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PLEASE CHECK FOR CHANGE INFORMATION AT THE REAR OF THIS MANUAL.

7M11
50-OHM
DELAY LINE

INSTRUCTION MANUAL

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Fig. 1-1. 7M11 50 Ω Delay Line.

SECTION 1
SPECIFICATION

Change information, if any, affecting this section will be found at the rear of the manual.

The 7M11 50 Ω Delay Line is a 175 ps risetime dual-channel signal delay unit with trigger pickoff, for use in Tektronix 7000-Series Oscilloscopes or separately in an accessory cabinet. It is useful with sequential sampling systems where the vertical sampler does not contain a delay line, and with random sampling systems operated at very low repetition rates. Each channel attenuates the input signal two times while the trigger pickoff signal is equivalent to the input signal attenuated 5×. The total delay per channel is 75 ns.

The following electrical characteristics are valid when the 7M11 is operated in an environment with an ambient temperature between 0° C and +50° C. Section 5, Performance Check, provides a procedure for checking the 7M11 with respect to the following characteristics.

TABLE 1-1

ELECTRICAL CHARACTERISTICS

Channel 1 or Channel 2 Delay Line

Characteristic	Performance Requirement
DC Input Resistance	50 Ω within 2%
Maximum Input Voltage	5 V (DC and peak AC combined)
Attenuation	2× within 2% into 50 Ω
Time Delay	75 ns within 1 ns
Delay Difference Between Channels	30 ps or less
Step/Response Risetime	175 ps or less
Aberration (After 100% point of step rise)	
First 500 ps	+10%, −10%, for total of 10% peak to peak
500 ps to 2 ns	+5%, −5%, for total of 5% peak to peak
After 2 ns	+2%, −2%, for total of 2% peak to peak

TABLE 1-1 (cont)

Trigger Output

Characteristic	Performance Requirement
DC Output Resistance	50 Ω within 10%
Attenuation	5× within 10% into 50 Ω (refers to signal applied to INPUT connector selected by TRIGGER SELECTOR switch).
Risetime	600 ps or less

TABLE 1-2

ENVIRONMENTAL CHARACTERISTICS

Characteristic	Information
Operating Temperature	0°C to +50°C
Maximum Non-operating Altitude	To 50,000 feet and −55° C
Transportation	Qualified under National Safe Transit Committee test procedure 1A, Category II

TABLE 1-3

PHYSICAL CHARACTERISTICS

Characteristic	Description
Dimensions	
Height	5 inches
Width	2¾ inches
Length	14 inches
Weight	
Net	≈5¾ lbs.
Shipping	≈7½ lbs.

SECTION 2
OPERATING INSTRUCTIONS

Change information, if any, affecting this section will be found at the rear of the manual.

General

Operation of the 7M11 50 Ω DELAY LINE requires no power, making it usable either in a 7000-series oscilloscope or alone in an accessory carrying case.

The unit has one control, the TRIGGER SELECTOR switch, which allows trigger pickoff from either the channel 1 signal input, or the channel 2 signal input. All connectors are on the front panel.

INSTALLATION

The 7M11 may be installed either in a 7000-series oscilloscope or in a separate carrying case. In either instance, the unit slides straight into the enclosure, using the upper and lower slide rails as guides, and self-locks in place. The unit may be removed, by pulling on the latch release (see Fig. 2-1) located on the lower left of the front panel and indicated by the letters 7M11. When this latch release is pulled out about one inch from the front panel, the 7M11 is released and will slide out.

CONTROL AND CONNECTORS

The functions of the control and connectors located on the 7M11 front panel (see Fig. 2-1) are described briefly in the following table.

TRIGGER SELECTOR Switch	Controls selection of trigger pickoff from channel 1 signal input or channel 2 signal input. No trigger pickoff occurs when switch is set to OFF.
INPUT 1 or INPUT 2 Connectors	Allows signals to be applied to their respective delay lines. DC input resistance of each input is 50 Ω; input voltage should not exceed ±5 V.
OUTPUT 1 or OUTPUT 2 Connectors	Provide output signal delayed 75 ns from input signal. Input signal is attenuated 2× at output connector when applied to 50 Ω load.
TRIGGER OUTPUT Connector	Provides trigger signal picked off from the input to one of the delay lines as determined by TRIGGER SELECTOR switch. Input signal is attenuated 5× at TRIGGER OUTPUT connector when applied to 50 Ω load.

GENERAL OPERATING INFORMATION

Connectors

The 7M11 is a 50 Ω system. The signal inputs have a DC resistance of 50 Ω and the signal outputs must be applied to 50 Ω to ensure the accuracy of the unit. The two delay lines may be connected in series to obtain a 150 ns signal delay. In this case the signal will be attenuated four times and the step risetime response of the two delay lines will be no less than 250 ps. If the TRIGGER SELECTOR switch is set to a channel in use, the TRIGGER SELECTOR connector should be terminated in 50 Ω. Improper termination of the TRIGGER OUTPUT connector can cause significant distortion of the delayed signal from which the trigger signal has been taken.

Cables

Signal cables transmitting signals either to or from the delay lines can alter the signal high frequency content if they are too long or too lossy. The two 50-Ω 2-ns signal cables provided as accessories with the 7M11 will not significantly deteriorate a signal when used between either a signal source and a 7M11 signal input or a 7M11 signal output and a display device. Avoid the use of RG-58C/U cables over four feet in length, unless only signals of relatively low frequency are involved. For longer cables and best high frequency response, use RG-213/U cable or 3-mm cable.

Trigger Selection

The TRIGGER SELECTOR switch determines from which signal input a trigger signal will be picked off. If the trigger signal is not being utilized, the TRIGGER SELECTOR switch should be set to the OFF position or to the unused channel position. If the trigger signal is to be used, set the TRIGGER SELECTOR switch to the channel in use and terminate the TRIGGER OUTPUT connector with 50 Ω. Distortion of the delayed signal may appear if the signal cable connecting the trigger signal to the load is other than 50 Ω.

Signal Amplitude Considerations

Display unit sweep trigger circuits generally require some minimum trigger signal amplitude for proper operation. The amplitude of the trigger signal appearing at the TRIGGER OUTPUT connector is one fifth the amplitude of the input signal. If, for example, a sweep unit requires a minimum external trigger signal of 10 mV, the signal into the 7M11 must be at least 50 mV in amplitude.

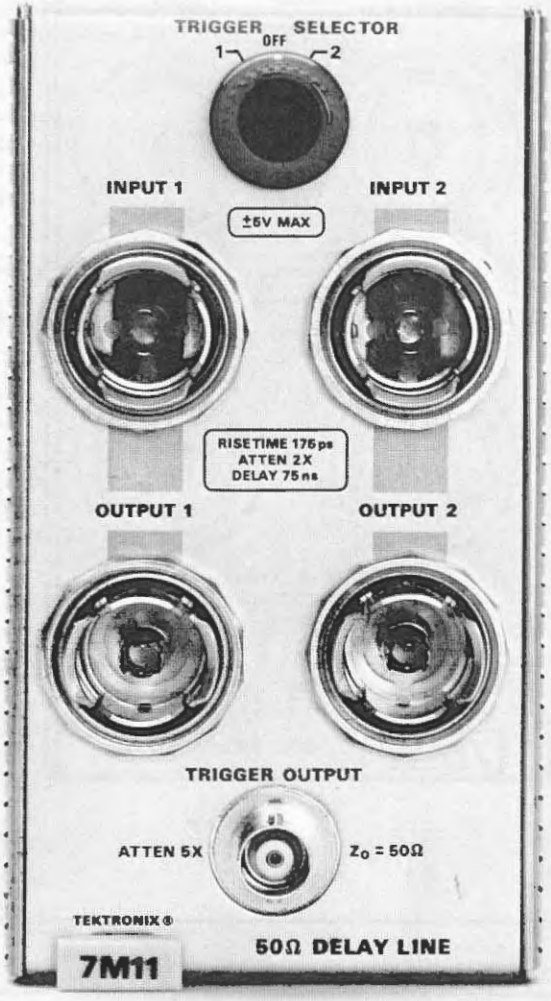
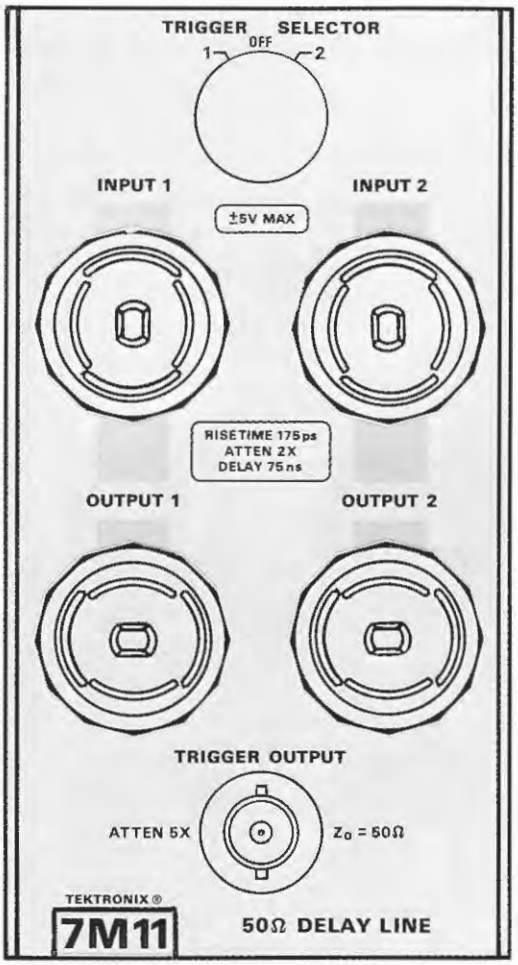


Fig. 2-1. Front-panel control and connectors.

7M11 TEST SET-UP CHART



NOTES:

Fig. 2-2. Control setup chart.

SECTION 3
CIRCUIT DESCRIPTION

Change information, if any, affecting this section will be found at the rear of the manual.

GENERAL

The circuits of the 7M11 are passive. No external or internal power is required. The two channels are very well isolated from each other. Delay is obtained through special high quality 50 Ω coaxial transmission line fabricated by Tektronix. Frequency compensation, trigger pickoff and 2× attenuation is performed by passive components located at the inputs of the delay lines. The output connectors are connected directly to the outputs of the delay lines.

