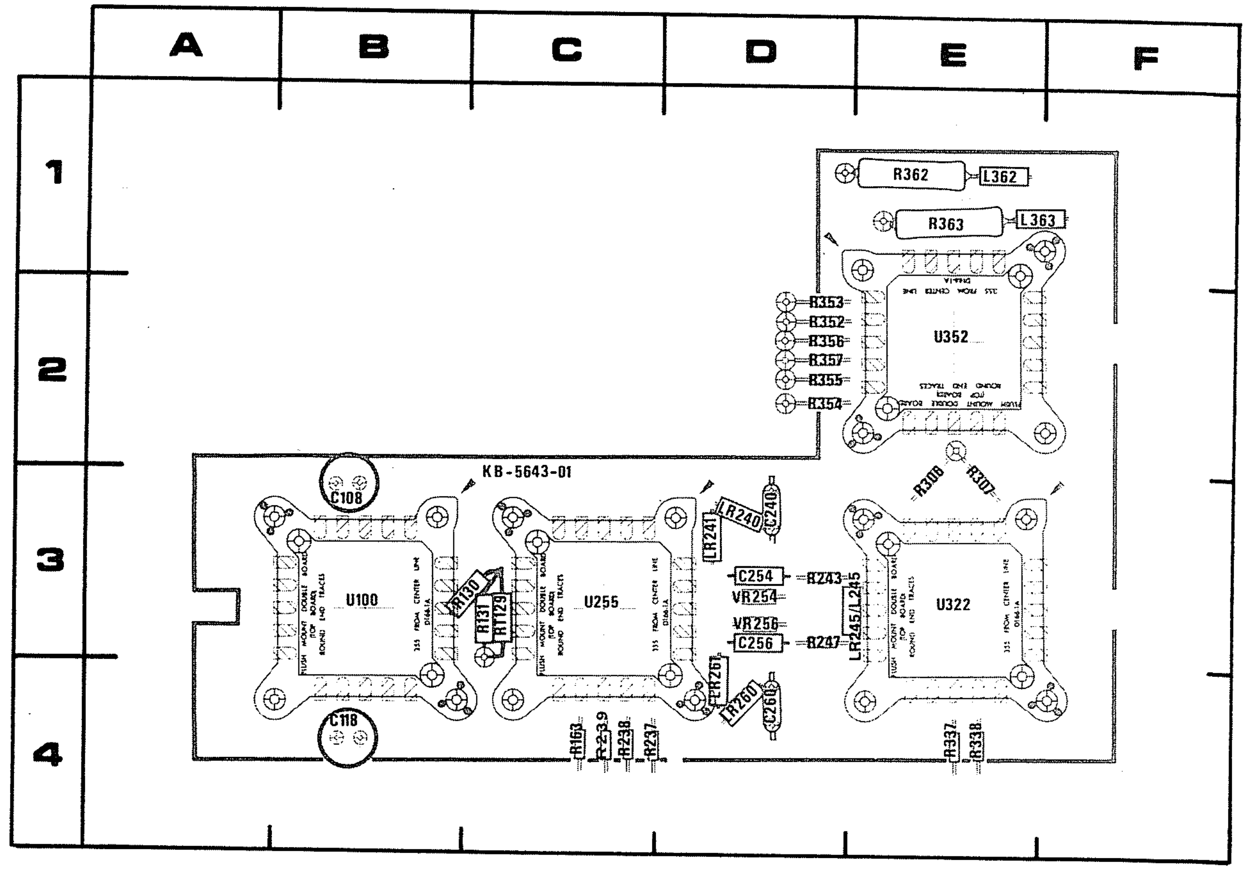
Circuit Number	Schematic Location	Board Location
Q248	F2	E2
Q268	F5	E3
R107	B2	H2
R109	B2	G2
R110	B2	I 3
R111	C1	I 3
R112	C2	I 3
R113	B2	H2
R115	B2	I 3
R120	B4	H4
R121	C4	H4
R122	C4	H4
R123	B3	G3
R124	B4	G2
R125	B4	G3
R132	C3	G5
R133	C3	G5
R134	C3	G5
R135	C3	H4
R140	C4	H5
R141	D4	H5
R142	D3	H4
R143	D4	G5
R144	D3	H5
R145	D3	H4
R146	D3	I 5
R147	D4	G5
R148	D4	I 5
R149	D4	G5
R150	D3	J5

Circuit Number	Schematic Location	Board Location
R151	D3	H4
R152	D4	J5
R153	D3	H4
R154	E4	G5
R155	D4	G5
R162	E4	G5
R163	E4	C4 (back)
R164	E4	G5
R166	E3	E2
R170	D4	K5
R171	D4	K5
R172	D4	K4
R173	E5	G5
R174	E5	K4
R175	D4	K5
R176	D4	K5
R177	D4	K4
R178	E5	K4
R179	E5	K4
R182	C5	K2
R183	C5	K2
R184	D5	K2
R185	C4	G2
R186	C4	K2
R187	D5	K2
R212	E1	E1
R219	C1	H2
R221	C1	H2
R223	E1	E2
R224	E1	E2
R225	F1	E5

Circuit Number	Schematic Location	Board Location
R226	E1	F5
R227	F1	G5
R228	E1	I 2
R229	F1	J2
R230	F1	E2
R231	F1	E2
R232	F1	E5
R233	F1	E5
R234	F1	F5
R235	E2	C5
R236	E2	C5
R237	E2	E4 (back)
R238	F2	E4 (back)
R239	F2	E4 (back)
R240	E2	E5
R241	G2	F3
R242	G2	F3
R244	G2	E3
R245	G1	F3
R246	G2	F2
R248	F1	E2
R249	H2	G2
R261	G4	G3
R262	G4	G2
R263	F5	D2
R264	G5	F3
R265	G5	F2
R266	G4	F2
R267	H5	E3
R268	F5	E2
R269	H5	F3

Circuit Number	Schematic Location	Board Location
R270	H1	G2
R271	H1	G2
R273	G2	F2
R276	H2	H2
R277	H2	K4
RT108	B2	G2
TP249	H2	H1
U111	C2	H3
U121	B4	H3
U132	C3	F5
U162	E4	E5
U174	E5	K4
U178A	D2	K3
U178B	E5	K3
U178C	D4	K3
U178D	D4	K3
U228A	F1	J3
U228B	E1	J3
U228C	F1	J3
U228D	E1	J3
U234A	F1	D5
U234B	E2	D5
U246	G2	F2
U266	G4	F2





← FRONT

Figure 8-5. A1A1—High Frequency circuit board assembly.

