Service Manual

Tektronix

TDS 210 & TDS 220
Digital Real-Time Oscilloscopes

070-9693-00

This document applies to firmware version 1.00 and above.

Warning
The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

TEK INTER-OFFICE COMMUNICATION

TO John Martin 94-540 DATE June 25, 1991

FROM Frank Gray, 50-PAT

SUBJECT GIDEP permit request

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Francis I. Gray
Group Patent Counsel

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

Only qualified personnel should perform service procedures.

Injury Precautions

Avoid Electric Overload

To avoid injury or fire hazard, do not apply a voltage to any input, including the common inputs, that varies from ground by more than the maximum rating for that input.

Avoid Electric Shock

To avoid injury or loss of life, do not connect or disconnect probes or test leads while they are connected to a voltage source.

Do Not Operate Without Covers

To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

Do Not Operate in Wet/Damp Conditions

To avoid electric shock, do not operate this product in wet or damp conditions.

Do Not Operate in Explosive Atmosphere

To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Product Damage Precautions

Use Proper Power Source

Do not operate this product from a power source that applies more than the voltage specified.

Do Not Operate With Suspected Failures

If you suspect there is damage to this product, have it inspected by qualified service personnel.

Safety Terms and Symbols

Terms in This Manual

These terms may appear in this manual:

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

CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Terms on the Product

These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product

The following symbols may appear on the product:

DANGER
High Voltage

Protective Ground
(Earth) Terminal

ATTENTION
Refer to Manual

Double
Insulated

Certifications and Compliances

CSA Certified AC Adapter

CSA Certification includes the AC adapters appropriate for use in the North America power network. All other AC adapters supplied are approved for the country of use.

Compliances

Consult the product specifications for Installation Category, Pollution Degree, and Safety Class.

Service Safety Summary

Only qualified personnel should perform service procedures. Read this *Service Safety Summary* and the *General Safety Summary* before performing any service procedures.

Do Not Service Alone

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

Use Care When Servicing With Power On

Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

Preface

This is the Service Manual for the TDS 210 and TDS 220 Digitizing Oscilloscopes. This manual provides information to troubleshoot and repair the instrument to the module level.

Related Manuals

Additional documentation for the instrument is contained in the related manuals listed below.

Language	User Manual Part Number	Extension Module Instructions Part Number	Programmer Manual Part Number
English	070-8483-XX	070-9565-XX	070-9576-XX
French	070-8520-XX	070-9567-XX	
German	070-8484-XX	070-9566-XX	
Italian	070-8980-XX	070-9569-XX	
Spanish	070-9560-XX	070-9570-XX	
Portuguese	070-9561-XX	070-9571-XX	
Japanese	070-9562-XX	070-9572-XX	
Korean	070-9564-XX	070-9575-XX	
Simplified Chinese	070-9563-XX	070-9573-XX	
Traditional Chinese	070-9568-XX	070-9574-XX	

Specifications

All specifications apply to the TDS 210 and TDS 220 with a P6112 probe unless noted otherwise. To meet specifications, two conditions must first be met:

- The instrument must have been operating continuously for ten minutes within the specified operating temperature.
- You must perform the Self Cal operation, accessible through the utility menu, if the operating temperature changes by more than 5° C.

All specifications are guaranteed unless noted "typical." Specifications that are marked with the ✓ symbol are checked in the chapter *Performance Verification*.

Table 1–1: Specifications

Acquisition		
Acquisition Modes	Sample, Peak detect, and Average	
Acquisition Rate, typical	Up to 100 waveforms per second (2 channels, sample acquisition mode, no measurements)	
Single Sequence	*Acquisition Mode*	*Acquisition Stops After*
	Sample, Peak Detect	Single acquisition, one or two channels simultaneously
	Average	N acquisitions, one or two channels simultaneously, N is selectable from 4, 16, 64, and 128
Inputs		
Input Coupling	DC, AC, or GND	
Input Impedance, DC Coupled	1 MΩ ±2% in parallel with 20 pF ±3 pF	
P6112 Probe Attenuation	10X	
Maximum Voltage Between Signal and Common at input BNC	*Overvoltage Category*	*Maximum Voltage*
	CAT I and CAT II	300 V_{RMS}
	For steady-state sinusoidal waveforms, derate at 20 dB/decade above 100 kHz to 13 V_{pk} at 3 MHz and above. Also, refer to Overvoltage Category description on page 1–5.	
Maximum Voltage Between Probe Tip and ground using P6112 connected to input BNC	*Overvoltage Category*	*Maximum Voltage*
	CAT I and CAT II	300 V_{RMS}
	Derate at 20 dB/decade above 900 kHz to 13 V_{RMS} at 27 MHz and above. Also, refer to Overvoltage Category description on page 1–5.	

Table 1–1: Specifications (Cont.)

Inputs		
Channel-to-Channel Common Mode Rejection, typical	*TDS 210*	*TDS 220*
	100:1 at 60 Hz 20:1 at 30 MHz	100:1 at 60 Hz 20:1 at 50 MHz
	Measured on MATH Ch1 – Ch2 waveform, with test signal applied between signal and common of both channels, and with the same VOLTS/DIV and coupling settings on each channel.	
Channel-to-Channel Crosstalk	*TDS 210*	*TDS 220*
	≥ 100:1 at 30 MHz	≥ 100:1 at 50 MHz
	Measured on one channel, with test signal applied between signal and common of the other channel, and with the same VOLTS/DIV and coupling settings on each channel.	
Vertical		
Digitizers	8 bit resolution, each channel sampled simultaneously	
VOLTS/DIV Range	2 mV/div to 5 V/div at input BNC (Full bandwidth at 10 mV/div to 5 V/div, 20 MHz at 2 mV/div to 5 mV/div)	
Position Range	2 mV/div to 200 mV/div, ±2 V > 200 mV/div to 5 V/div, ±50 V	
Analog Bandwidth at BNC or with P6112, probe DC Coupled	*TDS 210*	*TDS 220*
	60 MHz	100 MHz
Peak Detect Bandwidth, typical	*TDS 210*	*TDS 220*
	50 MHz (5 s/div to 5 µs/div) (20 MHz at 2 mV/div to 5 mV/div)	75 MHz (5 s/div to 5 µs/div) (20 MHz at 2 mV/div to 5 mV/div)
Analog Bandwidth Limit, typical	Selectable between 20 MHz or full	
Lower Frequency Limit, AC Coupled	≤10 Hz at BNC ≤1 Hz when using a 10X passive probe	
Rise Time at BNC, typical	*TDS 210*	*TDS 220*
	<5.8 ns	<3.5 ns
Peak Detect Response	Captures 50% or greater amplitude of pulses ≥10 ns wide (5 s/div to 5 µs/div)	
DC Gain Accuracy	±3% for Sample or Average acquisition mode	
Position Accuracy	2 mV/div to 200 mV/div	>200 mV/div to 5 V/div
	±(0.5% × selected value + 5 mV)	±(0.5% × selected value + 50 mV)
DC Measurement Accuracy, Average Acquisition Mode	*Measurement Type*	*Accuracy*
	Average of ≥16 waveforms	±[3% × |reading + (position × volts/div)| + (0.1 div × volts/div)]
	Delta volts between any two averages of ≥16 waveforms acquired under same setup and ambient conditions	±[3% × |reading| + (0.05 div × volts/div)]

Table 1–1: Specifications (Cont.)

Horizontal			
Sample Rate Range	50 S/s to 1 GS/s		
Record Length	2500 samples for each channel		
SEC/DIV Range	5 ns/div to 5 s/div, in a 1, 2.5, 5 sequence		
✓ Sample Rate and Delay Time Accuracy	±100 ppm over any ≥1 ms time interval		
Position Range	5 ns/div to 250 µs/div	500 µs/div to 5 s/div	
	(4 div × s/div) to 20 ms	(4 div × s/div) to 50 s	
Trigger			
✓ Trigger Sensitivity, Edge Trigger Type	*Coupling*	*Sensitivity*	
	DC	CH 1 and CH 2	1 div from DC to 10 MHz, 1.5 div from 10 MHz to Full
		EXT	100 mV from DC to 10 MHz, 150 mV from 10 MHz to Full
		EXT/5	500 mV from DC to 10 MHz, 750 mV from 10 MHz to Full
Trigger Sensitivity, Edge Trigger Type, typical	*Coupling*	*Sensitivity*	
	NOISE REJ	Reduces the DC-coupled trigger sensitivity	
	HF REJ	Same as the DC-coupled limit from DC to 7 kHz, attenuates signals above 80 kHz	
	LF REJ	Same as the DC-coupled limits for frequencies above 300 kHz, attenuates signals below 300 kHz	
Trigger Level Range	Source	Range	
	Internal	±8 divisions from center of screen	
	EXT	±1.6 V	
	EXT/5	±8 V	
Trigger Level Accuracy, typical	Accuracies are for signals having rise and fall times ≥20 ns		
	Source	Accuracy	
	Internal	±0.2 div × volts/div within ±4 divisions from center screen	
	EXT	±(6% of setting + 40 mV)	
	EXT/5	±(6% of setting + 200 mV)	
SET LEVEL TO 50%, typical	Operates with input signals ≥50 Hz		
Sensitivity, Video Trigger Type, typical	Composite video signal		
	Source	Range	
	Internal	Pk-pk amplitude of 2 divisions	
	EXT	400 mV	
	EXT/5	2 V	

Table 1–1: Specifications (Cont.)

Trigger	
Signal Formats and Field Rates, Video Trigger Type	Supports NTSC, PAL, and SECAM broadcast systems for any field or any line
Holdoff Range	500 ns to 10 s
Measurements	
Cursors	Voltage difference between cursors (DV) Time difference between cursors (DT) Reciprocal of DT in Hertz (1/DT)
Automated Measurements	Cycle RMS, Mean, Pk – Pk, Period, Frequency

Table 1–2: General Specifications

Display		
Display Type	4.7 in (120 mm) diagonal liquid crystal	
Display Resolution	320 horizontal by 240 vertical pixels	
Display Contrast	Adjustable, temperature compensated	
Backlight Intensity, typical	35 cd/m^2	
Probe Compensator Output		
Output Voltage, typical	5 V into ≥1 MΩ load	
Frequency, typical	1 kHz	
Power Source		
Source Voltage	85 – 275 VAC_{RMS} from 47 through 440 Hz, CAT II	
Power Consumption	Less than 20 W	
Fuse	1 A, T rating, 250 V	
Environmental		
Temperature	Operating	0° C to +50° C
	Nonoperating	–20° C to +60° C
Cooling Method	Convection	
Humidity	+40° C or below	≤90% relative humidity
	+41° C to +50° C	≤60% relative humudity
Altitude	Operating	2,000 m
	Nonoperating	15,000 m
Random Vibration	Operating	0.31 g_{RMS} from 5 Hz to 500 Hz, 10 minutes on each axis
	Nonoperating	2.46 g_{RMS} from 5 Hz to 500 Hz, 10 minutes on each axis

Table 1–2: General Specifications (Cont.)

Mechanical		
Size	Height	151.4 mm (5.96 in.)
	Width	304.8 mm (12 in.)
	Depth	120.7 mm (4.75 in.)
Weight (approximate)	When packaged for domestic shipment	3.06 kg (6.75 lbs)
Certifications and Compliances		
EC Declaration of Conformity	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility and Low-Voltage Directive 73/23/ECC for Product Safety. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities: EN 50081-1 Emissions: EN 55011 Class A Radiated and Conducted Emissions EN 60555-2 AC Power Line Harmonic Emissions EN 50082-1 Immunity: IEC 801-2 Electrostatic Discharge Immunity IEC 801-3 RF Electromagnetic Field Immunity IEC 801-4 Electrical Fast Transient/Burst Immunity IEC 801-5 Power Line Surge Immunity Low Voltage Directive 73/23/EEC: EN 61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use	
Certifications	Canadian Standards Association certified to Standard CSA 1010.1. Underwriters Laboratories listing to Standard UL3111-1 for Electrical and Electronic Measuring and Testing Equipment.	
CSA Certified Power Cords	CSA Certification includes the products and power cords appropriate for use in the North America power network. All other power cords supplied are approved for the country of use.	
Pollution Degree 2	Do not operate in environments where conductive pollutants may be present.	
Overvoltage Category	Category:	Examples of Products in this Category:
	CAT III	Distribution-level mains, fixed installation
	CAT II	Local-level mains, appliances, portable equipment
	CAT I	Signal levels in special equipment or parts of equipment, telecommunications,electronics
Adjustment Interval		
The recommended adjustment interval is one year		

Operator Information

The TDS 210 and TDS 220 Digitizing Oscilloscopes are two-channel oscilloscopes in a small, lightweight, benchtop package.

In addition to the list of general features, this chapter covers the following topics:

- How to install your product
- How to add extended functions
- How to perform a brief functional check
- How to compensate probes
- How to use the self calibration routine
- How to match your probe attenuation factor

For more detailed information about instrument operation, refer to the *TDS 210 & TDS 220 User Manual*.

General Features

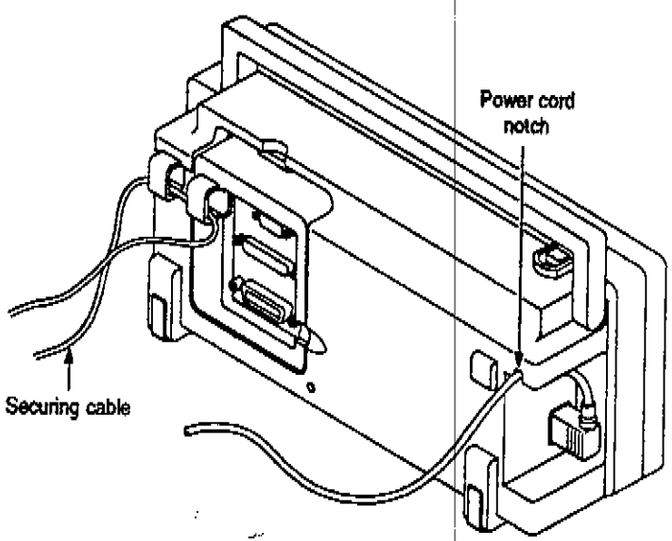
- 100 MHz (TDS 220) or 60 MHz (TDS 210) bandwidth with selectable 20 MHz bandwidth limit
- 1 GS/s sample rate and 2,500 point record length for each channel
- Cursors with readout and five automated measurements
- High-resolution, high-contrast LCD display with temperature compensation and replaceable backlight
- Setup and waveform storage
- Autoset for quick setup
- Waveform averaging and peak detection
- Digital real-time oscilloscope (at least ten-times oversampling)
- Dual time base
- Video trigger capability
- RS-232, GPIB, and Centronics communication ports easily added with optional extension modules
- Variable persistence display
- User interface available in 10 user selectable languages

Installation

Power Cord

Use only power cords designed for your oscilloscope. Use a power source that delivers 85 to 275 VAC_{RMS}, 47 to 63 Hz. Refer to page 10–6 for a list of available power cords.

Use the power cord notch to help route the cord to the rear of the instrument and avoid inadvertently disconnecting the power source.



Security Loop

Use the built-in cable channels to secure both your instrument and extension module to your location.

Extension Modules

You can increase the feature set of your oscilloscope by inserting an extension module. Refer to page 10–6 for information about the available modules. Figure 2–1 shows the proper way to install a module without bending the connecting pins.

CAUTION. *Electrostatic discharge (ESD) can damage components in the extension module and the oscilloscope. Do not operate you instrument with the extension module connector exposed.*

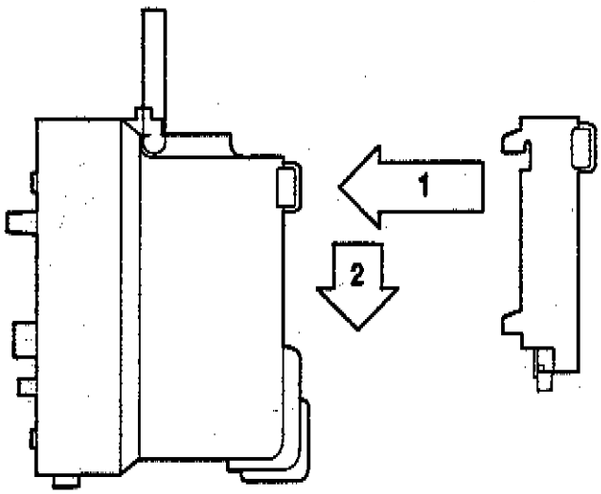
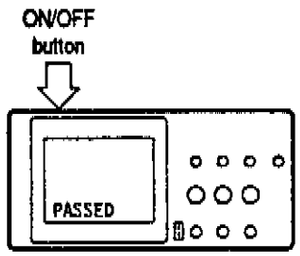


Figure 2–1: Installing an extension module

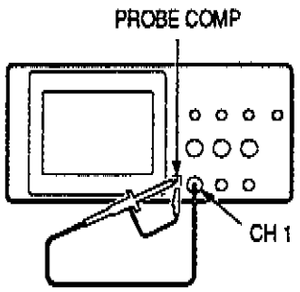
Functional Check

Perform this quick functional check to verify that your instrument is operating correctly.