FREQUENCY COMPENSATION

All coaxial transmission lines exhibit high frequency losses and some DC series resistance losses. These losses are essentially compensated for in the 7M11 by series resistance, series RC networks and shunt RL networks. Since passive networks cannot amplify the high frequency signals to compensate for normal losses, the low frequency signals are attenuated to amplitudes equal to the amplitudes of the highest frequency signals transmitted by the delay lines. As a convenience in calculating deflection factors, the total attenuation of the input signal is designed as exactly 2×. Each series RC and shunt RL network compensates a particular segment of the frequency spectrum.

TRIGGER PICKOFF

Trigger pickoff is provided by including the 50 ohms of the trigger output circuit, within a shunt RL circuit. As long as the trigger pickoff point (the junction of R38 and R39) is loaded by 50 Ω, the shunt RL time constant remains at its proper value, and one fifth of the input signal voltage is available for externally triggering a sweep unit.

The TRIGGER SELECTOR switch applies a proper 50 Ω load to both pickoff circuits when it is set to OFF. When the switch is set to one of its two trigger pickoff positions, a proper 50 Ω load is applied to the trigger pickoff point of the channel not being used as a trigger signal source. The other trigger pickoff point is left open allowing an external 50 Ω load to become part of the compensation network. If the TRIGGER OUTPUT connector is left open, the TRIGGER SELECTOR switch should either be set to the unused channel or to OFF.

SECTION 4
MAINTENANCE

Change information, if any, affecting this section will be found at the rear of the manual.

Introduction

This section of the manual provides information for use in preventive maintenance, troubleshooting and corrective maintenance of the 7M11.

PREVENTIVE MAINTENANCE

General

Preventive maintenance consists of cleaning, visual inspection, lubrication, etc. Preventive maintenance performed on a regular basis will improve the reliability of this instrument. The severity of the environment to which the 7M11 is subjected determines the frequency of maintenance.

Cleaning

The 7M11 should be cleaned as often as operating conditians require. Accumulation of dirt in the instrument can pravide an electrical conduction path.

Exterior. Laose dust accumulated on the outside of the 7M11 can be removed with a soft cloth or small paint brush. A paint 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.

Interior. Dust in the interior of the instrument should be removed occasionally to prevent electrical conductivity under high-humidity conditions. The best way to clean the interiar is to blow aut the accumulated dust with dry, low-velocity air. Remave any dirt which remains with a soft paint brush or a clath dampened with a mild detergent and water solution. A cotton-tipped applicator is useful for cleaning in narrow spaces or for cleaning circuit baards.

CAUTION

Avaid the use of chemical cleaning agents which might damage the plastics used in this instrument. Avoid chemicals which contain benzene, toluene, xylene, acetone or similar solvents.

Lubrication

The reliability of the rotary switch can be maintained through proper lubrication. Use a cleaning-type lubricant (such as Tektronix Part No. 006-0442-00) on switch contacts and a heavier grease (such as Tektronix Part No. 006-0219-00) on switch detents. A lubrication kit containing the necessary lubricants and instructions is available from Tektronix, Inc. (Tektronix Part No. 003-0342-00).

Visual Inspection

The 7M11 should be inspected occasionally for such defects as broken connections or damaged circuit boards. The corrective procedure for most visible defects is obvious. Additional information such as soldering techniques and removal procedures is available in this section under Corrective Maintenance.

Performance Check

To ensure accurate operation of the 7M11, its performance should be checked after each 2000 hours of operation or, if used infrequently, every year. Section 5, Performance Check, provides a procedure for checking the operation of the 7M11 with respect to the characteristics given in the Specification section. This procedure may also be helpful in lacating instrument malfunctions.

TROUBLESHOOTING AIDS

Diagram

The circuit diagram of the 7M11 shows each compenent, along with its circuit number and electrical value.

Electrical Parts List

The electrical parts list contains a complete list of all the electrical components within the instrument in the order of their circuit numbers. A component description is also included for each part, which includes the Tektronix part number, the electrical value, the tolerance, the method of construction and the construction material (when applicable). Instructions far ordering replacement parts are provided both at the beginning of the Electrical Parts List section and in the Corrective Maintenance part of this section.

Performance Check

The Performance Check section provides a performance check procedure which will help in determining the source of a malfunction.

Circuit Boards

Fig. 4-1 shows both sides of one of the circuit boards used in the 7M11 (the other board is identical). The electrical compenents on these pictures are identified by their

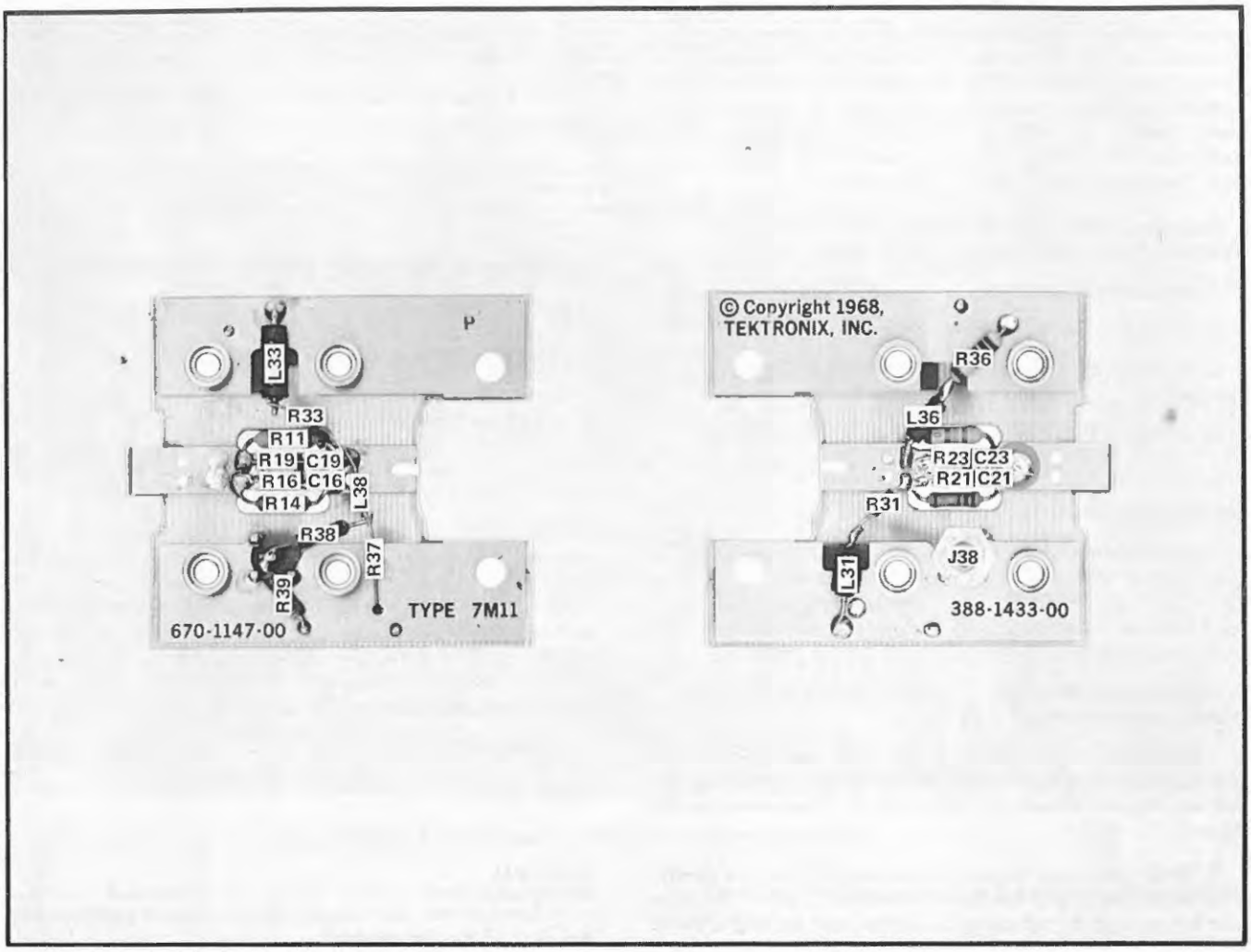


Fig. 4-1. 7M11 compensation network circuit board (the two boards in the instrument are identical).

circuit numbers. These pictures, when used along with the circuit diagram, aid in locating the components mounted on the circuit boards. The capacitors in Fig. 4-1 are square leadless capacitors which are mounted directly on the circuit board. See the Corrective Maintenance part of this section for replacement instructions.

Resistor Color Code. Both brown composition resistors and metal-film resistors (identifiable by their gray body color) are used in the 7M11. The resistance value of a composition resistor or metal-film resistor is color-coded on the component wtih EIA color code. The color code is read starting with a stripe nearest the end of the resistor. Composition resistors have four stripes which consist of two significant figures, a multiplier and a tolerance value. Metal-film resistors have five stripes consisting of three significant figures, a multiplier and a tolerance value.

CORRECTIVE MAINTENANCE

General

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

Obtaining Replacement Parts

Standard Parts. All electrical and mechanical port replacements for the 7M11 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 purchasing or ordering replacement parts, check the parts list for value, tolerance, rating and description.

NOTE

When selecting replacement parts, it is important to remember that the physical size and shape of a compenent may affect its performance, particularly at the upper frequency limits of the instrument. All replacement parts should be direct replacements unless it is known that a different component will not adversely affect instrument performance.

Special Parts. In addition to the standard electronic components, some special parts are used in the 7M11. These parts are manufactured or selected by Tektronix, Inc. to meet

specific performance requirements, or are manufactured for Tektronix, Inc. in accordance with our specifications. Each special part is indicated in the electrical parts list by an asterisk preceding the part number. Most of the mechanical parts used in this instrument have been manufactured by Tektronix, Inc. 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 circuit number).

4. Tektronix Part Number.

Soldering Techniques

Circuit Boards. Use ordinary 60/40 solder and a 15-watt pencil type soldering iron on the circuit boards. The tip of the iron should be clean and properly tinned for best heat transfer to the solder joint. A higher wattage soldering iron may separate the wiring from the base material.

The following techniques should be used to replace a component on a circuit board:

1. Grip the component lead with long-nose pliers. Touch the soldering iron to the lead at the solder connection. Do not lay the iron directly on the board, as it may damage the board.

2. When the solder begins to melt, pull the lead out gently. This should leave a clean hole in the board. If not, the hole can be cleaned by reheating the solder and placing a sharp object such as a toothpick into the hole to clean it out. A vacuum-type desoldering tool can be used for this purpose.

3. Bend the leads of the new component to fit the holes in the board. Insert the leads into the holes in the board so the component is firmly seated against the board (or as positioned originally). If it does not seat properly, heat the solder and gently press the component into place

4. Touch the iron to the connection and apply a small amount of solder to make a firm solder joint. To protect heat-sensitive components, hold the lead between the component body and the solder joint with a pair of long-nose pliers or other heat sink.