ASSEMBLY A1A1—Partial High-Frequency board

Circuit Number	Schematic Location	Board Location
C108	B2	B3
C118	B3	B4
C240	F2	D3
C254	G3	D3
C256	G4	D3
C260	F4	D4
J120	B3	A3
LR240	F2	D3
LR241	F2	D3
LR245	G3	D3
LR260	F4	D4
LR261	F4	D4
R130	C3	C3
R131	C3	C3
R237	E2	C4
R238	F2	C4
R239	F2	C4
R243	G3	D3
R247	G3	D3
RT129	C3	C3
U100	B2	B3
U255	E2	C3
VR254	G2	D3
VR256	G4	D3

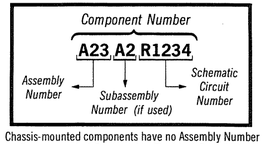
ASSEMBLY A2—Partial Front Panel Board (not shown)

Circuit Number	Schematic Location	Board Location
R221	C1	B3
R222	D1	B3
R275	H2	B1
S60A	C4	E2

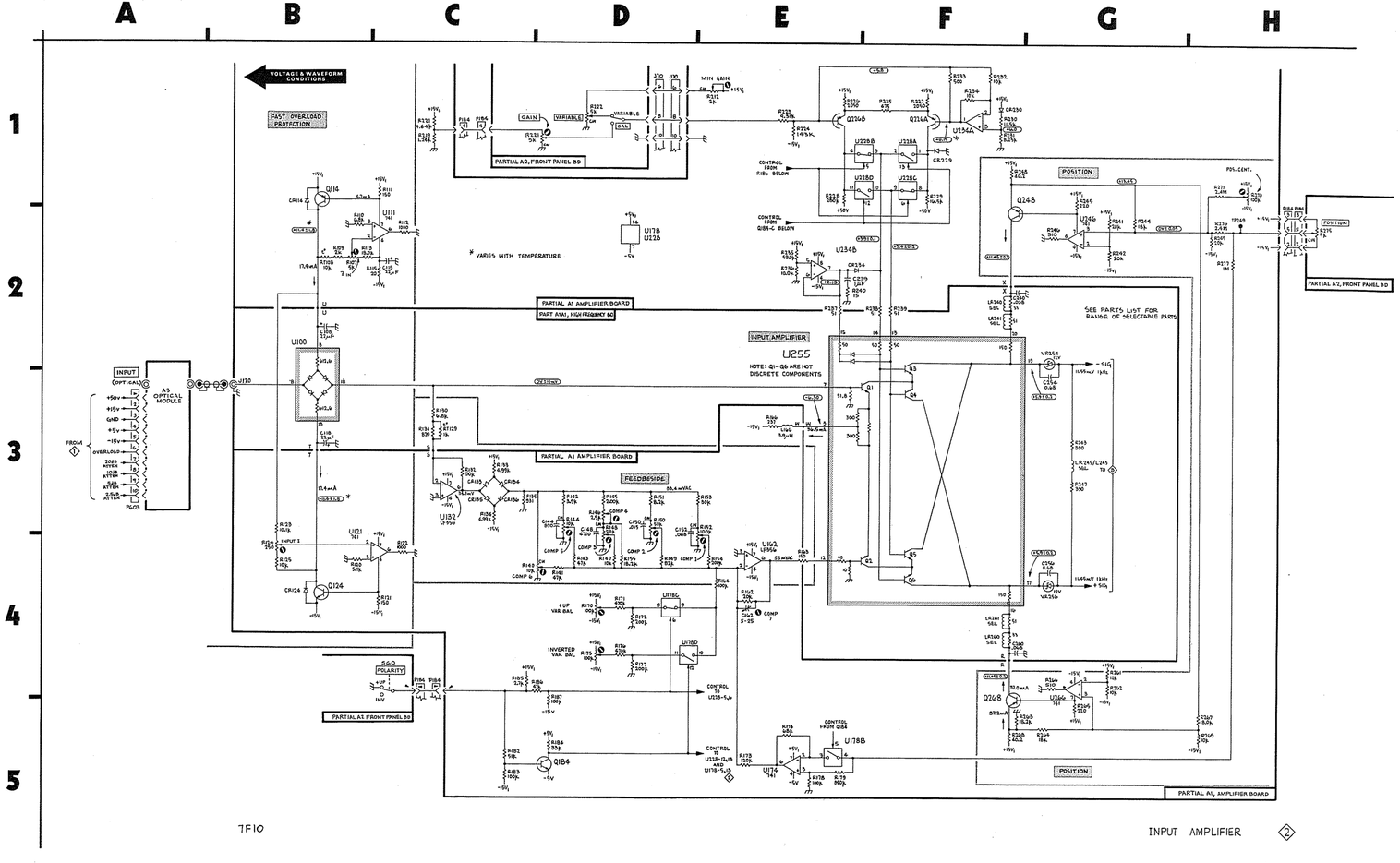
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE



Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.