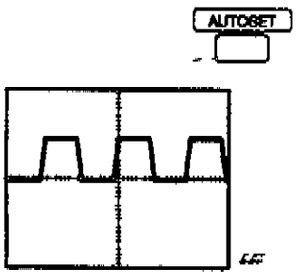


1. Turn on the instrument.

   Wait for the confirmation that all self tests have passed.



2. Connect the oscilloscope probe to channel 1. Attach the probe tip and reference lead to the PROBE COMP connectors.

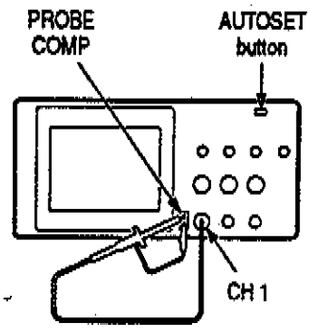


3. Push the AUTOSET button. Within a few seconds, you should see a squarewave in the display (approximately 5 V at 1 kHz).

   Repeat steps 2 and 3 for channel 2.

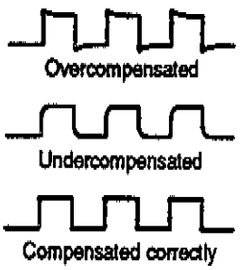
Probe Compensation

Perform this adjustment to match your probe to the input channel. This should be done whenever you attach a probe for the first time to any input channel.

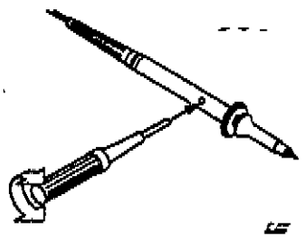


1. Connect the oscilloscope probe to channel 1. Attach the probe tip and reference lead to the PROBE COMP connectors and then press AUTOSET.

   If using the probe hook-tip, ensure a proper connection by firmly twisting the tip onto the probe.



2. Check the shape of the displayed waveform.



3. If necessary, adjust your probe.

   Repeat as necessary.

Self Calibration

The self calibration routine lets you quickly optimize the oscilloscope signal path for maximum measurement accuracy. You can run the routine at anytime but you should always run the routine if the ambient temperature changes by 5° C or more.

To compensate the signal path, disconnect any probes or cables from the channel 1 and channel 2 input connectors. Then, press the UTILITY button and select Do Self Cal to confirm that you are ready to proceed.

Probe Attenuation Setting

Probes are available with various attenuation factors which affect the vertical scale readout of the oscilloscope.

To change (or check) the probe attenuation setting, press the VERTICAL MENU button (of the channel you're using) and then press the menu selection next to Probe until the correct setting is displayed.

This setting remains in effect until changed again.

Factory Setup

The table below lists the state of the instrument after you select Recall Factory from the SAVE/RECALL menu.

Table 2–1: Factory Setup Setting

Control	Setting
Acquire mode	Sample
Acquire # of averages	16
Channel selection	Channel 1 on
Cursor H Bar position	–3.2 divisions from the center
Cursor V Bar position	–2 divisions from the center
Cursor function	Off
Cursor time units	Seconds
Delayed time base time/div	50 µs/div
Delay time, delayed runs after main	50 µs
Display format	YT
Display graticule type	Full
Display contrast	50%
Display style	Vectors
Display accumulate time	500 ms
Edge trigger coupling	DC
Edge trigger level	0.0 V
Edge trigger slope	Rising
Edge trigger source	Channel 1
Horizontal – main trigger position	50%
Horizontal – time base	Main only
Main time base time/div	500 µs/div
Math waveform function	CH1 + CH2
Saved setups	No change
Saved waveforms	No change
Trigger holdoff	Minimum (495 ns)
Trigger mode	Auto
Trigger type	Edge
Vertical bandwidth (all channels)	Full
Vertical coupling (all channels)	DC
Vertical position (all channels)	0 div
Vertical volts/div. (all channels)	100 mV/div

Theory of Operation

This chapter describes the electrical operation of the TDS 210 and TDS 220 to the module level. It describes the basic operation of each functional circuit block shown in Figure 3–1.

Main Board

The Main board contains a two channel acquisition system, trigger system, acquisition/display controller, and system processor. Interfaces are provided for two signal inputs, external trigger input, probe compensation, front panel, LCD display, extension module, and power supply. Acquisition and display functions are implemented in two ASICs.

Acquisition System

Signals from the CH 1, CH 2, and EXT TRIG input connectors pass through attenuators to the acquisition ASIC. The acquisition ASIC contains amplifiers and samplers for each input channel, A/D converter, and trigger logic. The digitized waveform samples are transferred to the display ASIC. Low voltage regulators supply isolated power to the acquisition ASIC.

Display System

The display system consists of the display ASIC, DRAM memory, and system oscillator. Digitized acquisition samples are processed by the display ASIC and stored into DRAM. The Display ASIC formats the waveform data and generates drive signals for the LCD display. Front panel scanning is also performed by the display ASIC.

Processor System

The processor system consists of the microprocessor, instruction ROM and nonvolatile memory. The processor system interprets the front panel controls, programs acquisition and display parameters, computes waveform measurements, and manages the extension module interface. Saved setups, waveforms, and calibration constants are stored in nonvolatile memory. The processor system shares DRAM with the display system.

Input Signal Interface

BNC connectors are mounted on the main board for CH 1, CH 2, and trigger input. The signal inputs are compatible with the P6112 probes supplied.

Probe Compensation

The PROBE COMP and ground terminals are provided for probe adjustment.

Power Supply

The power supply module generates low voltage DC and a line trigger signal for the main board, and high voltage AC to power the LCD backlight. The power supply operates over a wide power line voltage and frequency range.

Display Module

The display module consists of a liquid crystal display (LCD), a display driver, and a florescent backlight.

Front Panel

The front panel board holds the encoders and push button contacts that the operator uses to control the instrument. An elastomer mat holds the conductive pads for the push buttons. Circuits on the front panel convert the matrix into serial data which is read by the display ASIC on the main Board.

Extension Modules

The TDS2HM hardcopy module contains a Centronics parallel printer interface. The TDS2CM communication module also includes a GPIB and RS–232 interfaces. A ROM on the communications module contains processor instructions to support the communications interfaces. The extension modules interface with the processor system through the extension module port connector.

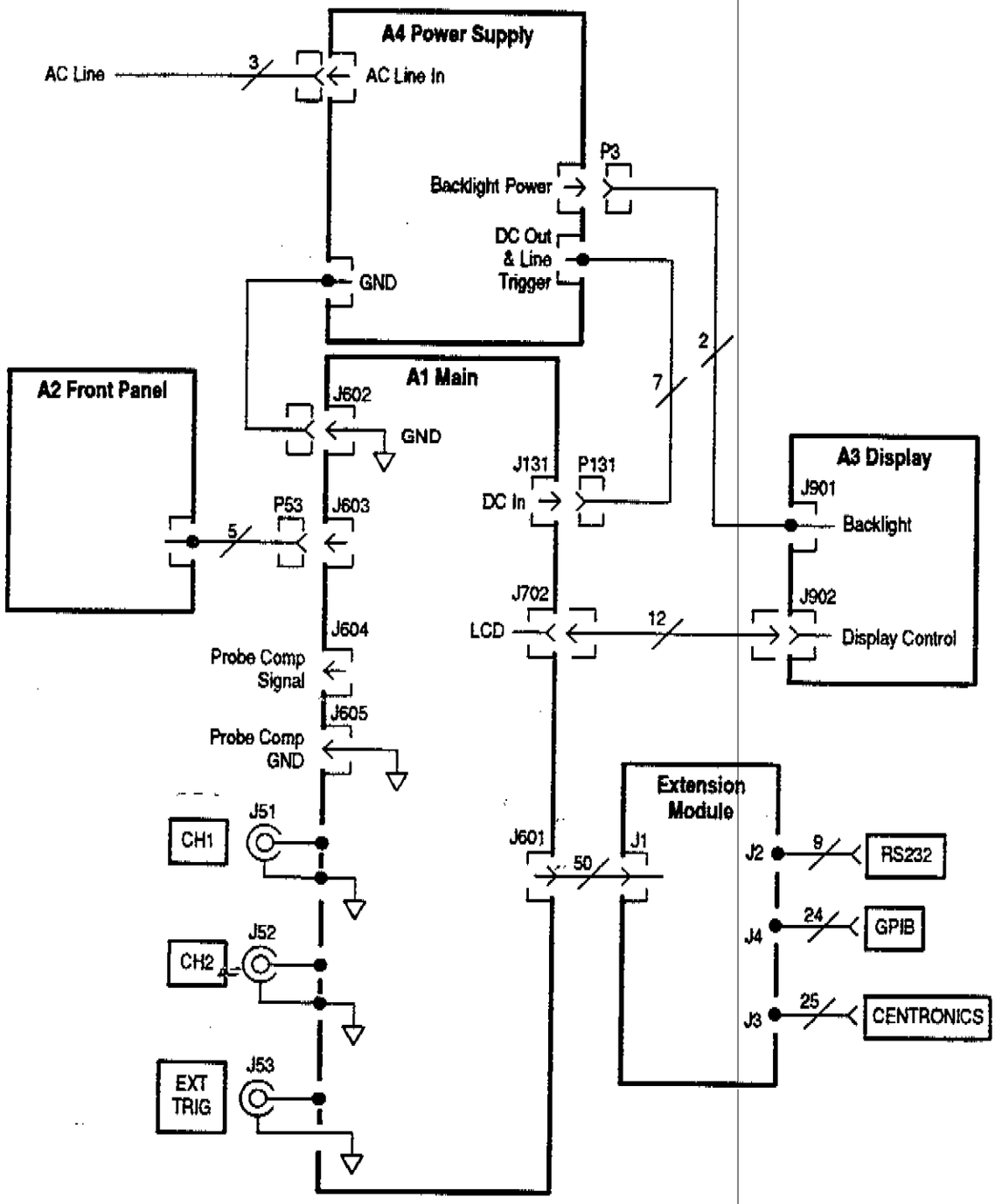


Figure 3–1: Module-level block diagram

Performance Verification

This chapter contains performance verification procedures for the specifications marked with the ✓ symbol. The following equipment, or a suitable equivalent, is required to complete these procedures.

Description	Minimum Requirements	Examples
DC Voltage Source	17.5 mV to 7 V, ±0.5% accuracy	Wavetek 9100 Universal Calibration System with Oscilloscope Calibration Module (Option 250) Fluke 5500A Multi-product Calibrator with Oscilloscope Calibration Option (Option 5500A-SC)
Leveled Sine Wave Generator	50 kHz and 100 MHz, ±3% amplitude accuracy	
Time Mark Generator	10 ms period, ±50 ppm accuracy	
50 Ω BNC Cable	BNC male to BNC male, ≈ 36 in (1 m) long	Tektronix part number 012-0482-XX
50 Ω Feedthrough Termination	BNC male and female connectors	Tektronix part number 011-0049-XX
Dual Banana to BNC Adapter	Banana plugs to BNC female	Tektronix part number 103-0090-XX

Test Record

Serial Number	Procedure Performed by	Date

Test	Passed	Failed
Self Test		

Oscilloscope Tests		Low Limit	Test Result	High Limit
Channel 1 DC Measurement Accuracy	5 mV/div	33.7 mV		36.3 mV
	200 mV/div	1.348 V		1.452 V
	2 V/div	13.48 V		14.52 V
Channel 2 DC Measurement Accuracy	5 mV/div	33.7 mV		36.3 mV
	200 mV/div	1.348 V		1.452 V
	2 V/div	13.48 V		14.52 V
Channel 1 Bandwidth		425 mV		—
Channel 2 Bandwidth		425 mV		—
Sample Rate and Delay Time Accuracy		–2 divs		+2 divs
Channel 1 Edge Trigger Sensitivity		Stable trigger		—
Channel 2 Edge Trigger Sensitivity		Stable trigger		—

Performance Verification Procedures

Before beginning these procedures, two conditions must first be met:

- The instrument must have been operating continuously for ten minutes within the operating temperature range specified.
- You must perform the Self Calibration operation described below. If the ambient temperature changes by more than 5° C, you must perform the Self Calibration operation again.

The time required to complete the entire procedure is approximately one hour.

WARNING. *Some procedures use hazardous voltages. To prevent electrical shock, always set voltage source outputs to 0 V before making or changing any interconnections.*

Self Test

This internal procedure is automatically performed every time the instrument is powered on. No test equipment or hookups are required. Verify that no error messages are displayed before continuing with this procedure.

Self Calibration

The self calibration routine lets you quickly optimize the oscilloscope signal path for maximum measurement accuracy. You can run the routine at anytime but you should always run the routine if the ambient temperature changes by 5° C or more.

1. Disconnect any probes or cables from the channel 1 and channel 2 input connectors.
2. Press the UTILITY button and select Do Self Cal to start the routine. The routine takes approximately one minute to complete.
3. Verify that Self calibration passed.

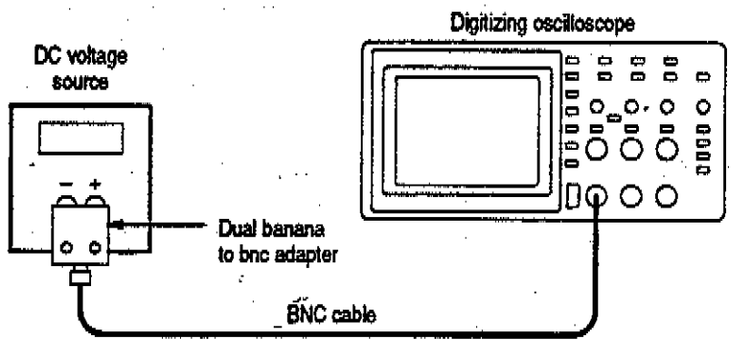
Check Channel 1 DC Measurement Accuracy

This test checks the DC measurement accuracy of channel 1.

1. Set the DC voltage source output level to **0** V.
2. Set up the instrument using the following steps:

Press Menu Button	Select Menu Item	Select Setting
SAVE/ RECALL	Recall Factory	—
CH 1	Probe	1X
ACQUIRE	Average	16
MEASURE	Source	CH1
	Type	Mean

3. Connect the instrument to the DC voltage source as shown below.



4. For each VOLTS/DIV setting listed below, perform the following steps:
   a. Set the DC voltage source output level to the positive voltage listed and then record the mean measurement as V_{pos}.
   b. Reverse the polarity of the DC voltage source and then record the mean measurement as V_{neg}.
   c. Calculate $V_{diff} = V_{pos} - V_{neg}$ and then compare V_{diff} to the accuracy limits in the table.

VOLTS/DIV Setting	DC Voltage Source Output Levels	Accuracy Limits for V_{diff}
5 mV/div	+17.5 mV, -17.5 mV	33.7 mV to 36.3 mV
200 mV/div	+700 mV, –700 mV	1.348 V to 1.452 V
2 V/div	+7.00 V, –7.00 V	13.48 V to 14.52 V

5. Set DC voltage source output level to 0 V.
6. Disconnect the test setup.

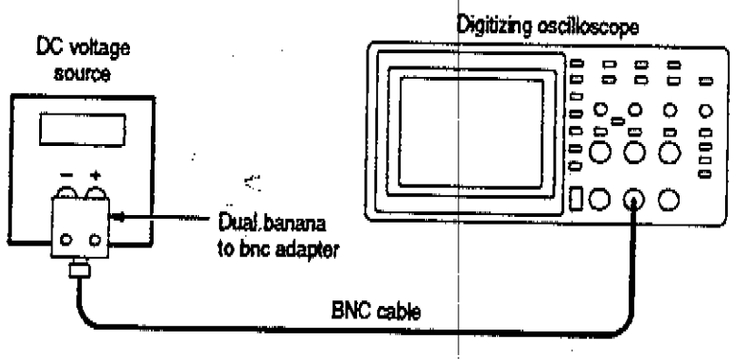
Check Channel 2 DC Measurement Accuracy

This test checks the DC measurement accuracy of channel 2.

1. Set the DC voltage source output level to 0 V.
2. Set up the instrument using the following steps:

Press Menu Button	Select Menu Item	Select Setting
CH 1 (twice)	—	—
CH 2	Probe	1X
ACQUIRE	Average	16
MEASURE	Source	CH2
	Type	Mean

3. Connect the instrument to the DC voltage source as shown below.



4. For each VOLTS/DIV setting listed below, perform the following steps:

   a. Set the DC voltage source output level to the positive voltage listed and then record the mean measurement as V_{pos}.

   b. Reverse the polarity of the DC voltage source and then record the mean measurement as V_{neg}.

   c. Calculate $V_{diff} = V_{pos} - V_{neg}$ and then compare V_{diff} to the accuracy limits in the table.

VOLTS/DIV Setting	DC Voltage Source Output Levels	Accuracy Limits for V_{diff}
5 mV/div	+17.5 mV, –17.5 mV	33.7 mV to 36.3 mV
200 mV/div	+700 mV, –700 mV	1.348 V to 1.452 V
2 V/div	+7.00 V, –7.00 V	13.48 V to 14.52 V

5. Set DC voltage source output level to 0 V.

6. Disconnect the test setup.

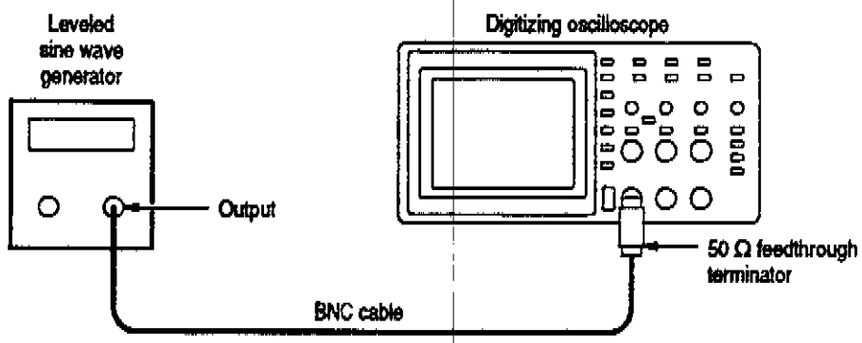
Check Channel 1 Bandwidth

This test checks the bandwidth of channel 1.