5. Clip off the excess lead that protrudes through the board.

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

Rotary Switch Terminals. When soldering to the metal terminals on the rotary switch, ordinary 60/40 solder can be used. Use a soldering iron with a 40- to 75-watt rating and a 1/8-inch wide wedge-shaped tip.

Observe the following precautions when soldering to a metal terminal:

1. Apply only enough heat to make the solder flow freely.

2. Apply only enough solder to form a solid connection. Excess solder may impair the function of the part.

3. If a wire extends beyond the solder joint, clip off the excess.

4. Clean the flux from the solder joint with a flux-remover solvent.

Component Removal and Replacement

Most of the components in this instrument are not accessible without first removing either the TRIGGER SELECTOR switch or one of the circuit boards.

Rotary Switches. Individual wafers or mechanical parts of rotary switches are normally not replaceable. If a switch is defective, replace the entire assembly. Replacement switches can be ordered either wired or unwired; refer to the Electrical Parts List for the applicable part number.

When replacing a switch, tag the leads and switch terminals with corresponding identification tags as the leads are disconnected. Then, use the old switch as a guide for installing the new one. An alternative method is to draw a sketch of the switch layout. When soldering to the new switch, be careful that the solder does not flow beyond the rivets of the switch terminals. Spring tension of the switch contact can be destroyed by excessive solder.

Compensation Network. Use the following procedure for removing and replacing a compensation network circuit board (see Fig. 4-2).

REMOVAL

1. Remove the side panels. Pull out on the panels from the rear of the instrument.

2. Disconnect the trigger lead. Pull the trigger lead connector toward the instrument center.

3. Disconnect the signal input connector from the front panel. With a 12 sided, 1 inch diameter nutdriver (Tektronix Part No. 003-0459-00), remove the front panel securing nut from the signal input connector. Slowly slide the compensation network and input connector backward and to the side. The delay cable is fairly stiff and should not have its shape changed more than necessary. In particular, do not kink it or it will have to be replaced.

4. Disconnect the compensation network from the signal input connector. When the compensation network and input connector are free and at the instrument side, loosen (do not remove) the knurled nut that secures the connector to the network side shields. The knurled nut has been applied with finger pressure only. If it has not been turned for several months, it may be necessary to use a large pair of pliers to gently free the nut. The nut threads are right handed. After the knurled nut has been loosened, the connector can easily be turned 90° and pulled free from the compensation network. The connector center conductor is a sliding contact allowing easy removal and replacement.

5. Remove the shields from the compensation network circuit board. With a Phillips screwdriver, remove the 4 throughbolts from the shield and network. Loosen the 4 rear screws (two on each side) and slide the shields free in a forward

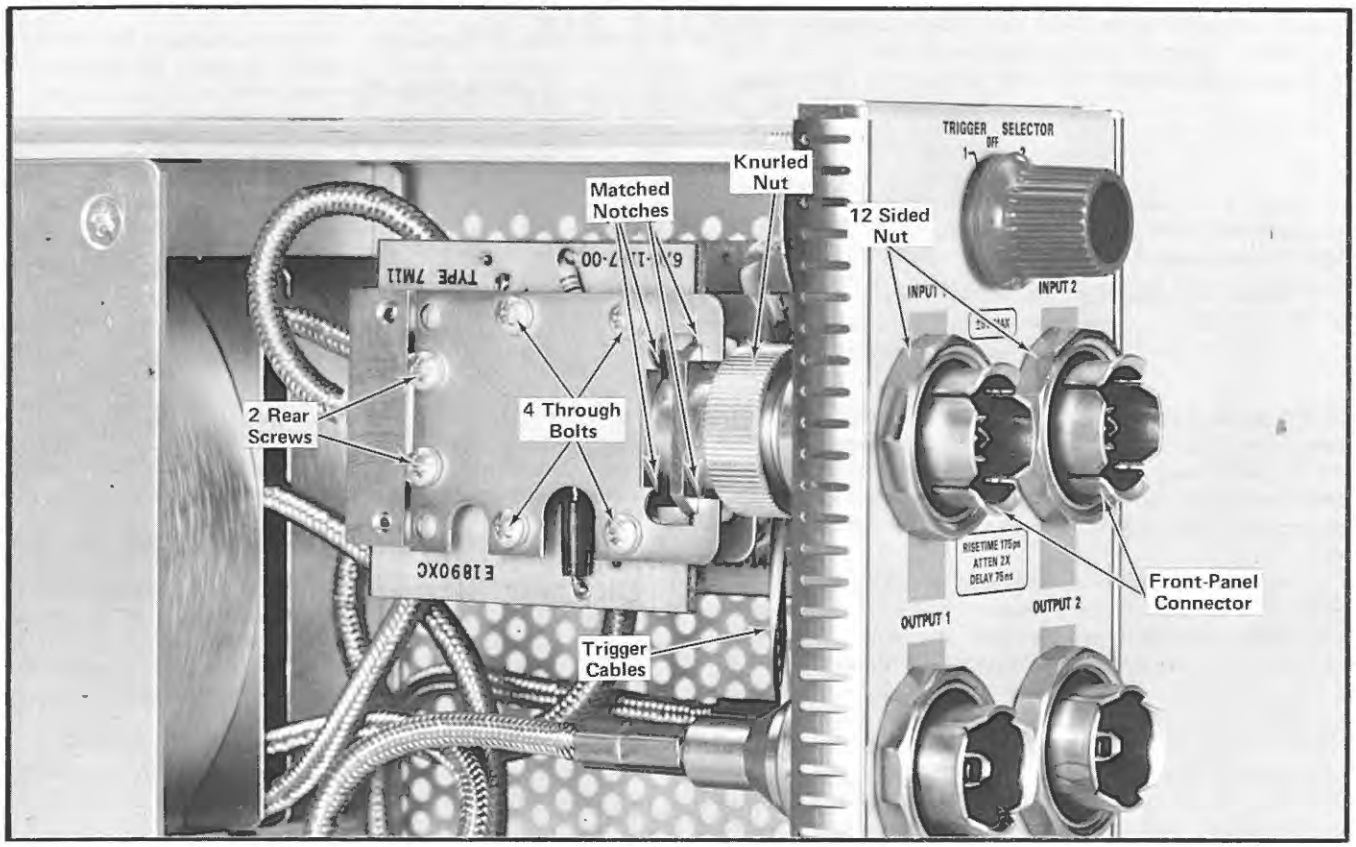


Fig. 4-2. Compensation network as installed in the 7M11.

direction. Removing these shields exposes both sides of the compensation network circuit board.

REPLACEMENT

1. Replace the shields. Slide each shield in place and tighten the 4 rear screws until the shield is slip tight. Replace the 4 through-bolts and their nuts, leaving them loose so that the shields are in their proper place, but free to move slightly.

2. Replace the signal input connector. Carefully slide the center connectar in place. Rotate the connector until the two notches on the rear of the connector are mated with the compensation network circuit board. Mate the 4 notches in the threaded section of the connector with the front arms of the shields. Slowly tighten the knurled nut finger tight. As the nut is tightened, the shields will be drawn forward until firmly mated with the rear of the connectar. The rear notches of the cannector must remain aligned with the circuit board.

3. Tighten the screws and bolts halding the shields against the circuit board. Press the shield-connector assembly together at the rear of the circuit board so that the circuit board is held firmly in the two rear notches of the connector. Tigthten the four rear screws, then the 4 through-bolts.

4. Connect the signal input connector to the front panel. Slide the signal input connector through the front panel. Be sure the large lockwasher is in place between the rear side of the front panel and the largest-diameter portion of the connector assembly. Secure the connector to the front panel with the 12-sided nut.

5. Reconnect the trigger cable to the compensation network circuit board.

6. Replace the side panels.

REPLACEMENT OF COMPENSATION NETWORK CIRCUIT BOARD

1. Ta remave the compensatian network circuit board, remave the signal input cannector and shields as described previously. Remove the two balts which hold the rear coaxial cable clamp in place. DO NOT remove the coaxial cable binding nut at the block rear. Use a 15-watt soldering iron and heat the junction of coaxial cable center conductor and the circuit board. While heating this junction, free the cable and clamp from the circuit board.

2. To install a new compensatian network circuit board, position the cable clamp and circuit board so that the cable center conductor is in the notch of the circuit board. Replace the two bolts which connect the cable clamp block ta the circuit board, but do not tighten them. Push the block forward until there is no space between the front of the block and the rear of the board. Tighten the two bolts securely. Solder the center conductor to the baard.

NOTE

Removal of the coaxial cable from the mounting block is not recommended as a routine maintenonce item.

Leadless Capacitors. The coupling capacitors in the series RC networks of the 7M11 are leadless capacitors which are soldered directly to the circuit board (see Fig. 4-1). Use the following procedure when replacing one of these capacitors.

1. Apply heat with a 15 watt soldering iron to the leadless capacitor from the backside of the circuit board. (The circuit board should have a hole in it under the chip.) When the solder around the chip begins to melt, lift the chip from the circuit board.

2. Place the new chip on the circuit board in the same position as the old chip. Apply slight pressure to the top of the clip, while applying heat to the backside of the circuit board, until the chip rests solidly against the circuit board. The resistor lead may now be soldered to the top of the chip.

Repackaging for Shipment

If the Tektronix instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag showing: owner (with address) and the name of an individual at your firm that can be contacted, complete instrument serial number and a description of the service required.

Save and re-use the package in which your instrument was shipped. If the original packaging is unfit for use or not available, repackage the instrument as follows:

Surround the instrument with polyethylene sheeting to protect the finish of the instrument. Obtain a carton of corrugated cardboard of the correct carton strength and having inside dimensions of no less than six inches more than the instrument dimensions. Cushion the instrument by tightly packing three inches of dunnage or urethane foam between carton and instrument, on all sides. Seal carton with shipping tape or industrial stapler.

The carton test strength for your instrument is 200 pounds.

SECTION 5
PERFORMANCE CHECK

Change information, if any, affecting this section will be found at the rear of the manual.

The following section provides a procedure for comparing the 7M11 operation with the performance requirements given in the Specification section. This check should be done after each 2000 hours of operation or once a year. Any maintenance known to be needed should be completed before doing this performance check. Table 5-1 provides an index and record of the characteristics checked in the pracedure.

EQUIPMENT REQUIRED

The following (or equivalent) items of equipment are required for a complete calibration of the 7M11. The equipment is illustrated in Fig. 5-1. If substitute equipment is used, its accuracy must exceed the tolerances to be measured by at least 4 times in order to make an accurate measurement.