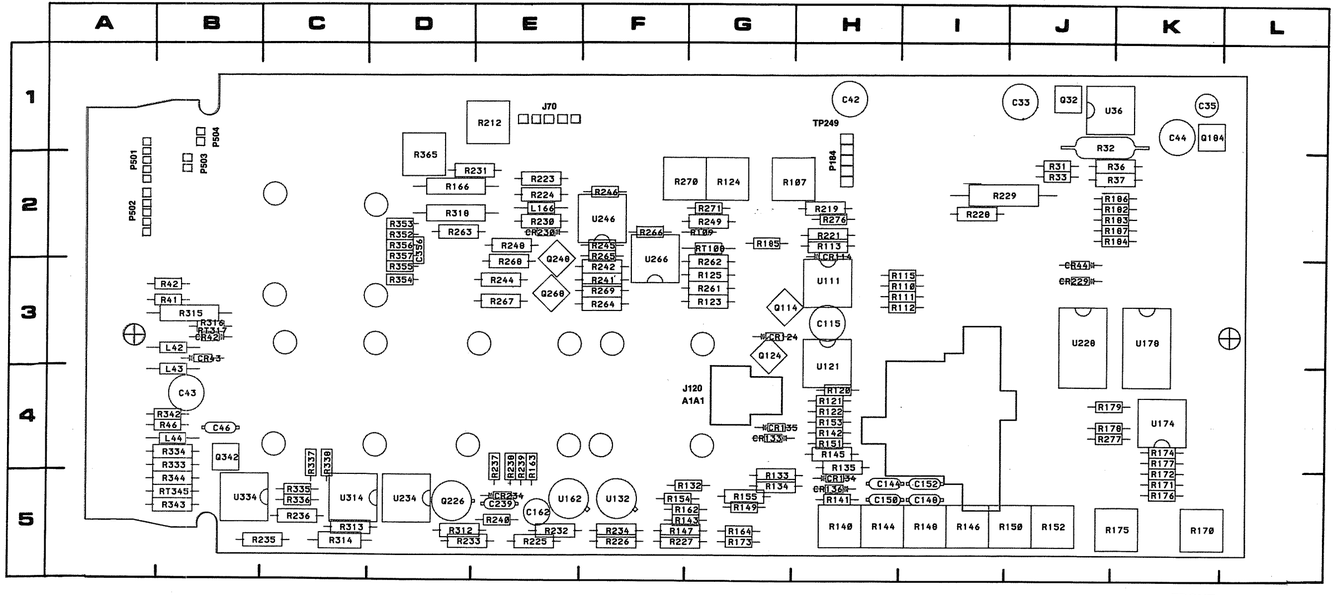


Figure 8-6. A1—Amplifier circuit board assembly.

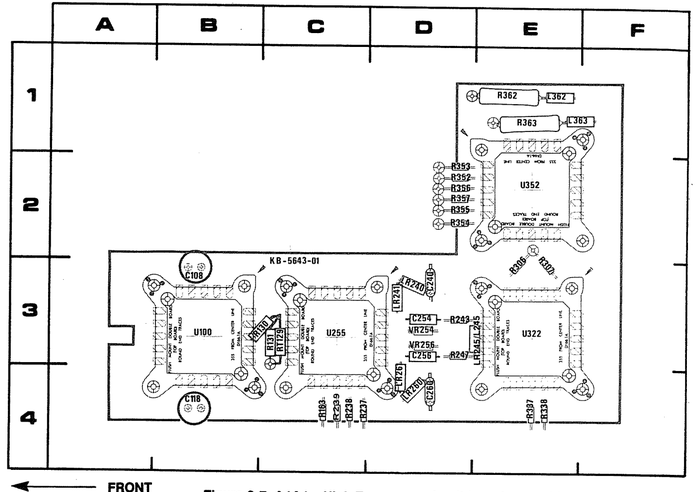
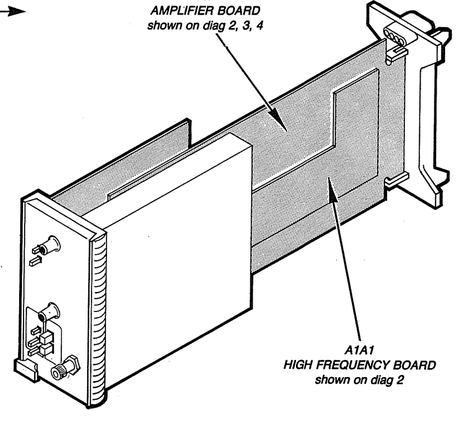


Figure 8-7. A1A1—High Frequency circuit board assembly.

ASSEMBLY A1—Partial Amplifier Board

Circuit Number	Schematic Location	Board Location
C356	B5	D2 (back)
Q342	F2	B4
R262	B2	G2
R306	F4	E3
R307	G4	E3
R312	G5	D5
R313	G5	C5
R314	G4	C5
R315	C5	B3
R316	C5	B3
R318	C5	D2
R333	D4	B4
R334	D4	B4
R335	D3	C5
R336	E3	C5
R337	E3	C4 (back)
R338	E3	C4 (back)
R342	F2	B4
R343	F1	B5
R344	F1	B5
R352	B5	D2 (back)
R353	B5	D2 (back)
R354	C5	D3 (back)
R355	C5	D3 (back)
R356	B5	D2 (back)
R357	B5	D2 (back)
R365	B2	D2
RT317	C5	B3
RT345	F1	B5
U314	F4	C5
U334A	D3	B5
U334B	F2	B5



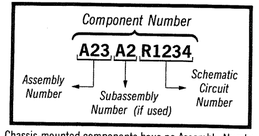
ASSEMBLY A1A1—Partial High-Frequency Board

Circuit Number	Schematic Location	Board Location
L362	B2	E1
L363	C2	E1
R337	E3	E4
R338	E3	E4
R352	B5	D2
R353	B5	D2
R354	C5	D2
R355	C5	D2
R356	B5	D2
R357	B5	D2
R362	B2	E1
R363	C2	E1
U322	E4	E3
U352	B3	E2

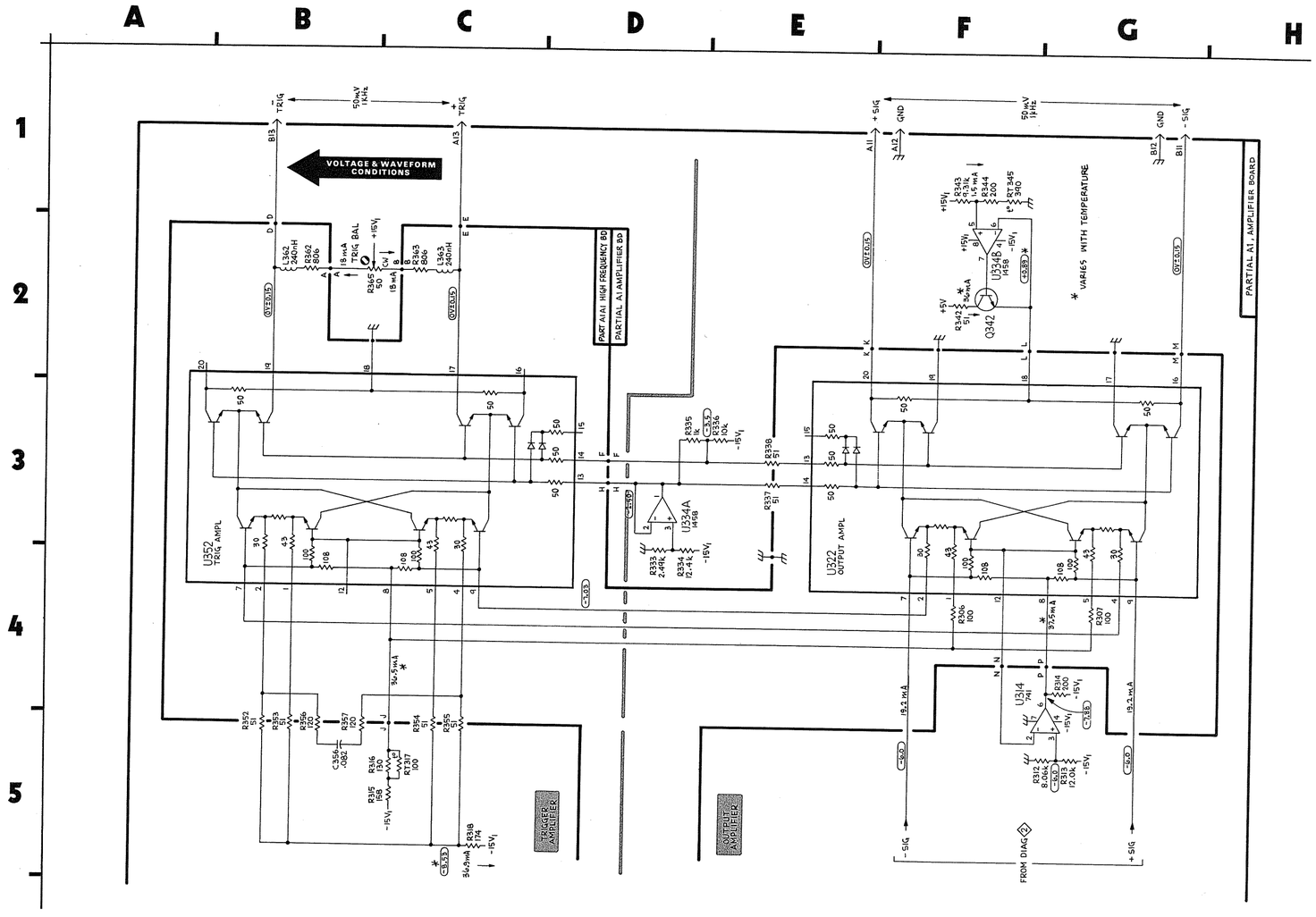
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE



Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.



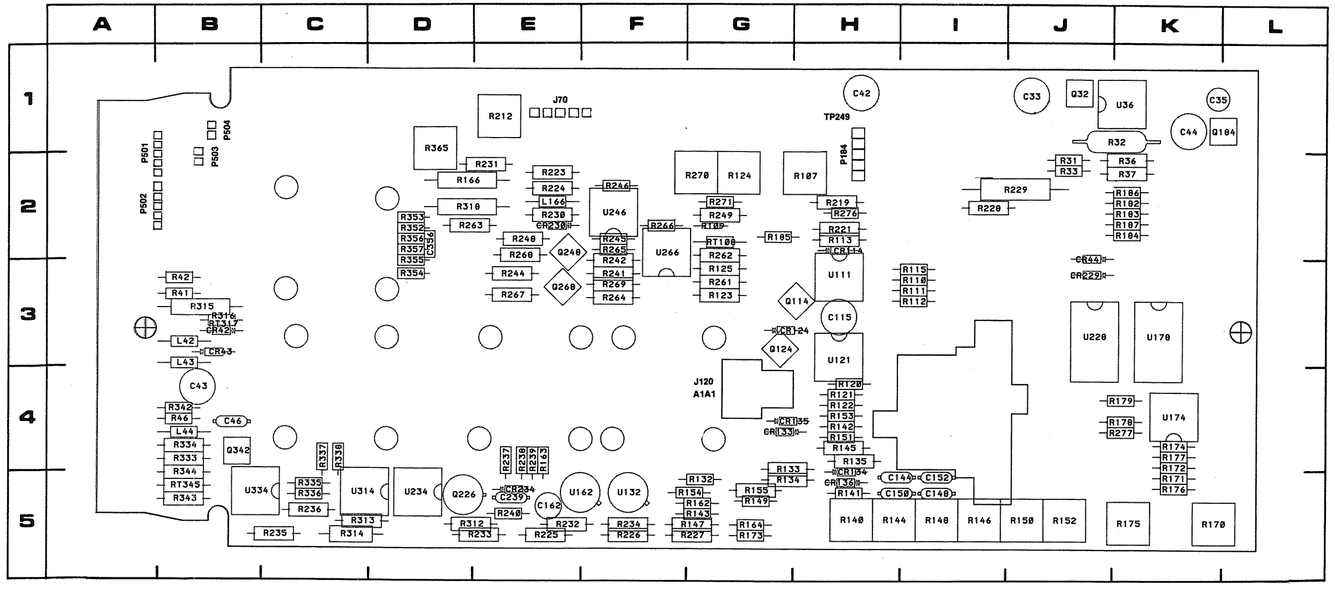
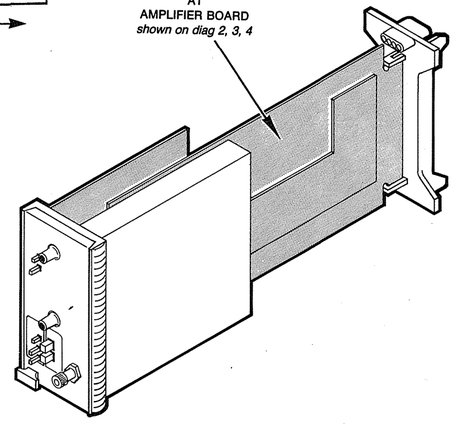


Figure 8-8. A1—Amplifier circuit board assembly.

ASSEMBLY A1—Partial Amplifier Board

Circuit Number	Schematic Location	Board Location
C33	D3	J1
C35	D3	K1
C42	D4	H1
C43	E4	B4
C44	D5	K1
C46	C5	B4
CR42	D4	B3
CR43	E4	B3
CR44	D5	J3
L42	C4	B3
L43	E4	B4
L44	C5	B4
Q32	D3	J1

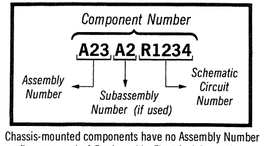
Circuit Number	Schematic Location	Board Location
R31	D3	J2
R32	D3	K1
R33	D3	J2
R36	E3	K2
R37	E3	K2
R41	E3	B3
R42	C3	B3
R46	C5	B4
U36	D3	K1