1. Set up the instrument using the following steps:

Press Menu Button	Select Menu Item	Select Setting
SAVE/ RECALL	Recall Factory	—
CH 1	Probe	1X
ACQUIRE	Average	16
TRIGGER	Coupling	Noise Reject
MEASURE	Source	CH1
	Type	Pk-Pk

2. Connect the instrument to the leveled sine wave generator as shown below.



3. Set the instrument VOLTS/DIV to **100 mV/div**.
4. Set the instrument SEC/DIV to **10 µs/div**.
5. Set the leveled sine wave generator frequency to **50 kHz**.
6. Set the leveled sine wave generator output level so the peak-to-peak measurement is between **599 mV** and **601 mV**.
7. Set the leveled sine wave generator frequency to **60 MHz** if you are checking a TDS 210 or to **100 MHz** if you are checking a TDS 220.
8. Set the instrument SEC/DIV to **10 ns/div**.
9. Check that the peak-to-peak measurement is **≥425 mV**.
10. Disconnect the test setup.
11. Proceed to the next test to check the channel 2 bandwidth.

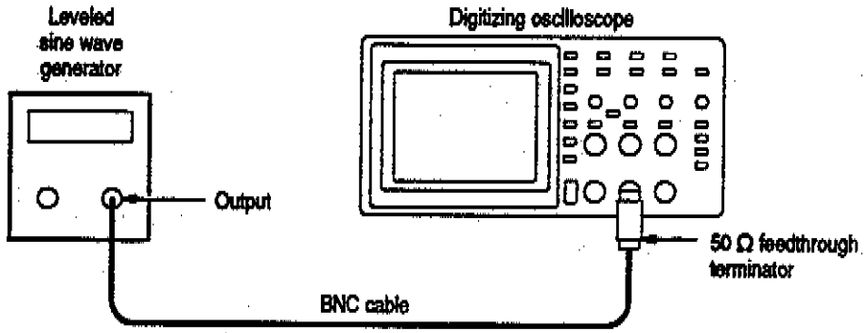
Check Channel 2 Bandwidth

This test checks the bandwidth of channel 2.

1. First check the channel 1 bandwidth using the previous test. Then, perform these additional steps to check the channel 2 bandwidth:

Press Menu Button	Select Menu Item	Select Setting
CH 1 (twice)	—	—
CH 2	Probe	1X
TRIGGER	Source	CH2
MEASURE	Source	CH2
	Type	Pk-Pk

2. Connect the instrument to the leveled sine wave generator as shown below.



3. Set the instrument VOLTS/DIV to **100 mV/div.**
4. Set the instrument SEC/DIV to **10 µs/div.**
5. Set the leveled sine wave generator frequency to **50 kHz.**
6. Set the leveled sine wave generator output level so the peak-to-peak measurement is between **599 mV** and **601 mV.**
7. Set the leveled sine wave generator frequency to **60 MHz** if you are checking a TDS 210 or to **100 MHz** if you are checking a TDS 220.
8. Set the instrument SEC/DIV to **10 ns/div.**
9. Check that the peak-to-peak measurement is **≥425 mV.**
10. Disconnect the test setup.

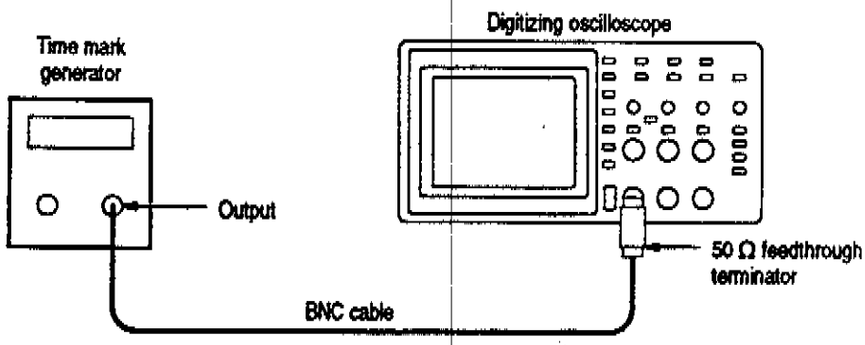
Check Sample Rate and Delay Time Accuracy

This test checks the time base accuracy.

1. Set up the instrument using the following steps:

Press Menu Button	Select Menu Item	Select Setting
SAVE/ RECALL	Recall Factory	—
CH 1	Probe	1X

2. Connect the instrument to the time mark generator as shown below.



3. Set the time mark generator period to **10 ms**.
4. Set the instrument VOLTS/DIV to **500 mV/div**.
5. Set the instrument Main SEC/DIV to **1 ms/div**.
6. Press **SET LEVEL TO 50%**.
7. Use the vertical POSITION control to center the test signal on screen.
8. Change the instrument setup using the following steps:

Press Menu Button	Select Menu Item	Select Setting
HORIZONTAL	Window	—

9. Set the instrument Window SEC/DIV to **500 µs/div**.

NOTE. *Setting the Window SEC/DIV to a setting slower than the Main SEC/DIV setting resets the main timebase. If this happens, reset the Main SEC/DIV and then the Window SEC/DIV settings.*

10. Use the horizontal POSITION control to set the window position to 10.00 ms.
11. Set the instrument Window SEC/DIV to **500 ns/div**.
12. Check that the rising edge of the marker crosses the center horizontal graticule line within ±2 divisions of center graticule.

NOTE. *One division of displacement from graticule center corresponds to a 50 ppm time base error.*

13. Disconnect the test setup.

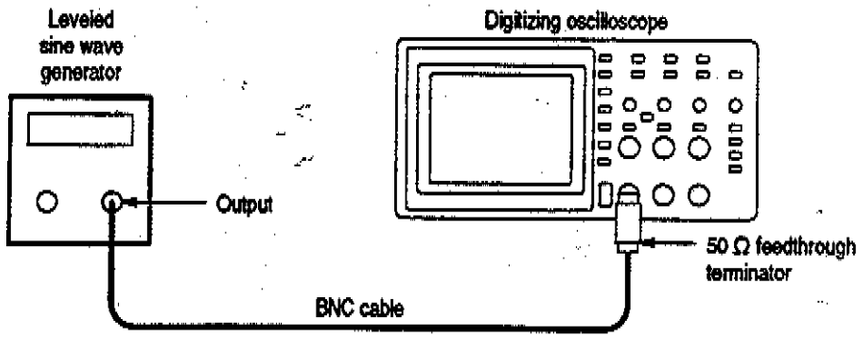
Check Channel 1 Edge Trigger Sensitivity

This test checks the edge trigger sensitivity for channel 1.

1. Set up the instrument using the following steps:

Press Menu Button	Select Menu Item	Select Setting
SAVE/ RECALL	Recall Factory	—
CH 1	Probe	1X
TRIGGER	Mode	Normal
ACQUIRE	Sample	—
MEASURE	Source	CH1
	Type	Pk-Pk

2. Connect the instrument to the leveled sine wave generator as shown below.



3. Set the leveled sine wave generator frequency to **60 MHz** if you are checking a TDS 210 or to **100 MHz** if you are checking a TDS 220.
4. Set the instrument VOLTS/DIV to **500 mV/div.**
5. Set the instrument SEC/DIV to **10 ns/div.**
6. Set the leveled sine wave generator output level to approximately **500 mV_{p-p}** so that the measured amplitude is approximately **500 mV.** (The measured amplitude can fluctuate around 500 mV.)

7. Press **SET LEVEL TO 50%**. Adjust **TRIGGER LEVEL** as necessary and then check that triggering is stable.

8. Change the instrument setup using the following steps:

Press Menu Button	Select Menu Item	Select Setting
TRIGGER	Slope	Falling

9. Press **SET LEVEL TO 50%**. Adjust **TRIGGER LEVEL** as necessary and then check that triggering is stable.

10. Change the instrument setup using the following steps:

Press Menu Button	Select Menu Item	Select Setting
TRIGGER	Slope	Rising

11. Disconnect the test setup.

12. Proceed to the next test to check the channel 2 edge trigger sensitivity.

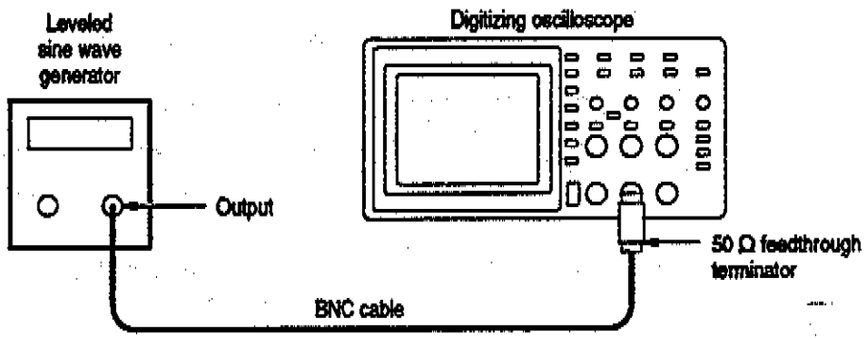
Check Channel 2 Edge Trigger Sensitivity

This test checks the edge trigger sensitivity for channel 2.

1. First check the channel 1 edge trigger sensitivity using the previous test. Then, perform these additional steps to check the channel 2 edge trigger sensitivity:

Press Menu Button	Select Menu Item	Select Setting
CH 1 (twice)	—	—
CH 2	Probe	1X
TRIGGER	Source	CH2
MEASURE	Source	CH2
	Type	Pk-Pk

2. Connect the instrument to the leveled sine wave generator as shown below.



3. Set the leveled sine wave generator frequency to **60 MHz** if you are checking a TDS 210 or to **100 MHz** if you are checking a TDS 220.

4. Set the instrument VOLTS/DIV to **500 mV/div**.

5. Set the instrument SEC/DIV to **10 ns/div**.

6. Set the leveled sine wave generator output level to approximately **500 mV_{p-p}** so that the measured amplitude is approximately **500 mV**. (The measured amplitude can fluctuate around 500 mV.)

7. Press **SET LEVEL TO 50%**. Adjust **TRIGGER LEVEL** as necessary and then check that triggering is stable.

8. Change the instrument setup using the following steps:

Press Menu Button	Select Menu Item	Select Setting
TRIGGER	Slope	Falling

9. Press **SET LEVEL TO 50%**. Adjust **TRIGGER LEVEL** as necessary and then check that triggering is stable.

10. Disconnect the test setup.

Adjustment

This chapter contains adjustment procedures for the TDS 210 and TDS 220 Digitizing Oscilloscopes.

Only qualified personnel should perform service procedures. Read the *Service Safety Summary* and the *General Safety Summary* before performing any service procedures. Also refer to the chapter *Operating Information* for information about using the TDS 210 and TDS 220.

NOTE. *The voltage references inside the* TDS 210 and TDS 220 *are very stable over time and should not require routine updates. Before performing any procedure in this chapter, first verify that the instrument does not meet specifications. Refer to the chapter* Performance Verification *to verify the specifications.*

Required Equipment

The following equipment, or a suitable equivalent, is required to complete these procedures.

Table 5–1: Required equipment

Description	Minimum Requirements	Examples
DC Voltage Source	–20 V to 20 V, ±0.1% accuracy	Wavetek 9100 Universal Calibration System with Oscilloscope Calibration Module (Option 250)
Leveled Sinewave Generator	50 kHz and 100 MHz, ±0.6% amplitude accuracy	Fluke 5500A Multi-product Calibrator with Oscilloscope Calibration Option (Option 5500A-SC)
50 Ω BNC Cable	BNC male to BNC male, ≈ 36 in (1 m) long	Tektronix part number 012-0482-00
50 Ω BNC Cable (two)	BNC male to BNC male, ≈ 10 in (25 cm) long	Tektronix part number 012-0208-00
50 Ω Feedthrough Termination	BNC male and female connectors	Tektronix part number 011-0049-01
Dual Banana to BNC Adapter	Banana plugs to BNC female	Tektronix part number 103-0090-XX
BNC T	One male and two female BNC connectors	Tektronix part number 103-0030-XX

Adjustment Procedure

The adjustment procedure consists of 55 steps. Each step requires an external voltage source for new calibration constants.

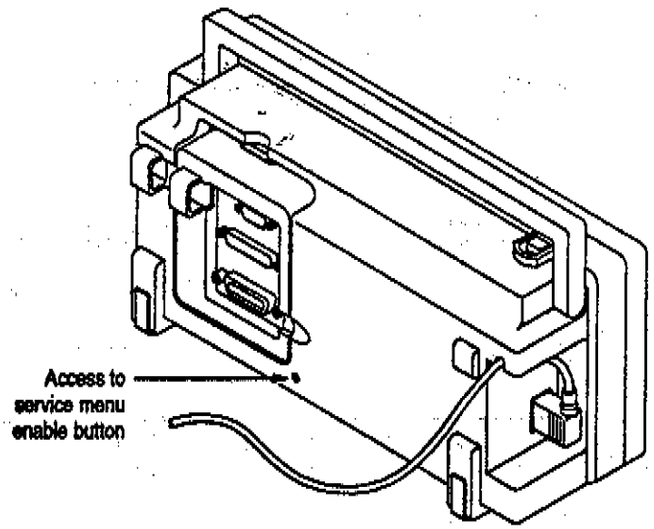
Before performing the adjustment procedure, you must warm up the instrument for at least ten minutes in an ambient temperature between 20° C and 30° C. Adjustments performed prior to warm-up or outside this temperature range may result in poor performance.

If all steps in the procedure are completed successfully, a "Pass" message is displayed and the new calibration constants take affect. If any step fails, the procedure is aborted and the current calibration is not affected. You can choose to abort the procedure at any step by selecting FCAL ABORT without affecting the current calibration.

Two equipment setups, shown in Figure 5–1, are required to complete the adjustment procedure. Table 5–2 lists the steps in the procedure and the signal requirement for each step.

Enable the Service Menu

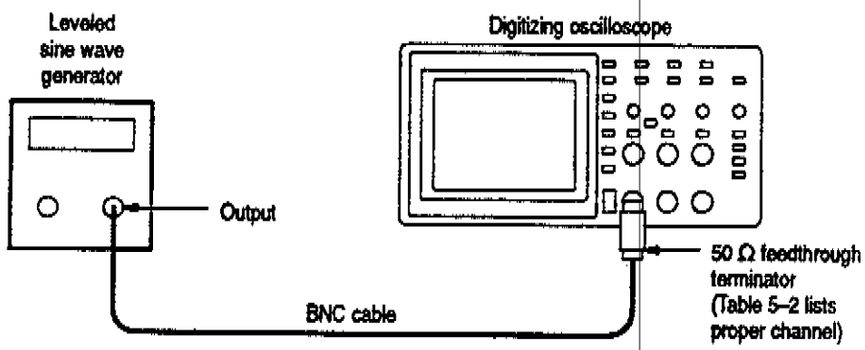
With the instrument on, insert a narrow object such as a plastic alignment tool into the hole provided on the back of the instrument until you feel the click of the momentary button. Hold this button in and press the front panel UTILITY button.



A Service menu selection replaces the Language menu selection, giving you access to the service routines.

After adjustment is complete, disable the service menu by again holding in the internal momentary button and pressing the front panel UTILITY button.

Sinewave generator setup



DC voltage setup

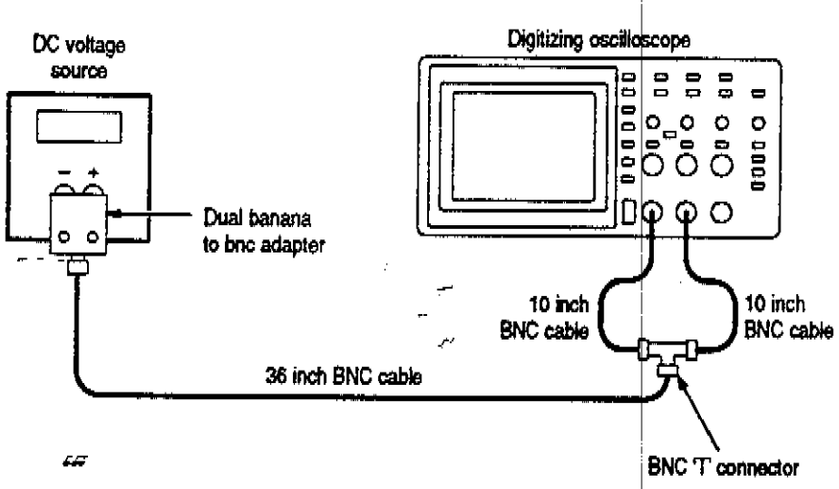


Figure 5–1: Adjustment setups

Adjustment Procedure

Use this procedure to load new calibration constants.