1. Test Oscillascope, Tektronix Type 547 with Type W Differential Comparatar Plug-In Unit. Minimum alternate requirements; sweep rate 0.2 ms/cm, vertical deflection factor 50 mV/cm, accuracy of voltage measurement within 3%, internal comparison voltage provided with accuracy 0.5%, DC vertical input coupling, and internal triggering.

2. Sampling and Time Domain Reflectometer Plug-In Unit, Tektronix Type 1S2. Minimum alternate requirements; instrumentation capable of measuring a delay time of 75 ns within 1 ns and a difference in two delay times of 30 ps (preferably a 50-Ω system).

3. Sampling Oscilloscope, Tektronix 7504 with a 7S11 Sampling Unit, a Type S-2 Sampling Head, and a 7T11 Sampling Sweep Unit. Minimum alternate requirements: sweep rates of 50 ps through .5 ns, vertical deflection factors 50 mV/div through 5 mV/div, risetime less than 75 ps, 50-Ω input and internal triggering. Aberrations (observed using Tektronix Type 284 pulse output) first 2.5 ns following step transition, +5%, —5% or less, total of 10% or less peak to peak; after 2.5 ns, total of 4% or less peak to peak.

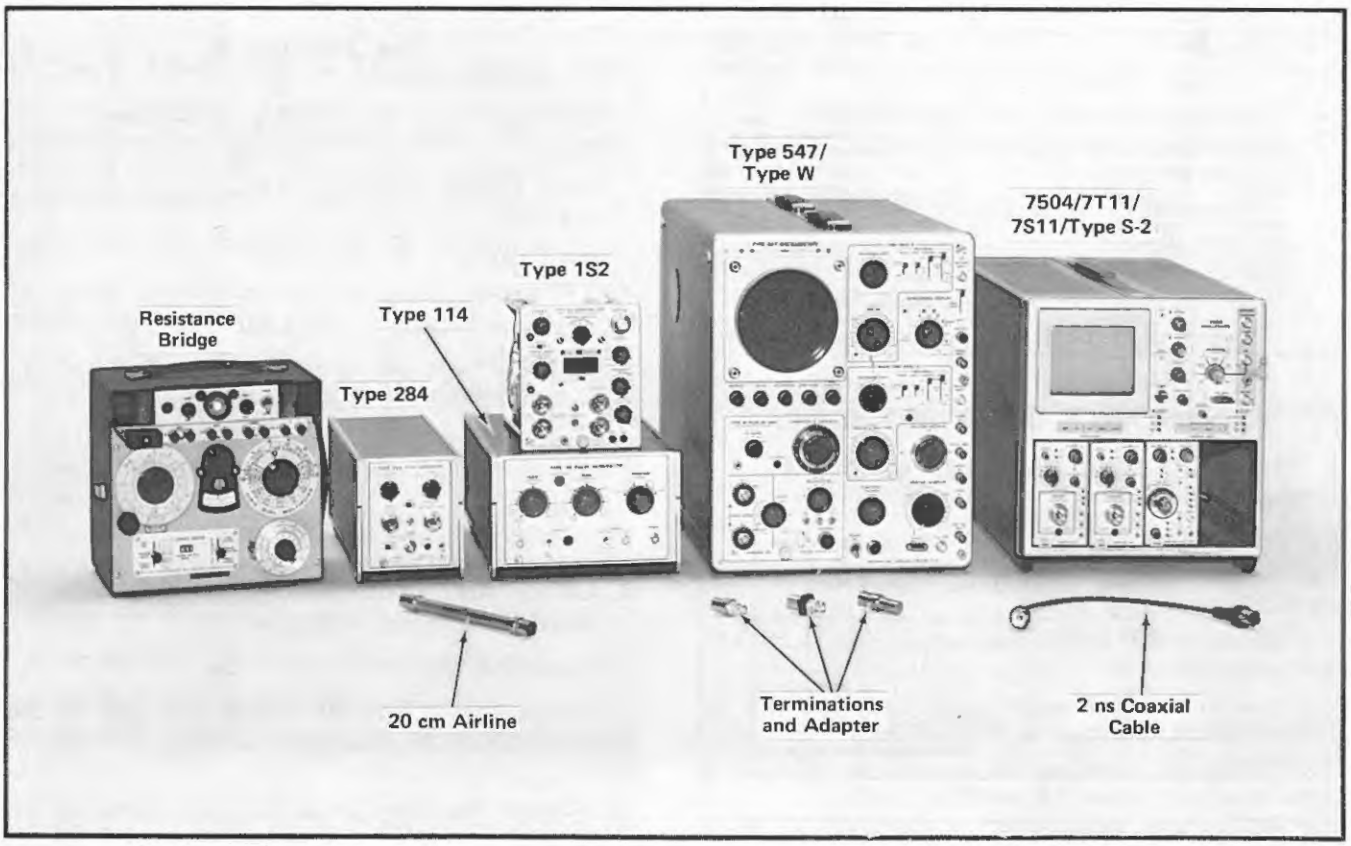


Fig. 5-1. Equipment Required.

4. Resistance Bridge, Minimum alternate requirement: for example, ESI 250 DA (or digitol ohmmeter). DC resistance measurement of 50 Ω within 0.5%.

5. Pulse Generator, Tektronix Type 114. Minimum alternate requirements: Pulse period 1 ms, variable amplitude of 5 volts.

6. Pulse Generator, Tektronix Type 284. Minimum alternate requirements: Pulse amplitude about +200 mV with a risetime less than 70 ps.

7. Two 50-Ω end-line terminations. Tektronix Part No. 017-0081-00.

8. 50-Ω through-line termination, GR-to-BNC female connectors. Tektronix Part No. 017-0083-00.

9. 50-Ω 2× attenuator with GR connectors. Tektronix Part No. 017-0080-00 (not shown in Fig. 5-1).

10. Two 50-Ω 2-ns coaxial cables. Tektronix Part No. 017-0505-00 (supplied with 7M11 as standard accessories).

11. 50-Ω coaxial cable, 18 inches, with BNC connectors. Tektronix Part No. 012-0076-00 (not shown in Fig. 5-1).

12. 12 inch patch cord with banana plug connectors (not shown in Fig. 5-1).

13. 50-Ω 20 cm airline. Tektronix Part No. 017-0084-00.

14. Two GR-to-BNC female connector adapter. Tektronix Part No. 017-0064-00.

15. 3-mm male-to-BNC female connector adapter. Tektronix Part No. 015-1018-00 (not shown in Fig. 5-1).

TABLE 5-1

PERFORMANCE CHECK INDEX AND RECORD

√	Check	Page
	DC Input Resistance of Signal Inputs	5-2
	DC Output Resistance of Trigger Output	5-2
	Attenuation and Operation with Maximum Input Voltage	5-2
	Attenuation of Trigger Output Pulse	5-3
	Delay Time	5-3
	Risetime Response of Signal Inputs	5-4
	Aberrations Response of Signal Inputs	5-5
	Risetime of Output Pulse	5-5

PERFORMANCE CHECK PROCEDURE

1. Check DC Input Resistance of Signal Inputs

a. Set the 7M11 TRIGGER SELECTOR switch to OFF.

b. Set the resistance bridge (or digital ohmmeter) to measure a DC resistance of 50 Ω.

c. Connect a 50-Ω end-line termination to the 7M11 OUTPUT 1 connector.

d. Connect the resistance bridge test leads across the inside and outside conductors of the 7M11 INPUT 1 connector.

e. CHECK—DC input resistance across the Chonnel 1 signal input of 50 ohms ±1 ohm (50 Ω ±2%).

f. Disconnect the 50 Ω end-line termination from the 7M11 OUTPUT 1 connector and reconnect it to the OUTPUT 2 connector.

g. Repeat parts d and e for the Channel 2 signal input.

2. Check DC Output Resistance of Trigger Output

a. Connect 50-Ω end-line terminations to both the 7M11 INPUT 2 and OUTPUT 2 connectors. (The termination should already be connected to the OUTPUT 2 connector from the last step.)

b. Set the 7M11 TRIGGER SELECTOR switch to 2.

c. Connect the resistance bridge test leads between the inside and outside conductors of the 7M11 TRIGGER OUTPUT connector.

d. CHECK—DC output resistance of TRIGGER OUTPUT connector 50 ohms ±5 ohms (50 Ω ±10%).

e. Disconnect the 50-Ω end-line terminations from the 7M11 Channel 2 signal connectors and reconnect them to the Channel 1 signal connectors.

f. Set the 7M11 TRIGGER SELECTOR switch to 1.

g. Repeat parts c and d.

h. Disconnect the terminations and the resistance bridge test leads from the 7M11 connectors.

Control Settings

7M11	
TRIGGER SELECTOR	OFF
Type 547/Type W	
Horizontal Display	A
Triggering	Trig, +, AC, Int
Time/Cm	0.2 ms
Vertical Display	A-Vc
Input Atten	1
Input Coupling	DC
Vc Range	0
Comparison Voltage	5.000
Millivolts/Cm	50
Type 114	
Period	1 ms (Calibrated)
Width	Square Wave
Amplitude	+3 V to 10 V

3. Check Attenuation and Operation with Maximum Input Voltage

a. Install the Type W Unit in the Type 547.

b. Set the 7M11, Type 547/Type W and Type 114 controls as shown in the list of control settings preceding this step.

c. Connect the Type 114 Output Pulse though a 2 ns coaxial cable and a 50-Ω in-line termination to the Channel A input of the Type W Unit. (Use BNC-to-GR connector adapter in connecting the 2 ns coaxial cable to the Type 114.)

d. Position the pulse baseline to the center horizontal line of the CRT graticule using the Type W Unit vertical Position control.

e. Set the Type W Unit Vc Range switch to +11.

f. Adjust the Type 114 Variable Amplitude control for a display of the pulse tops at the center horizontal line on the CRT graticule (Type 114 output pulse of 5 volts).

g. Disconnect the 2 ns coaxial cable from the Type W Unit (leave the 50 Ω termination still connected to the Type W Unit) and reconnect it to the 7M11 INPUT 1 connector. Connect a 2 ns coaxial cable between the 7M11 OUTPUT 1 connector and the 50-Ω termination connected to the Type W Unit.

h. Set the Type W Unit Comparison Voltage control to 2.500 and the Vc Range switch to 0.

i. Position the baseline of the pulse to the center horizontal line of the CRT graticule and set the Vc Range switch to +11.

j. CHECK—Display of pulse taps at the center horizontal line of the CRT graticule ±1 division (2.5 volts ±2%).

k. Disconnect the 2 ns coaxial cable from the 7M11 INPUT 1 connector and reconnect it to the INPUT 2 connector. Disconnect the 2 ns cable from the OUTPUT 1 connector and reconnect it to the OUTPUT 2 connector.

l. Set the Type W Unit Vc Range switch to 0.

m. Repeat parts i and j for the 7M11 Channel 2 delay line.