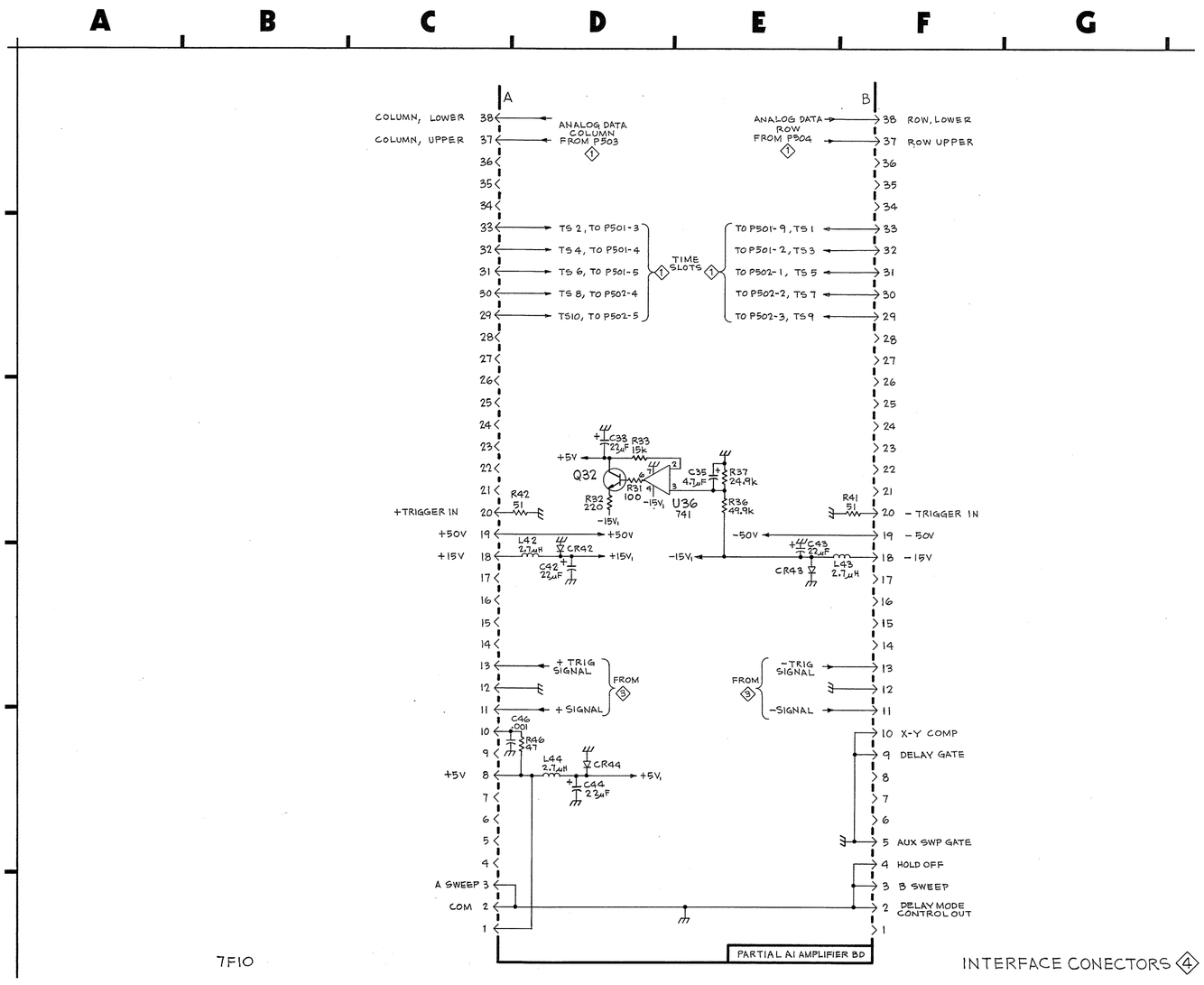
SEE PARTS LIST FOR SEMICONDUCTOR TYPES.

Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE



Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.



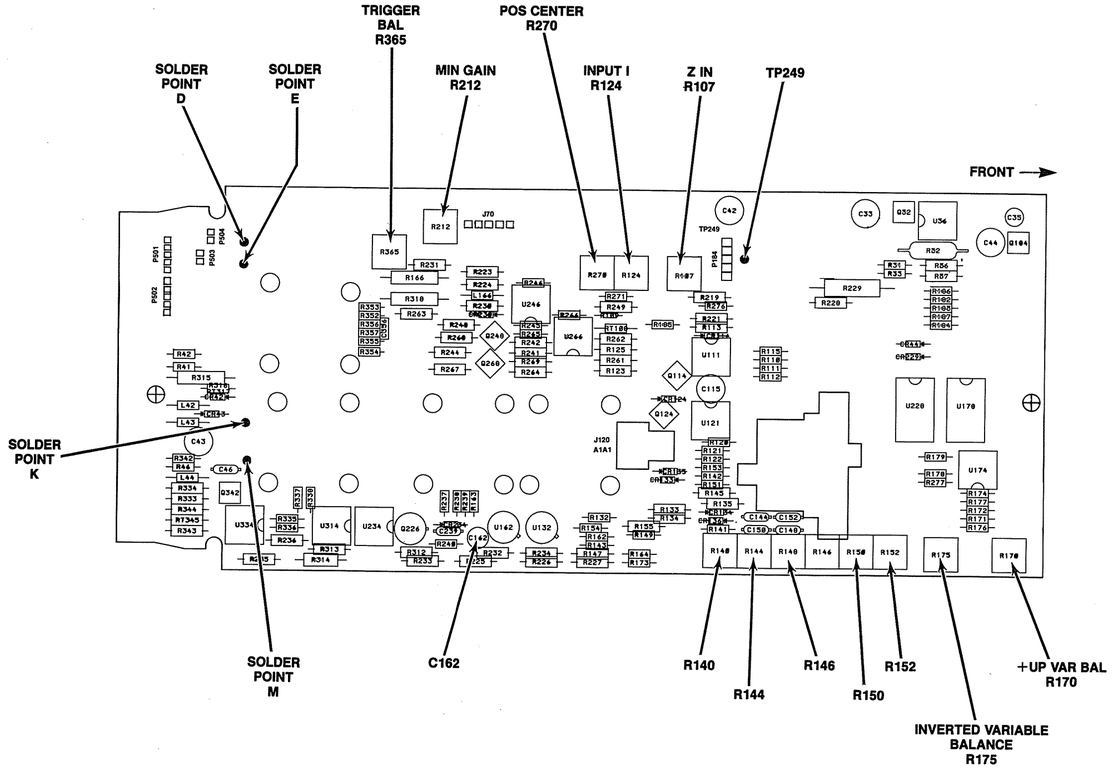


Figure 8-9. Location of adjustments on A1—Amplifier circuit board.

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.

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.

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	
	****END ATTACHING PARTS****
Detail Part of Assembly and/or Component	
Attaching parts for Detail Part	
	****END ATTACHING PARTS****
Parts of Detail Part	
Attaching parts for Parts of Detail Part	
	****END ATTACHING PARTS****

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.

Attaching parts must be purchased separately, unless otherwise specified.