1. Turn on the instrument and let it warm up for at least ten minutes.
2. Enable the Service menu as described on Page 5–2.
3. Press the UTILITY button and select Service from the menus.
4. Select FCAL INIT to initiate the factory calibration routine. You are now in step 1 of the procedure.
5. As indicated by Step 1 in Table 5–2, connect a 0.0 VDC source to channel 1 and 2.
6. Press FCAL STEP to load the calibration constant for step 1.
7. Follow the screen prompts along with Table 5–2 on page 5–5 for the remainder of the routine, applying the proper signal for for each step.

NOTE. *During some steps, the instrument may appear to be idle for several minutes while it is processing information internally. Please have patience.*

If any step in the procedure fails, the procedure terminates. Failure will result if an incorrect signal source is connected. If this happens, you must start the procedure over from the beginning.

If the procedure completes successfully, a "Pass" message is displayed and the new adjustment takes effect.

8. Compensate the signal path by performing the self calibration routine. Disconnect any probes or cables from the channel 1 and channel 2 input connectors. Then, press the UTILITY button and select Do Self Cal to confirm that you are ready to proceed.
9. Disable the Service menu option.

Table 5–2: Adjustment steps

Step	Equipment Setup	Signal Source Setting
1	DC Voltage	0.0 V
2	DC Voltage	–20.0 V
3	DC Voltage	–2.0 V
4	DC Voltage	–1.6 V
5	DC Voltage	–1.2 V
6	DC Voltage	–0.8 V
7	DC Voltage	–0.4 V
8	DC Voltage	–0.32 V
9	DC Voltage	–0.2 V
10	DC Voltage	–0.16 V
11	DC Voltage	–0.08 V
12	DC Voltage	–0.04 V
13	DC Voltage	–0.03 V
14	DC Voltage	–0.02 V
15	DC Voltage	–0.015 V
16	DC Voltage	0.015 V
17	DC Voltage	0.02 V
18	DC Voltage	0.03 V
19	DC Voltage	0.04 V
20	DC Voltage	0.08 V
21	DC Voltage	0.16 V
22	DC Voltage	0.2 V
23	DC Voltage	0.32 V
24	DC Voltage	0.4 V
25	DC Voltage	0.8 V
26	DC Voltage	1.2 V
27	DC Voltage	1.6 V
28	DC Voltage	2.0 V
29	DC Voltage	20.0 V
30	DC Voltage	0.0 V
31	DC Voltage	–5.0 V
32	DC Voltage	–1.0 V
33	DC Voltage	1.0 V
34	DC Voltage	5.0 V
35	Sinewave Generator	5 kHz, 1 V_{p-p} (CH1)
36	Sinewave Generator	20 MHz, 1 V_{p-p} (CH1)
37	Sinewave Generator	50 kHz, 1 V_{p-p} (CH1)
38	Sinewave Generator	20 MHz, 1 V_{p-p} (CH1)
39	Sinewave Generator	TDS 210: 60 MHz, 1 V_{p-p} (CH1)
		TDS 220: 100 MHz, 1 V_{p-p} (CH1)
40	Sinewave Generator	5 kHz, 2.5 V_{p-p} (CH1)
41	Sinewave Generator	20 MHz, 2.5 V_{p-p} (CH1)
42	Sinewave Generator	50 kHz, 2.5 V_{p-p} (CH1)
43	Sinewave Generator	20 MHz, 2.5 V_{p-p} (CH1)
44	Sinewave Generator	TDS 210: 60 MHz, 2.5 V_{p-p} (CH1)
		TDS 220: 100 MHz, 2.5 V_{p-p} (CH1)
45	Sinewave Generator	TDS 210: 60 MHz, 2.5 V_{p-p} (CH1)
		TDS 220: 100 MHz, 2.5 V_{p-p} (CH1)
46	Sinewave Generator	5 kHz, 1 V_{p-p} (CH2)
47	Sinewave Generator	20 MHz, 1 V_{p-p} (CH2)
48	Sinewave Generator	50 kHz, 1 V_{p-p} (CH2)
49	Sinewave Generator	20 MHz, 1 V_{p-p} (CH2)
50	Sinewave Generator	TDS 210: 60 MHz, 1 V_{p-p} (CH2)
		TDS 220: 100 MHz, 1 V_{p-p} (CH2)
51	Sinewave Generator	5 kHz, 2.5 V_{p-p} (CH2)
52	Sinewave Generator	20 MHz, 2.5 V_{p-p} (CH2)
53	Sinewave Generator	50 kHz, 2.5 V_{p-p} (CH2)
54	Sinewave Generator	20 MHz, 2.5 V_{p-p} (CH2)
55	Sinewave Generator	TDS 210: 60 MHz, 2.5 V_{p-p} (CH1)
		TDS 220: 100 MHz, 2.5 V_{p-p} (CH2)

Maintenance

This chapter contains the information needed to do periodic and corrective maintenance on the TDS 210 and TDS 220 Digitizing Oscilloscopes. The following sections are included:

- *Preparation* refers you to important information contained elsewhere in this manual.
- *Preventing ESD* provides general information on preventing damage to internal modules when doing maintenance.
- *Inspection and Cleaning* provides procedures for inspecting the instrument and cleaning its external and internal modules.
- *Removal and Installation Procedures* provide procedures for the removal and installation of modules.
- *Troubleshooting* provides information for isolating failed modules.
- *Repackaging Instructions* provides packaging information for shipment or storage.

Preparation

Only qualified personnel should perform service procedures. Read the *Service Safety Summary* and the *General Safety Summary* before performing any service procedures. Also refer to the chapter *Operating Information* for information about using the TDS 210 and TDS 220.

Preventing ESD

When performing any service which requires internal access to the instrument, adhere to the following precautions to avoid damaging internal modules and their components due to electrostatic discharge (ESD).

CAUTION. *Static discharge can damage any semiconductor component in this* instrument

1. Minimize handling of static-sensitive modules.
2. Transport and store static-sensitive modules in their static protected containers or on a metal rail. Label any package that contains static-sensitive modules.

3. Discharge the static voltage from your body by wearing a grounded antistatic wrist strap while handling these modules. Do service of static-sensitive modules only at a static-free work station.
4. Nothing capable of generating or holding a static charge should be allowed on the work station surface.
5. Handle circuit boards by the edges when possible.
6. Do not slide the modules over any surface.
7. Avoid handling modules in areas that have a floor or work-surface covering capable of generating a static charge.

Inspection and Cleaning

This section describes how to inspect for dirt and damage, and how to clean the instrument. Inspection and cleaning are done as preventive maintenance. Preventive maintenance, when done regularly, may prevent malfunctions and enhance reliability.

Preventive maintenance consists of visually inspecting and cleaning the instrument, and using general care when operating it. How often to do maintenance depends on the severity of the environment in which the instrument is used. A proper time to perform preventive maintenance is just before adjustment of the instrument.

General Care

Protect the instrument from adverse weather conditions. The instrument is not waterproof.

Do not store or leave the instrument where the LCD display will be exposed to direct sunlight for long periods of time.

The front and back covers help keep dust out of the instrument and must be in place during normal operation.

CAUTION. *To avoid damage to the* instrument, *do not expose it to any sprays, liquids, or solvents.*

Inspection and Cleaning Procedures

Inspect and clean the instrument as often as operating conditions require. The collection of dirt on internal components can cause them to overheat and breakdown. Dirt also provides an electrical conduction path that could cause an instrument failure, especially under high-humidity conditions.

Inspection — Exterior. Inspect the outside of the instrument for damage, wear, and missing parts. Instruments that appear to have been dropped or otherwise abused should be checked thoroughly to verify correct operation and performance. Immediately repair defects that could cause personal injury or lead to further damage to the instrument.

Cleaning Procedure — Exterior. To clean the instrument exterior, perform the following steps:

1. Remove loose dust on the outside of the instrument with a lint free cloth. Use care to avoid scratching the clear plastic display filter.
2. Use a soft cloth dampened with water to clean the instrument. You can use a 75% isopropyl alcohol solution for more efficient cleaning.

CAUTION. *To avoid damage to the surface of the* instrument, *do not use any abrasive or chemical cleaning agents.*

Inspection — Interior. During normal use, the instrument case guards the internal components against common dust and dirt. However, if it appears that the instrument may have been damaged or has been exposed to an unusually dirty environment, you should inspect and clean the interior.

To inspect and clean the interior, disassemble the instrument by completing each of the disassembly procedures in the order given staring on page 6–10.

Inspect the internal portions of the instrument for damage and wear using Table 6–1 as a guide. Defects found should be repaired immediately.

Table 6–1: Internal inspection check list

Item	Inspect For	Repair Action
Front and Back Cover	Cracks or deformations. Scratched lettering or display filter. Loose connectors or labels.	Repair or replace defective hardware.
Gasket and Foam Pads	Misplaced or missing pieces.	Relocate or replace defective pieces.
Circuit boards	Loose, broken, or corroded solder connections. Burned circuit boards. Burned, broken, or cracked circuit-run plating.	Remove failed module and replace with a new module.

Table 6–1: Internal inspection check list (Cont.)

Item	Inspect For	Repair Action
Solder connections	Cold solder or rosin joints.	Resolder joint and clean with isopropyl alcohol.
Wiring and cables	Loose plugs or connectors. Burned, broken, or frayed wiring.	Firmly seat connectors. Repair or replace modules with defective wires or cables.

Cleaning Procedure — Interior. To clean the instrument interior, perform the following steps:

1. Blow off dust with dry, low-pressure, deionized air (approximately 9 psi).
2. Remove any remaining dust with a lint-free cloth dampened in isopropyl alcohol (75% solution) and rinse with warm deionized water. (A cotton-tipped applicator is useful for cleaning in narrow spaces and on circuit boards.)

STOP. *If, after performing steps 1 and 2, a module is clean upon inspection, skip steps 3 and 4. Proceed with step 5.*

If steps 1 and 2 do not remove all the dust or dirt, all modules in the instrument except the Display Module may be spray washed using a solution of 75% isopropyl alcohol. Proceed with step 3.

3. Spray wash dirty parts with the 75% isopropyl alcohol solution and wait 60 seconds for the majority of the alcohol to evaporate.
4. Use hot (49° C to 60° C / 120° F to 140° F) deionized water to thoroughly rinse the parts.
5. Dry all parts with low-pressure, deionized air.
6. Dry all components and assemblies in an oven or drying compartment using low-temperature (52° C to 66° C / 125° F to 150° F) circulating air.

Lubrication. There is no periodic lubrication required for the TDS 210 and TDS 220.

Removal and Installation Procedures

This section describes how to remove and install the major mechanical and electrical modules. It provides the following information:

- *List of Modules* on page 6–6 describes where to locate a list of replaceable modules.
- *Summary of Procedures* on page 6–6 lists the procedures for removal and installation of modules.
- *Tools Required* on page 6–6 describes the tools needed to perform the procedures.
- *Flip Stand,* on page 6–16, begins a series of procedures that describe the removal and installation of modules.

Preparation

Please read the following warning statement. Then read the following general instructions before removing a module.

WARNING. *Only qualified personnel should perform service procedures. Before doing this or any other procedure in this manual, read the* General Safety Summary *and* Service Safety Summary *found at the beginning of this manual.*

Always disconnect the power cord before disassembling any portion of the instrument.

Also, to prevent possible injury to service personnel or damage to electrical components, read Preventing ESD *on page 6–1.*

1. Use Figure 10–1 (the exploded view of the instrument) on page 10–5 to give you an overview of how the entire instrument is assembled.
2. Read the *Summary of Procedures* on page 6–6 to understand which procedure to use to access a given module. Then read *Tools Required* on page 6–6 for a list of tools needed to remove and install modules in the TDS 210 or TDS 220.
3. If you are disassembling the TDS 210 or TDS 220 for cleaning, refer to the *Inspection and Cleaning* procedure on page 6–2 for cleaning instructions.

Tools Required

You will need the following tools to remove and replace all the modules in the TDS 210 or TDS 220.

Tools
Torque-limiting screwdriver, 12 in · lb (1.3 N · V · m) range with Torx® T-15 tip
Screwdriver with ¼ inch flat blade
Pliers
Sharp knife (X-ACTO® knife or equivalent)

List of Modules

The *Mechanical Parts List* chapter provides a list of all replaceable modules. Any electrical or mechanical module, assembly, or part listed in the parts list is referred to as a module.

Summary of Procedures

Table 6–2 lists the removal and installation procedures in order of increasing complexity. Complete disassembly is best achieved by following the procedures in the order given.

Table 6–2: Removal and installation procedures

Procedure	Begins on Page
Rear Feet	6–7
Front-panel Label	6–9
Handle	6–10
Front Panel Knobs	6–11
Power Button	6–12
Rear Case	6–12
Front Feet	6–14
EMI Clips	6–15
Flip Stand	6–16
Power Line Fuse	6–18
Power Supply Module	6–19
Internal Assembly	6–21
Main Board Module	6–22
Display Module	6–24
Backlight	6–26
Front Panel Module	6–28
Switch Keypad	6–30
Display Shield	6–32
Front Case	6–34

Rear Feet

No tools are required to remove the feet.

Removal. Use this procedure to remove the rear feet.

1. Place the instrument face down on a soft surface (such as an anti-static mat).
2. Slide the feet up and out of the rear case as shown in Figure 6–1.

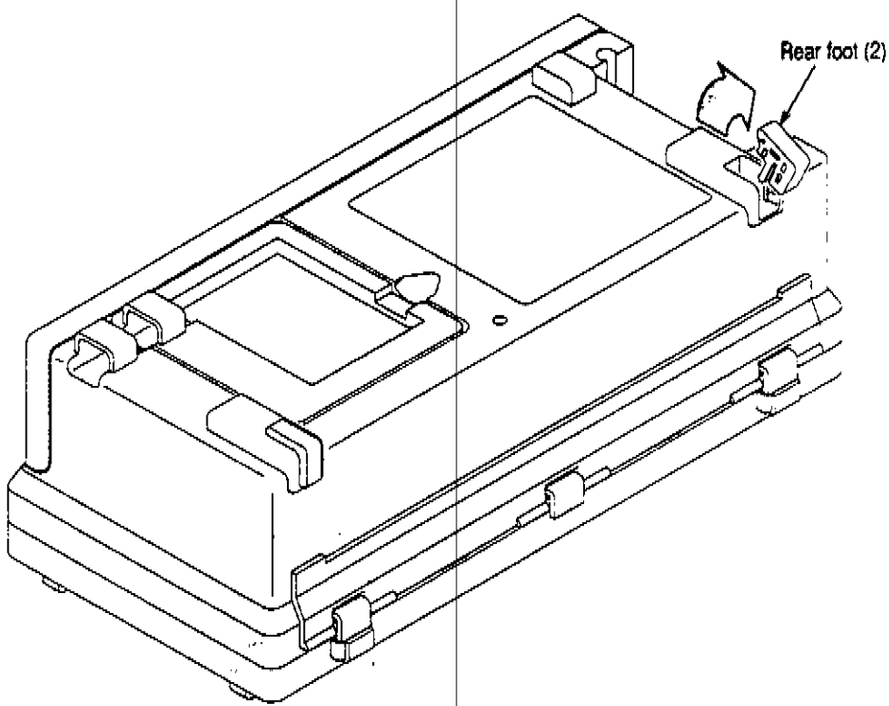


Figure 6–1: Removing the rear feet

Installation. Use this procedure to install the feet.

1. Place the rear case face down on a soft surface (such as an anti-static mat).
2. Align the slots of the rear foot with the guides in the rear case as shown in Figure 6–2 and press the foot in.

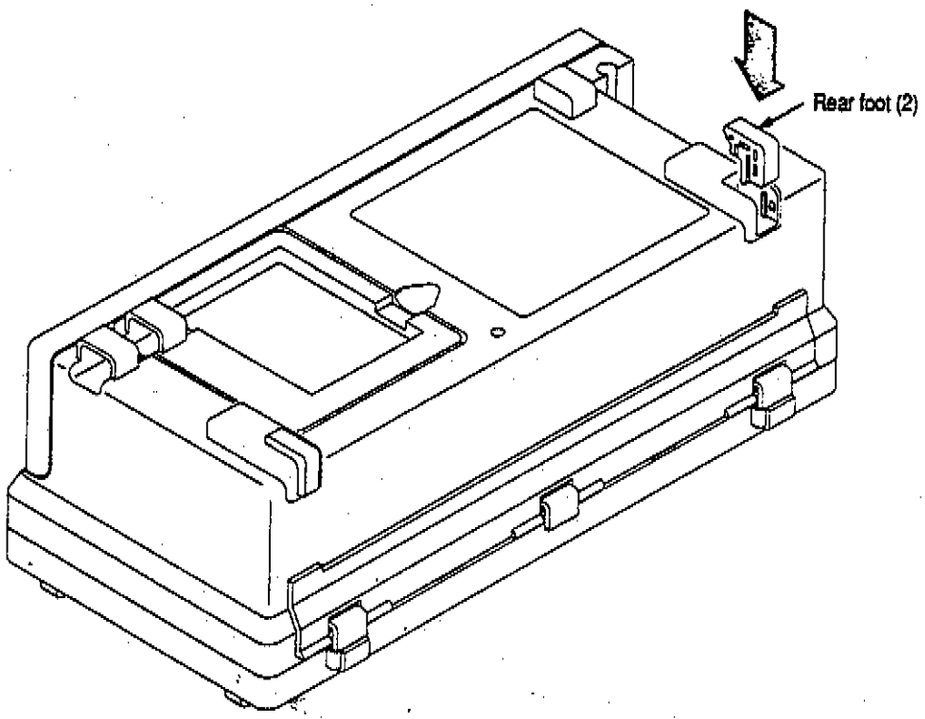


Figure 6–2: Installing the rear feet

Front-Panel Label

You will need a sharp knife and needle-nose pliers to remove the front-panel label.