4. Check Attenuation of Trigger Output Pulse

a. Disconnect the 2 ns cable from the 7M11 OUTPUT 2 connector and reconnect it (through a BNC-to-GR connector adapter) to the TRIGGER OUTPUT connector. Connect a 50-Ω end-line termination to the OUTPUT 2 connector.

b. Set the 7M11 TRIGGER SELECTOR switch to 2.

c. Set the Type W Unit Vc Range switch to 0 and the Comparison Voltage switch to 1.000.

d. Position the pulse baseline to the center horizontal line of the CRT graticule and set the Vc Range switch to +11.

e. CHECK—Display of trigger pulse tops at the center horizontal line of the CRT graticule ±2 divisions (1 volt ±10%).

f. Disconnect the 2 ns coaxial cable from the 7M11 INPUT 2 connector and reconnect it to the INPUT 1 connector. Disconnect the 50-Ω end-line termination from the OUTPUT 2 connector and reconnect it to the OUTPUT 1 connector.

g. Set the 7M11 TRIGGER SELECTOR switch to 1.

h. Set the Type W Unit Vc Range switch to 0.

i. Repeat parts d and e for the 7M11 Channel 1 trigger output pulse.

j. Disconnect the cables and terminations from the 7M11, Type 547/Type W and Type 114.

k. Remove the Type W Unit from the Type 547.

Control Settings

	7M11
TRIGGER SELECTOR	OFF
	Type 547/Type 1S2
Horizontal Display	×1 External
Horiz Input Variable 10-1	Fully Counterclockwise
Vertical Display Mode	Normal
Resolution	Normal
Vertical Units/Div	.2 (Calibrated)
ρ-Volts	ρ
Position	0.00
Horizontal Units/Div	Time
Range	.1 μs
Magnifier	×100 (Calibrated)
Trigger Mode	Internal Pulse .25 V 50 ps

5. Check Delay Time

a. Install the Type 1S2 in the Type 547.

b. Set the 7M11 and the Type 547/Type 1S2 controls as shown in the list of control settings preceding this step.

c. Connect a patch cable with banana plugs between the Type 1S2 Horiz Output jack and the Type 547 Horiz Input jack. Connect two 2 ns coaxial cables together and then connect the double cable between the Type 1S2 .25 V, 50 ps internal pulse connector and one of the sampler inputs (GR connectors on left side of plug-in unit). Connect a 50-Ω end-line termination to the other sampler input.

d. Obtain a 5 division display and center it vertically using the Type 1S2 Offset controls (see Fig. 5-2). The Type 1S2 position control may have to be turned slightly (no more than 1 turn) to locate the rise of the display.

e. Position the 50% point of the leading edge of the display to the center vertical graticule line of the CRT with the Type 1S2 Position control.

f. Note the dial reading of the Position control.

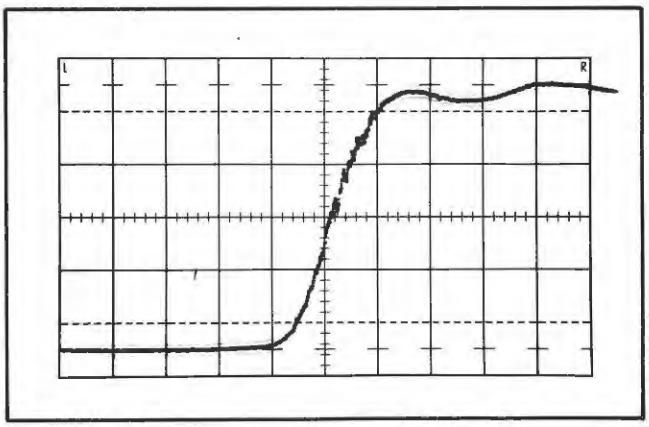


Fig. 5-2. Type 1S2 .25 V-50 ps internal pulse.

g. Disconnect the 2 ns coaxial cables from each other. Connect the open end of the cable connected to the internal pulse connector .25 V-50 ps to the 7M11 INPUT 1 connector. Connect the open end of the cable connected to the sampler input to the OUTPUT 1 connector.

h. Set the Type 1S2 Units/Div switch to .1.

i. Position the 50% point of the leading edge of the display to the center vertical graticule line of the CRT using the Type 1S2 position control and note the dial reading of the Position control.

j. CHECK—Difference between the dial readings in part f and part i of 75.0 ±1.0 (75 ns ±1 ns).

k. Disconnect the 2 ns coaxial cable from the 7M11 INPUT 1 connector and reconnect it to the INPUT 2 connector. Disconnect the cable from the OUTPUT 1 connector and reconnect it to the OUTPUT 2 connector.

l. CHECK—50% point of the leading edge of the display at the center vertical graticule line of the CRT ±0.3 divisions (delay difference between channels less than 30 ps).

m. Repeat parts i and j for the 7M11 Channel 2 delay line.

n. Disconnect the cables and the terminations from the 7M11 and Type 547/Type 1S2.

Control Settings

7M11	
TRIGGER SELECTOR	OFF
7504	
Vertical Mode	Right
Horizontal Mode	A
7T11	
Sweep Range (Time Pos. Ring)	50 ns
Time/Div	.2 ns (Calibrated)
Sampling Mode	Sequential
Time Position	As Is
Trigger Slope	+
Trig Level	Centered
Stability	Centered
Trig Amp	×1
Triggering Mode	Ext, 50 Ω, 2 V Max
Scan Mode	Rep
Scan	Fully Clockwise
7S11	
mVolts/Div	50 (Uncalibrated)
Delay	Fully Clockwise
DC Offset	Display Centered
Dot Response	As Is
Normal-Smooth	Normal
Type 284	
Mode	Pulse Output
Lead Time	75 ns

6. Check Risetime Response of Signal Inputs

a. Install a 7T11 Sampling Time Base Unit in the A Horiz compartment of a 7504 and a 7S11 Sampling Amplifier Unit in the Right Vert compartment. Install a Type S-2 Sampling Head in the 7S11.

b. Set the 7M11, 7504/7T11/7S11/S-2 and Type 284 controls as shown in the list of control settings preceding this step.

c. Connect the pulse output of the Type 284 through a 2 ns coaxial cable and a 20 cm airline to the Type S-2. (The 20 cm airline should be connected to the Type S-2.)

d. Connect an 18 inch 50 Ω coaxial cable with BNC connectors and one BNC female-to-3 mm male connector adapter, between the Trigger Output connector of the Type 284 and the Trig Input connector of the 7T11.

e. Center the display on the CRT graticule using the 7S11 DC Offset controls and the 7T11 Time Position control. Adjust the display amplitude for 5 divisions using the mVolts/Div Variable control.

f. Set the 7T11 Time/Div switch to 50 ps and position the display on the CRT graticule using the Time Position controls. A better defined display may be obtained at this point by adjusting the 7S11 Dot Response control and/or pressing the Smooth button. If the Smooth button is pressed, turn the Type 7T11 Scan control fully counterclockwise.

g. Note the exact risetime of the leading edge of the pulse (10% to 90%). See Fig. 5-3A.

h. Disconnect the 20 cm airline from the 2 ns coaxial cable. Connect the open end of the 20 cm airline to the 7M11 OUTPUT 1 connector. Connect the open end of the 2 ns coaxial cable to the INPUT 1 connector.

i. Set the Type 284 Lead Time switch to 5 ns.

j. Reset the 7S11 mVolts/Div switch to 20 and center the display on the CRT graticule. Adjust the Variable control for a display amplitude of 5 divisions.

k. Note the exact risetime of the leading edge of the pulse. See Fig. 5-3B.

l. Square the risetime value measured in part g and subtract it from the square of the risetime measured in part k (T_r^2 part k − T_r^2 part g).

m. CHECK—Difference in squares calculated in part l of less than 30625 (less than 175 ps squared).[1]

n. Disconnect the 20 cm airline from the 7M11 OUTPUT 1 connector and reconnect it to the OUTPUT 2 connector. Disconnect the 2 ns coaxial cable from the INPUT 1 connector and reconnect it to the INPUT 2 connector.

o. Repeat parts i through k for the 7M11 Channel 2 delay line.

[1] **The equation used to determine the risetime delay of the 7M11 is** T_R^2 7M11 = T_R^2 7M11 + 7S11 − T_R^2 7S11.

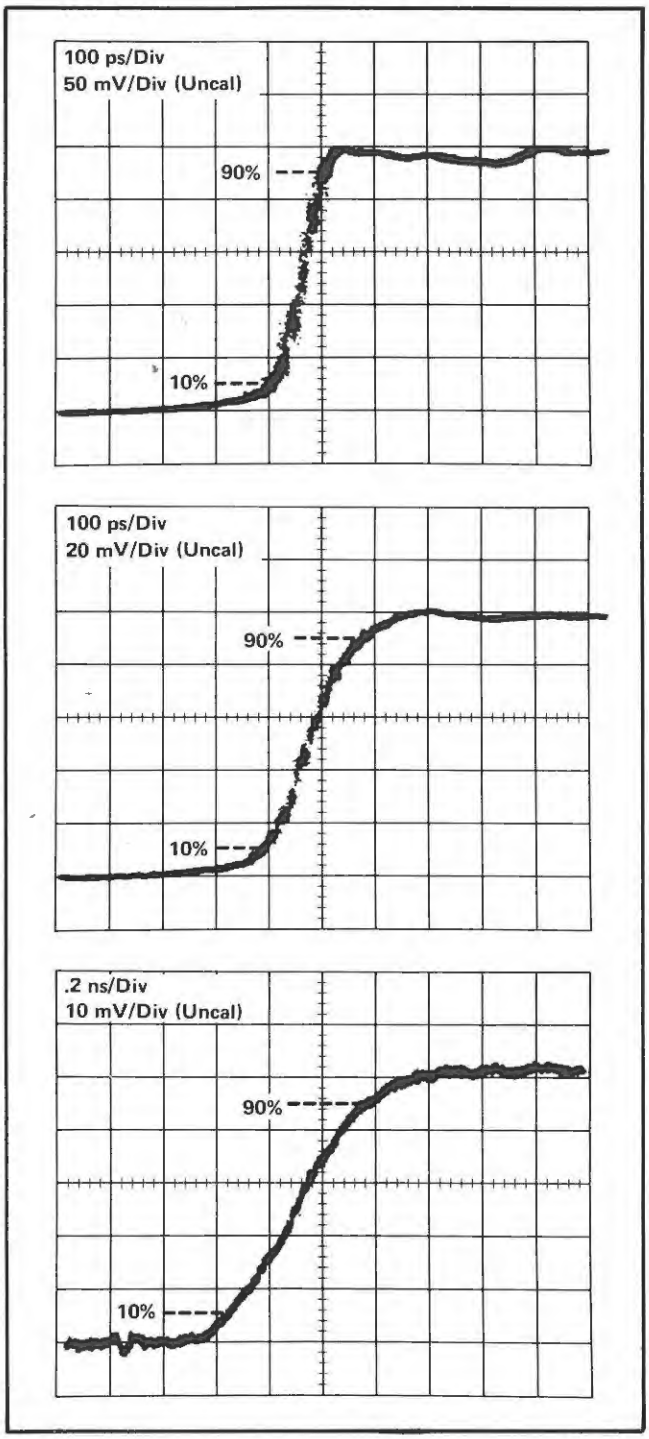


Fig. 5-3. Type 284 output pulse risetime; (A) Applied directly to Type S-2; (B) Applied to Type S-2 through 7M11; (C) Applied to Type S-2 through 7M11 trigger pickoff circuit.