ABBREVIATIONS

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

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00779	AMP INC	P O BOX 3608	HARRISBURG PA 17105
01536	TEXTRON INC		ROCKFORD IL 61108
	CAMCAR DIV	1818 CHRISTINA ST	
	SEMS PRODUCTS UNIT		
07707	USM CORP	510 RIVER RD	SHELTON CT 06484
	SUB OF EMHART INDUSTRIES INC		
	USM FASTENER DIV		
12327	FREEWAY CORP	9301 ALLEN DR	CLEVELAND OH 44125
22526	DU PONT E I DE NEMOURS AND CO INC	30 HUNTER LANE	CAMP HILL PA 17011
	DU PONT CONNECTOR SYSTEMS		
22599	AMERACE CORP ESNA DIV	15201 BURBANK BLVD SUITE C	VAN NUYS CA 91411
28520	HEYCO MOLDED PRODUCTS	147 MICHIGAN AVE	KENILWORTH NJ 07033
		P O BOX 160	
53387	MINNESOTA MINING AND MFG CO	3M CENTER	ST PAUL MN 55101
	ELECTRONIC PRODUCTS DIV		
73743	FISCHER SPECIAL MFG CO	446 MORGAN ST	CINCINNATI OH 45206
80009	TEKTRONIX INC	4900 S W GRIFFITH DR	BEAVERTON OR 97077
		P O BOX 500	
83486	ELCO INDUSTRIES INC	1101 SAMUELSON RD	ROCKFORD IL 61101
93907	TEXTRON INC	600 18TH AVE	ROCKFORD IL 61101
	CAMCAR DIV		
TK0435	LEWIS SCREW CO	4114 S PEORIA	CHICAGO IL 60609

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	366-1058-00			1	KNOB:GRAY,0.625 X 0.255 X 0.485	80009	366-1058-00
					(ATTACHING PARTS)		
-2	214-1095-00			1	PIN,SPRING:0.187 L X 0.094 OD,STL,CD PL	22599	52-022-094-0187
					(END ATTACHING PARTS)		
-3	105-0076-04			1	RELEASE BAR,LCH:PLUG-IN UNIT	80009	105-0076-04
-4	214-1280-00			1	SPRING,HLCPS:0.14 OD X 1.126 L,TWIST LOOP	80009	214-1280-00
-5	426-1072-00			2	FRAME,PUSH BTN:SILVER GRAY PLSTC	80009	426-1072-00
-6	358-0599-00			1	BUSHING,SLEEVE:0.125 ID X 0.25 OD X 0.234	28520	B-187-125
-7	366-0494-04			2	KNOB:GY,0.127 ID X 0.5 OD X 0.531 H	80009	366-0494-04
-8	210-0583-00			2	NUT,PLAIN,HEX:0.25-32 X 0.312,BRS CD PL	73743	2X-20319-402
-9	210-0940-00			2	WASHER,FLAT:0.25 ID X 0.375 OD X 0.02,STL	12327	ORDER BY DESCR
-10	333-3435-00			1	PANEL,FRONT:	80009	333-3435-00
-11	386-5538-00			1	FRAME SECT,CAB.:	80009	386-5538-00
					(ATTACHING PARTS)		
-12	213-0793-00			4	SCREW,TPG,TF:6-32 X 0.4375,TAPTITE,FILH	83486	239-006-406043
					(END ATTACHING PARTS)		
-13	348-0235-00			2	SHLD GSKT,ELEK:FINGER TYPE,4.734 L	92101	ORDER BY DESCR
-14	214-1054-00			1	SPRING,FLAT:0.825 X 0.322,SST	80009	214-1054-00
-15	105-0075-00			1	BOLT,LATCH:	80009	105-0075-00
-16	426-0499-07			1	FR SECT,PLUG-IN:BOTTOM	80009	426-0499-07
					(ATTACHING PARTS)		
-17	211-0105-00			3	SCREW,MACHINE:4-40 X 0.188,FLH,100 DEG	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
-18	337-1064-12			2	SHIELD,ELEC:SIDE FOR PLUG-IN UNIT	80009	337-1064-12
-19	119-1965-00			1	OPTICAL MODULE:	80009	119-1965-00
					(ATTACHING PARTS)		
-20	211-0007-00			3	SCREW,MACHINE:4-40 X 0.188,PNH,STL	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
					OPTICAL MODULE INCLUDES:		
-21	200-3081-00			1	.COVER,PROT:	80009	200-3081-00
					.(COVER SHOULD REMAIN IN PLACE WHEN		
					.CONNECTOR NOT IN USE)		
-22	220-0957-00			1	.NUT,PLAIN:9-0.5,BRASS,SHINY NICKEL PL	80009	220-0957-00
-23	210-0978-00			1	.WASHER,FLAT:0.375 ID X 0.5 OD X 0.024,STL	12327	ORDER BY DESCR
-24	----- -----			1	CIRCUIT BD ASSY:AMPLIFIER		
					(SEE A1 REPL)		
-25	426-1351-00			4	.FRAME,MICROCKT:1.75 CM	80009	426-1351-00
					. (ATTACHING PARTS)		
-26	211-0259-00			16	.SCR,ASSEM WSHR:2-56 X 0.437,PNH,STL,POZ	01536	4821-00021
					. (END ATTACHING PARTS)		
-27	131-1967-00			4	.CONT SET,ELEC:MICROCKT,1.75 CM,RUBBER	80009	131-1967-00
-28	131-2032-00			1	.CONTACT,ELEC:SINGLE,TOP,CU BE	80009	131-2032-00
-29	131-2033-00			1	.CONTACT,ELEC:SINGLE,BOTTOM,CU BE	80009	131-2033-00
					. (ATTACHING PARTS)		
-30	210-0629-00			2	.EYELET,METALLIC:0.059 OD X 0.093 L,BRS	80009	210-0629-00
					.GOLD PL		
					. (END ATTACHING PARTS)		
-31	136-0252-00			1	.SOCKET,PIN TERM:U/W 0.019 DIA PINS	00779	2-330808-7
-32	136-0252-07			43	.SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012
-33	220-0547-01			6	NUT BLOCK:4-40 X 0.282,NI SIL NP	80009	220-0547-01
					(ATTACHING PARTS)		
-34	211-0008-00			6	SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
-35	129-0811-00			1	SPCR,POST:0.762,4-40 EXT/INT,BRS,0.188 HEX	80009	129-0811-00
-36	----- -----			1	CIRCUIT BD ASSY:FRONT PANEL		
					(SEE A2 REPL)		
					(ATTACHING PARTS)		
-37	211-0008-00			1	SCREW,MACHINE:4-40 X 0.25,PNH,STL	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
					FRONT PANEL BOARD ASSY INCLUDES:		
	214-3172-00			1	.KEY,CONNECTOR:	53387	3518
					.(SNAPS ONTO CONNECTOR.SEE A2P603 REPL)		
-38	343-0499-11			1	.CLIP,SWITCH:REAR,7.5MM X 2 UNIT	80009	343-0499-11
					. (ATTACHING PARTS)		
-39	210-3033-00			2	.EYELET,METALLIC:0.059 OD X 0.156 L,BRS	07707	SE-25
					. (END ATTACHING PARTS)		
-40	343-0495-02			1	.CLIP,SWITCH:FRONT,7.5MM X 2 UNIT	80009	343-0495-02