CAUTION. *Removal of a front-panel label will destroy it. Do not remove it unless it needs to be replaced.*

Removal. Use this procedure to remove the front-panel label.

1. Use the sharp knife to pry up a corner of the label.
2. Use the needle-nose pliers to peel the label off.

Installation. Use this procedure to install a new front-panel label in either a new or the existing front case.

1. Peel the paper off the back side of the new label.
2. Handling the label by its edges only, align it with the recess in the front panel as shown in Figure 6–3.
3. When properly aligned, press the new label into place.

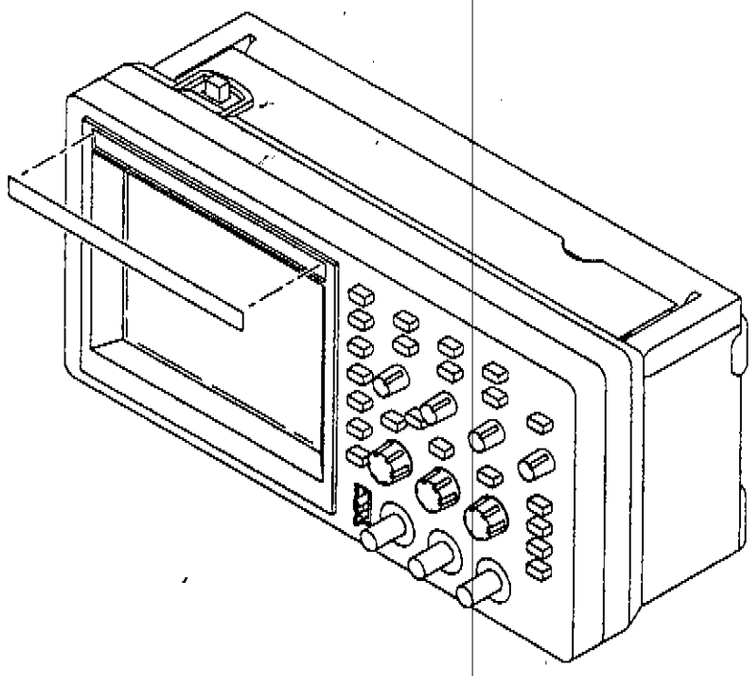


Figure 6–3: Removing and installing a new front-panel label

Handle

You will need a flat-blade screw driver to remove the handle.

Removal. Use this procedure to remove the handle.

1. Place the instrument on its feet.
2. With the handle laying down, pry one end of the handle out of the case as shown in Figure 6–4.
3. Slide the handle towards the back of the rear case.

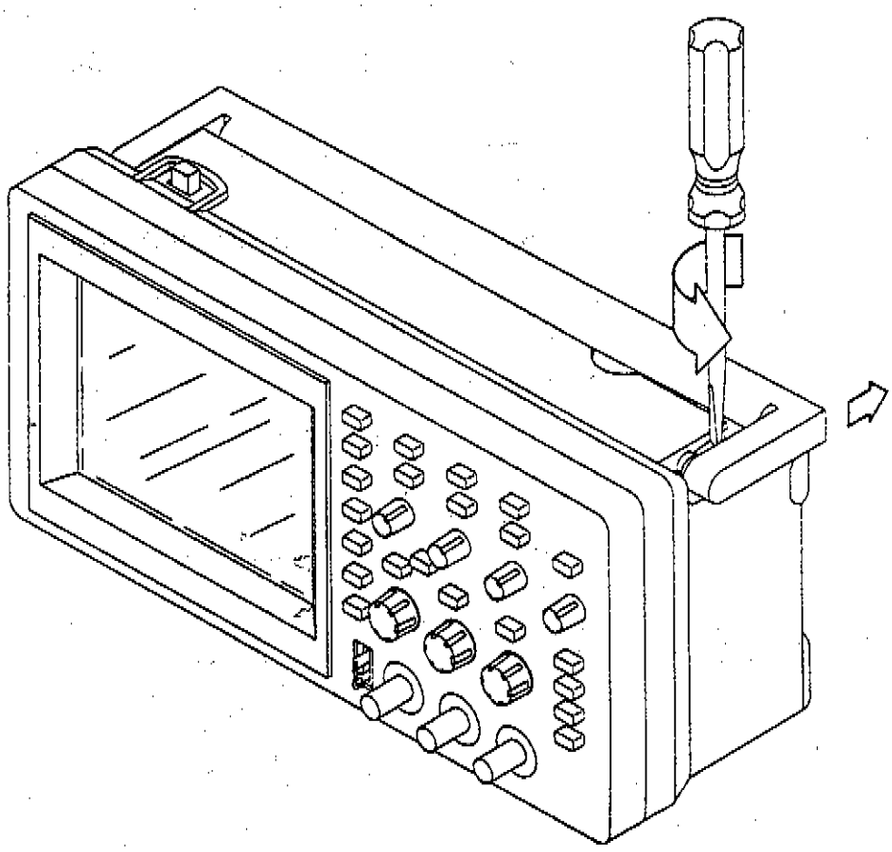


Figure 6–4: Removing the handle

Installation. Use this procedure to install the handle.

1. Place the instrument on its feet.
2. From behind the rear case with the handle laying down, slide the handle along the groves in the case until the handle snaps into place as shown in Figure 6–5.

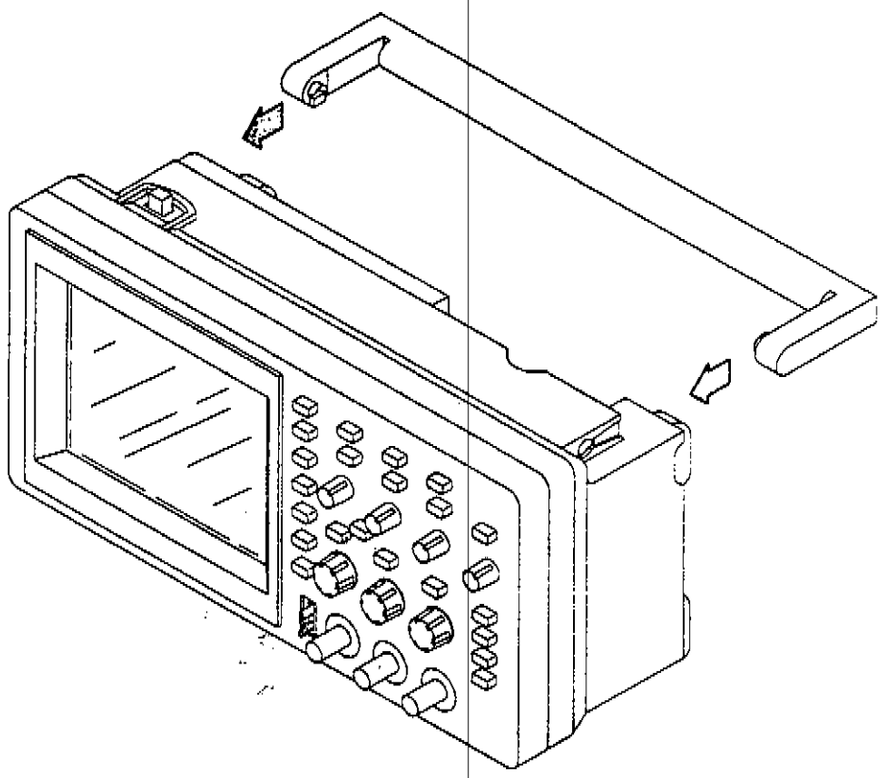


Figure 6–5: Installing the handle

Front-Panel Knobs

Remove the front panel knobs by firmly grasping the knob (with pliers if necessary) and pull it away from the front panel. Install front panel knobs by aligning the keyed knob with the shaft and pressing the knob onto the shaft.

NOTE. *Wrap the plier jaws with tape to avoid marring the button surface.*

Power Button

Remove the power button by firmly grasping the button (with pliers if necessary) and pull it straight out of the cabinet. Reinstall the button by pressing it onto the power button shaft until it snaps into place.

NOTE. *Wrap the plier jaws with tape to avoid marring the button surface.*

Rear Case

You will need a torque-limiting Torx® T-15 screwdriver and a flat-blade screwdriver for this procedure.

Removal. First remove the handle and power button using the procedures on pages 6–10 and 6–12, then use this procedure to remove the rear cover.

1. If installed, remove the extension module from the rear of the instrument.

CAUTION. *Attempting to remove the rear cover with an extension module installed will damage the connector pins. A blank module (no ports) can remain installed.*

2. Place the instrument face down on a soft surface (such as an anti-static mat).
3. Remove the two screws located in the handle recesses.
4. Slip the flat-blade screwdriver between the rear case and front case at the bottom of the instrument to disengage the tabs and lift the rear case off. Refer to Figure 6–6.

Installation. Use this procedure to install the rear cover.

1. Place the instrument face down on a soft surface (such as an anti-static mat).
2. Slide the rear case over the assembly until the bottom tabs of the front case lock into the rear case.

CAUTION. *Be careful not to pinch any wires between the front and rear cases. Make sure that the copper grounding tube is in the proper place as shown in Figure 6–6.*

3. Install the two screws located in the handle recesses.

CAUTION. *Avoid cross threading the screws that secure the rear case to the front case. An easy way to avoid this is to slip the screw into the hole and, using slight pressure, slowly rotate the screw counterclockwise until you feel the screw slip into the screw threads. Then tighten the screw clockwise. A properly started screw will have very little resistance going in.*

4. Install the handle and the power button.

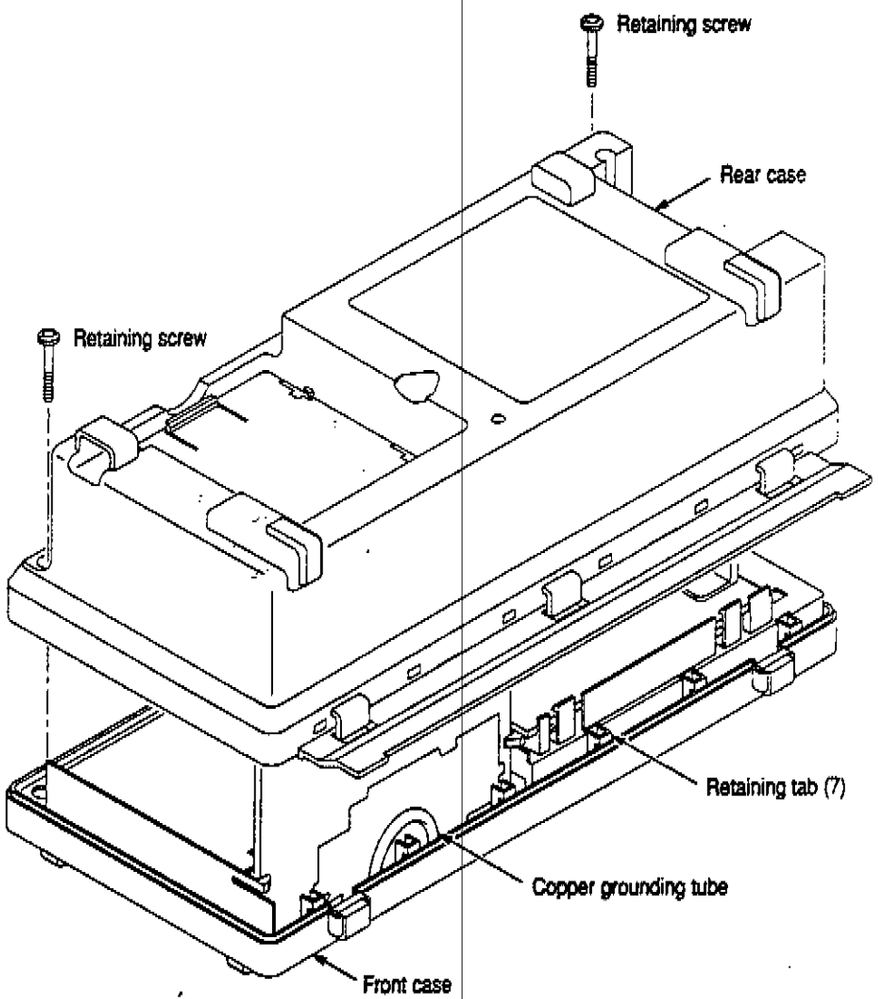


Figure 6–6: Removing and installing the rear cover

Front Feet

You will need a torque-limiting Torx® T-15 screwdriver and a flat-blade screwdriver for this procedure.

Removal. First remove the handle, power button, and rear case using the procedures on pages 6–10, 6–12, and 6–12. Then, slide the front feet out of the front cover.

Installation. Slide the feet into the slots provided for the feet in the front cover. Use the Installation procedures for each module removed to reassemble the instrument.

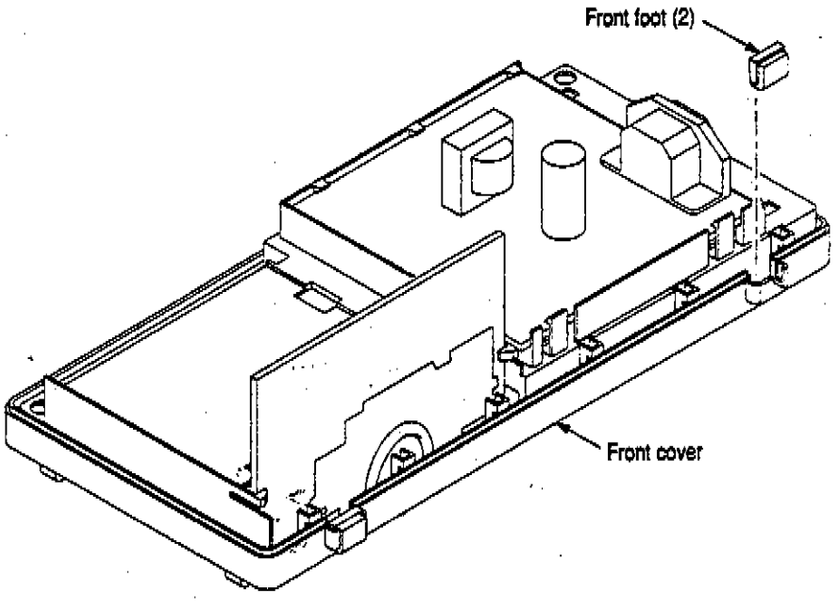


Figure 6–7: Removing and installing the front feet

EMI Clips

You will need a torque-limiting Torx® T-15 screwdriver and a flat-blade screwdriver for this procedure.

Removal. First remove the handle, power button, and rear case using the procedures on pages 6–10, 6–12, and 6–12. Then, slide the four EMI clips out of the rear case as shown in Figure 6–8.

NOTE. *The EMI clips can be pushed out from the rear of the case using a narrow flat-blade screwdriver.*

Installation. Slide the four EMI clips into the slots provided in the rear case as shown in Figure 6–8. Use the Installation procedures for each module removed to reassemble the instrument.

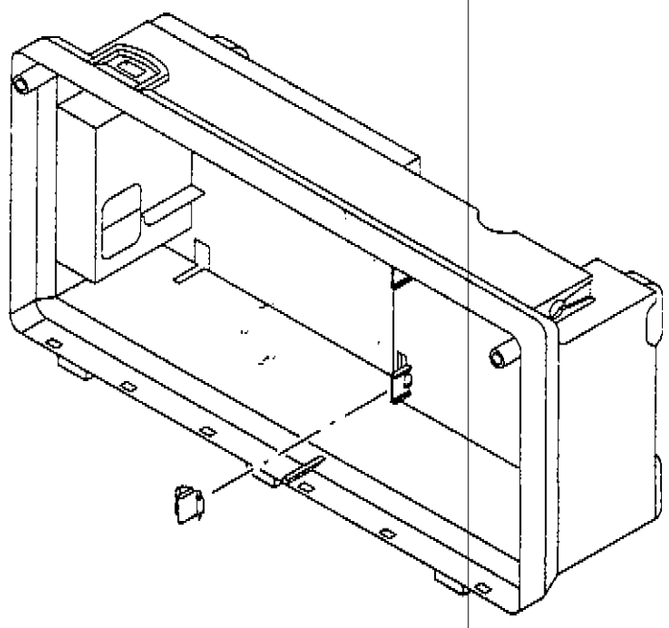


Figure 6–8: Removing and installing the EMI clips

Flip Stand

You will need a torque-limiting Torx® T-15 screwdriver and a flat-blade screwdriver for this procedure.

Removal. First remove the handle, power button, and rear case using the procedures on pages 6–10, 6–12, and 6–12. Then, use the following procedure to remove the flip stand.

1. Place the rear case face down on a soft surface (such as an anti-static mat).
2. With the stand folded against the rear case (in the up position), push the stand out of the rear case channels as shown in Figure 6–9.