7. Check Risetime of Trigger Output

a. Disconnect the 20 cm airline from the 7M11 OUTPUT 2 connector and reconnect it to the TRIGGER OUTPUT connector (use a BNC-to-GR adapter). Connect a 50-Ω end-line termination to the OUTPUT 2 connector.

b. Set the 7M11 TRIGGER SELECTOR switch to 2.

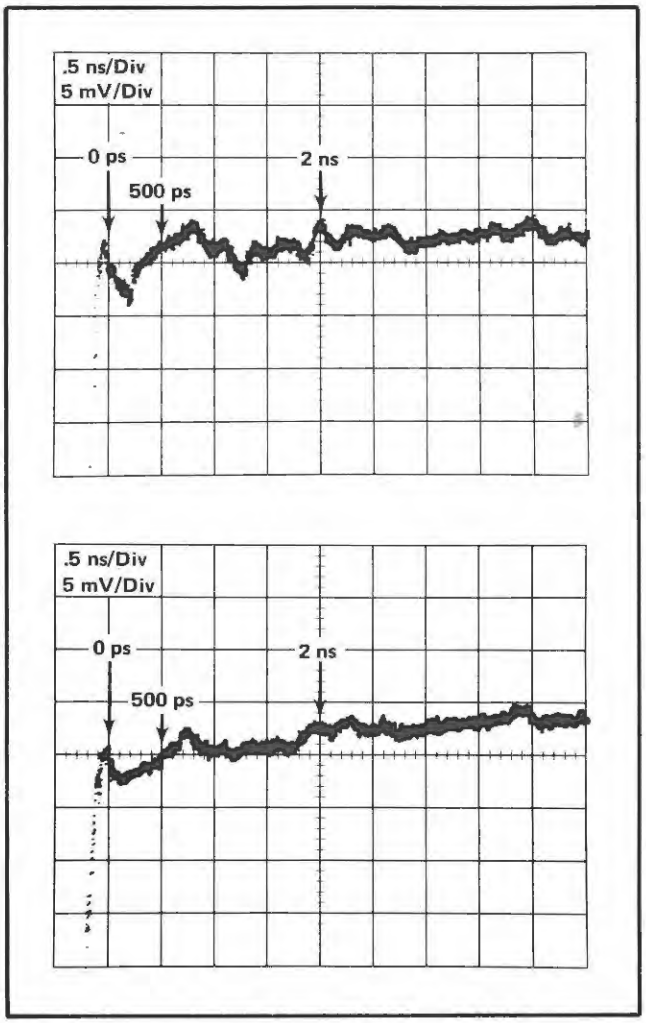


Fig. 5-4. Type 284 output pulse aberrations; (A) Applied directly to Type S-2; (B) Applied to Type S-2 through 7M11.

c. Reset the following 7S11 and 7T11 controls to:

mVolts/Div	10
Time/Div	.2 ns

d. Set the Type 284 Lead Time switch to 75 ns.

e. Center the display on the CRT graticule. Adjust the display amplitude of the pulse on the CRT for 5 divisions using the 7S11 mVolts/Div Variable control.

f. Note the pulse risetime (see Fig. 5-3C).

g. Square the risetime value measured in part g of step 6, and subtract it from the square of the risetime measured in part f of this step (T_r^2 part f — T_r^2 part g).

h. CHECK—Difference between squares in part g of less than 360,000 (less than 600 ps squared).

i. Disconnect the 2 ns coaxial cable from the 7M11 INPUT 2 connector and reconnect it to the INPUT 1 connector. Disconnect the 50-Ω end-line termination from the OUTPUT 2 connector and reconnect it to the OUTPUT 1 connector.

j. Set the 7M11 TRIGGER SELECTOR switch to 1.

k. Repeat parts f through h for the 7M11, Channel 1 signal input.

8. Check Aberrations of Pulse Transmitted Through Delay Lines

a. Disconnect the 20 cm airline and the 2 ns coaxial cable from the 7M11 and connect a 2× attenuator with GR connectors between them.

b. Set the 7M11 Time/Div switch to 500 ps and the mVolts/Div switch to 20.

c. Position the rise of the pulse on the second vertical graticule line using the 7S11 DC Offset controls and adjust the Variable mVolts/Div control for a pulse amplitude of 5 divisions.

d. Set the 7S11 mVolts/Div control to 5 and position the pulse top to the vertical center of the graticule using the DC Offset controls.

e. Note the pulse aberrations (+, —, and total peak to peak) for the first 500 ps after the rise of the pulse, from 500 ps to 2 ns after the rise of the pulse and from 2 ns on (see Fig. 5-4A).

f. Disconnect the 20 cm airline and the 2 ns coaxial cable from the 2× attenuator. Reconnect the open end of the 20 cm airline to the 7M11 OUTPUT 1 connector and the open end of the 2 ns coaxial coble to the INPUT 1 connector.

g. Set the Type 284 Lead Time switch to 5 ns.

h. Position the pulse top to the center of the CRT graticule.

i. Note the pulse aberrations over the three ranges indicated in part f(see Fig. 5-4B).

j. For each range, subtract the pulse aberrations noted in part f from those noted in part i.

k. CHECK—Differences in aberrations between part f and part i as shown in Table 5-2.

NOTE

Since the 7M11 has a risetime response of only 175 ps, some high frequency information is lost when transmitted through it. For this reason, the aberrations noted in part i will probably be less than those noted in part e.

TABLE 5-2

PULSE ABERRATIONS DUE TO 7M11

Time After Pulse Reached Full Amplitude	Aberrations (+, —, and peak to peak)	
	Percent	Display
0 to 500 ps	10%	2 divisions
500 ps to 2 ns	5%	1 division
After 2 ns	2%	0.4 division

l. Disconnect the 20 cm airline from the 7M11 OUTPUT 1 connector and reconnect it to the OUTPUT 2 connector. Disconnect the 2 ns coaxial cable from the INPUT 1 connector and reconnect it to the INPUT 2 connector.

m. Repeat parts i through k for the 7M11 Channel 2 delay line.

n. Disconnect the 20 cm airline, the 2 ns coaxial cable and the trigger cable from the 7S11, Type 284 and 7T11.

This completes the Performance Check procedure.

SECTION 6
ELECTRICAL PARTS LIST

Values are fixed unless marked Variable.

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description

CHASSIS

Connectors

J11	*131-0881-00			GR Input conn. assembly		
J12	*131-0881-00			GR Input conn. assembly		
J21	*131-0882-00			GR Input conn. assembly		
J22	*131-0882-00			GR Input conn. assembly		
J49	131-0276-00			BNC, female		
P38	131-0375-00			Right angle		
P39	131-0375-00			Right angle		

Resistors

Resistors are fixed, composition, ±10% unless otherwise indicated.

R41	321-0097-00	100 Ω	1/8 W	Prec	1%
R43	321-0097-00	100 Ω	1/8 W	Prec	1%
R45	321-0097-00	100 Ω	1/8 W	Prec	1%
R47	321-0097-00	100 Ω	1/8 W	Prec	1%
R49	315-0510-00	51 Ω	1/4 W		5%

Switch

	Wired or Unwired			
S40	Wired	*262-0893-00	Rotary	TRIGGER SELECTOR
S40		260-1108-00	Rotary	TRIGGER SELECTOR

CHANNEL 1 and 2 Circuit Board Assemblies (2)

*670-1147-00 Complete Board

Capacitors

Tolerance ±20% unless otherwise indicated.

C16	283-0133-00	5 pF	Cer	50 V	5%
C19	283-0132-00	10 pF	Cer	50 V	5%
C21	283-0135-00	100 pF	Cer		
C23	283-0205-00	510 pF	Cer	50 V	10%

CHANNEL 1 and 2 Circuit Board Assemblies (2) (cont)

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description		
				Connector		
J38	131-0391-00			Receptacle, electrical		
				Inductors		
L31	108-0240-00			820 μH		
L33	*108-0146-01			5 μH		
L36	*108-0182-00			0.3 μH		
L38	108-0606-00			50 nH		
				Resistors		
Resistors are fixed, composition, ±10% unless otherwise indicated.						
R11	321-0067-00			48.7 Ω	1/8 W	Prec 1%
R14	321-1068-01			50.5 Ω	1/8 W	Prec 1/2%
R16	317-0100-00			10 Ω	1/8 W	5%
R19	317-0111-00			110 Ω	1/8 W	5%
R21	317-0111-00			110 Ω	1/8 W	5%
R23	317-0122-00			1.2 kΩ	1/8 W	5%
R31	317-0122-00			1.2 kΩ	1/8 W	5%
R33	317-0511-00			510 Ω	1/8 W	5%
R36	321-0126-00			200 Ω	1/8 W	Prec 1%
R37	317-0681-00			680 Ω	1/8 W	5%
R38	321-0074-00			57.6 Ω	1/8 W	Prec 1%
R39	321-0114-00			150 Ω	1/8 W	Prec 1%

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.

Assembly and/or Component
Detail Part of Assembly and/or Component
mounting hardware for Detail Part
Parts of Detail Part
mounting hardware for Parts of Detail Part
mounting hardware for Assembly and/or Component

Mounting hardware always appears 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.

Mounting hardware must be purchased separately, unless otherwise specified.

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 or model 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.