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-					. (ATTACHING PARTS)		
-41	210-3033-00			2	.EYELET,METALLIC:0.059 OD X 0.156 L,BRS	07707	SE-25
					. (END ATTACHING PARTS)		
-42	366-1650-00			2	.PUSH BUTTON:CLEAR,0.184 X 0.214 X 8.0	80009	366-1650-00
-43	----- -----			1	.SWITCH PB ASSY:2 LATCH,7.5MM,4 CONTACTS		
					.(SEE A2S60 REPL)		
-44	343-0499-12			1	.CLIP,SWITCH:REAR,7.5MM X 3 UNIT	80009	343-0499-12
					. (ATTACHING PARTS)		
-45	210-3033-00			1	.EYELET,METALLIC:0.059 OD X 0.156 L,BRS	07707	SE-25
					. (END ATTACHING PARTS)		
-46	343-0495-03			1	.CLIP,SWITCH:FRONT,7.5MM X 3 UNIT	80009	343-0495-03
					. (ATTACHING PARTS)		
-47	210-3033-00			1	.EYELET,METALLIC:0.059 OD X 0.156 L,BRS	07707	SE-25
					. (END ATTACHING PARTS)		
-48	366-1650-00			3	.PUSH BUTTON:CLEAR,0.184 X 0.214 X 8.0	80009	366-1650-00
-49	----- -----			1	.SWITCH PB ASSY:3 LCH,7.5MM,6 CONTACTS		
					.(SEE A2S583 REPL)		
-50	343-0499-11			1	.CLIP,SWITCH:REAR,7.5MM X 2 UNIT	80009	343-0499-11
					. (ATTACHING PARTS)		
-51	210-3050-00			2	.EYELET,METALLIC:0.059 OD X 0.218 L,BRS	80009	210-3050-00
					.(ALSO ATTACHES 1-40)		
					. (END ATTACHING PARTS)		
-52	343-0495-02			1	.CLIP,SWITCH:FRONT,7.5MM X 2 UNIT	80009	343-0495-02
					. (ATTACHING PARTS)		
-53	210-3050-00			2	.EYELET,METALLIC:0.059 OD X 0.218 L,BRS	80009	210-3050-00
					.(ALSO ATTACHES 1-46)		
					. (END ATTACHING PARTS)		
-54	366-1512-00			2	.PUSH BUTTON:SIL GY,0.18 SQ X 0.83	80009	366-1512-00
-55	----- -----			2	.SWITCH PB ASSY:1 MOMENTARY,7.5MM,2 CONTACT		
					.(SEE A2S650 REPL)		
-56	214-1061-00			1	CONTACT,ELEC:GROUNDING,CU BE	80009	214-1061-00
-57	334-3438-00			1	MARKER,IDENT:MARKED TURN OFF POWER	80009	334-3438-00
-58	426-0505-07			1	FR SECT,PLUG-IN:TOP	80009	426-0505-07
					(ATTACHING PARTS)		
-59	211-0105-00			3	SCREW,MACHINE:4-40 X 0.188,FLH,100 DEG	TK0435	ORDER BY DESCR
					(END ATTACHING PARTS)		
-60	386-1402-00			1	PANEL,REAR:	80009	386-1402-00
					(ATTACHING PARTS)		
-61	213-0793-00			4	SCREW,TPG,TF:6-32 X 0.4375,TAPTITE,FILH	83486	239-006-406043
					(END ATTACHING PARTS)		
					WIRE ASSEMBLIES		
	174-0539-00			1	CA ASSY,SP,ELEC:7,26 AWG,8.0 L,RIBBON	80009	174-0539-00
					(SUBPART OF A1 BOARD.A2P601 TO A1)		
	174-0540-00			2	CA ASSY,SP,ELEC:7,26 AWG,8.0 L,RIBBON	80009	174-0540-00
					(A2P502/P504 TO A1P502/P504)		
					(A2P501/P503 TO A1P501/P503)		
	174-0541-00			1	CA ASSY,SP,ELEC:5,26 AWG,5.5 L,RIBBON	80009	174-0541-00
					(A2P70 TO A1J70)		
	174-0542-00			1	CA ASSY,SP,ELEC:5,26 AWG,5.5 L,RIBBON	80009	174-0542-00
					(A2P184 TO A1P184)		
	174-0544-00			1	CA ASSY,SP,ELEC:10,24 AWG,8.0 L,RIBBON	80009	174-0544-00
					(A2P603 TO OPTICAL MODULE)		
	175-7420-00			1	CABLE ASSY,RF:50 OHM COAX,4.0 L,6-N	80009	175-7420-00
					(A1J120 TO OPTICAL MODULE)		
					STANDARD ACCESSORIES		
	070-6277-00			1	MANUAL,TECH:INSTRUCTION,7F10	80009	070-6277-00
					OPTIONAL ACCESSORIES		
	174-0045-00			1	CA ASSY,FBR OPT:MULTIMODE,3 METER	80009	174-0045-00
	174-0045-01			1	CA ASSY,FBR OPT:MULTIMODE,1 METER L	80009	174-0045-01
	174-0524-00			1	CA ASSY,FBR OPT:DIAMOND TO SMA,3 METERS	80009	174-0524-00
	174-0524-01			1	CA ASSY,FBR OPT:MULTIMODE,1 METER L	80009	174-0524-01

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345	Name & Description	Mfr. Code	Mfr. Part No.
1-	174-0527-00			1		CA ASSY,FBR OPT:DIAMOND TO FC,3 METERS	80009	174-0527-00
	174-0527-01			1		CA ASSY,FBR OPT:MULTIMODE,1 METER L	80009	174-0527-01
	174-0528-00			1		CA ASSY,FBR OPT:DIAMOND TO D4,3 METERS	80009	174-0528-00
	174-0528-01			1		CA ASSY,FBR OPT:MULTIMODE,1 METER L	80009	174-0528-01
	174-0530-00			1		CA ASSY,FBR OPT:DIAMOND TO BICONIC,3 METERS	80009	174-0530-00
	174-0530-01			1		CA ASSY,FBR OPT:MULTIMODE,1 METER L	80009	174-0530-01