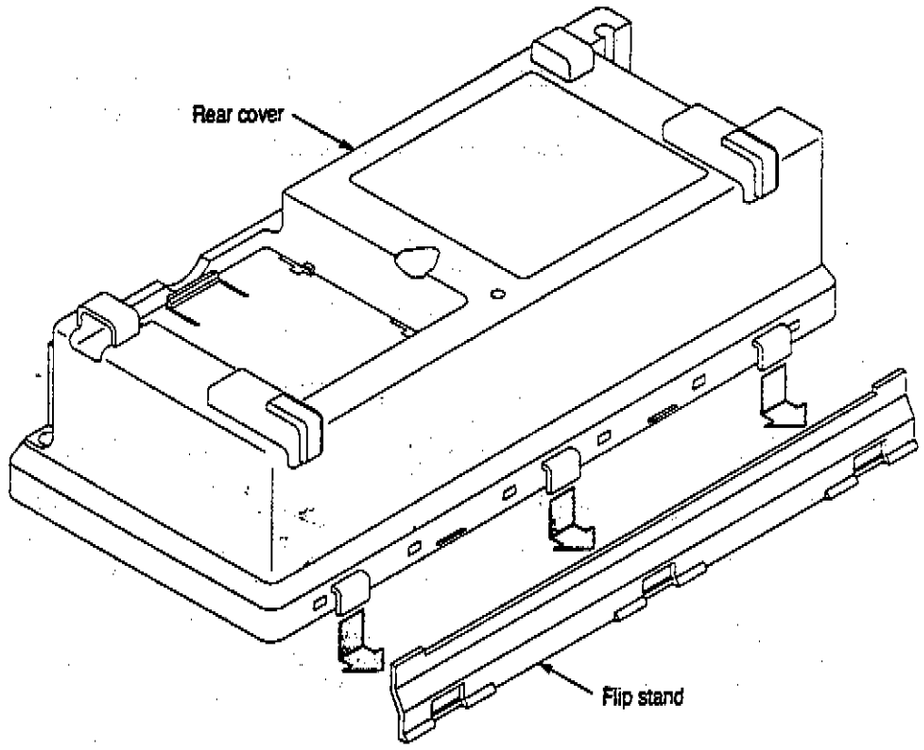


Figure 6–9: Removing the flip stand

Installation. Use this procedure to install the flip stand.

1. Orient the flip stand to the rear cover, aligning the flip stand slots to the rear cover tabs as shown in Figure 6–10.
2. With the stand in the folded up position, snap the stand into place.
3. Use the installation procedures for each module removed to reassemble the instrument.

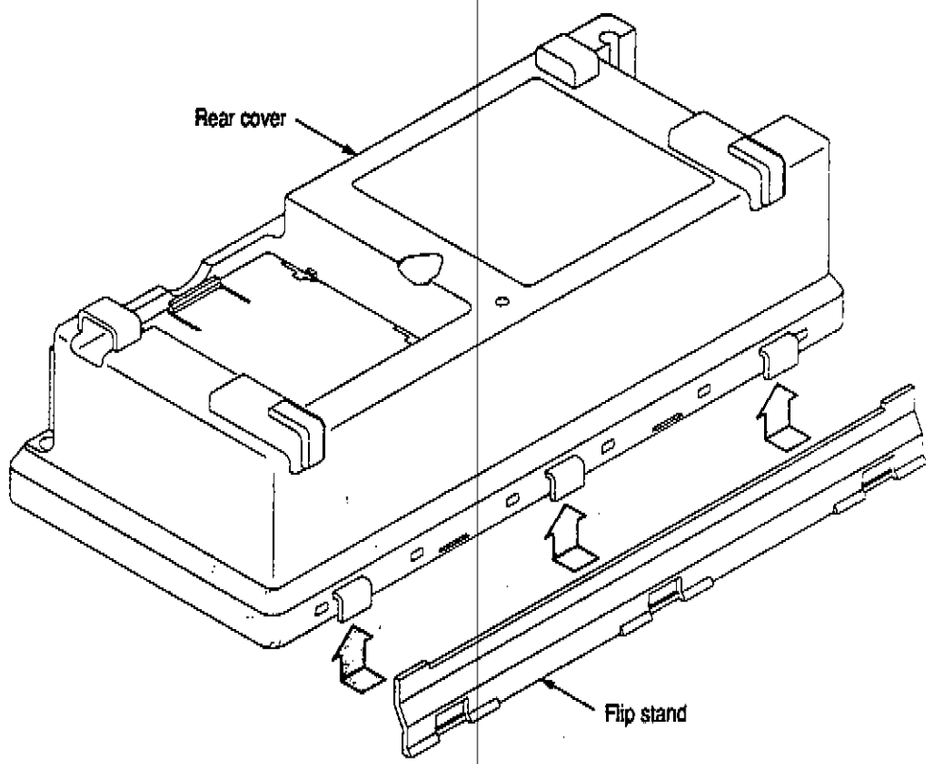


Figure 6–10: Installing the flip stand

Power Line Fuse

You will need a torque-limiting Torx® T-15 screwdriver and a flat-blade screwdriver for this procedure.

First remove the handle, power button, and rear case using the procedures on pages 6–10, 6–12, and 6–12 to access the line fuse.

The line fuse is located on the power supply module as shown in Figure 6–11. If the fuse tests bad, replace it with the same type and rating.

Use the installation procedures for each module removed to reassemble the instrument.

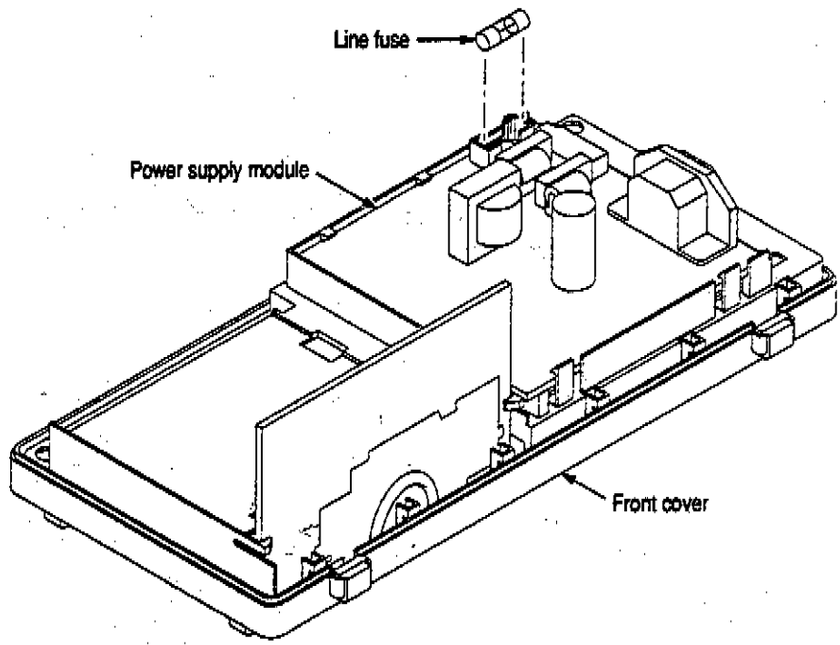


Figure 6–11: Line fuse location

Power Supply Module

You will need a torque-limiting Torx® T-15 screwdriver and a flat-blade screwdriver for this procedure.

Removal. First remove the handle, power button, and rear case using the procedures on pages 6–10, 6–12, and 6–12. Then, use the following procedure to remove the power supply module. Refer to Figure 6–13.

1. Disconnect the following wires.
   a. The line cord ground wire from the main board at J101.
   b. The seven-conductor ribbon cable from the main board at J131.
   c. The two-conductor back light cable from the power supply module.
2. Slightly bend back the two securing tabs at the bottom of the power supply module and lift the module out of the inner chassis.

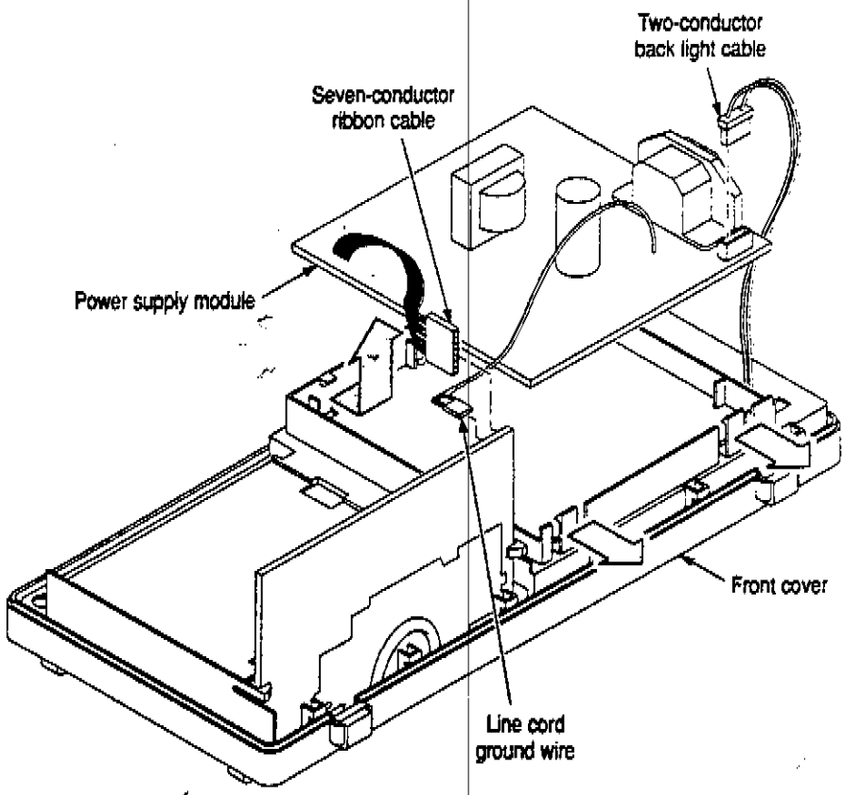


Figure 6–12: Removing the power supply module

Installation. Use this procedure to install the power supply module. Refer to Figure 6–13.

1. Place the power supply module into the inner chassis, placing the board under the three tabs at the top of the chassis.
2. Snap the bottom of the module into place.
3. Reconnect the following wires.
   a. The line cord ground wire on the main board at J101.
   b. The seven-conductor ribbon cable on the main board at J131.
   c. The two-conductor back light cable on the power supply module.
4. Use the installation procedures for each module removed to reassemble the instrument.

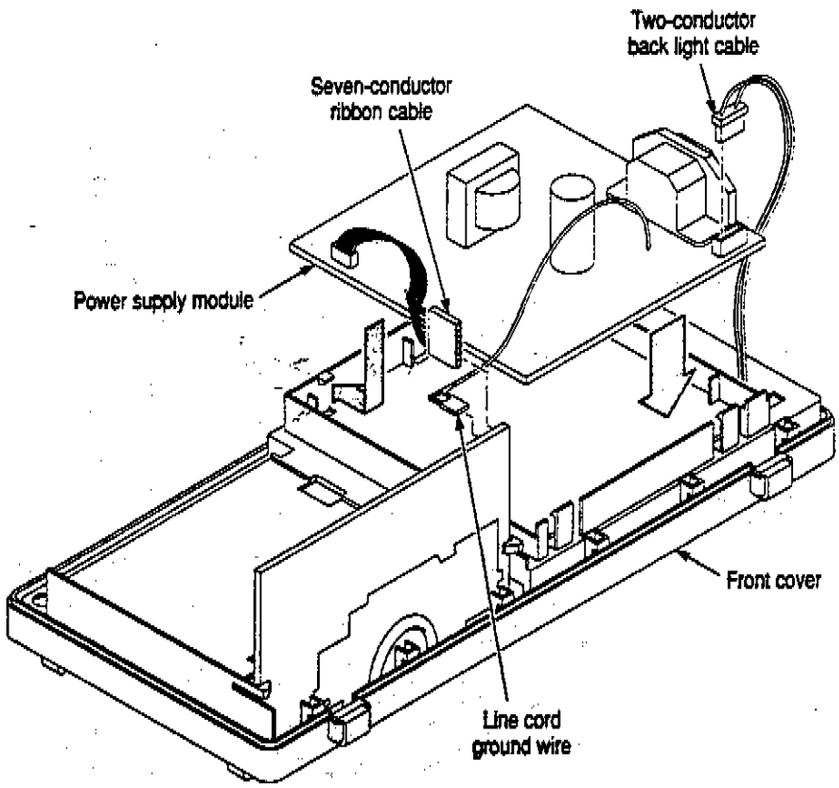


Figure 6–13: Installing the power supply module

Internal Assembly

You will need a torque-limiting Torx® T-15 screwdriver and a flat-blade screwdriver for this procedure.

Removal. First remove the handle, power button, and rear case using the procedures on pages 6–10, 6–12, and 6–12. Then, use the following procedure to remove the internal assembly.

1. Remove all the front panel knobs.
2. Lift the entire internal assembly (housing the all boards and display screen) out of the front case as shown in Figure 6–14.

NOTE. *The switch keypad will most likely remain inside the front case. It does not need to be removed with the internal assembly.*

Installation. Use this procedure to install the internal assembly.

1. Place the internal assembly into the front case as shown in Figure 6–14.

NOTE. *If the switch keypad was removed from the front case, refer to page 6–30 for proper installation instructions.*

2. Use the installation procedures for each module removed to reassemble the instrument.

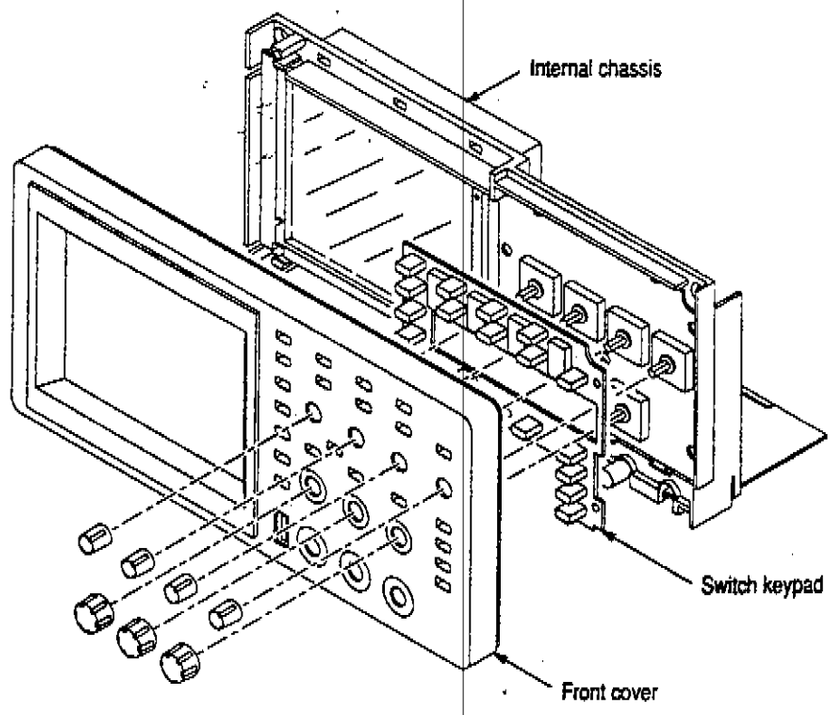


Figure 6–14: Removing and installing the internal assembly

Main Board Module

You will need a torque-limiting Torx® T-15 screwdriver and a flat-blade screwdriver for this procedure.

Removal. First remove the handle, power button, and rear case using the procedures on pages 6–10, 6–12, and 6–12. Then, use the following procedure to remove the main board module.

1. Remove the entire internal chassis from the front case using the procedure on page 6–21.
2. Disconnect the following wires from the main board. Refer to Figure 6–15.
   a. The line cord ground wire at J101 and the seven-conductor ribbon cable at J131 from the power supply module.
   b. The ribbon cable at J200 from the front panel module.
   c. The ribbon cable at J202 from the display module.
3. From the bottom of the internal chassis, slightly bend the two securing tabs and tilt the board down until it clears the tabs. Refer to Figure 6–16.
4. Pull the board out of the front slots of the internal chassis (near the BNC connectors).

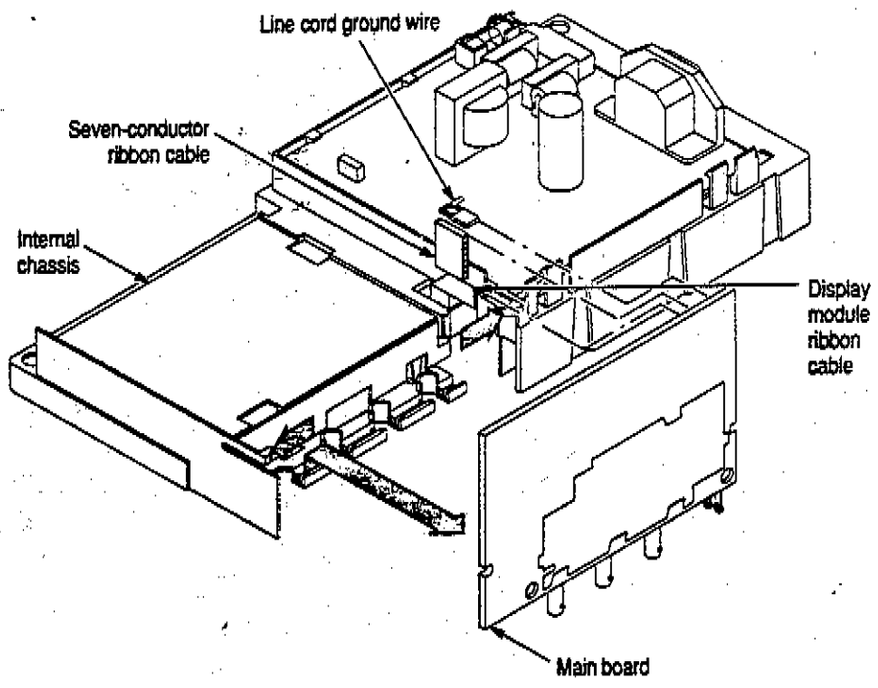


Figure 6–15: Main board removal

Installation. Use this procedure to install the main board module. Refer to Figure 6–16.