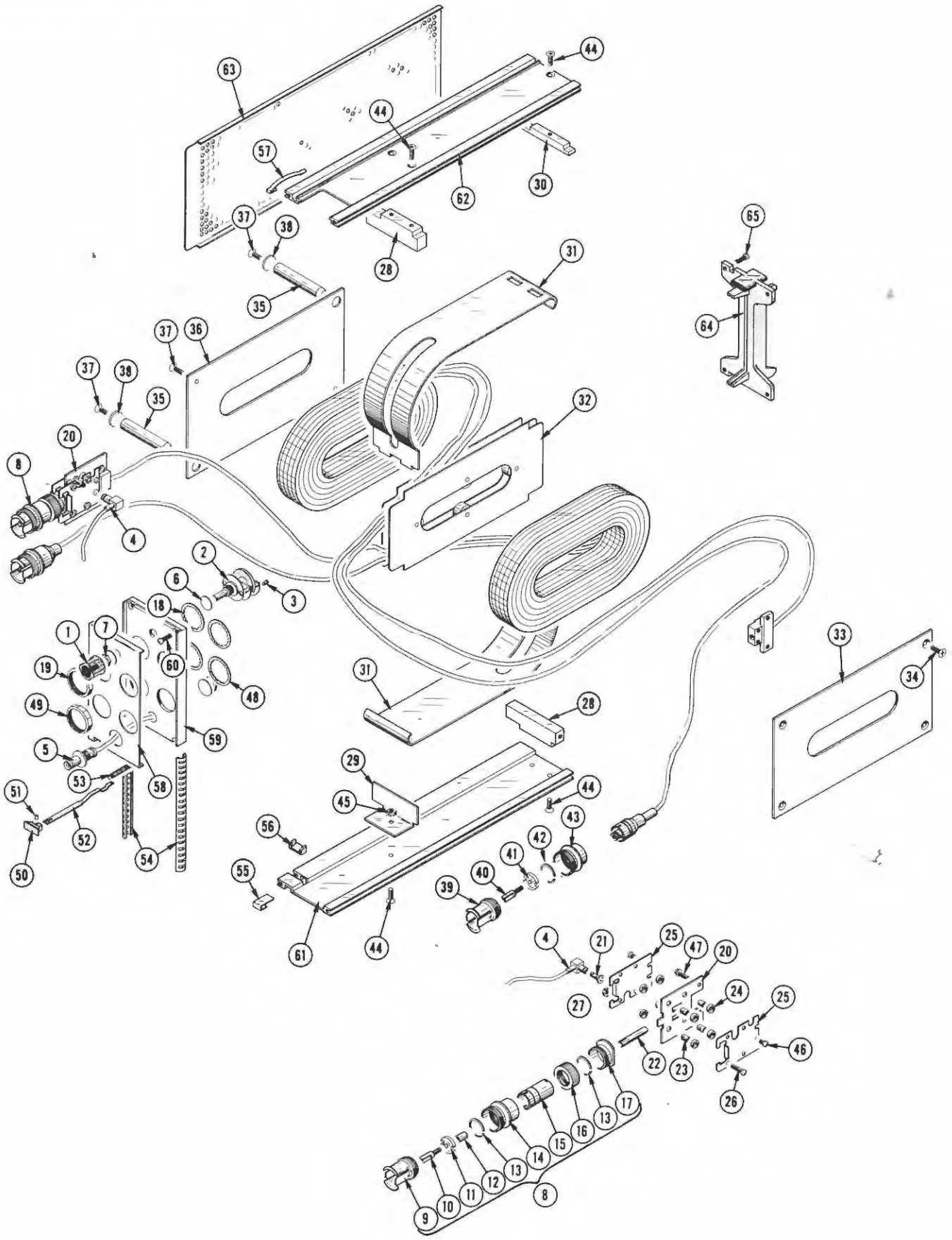


Figure 7-1. Exploded

SECTION 7
MECHANICAL PARTS LIST

FIGURE 1 EXPLODED

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty 1 2 3 4 5	Description
1-1	366-1190-00			1	KNOB, gray—TRIGGER SELECTOR
	- - - - - -			-	knob includes:
	213-0153-00			2	SETSCREW, 5-40 x 0.125 inch, HSS
-2	262-0893-00			1	SWITCH, wired—TRIGGER SELECTOR
	- - - - - -			-	switch includes:
	260-1108-00			1	SWITCH, unwired
-3	210-0707-00			3	EYELET, 0.089 inch ID
-4	131-0375-00			2	CONNECTOR, right angle, 50 Ω, female
-5	131-0276-00			1	CONNECTOR, BNC, female, w/hardware
	- - - - - -			-	mounting hardware: (not included w/switch)
-6	210-0012-00			1	WASHER, lock, internal, 3/8 ID x 1/2 inch OD
	210-0978-00			1	WASHER, flat, 3/8 ID x 1/2 inch OD
-7	210-0590-00			1	NUT, hex., 3/8-32 x 7/16 inch
-8	131-0881-00			2	CONNECTOR, electrical, input
	- - - - - -			-	each connector includes:
-9	132-0002-00			1	SLEEVE CONDUCTOR, outer
-10	132-0029-00			1	INNER CONDUCTOR
-11	132-0028-00			1	INSULATOR
-12	103-0055-00			1	ADAPTER, contact to contact
-13	132-0007-00			2	SNAP RING
-14	214-0700-00			1	COUPLER
-15	205-0063-00			1	SHELL, RF transmission line
-16	220-0460-00			1	NUT, coupling
-17	103-0054-00			1	ADAPTER, connector to transmission line
	- - - - - -			-	mounting hardware for each: (not included w/connector)
-18	210-0047-00			1	WASHER, lock, internal, 0.880 ID x 1.110 inches OD
-19	220-0459-00			1	NUT, dodecagon, 0.875-32 x 1 inch
-20	670-1147-00			2	ASSEMBLY, circuit board—CHANNEL 1/CHANNEL 2
	- - - - - -			-	each assembly includes:
	38B-1433-00			1	BOARD, circuit
-21	131-0391-00			1	CONNECTOR, coaxial, male
-22	214-0697-00			1	CONTACT, electrical
-23	210-0709-00			4	EYELET, 0.138 inch OD
-24	361-0130-00			8	SPACER, sleeve
-25	119-0201-00			4	LINE SECTION, RF transmission
-26	211-0014-00			8	SCREW, 4-40 x 1/2 inch, PHS
-27	210-0586-00			8	NUT, keps, 4-40 x 1/4 inch

FIGURE 1 EXPLODED (cont)

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty 1 2 3 4 5	Description
1-	119-0218-00			1	ASSEMBLY, delay line
	- - - - - -			-	assembly includes:
-28	391-0081-00			2	BLOCK, mounting
-29	407-0702-00			1	BRACKET, angle
-30	386-1670-00			1	SUPPORT
-31	380-0182-00			2	HOUSING HALF
-32	361-0294-00			1	SPACER PLATE ASSEMBLY
-33	200-1047-00			1	COVER, right
	- - - - - -			-	mounting hardware: (not included w/cover)
-34	211-0559-00			4	SCREW, 6-32 x 0.375 inch, 100° csk, FHS
-35	129-0243-00			2	POST
-36	200-1048-00			1	COVER, left
	- - - - - -			-	mounting hardware: (not included w/cover)
-37	211-0559-00			4	SCREW,6-32 x 0.375 inch, 100° csk, FHS
-38	210-0949-01			2	WASHER, recessed, 9/64 ID x 1/2 inch OD
-39	132-0002-00			2	SLEEVE CONDUCTOR, outer
-40	132-0029-00			2	INNER CONDUCTOR
-41	132-0028-00			2	INSULATOR
-42	132-0007-00			2	SNAP RING
-43	214-0700-00			2	COUPLER
	- - - - - -			-	mounting hardware: (not included w/assembly)
-44	211-0538-00			6	SCREW, 6-32 x 0.312 inch, 100° csk, FHS
-45	210-0457-00			1	NUT, keps, 6-32 x 5/16 inch
-46	211-0005-00			4	SCREW, 4-40 x 0.125 inch, PHS
-47	211-0116-00			2	SCREW, sems, 4-40 x 0.312 inch, PHB
-48	210-0407-00			2	WASHER, lock, internal, 0.880 ID x 1.110 inches OD
-49	220-0459-00			2	NUT, dodecagon, 0.875-32 x 1 inch
-50	366-1058-13			1	KNOB, latch
	- - - - - -			-	mounting hardwore: (not included w/knob)
-51	214-1095-00			1	PIN, spring, split
-52	105-0076-00			1	RELEASE BAR, latch
-53	214-1280-00			1	SPRING, helical compression
-54	348-0235-00			2	SHIELDING GASKET
-55	214-1054-00			1	SPRING, flat, latch detent
-56	105-0075-00			1	BOLT, latch
-57	214-1061-00			1	SPRING, flat, sliding ground
-58	333-1249-00			1	PANEL, front
-59	386-1447-24			1	SUBPANEL, front
	- - - - - -			-	mounting hardware: (not included w/subpanel)
-60	213-0192-00			4	SCREW, thread forming, 6-32 x 0.50 inch Fil HS
-61	426-0573-00			1	FRAME SECTION, bottom
-62	426-0574-00			1	FRAME SECTION, top
-63	337-1064-00			2	SHIELD, electrical, side
-64	386-1402-01			1	PANEL, rear
	- - - - - -			-	mounting hardware: (not included w/panel)
-65	213-0192-00			4	SCREW, thread forming, 6-32 x 0.50 inch Fil HS
	361-0326-00			1	SPACER, 0.18 ID x 0.25 inch OD