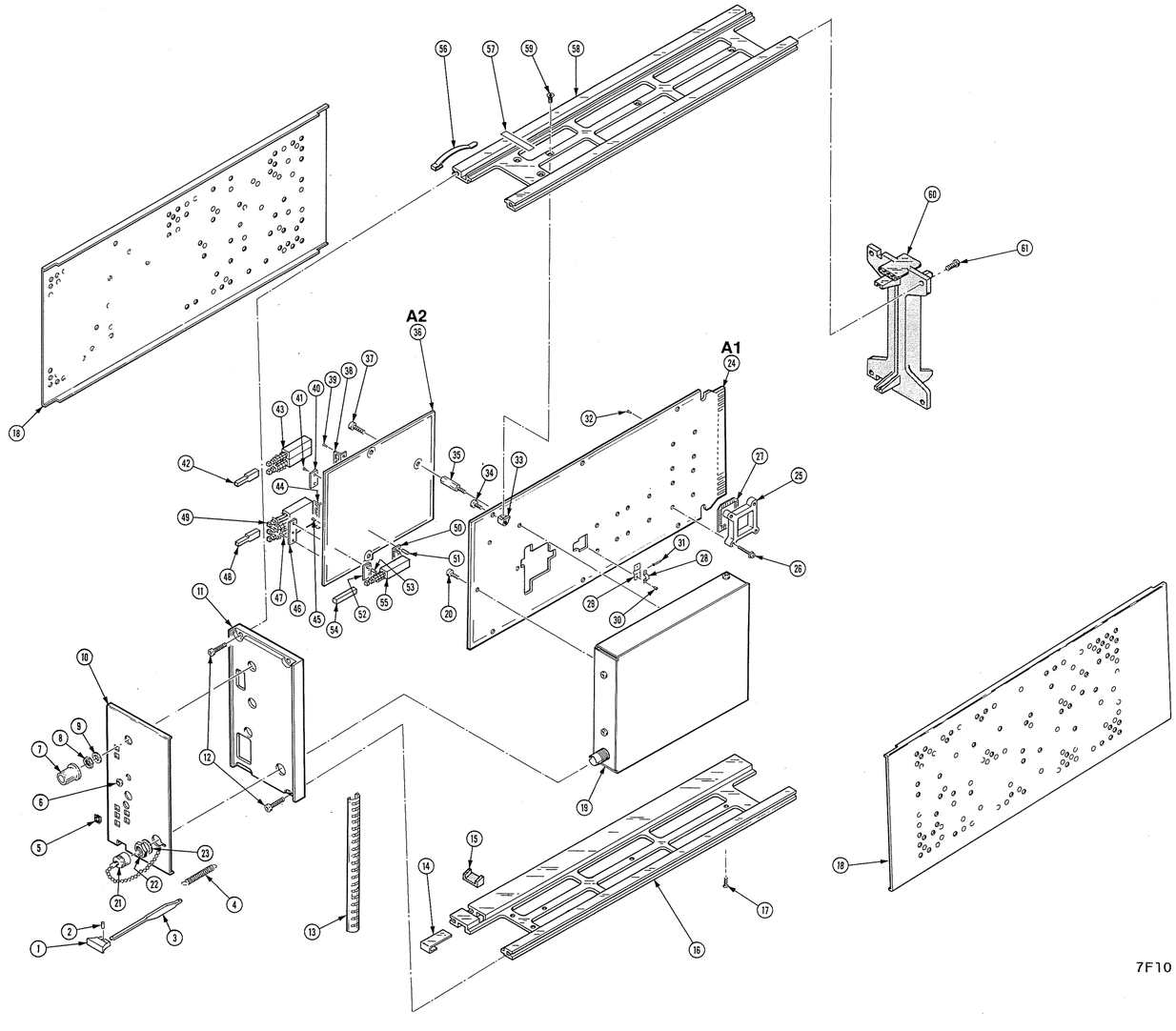


FIG. 1 EXPLODED

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

A single change may affect several sections. Since the change information sheets are carried in the manual until all changes are permanently entered, some duplication may occur. If no such change pages appear following this page, your manual is correct as printed.

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MANUAL CHANGE INFORMATION

Date: 1/27/87 Change Reference: C1/0187

Product: 7F10 Optical-Electrical Converter Manual Part No.: 070-6277-00

DESCRIPTION PG 42

THESE CHANGES ARE EFFECTIVE FOR ALL SERIAL NUMBERS

Please change Table 5-1 (cont) to read:
See page 5-3

Table 5-1 (cont)
Test Equipment

Description	Minimum Specifications	Purpose	Examples of Applicable Test Equipment
11. Fiber Optic Cable	Connectors, Diamond 3.5; length, 1 meter.	Provide optical connection.	a. Tektronix Part 174-0045-01 with interlock.
12. Adapter*	Connectors, SMA male-to-BNC female.	Used to connect signals to amplifier section.	a. Tektronix Part 015-1018-00.
13. Adapter*	Connectors, SMA female-to-SMA female.	Used to connect signals to amplifier section.	a. Tektronix part 015-1012-00.
14. Attenuator*	Attenuation, 2X; impedance, 50-ohms; connectors, BNC.	Signal attenuation.	a. Tektronix part 011-0069-02.
15. Attenuator	Attenuation, 5X; impedance, 50-ohms; connectors, BNC.	Signal attenuation.	a. Tektronix part 011-0060-02.
16. Attenuator*	Attenuation, 10X; impedance, 50-ohms; connectors, BNC.	Signal attenuation.	a. Tektronix part 011-0059-02.
17. Terminator	Impedance, 50-ohms; connectors, BNC.	Signal termination.	a. Tektronix part 011-0049-01.
18. Adapter	Connectors, BNC female-to-N male.	Connect to OT503 input.	a. Tektronix part 103-0045-00.
19. Srewdriver *	Three-inch shaft, 3/32-inch bit.	Used throughout adjustment procedure.	a. Xcelite R3323.

* Required for adjustment only, not used for performance check.

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MANUAL CHANGE INFORMATION

Date: 12/15/87 Change Reference: M60204

Product: 7F10 Optical-Electrical Converter

Manual Part No.: 070-6277-00

PRODUCT GROUP CODE: 42

DESCRIPTION

These changes are effective at serial number B010166.

MECHANICAL PARTS LIST CHANGE

CHANGE TO:

FIG. & INDEX NO.		
1-60	386-5466-00	PANEL, REAR