1. Working from the bottom of the inner chassis, place the front of the main board module into the slots on the inner chassis (near the BNC connectors).
2. Keeping the module in place, press the board into place so that the securing tabs lock onto the bottom of the board. Note that there are two board guides on the chassis that must match the cutouts on the main board.
3. Reconnect the following wires on the main board. Refer to Figure 6–15.
   a. The line cord ground wire at J101 and the seven-conductor ribbon cable at J131 from the power supply module.
   b. The ribbon cable at J200 from the front panel module.
   c. The ribbon cable at J202 from the display module.
4. Place the entire internal chassis (housing the all boards and display screen) into the front cover as shown in Figure 6–14.
5. Use the installation procedures for each module removed to reassemble the instrument.

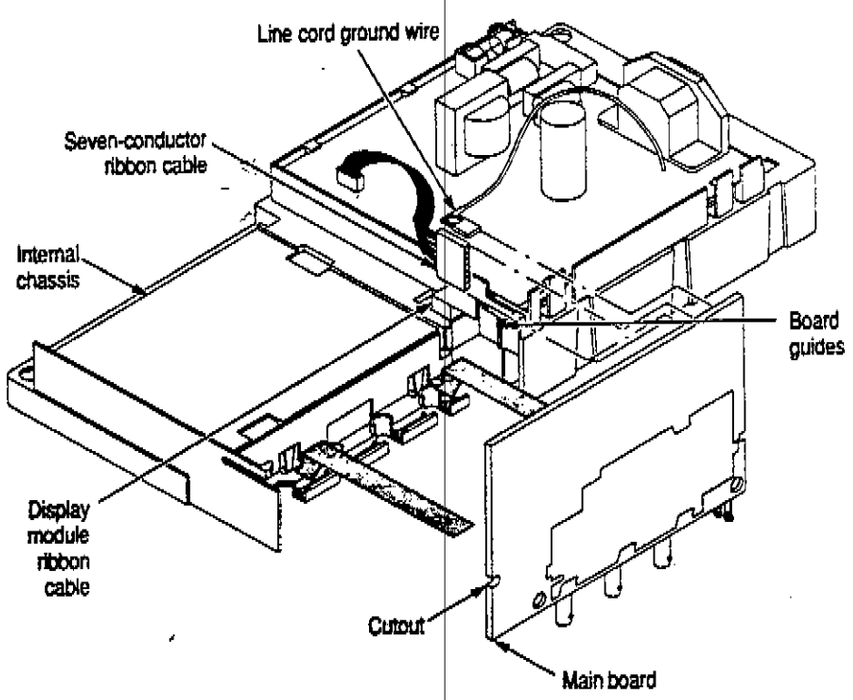


Figure 6–16: Main board installation

Display Module

You will need a torque-limiting Torx® T-15 screwdriver and a flat-blade screwdriver for this procedure.

Removal. First remove the handle, power button, and rear case using the procedures on pages 6–10, 6–12, and 6–12. Then, use the following procedure to remove the display module.

1. Remove the entire internal chassis from the front case using the procedure on page 6–21.
2. Disconnect display module ribbon cable at J202 on the main board. Refer to Figure 6–15.
3. Disconnect the backlight cable from the power supply module. Refer to Figure 6–13.
4. Slightly bend the two securing tabs on the left side of the display module and lift the left side up until it clears the tabs. Then slide the display to the left until the right-side tabs are disengaged. Refer to Figure 6–17.

NOTE. *The display shield is attached to the display module. Removing the shield will destroy the attaching gasket, requiring that a new shield be installed.*

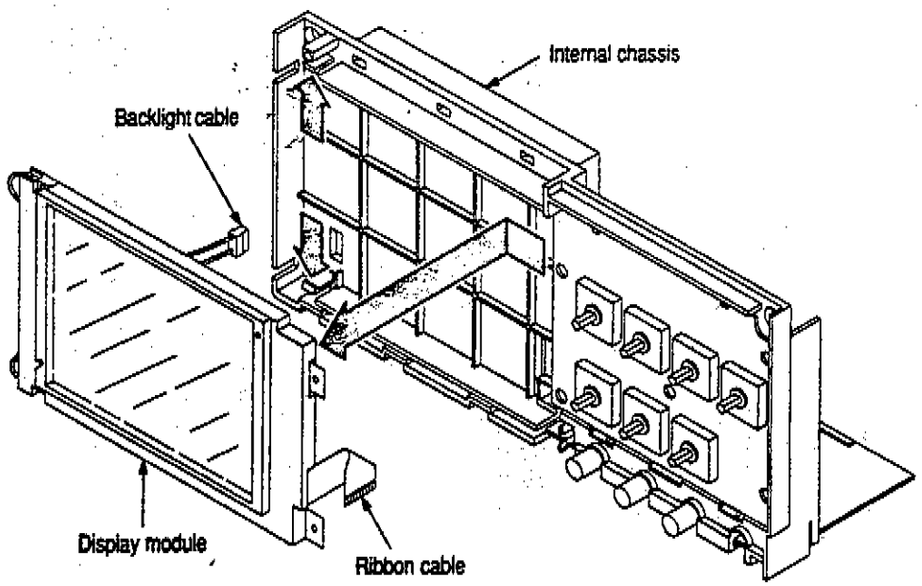


Figure 6–17: Removing the display module

Installation. Use this procedure to install the display module.

1. Route the display ribbon cable through the opening in the chassis as shown in Figure 6–18. If installing a new module, fold the ribbon cable as shown.
2. Place the tabs on the right side of the display module into the slots provided in the inner chassis. These are located under the front panel board but it is not necessary to remove the front panel board. Refer to Figure 6–18.
3. Route the backlight cable through the opening in the chassis as shown in Figure 6–18.
4. Lower the left side of the display module into the chassis until the two securing tabs lock on to the display module. Note that the backlight cable protruding from each end of the module must align with the cutouts of the inner chassis. Refer to Figure 6–18.
5. Reconnect the display module ribbon cable at J202 on the main board. Refer to Figure 6–15.
6. Reconnect the backlight cable from the power supply module. Refer to Figure 6–13.
7. Place the entire internal chassis into the front cover as shown in Figure 6–14.
8. Use the installation procedures for each module removed to reassemble the instrument.

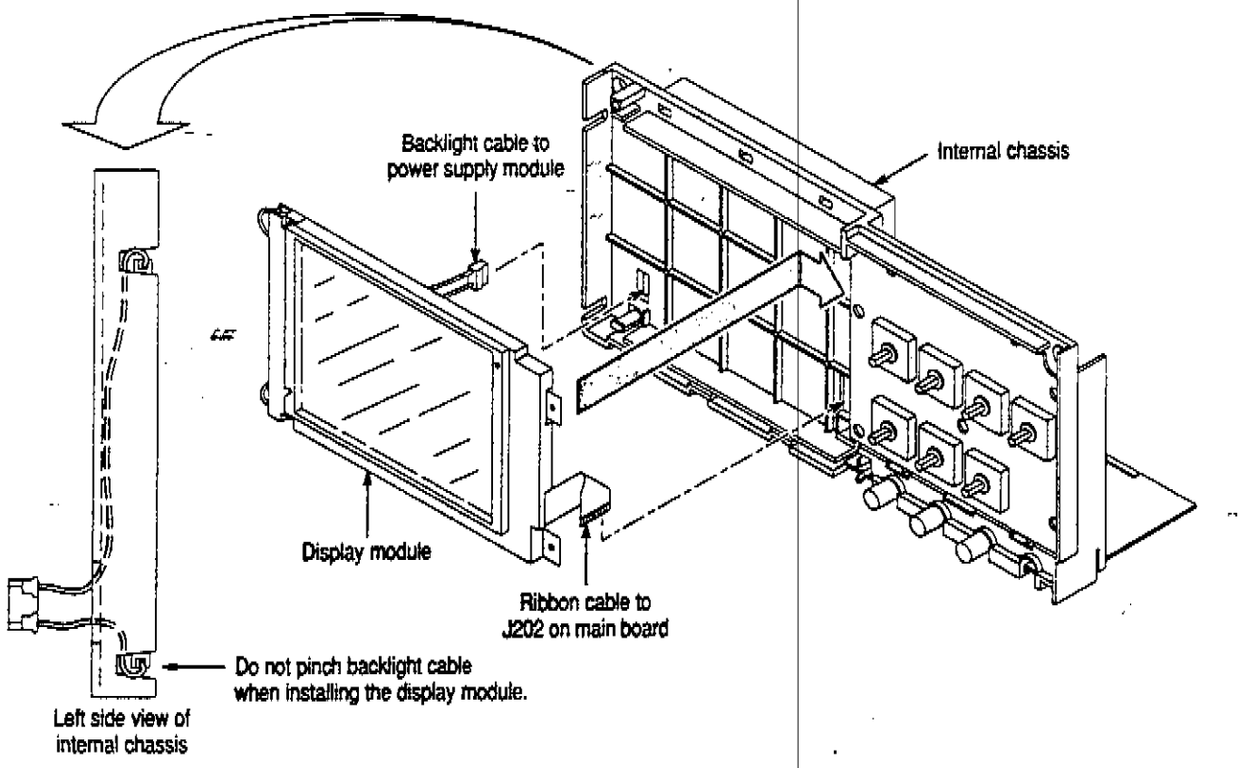


Figure 6–18: Installing the display module

Backlight

You will need a torque-limiting Torx® T-15 screwdriver and a flat-blade screwdriver for this procedure.

Removal. First remove the handle, power button, and rear case using the procedures on pages 6–10, 6–12, and 6–12. Remove the display module using the procedure on page 6–24. Then, use the following procedure to remove the backlight.

1. Disengage the three tabs from the left side of the display module and lift the backlight cover off as shown in Figure 6–19.
2. Gently lift the backlight out of the module.

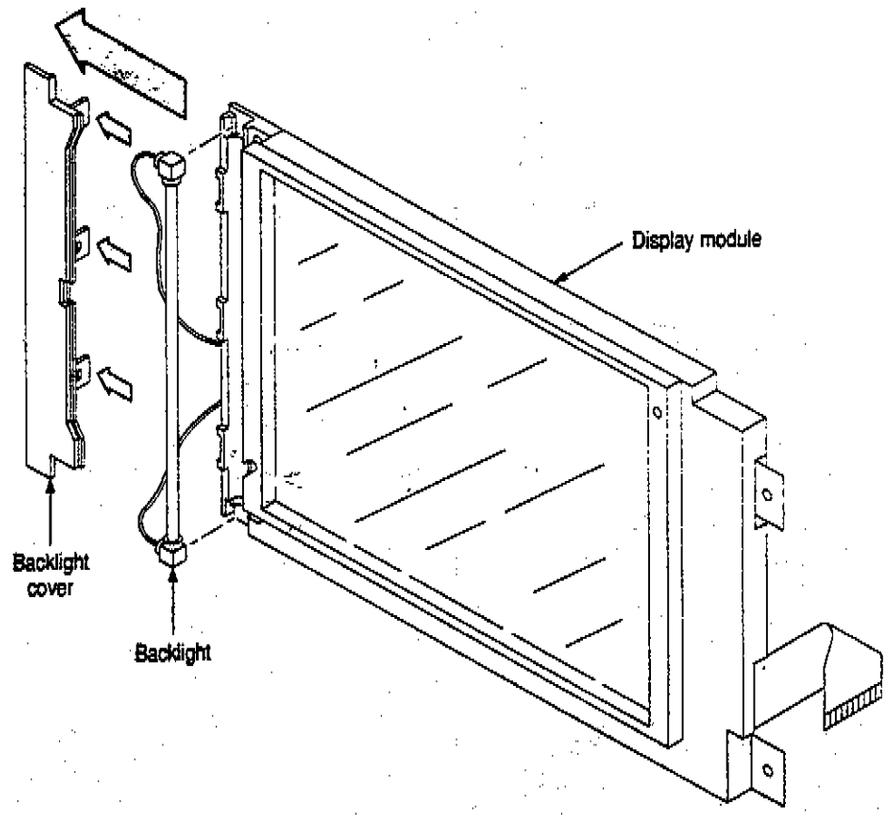


Figure 6–19: Removing the backlight

Installation. Use this procedure to install the display module.

1. Place the backlight into the display module. Note the proper routing of the cables as shown in Figure 6–20.
2. Slide the grooved section on the right of the backlight cover under the metal edge of the display as shown in Figure 6–20.
3. Snap the cover into place noting that all three securing tabs on the left side lock into place.
4. Install the backlight cover screw.
5. Use the installation procedures for each module removed to reassemble the instrument.

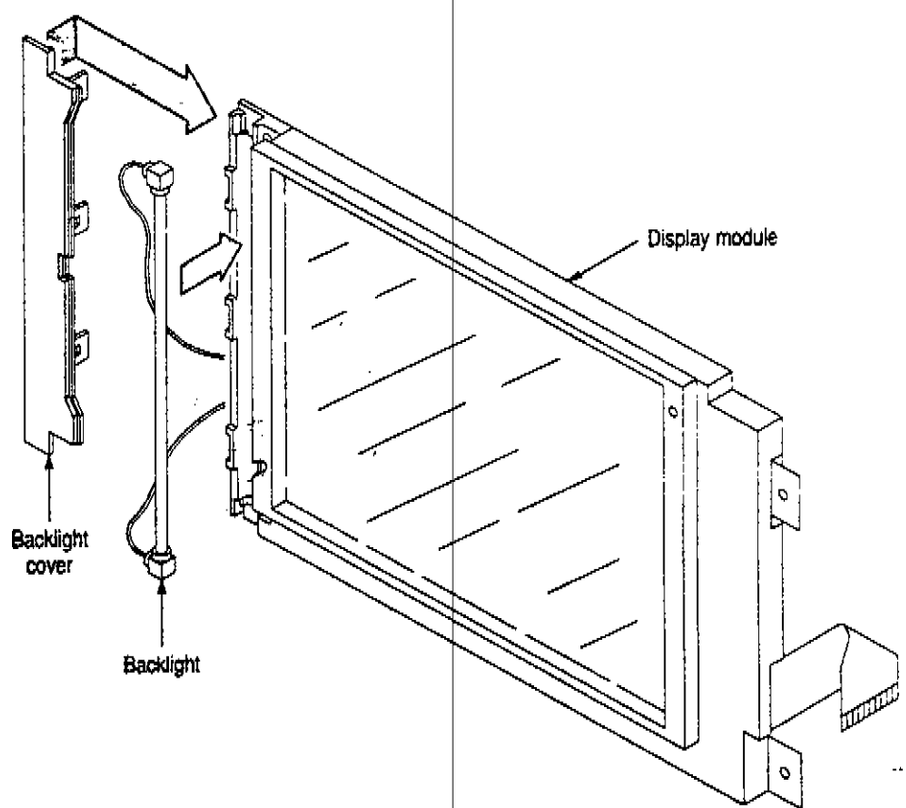


Figure 6–20: Installing the backlight and cover

Front Panel Module

You will need a torque-limiting Torx® T-15 screwdriver and a flat-blade screwdriver for this procedure.

Removal. First remove the handle, power button, and rear case using the procedures on pages 6–10, 6–12, and 6–12. Then, use the following procedure to remove the front panel module.

1. Remove the entire internal assembly from the front case using the procedure on page 6–21.
2. Disconnect the front panel ribbon cable at J200 on the main board. Refer to Figure 6–15.
3. Disengage the two securing tabs at the bottom of the board and slide the board down and out of the internal chassis. Refer to Figure 6–21

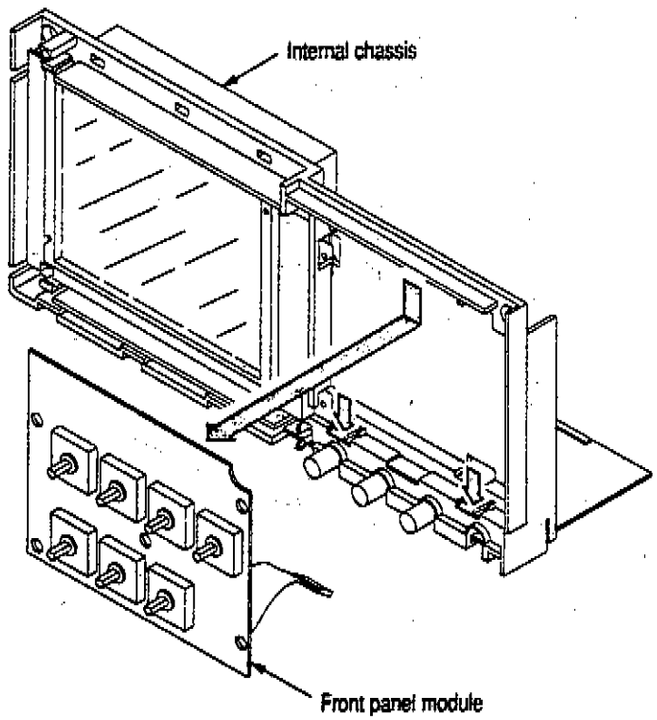


Figure 6–21: Removing the front panel module

Installation. Use this procedure to install the front panel module.