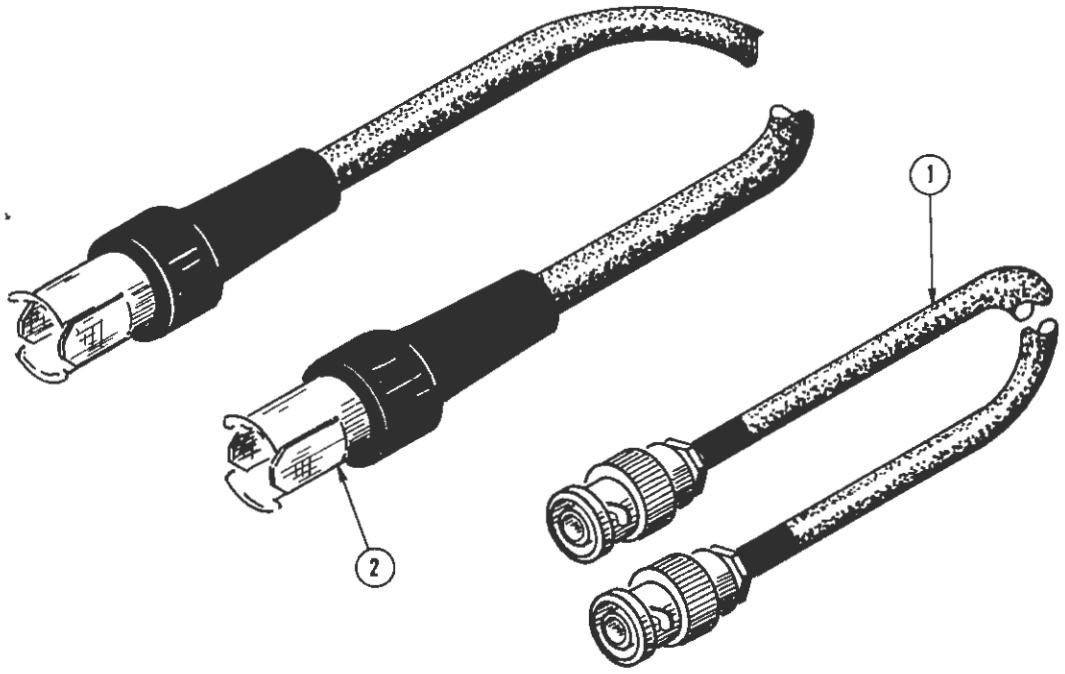


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Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Qty 1 2 3 4 5	Description
2-1	012-0076-00	B010100	B019999	1	CABLE, BNC, 50 Ω
	012-0208-00	B020000		1	CABLE ASSEMBLY, RF, 50 Ω, BNC, 10 inches long
-2	017-0505-00			2	CABLE, 2 ns, 50 Ω
	070-0987-00			1	MANUAL, instruction (not shown)

Figure 7-2. Standard Accessories

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CARTON ASSEMBLY
(Part No. 065-0125-00)

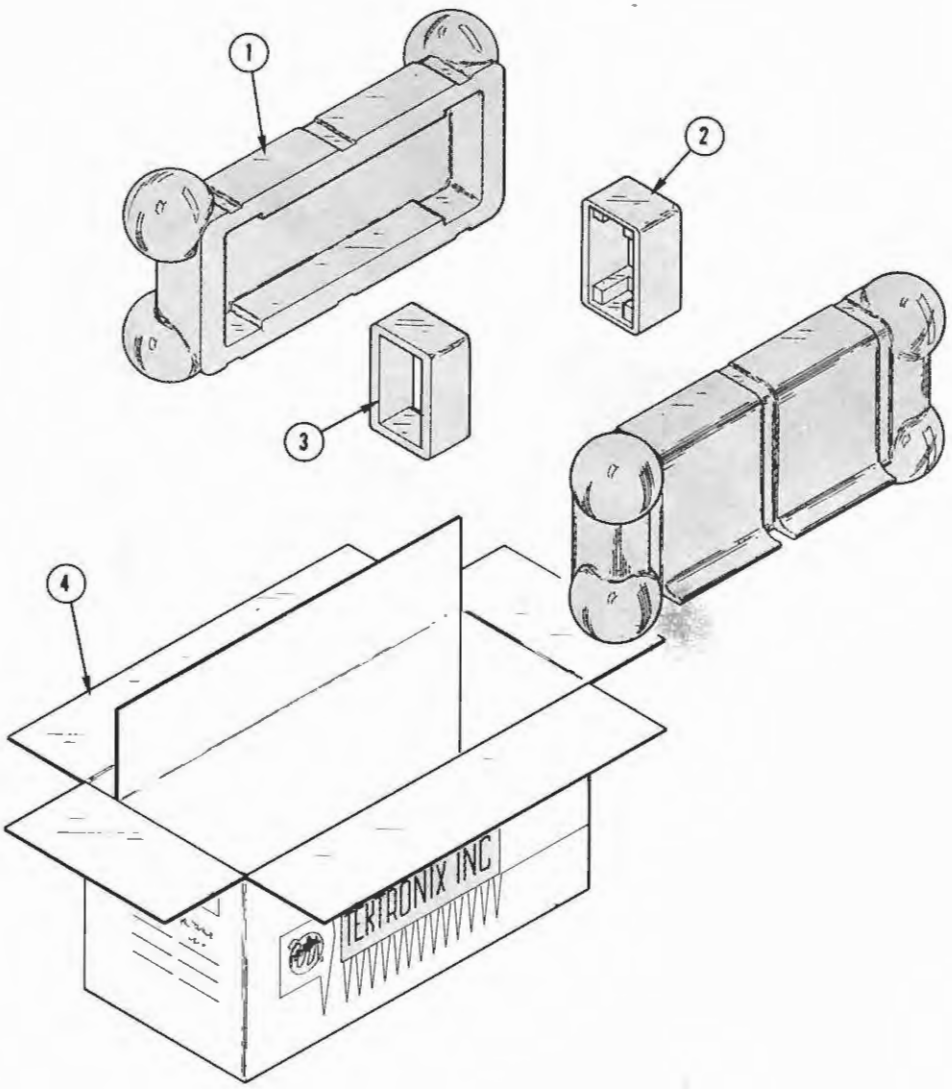

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Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Disc	Qty	1 2 3 4 5	Description
3-	065-0125-00			1		ASSEMBLY, carton
	- - - - - -			-		assembly includes:
-1	004-0241-00			2		CASE HALF
-2	004-0242-00			1		END CAP, rear
-3	004-0243-00			1		END CAP, front
-4	004-0748-00			1		CARTON

Figure 7-3. Repackaging

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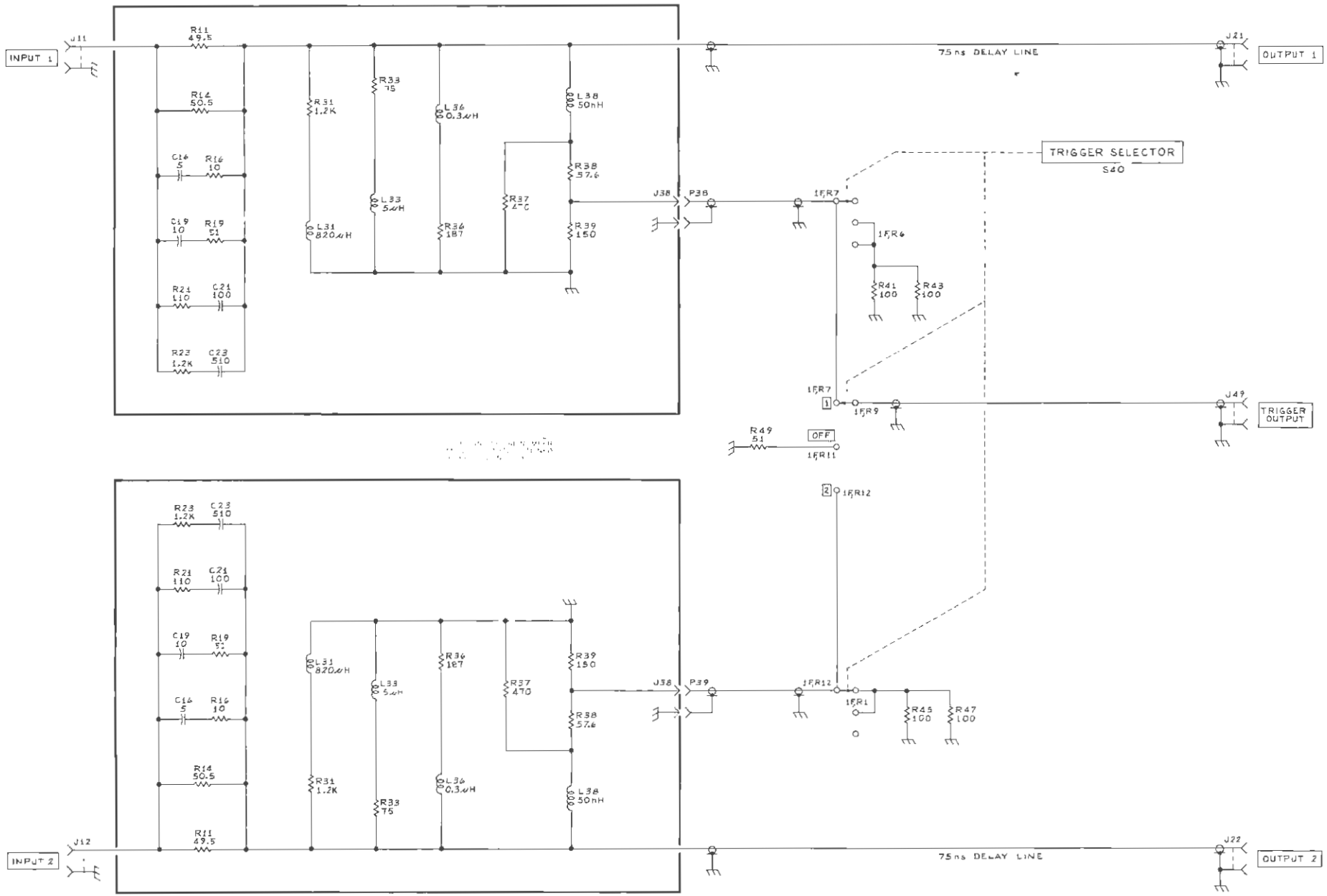
INPUT 1
J11
R11 49.5
R14 50.5
C14 5
R16 10
C19 10
R19 51
R21 110
C21 100
R23 1.2K
C23 510
R31 1.2K
R33 75
L33 5μH
L31 820μH
L36 0.3μH
R36 187
R37 470
L38 50nH
R38 57.6
R39 150
J38
P38
1ER7
1ER6
R41 100
R43 100
TRIGGER SELECTOR
S40
75ns DELAY LINE
J21
OUTPUT 1
1ER7
1
1ER9
J49
TRIGGER OUTPUT
R49 51
OFF
1ER11
2
1ER12
P39
1ER12
1ER1
R45 100
R47 100
INPUT 2
J12
J22
OUTPUT 2

Tektronix
COMMITTED TO EXCELLENCE

MANUAL CHANGE INFORMATION

Date: 8-29-79 Change Reference: M38026

Product: 7M11 50-OHM DELAY LINE Manual Part No.: 070-0987-00

DESCRIPTION

EFF SN B021209

ELECTRICAL PARTS LIST AND SCHEMATIC CHANGES

CHANGE TO: CHANNEL 1 and 2 Circuit Board Assemblies

R11	321-0909-01	49.5 Ω	1/8 W	Prec	1/2%
R19	317-0510-00	51 Ω	1/8 W		5%
R33	317-0751-00	75 Ω	1/8 W		5%
R36	321-0123-00	187 Ω	1/8 W	Prec	1%
R37	317-0471-00	470 Ω	1/8 W		5%