1. Route the front panel ribbon cable through the opening in the chassis as shown in Figure 6–22.
2. Insert the top of the front panel module under the tabs at the top of the chassis and press the board down until the securing tabs at the bottom of the chassis lock into place. Refer to Figure 6–21.
3. Reconnect the front panel ribbon cable at J200 on the main board. Refer to Figure 6–15.
4. Place the entire internal chassis (housing the all boards and display screen) into the front cover as shown in Figure 6–14.
5. Use the installation procedures for each module removed to reassemble the instrument.

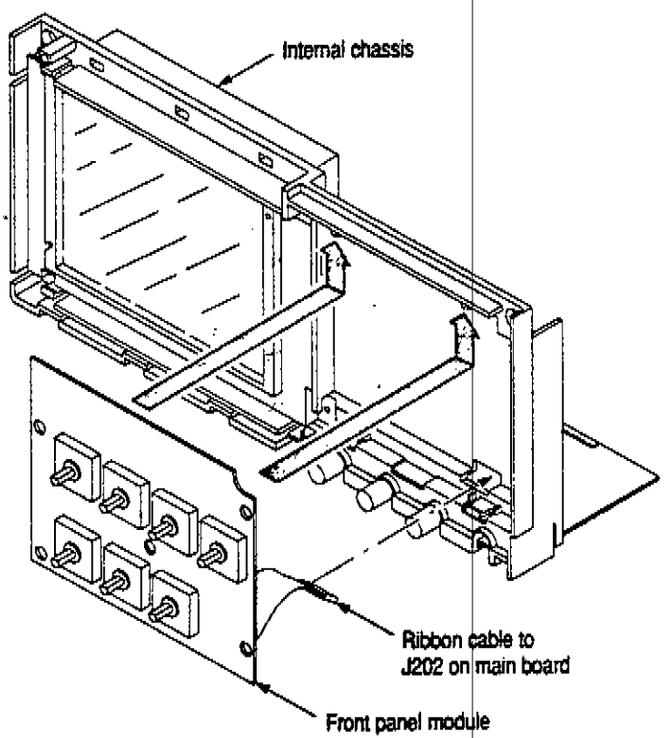


Figure 6–22: Installing the front panel module

Switch Keypad

You will need a torque-limiting Torx® T-15 screwdriver and a flat-blade screwdriver for this procedure.

Removal. First remove the handle, power button, and rear case using the procedures on pages 6–10, 6–12, and 6–12. Then, use the following procedure to remove the switch keypad.

1. Remove the entire internal assembly from the front case using the procedure on page 6–21.
2. Lift the switch pad out of the front cover.

CAUTION. *Keep the electrical contacts on the back of the switch pad clean. Skin oils and dust will inhibit good electrical contact.*

Installation. Use this procedure to install the switch keypad.

1. Align the switch keypad into the front case using the five guide posts as shown in Figure 6–23.

CAUTION. *Keep the electrical contacts on the back of the switch pad clean. Skin oils and dust will inhibit good electrical contact.*

2. Check that all the button are properly seated into place before proceeding.
3. Place the entire internal assembly into the front cover as shown in Figure 6–14.
4. Use the installation procedures for each module removed to reassemble the instrument.

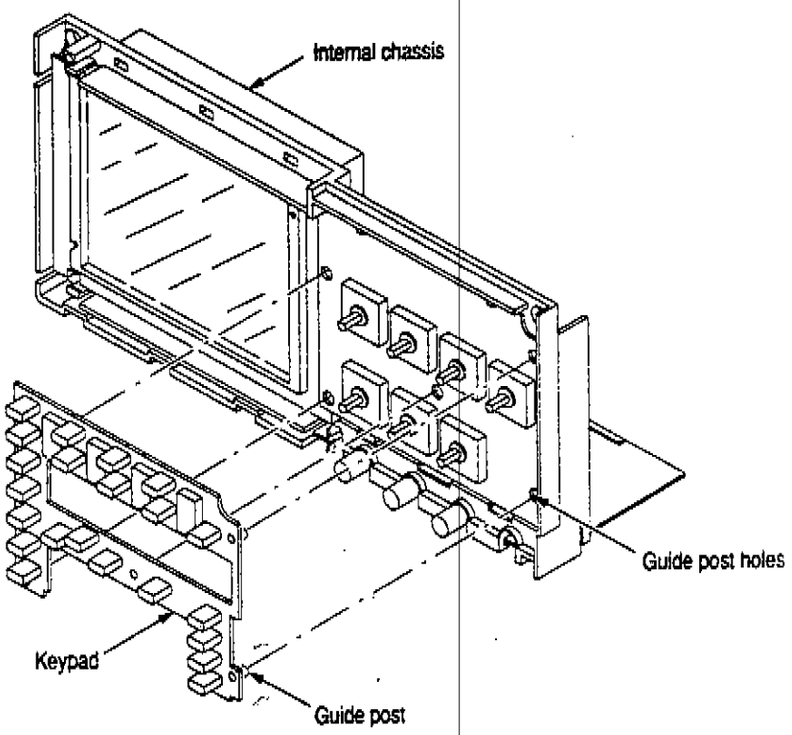


Figure 6–23: Installing the keypad

Display Shield

You will need a torque-limiting Torx® T-15 screwdriver and a flat-blade screwdriver for this procedure.

STOP. *Removing the display shield from the display module will destroy the display shield gasket. Only remove the shield if you intend to replace it with a new shield and gasket assembly.*

Removal. First remove the handle, power button, and rear case using the procedures on pages 6–10, 6–12, and 6–12. Then, use the following procedure to remove the display shield.

1. Remove the entire internal assembly from the front case using the procedure on page 6–21.
2. Remove the shield from the display module.

Installation. Use this procedure to install the display shield.

1. Align the display shield into the front case, using the two guide posts as shown in Figure 6–24.
2. Carefully place the entire internal assembly into the front case as shown in Figure 6–14 making sure that the display module properly contacts the display shield foam.
3. Use the installation procedures for each module removed to reassemble the instrument.

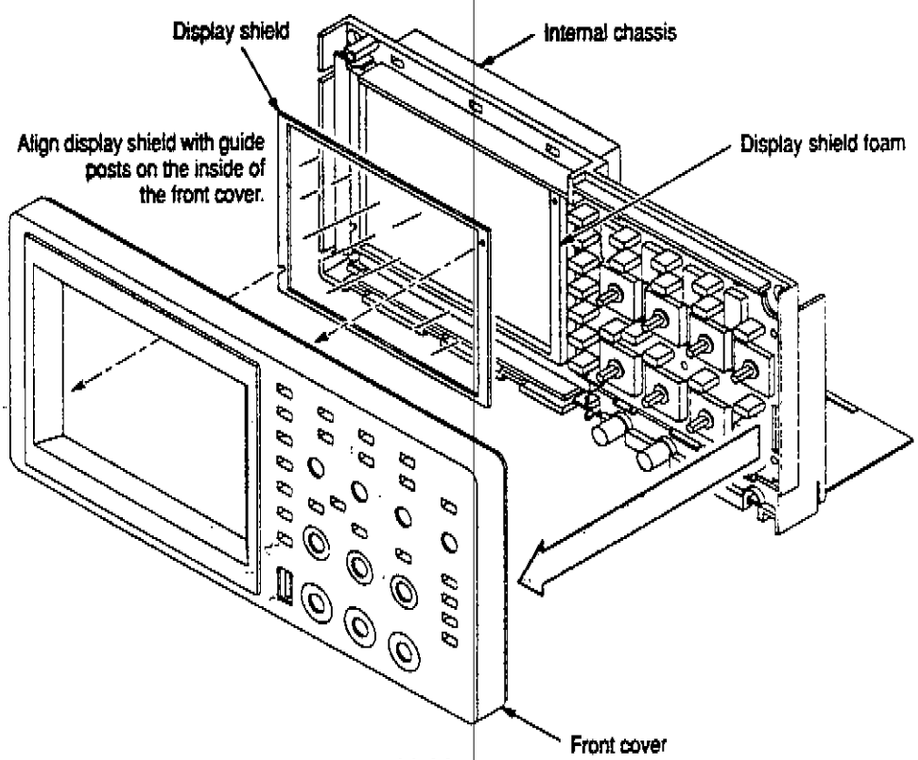


Figure 6–24: Installing the display shield

Front Case

You will need a torque-limiting Torx® T-15 screwdriver and a flat-blade screwdriver for this procedure.

Removal. First remove the handle, power button, and rear case using the procedures on pages 6–10, 6–12, and 6–12. Then, use the following procedure to remove the display shield.

1. Remove the entire internal chassis from the front case using the procedure on page 6–21.
2. Remove the switch keypad using the procedures on pages 6–30.
3. Remove the conductive foam pad from the front case.

Installation. Use this procedure to install the front cover.

1. Place the conductive foam pad into the front case.
2. Place the switch keypad into the front case.
3. Place the entire internal assembly into the front case as shown in Figure 6–14.
4. Use the installation procedures for each module removed to reassemble the instrument.
5. If installing a new front panel label onto the cover as described on page 6–9.

Options

There are no options available for the TDS 200 series oscilloscopes. For a list of available accessories, refer to chapter *Mechanical Parts List*.

(7-2 BLANK)

Electrical Parts List

Refer to the *Mechanical Parts List* chapter for a complete listing and description of replaceable parts for the TDS 210 and TDS 220 Digitizing Oscilloscopes.

Diagrams

See Figure 3–1 on page 3–3 for a block/interconnect diagram of the TDS 210 and TDS 220 Digitizing Oscilloscopes. There are no additional diagrams in this chapter.

Replaceable Parts

This section contains a list of the replaceable modules for the TDS 210 and TDS 220 Digitizing Oscilloscopes. Use this list to identify and order replacement parts.

Parts Ordering Information

Replacement parts are available through your local Tektronix field office or representative.

Changes to Tektronix products are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest improvements. Therefore, when ordering parts, it is important to include the following information in your order.

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

If you order a part that has been replaced with a different or improved part, your local Tektronix 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.

Module Servicing

Modules can be serviced by selecting one of the following three options. Contact your local Tektronix service center or representative for repair assistance.

Module Exchange. In some cases you may exchange your module for a remanufactured module. These modules cost significantly less than new modules and meet the same factory specifications. For more information about the module exchange program, call 1-800-TEK-WIDE, extension 6630.

New Modules. You may purchase replacement modules in the same way as other replacement parts.

Using the Replaceable Parts List

This section contains a list of the mechanical and/or electrical components that are replaceable for the TDS 210 and TDS 220 Digitizing Oscilloscopes. Use this list to identify and order replacement parts. The following table describes each column in the parts list.

Parts List Column Descriptions

Column	Column Name	Description
1	Figure & Index Number	Items in this section are referenced by figure and index numbers to the exploded view illustrations that follow.
2	Tektronix Part Number	Use this part number when ordering replacement parts from Tektronix.
3 and 4	Serial Number	Column three indicates the serial number at which the part was first effective. Column four indicates the serial number at which the part was discontinued. No entries indicates the part is good for all serial numbers.
5	Qty	This indicates the quantity of parts used.
6	Name & Description	An item name is separated from the description by a colon (:). Because of space limitations, an item name may sometimes appear as incomplete. Use the U.S. Federal Catalog handbook H6-1 for further item name identification.
7	Mfr. Code	This indicates the code of the actual manufacturer of the part.
8	Mfr. Part Number	This indicates the actual manufacturer's or vendor's part number.

Abbreviations

Abbreviations conform to American National Standard ANSI Y1.1–1972.

Mfr. Code to Manufacturer Cross Index

The table titled Manufacturers Cross Index shows codes, names, and addresses of manufacturers or vendors of components listed in the parts list.

Manufacturers Cross Index

Mfr. Code	Manufacturer	Address	City, State, Zip Code
0KB01	STAUFFER SUPPLY CO	810 SE SHERMAN	PORTLAND, OR 97214–4657
14310	AULT INC	7300 BOONE AVE NORTH BROOKLINE PARK	MINNEAPOLIS, MN 55428
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON, OR 97077–0001
TK1416	SHARP CORP	22–22 NAGAIKE–CHO ABENO–KU	OSAKA, JAPAN,

Replaceable Parts List

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
10-1-1	202-0345-00			1	CASE,BACK:BACK CASE,MACROBLEND DP4-1368,	80009	202-0345-00
10-1-2	366-0774-00			1	PUSH BUTTON:POWER PUSH BUTTON,PC/ABS BAYBLEND,FR110, TEXTURED	80009	366-0774-00
10-1-3	213-1099-00			2	SCREW,TPG,PT:K40-1.79 X 31 MM,STEEL,ZINC BLACK CHROMATE,T-15 TORX- SLOT,FLAT TOP PNH	0KB01	213-1099-00
10-1-4	334-9262-00			1	MARKER,IDENT:REAR PANEL WARNING LABEL,MARKED "WARNING TO AVOID ELECTRIC . . . ,3.765 X 3.990,	80009	334-9262-00
10-1-4					EXTENSION MODULE:OPTIONAL PLUG-IN ACCESSORY		
10-1-6	367-0472-00			1	HANDLE,CARRYING:MACROBLEND,PRESTO,SAFETY CONTROLLED	80009	367-0472-00
10-1-7	348-1484-00			2	FOOT:REAR,BLACK SANTOPRENE,TEXTURED	80009	348-1484-00
10-1-8	159-			1	FUSE		
10-1-9	119-5417-00			1	POWER SUPPLY:11W,5.0V 1.0A,-5.0V 0.3A,-23V 10MA,450VAC 30KHZ 5MA,85-275VAC 45-66HZ INPUT,UL,C	14310	SW422KA0000F02
10-1-10	441-2082-00			1	CHASSIS ASSY:CKT BD & LCD SUPPORT, MACROBLEND DP4-1368	80009	441-2082-00
10-1-11	671-3546-00			1	CKT BB ASSY:MAIN,389-2037-XX WIRED,TDS210	80009	671-3546-00
10-1-11	671-4024-00			1	CIRCUIT BD ASSY:MAIN,389-2037-XX WIRED,TDS220	80009	671-4024-00
10-1-12	348-1526-00			1	SHLD,TUBE:COPRESSION,KNITTED WIRE SHIELDING TUBE,0.312 OD,ACCOM 0.292X0.234 GROOVE,BECU	0KM03	8502-0310-40
10-1-13	671-3743-00			1	CIRCUIT BD ASSY:FRONT PANEL,TDS210 & TDS220	80009	671-3743-00
10-1-14	260-2654-00			1	SWITCH:ELASTOMER KEY PAD	80009	260-2654-00
10-1-15	119-4991-10			1	SHIELD ASSY:LCD SHIELD ASSY,119-4991-00 AND 337-4069-00	80009	119-4991-10
10-1-16	348-1534-00			1	GASKET,EMI:0.5 X 0.5 X 1 INCH LONG,OPEN CELL URETHANE FOAM,W/ADHESIVE STRIP	77824	EXX16T00100
10-1-17	348-1525-00			2	FOOT:FRONT,BLACK SANTOPRENE,TEXTURED	80009	348-1525-00
10-1-18	366-0771-00			3	KNOB,CAP:0.650 DIA,MACROBLEND DP4-1368	80009	366-0771-00
10-1-19	366-0772-00			4	KNOB,CAP:0.425 DIA,MACROBLEND DP4-1368	80009	366-0772-00
10-1-20	334-8682-00			1	MARKER,IDENT:FRONT BEZEL LABEL,MARKED "TEKTRONIX TDS220 TWO CHANNEL OSCILLOSCOPE 100MHZ",5.47	80009	334-8682-00
10-1-20	334-9261-00			1	MARKER,IDENT:FRONT BEZEL LABEL,MARKED "TDS210 TWO CHANNEL OSCILLOSCOPE 60MHZ",5.470 X 0.345,0	80009	334-9261-00
10-1-21	202-0346-00			1	CASE,FRONT:FRONT CASE,MACROBLEND DP4-1368,	80009	202-0346-00
10-1-22	337-4069-00			1	SHIELD,DISPLAY:DISPLAY SHIELD,4.895 X 3.495,0.062 THICK GE LEXAN CTG POLY,HARDCOATED BOTH SUFAC	80009	337-4069-00
10-1-23	119-5585-00			1	LAMP:CCFT,REPLACEMENT FOR LCD 119-4991-00 W/LEADS	TK2569	LM0F2964
10-1-24	367-0476-00			1	FLIP STAND:FLIP STAND,PC/ABS BAYBLEND,FR110,TEXTURED	80009	367-0476-00
10-1-25	131-6173-00			4	CONTACT,ESD:ESD CLIP,0.005 C17200 BECU,ACCOM 0.062 PCB,0.5 X 0.335 WIDE CONTACT,W/0.230 H	TK1326	131-6173-00

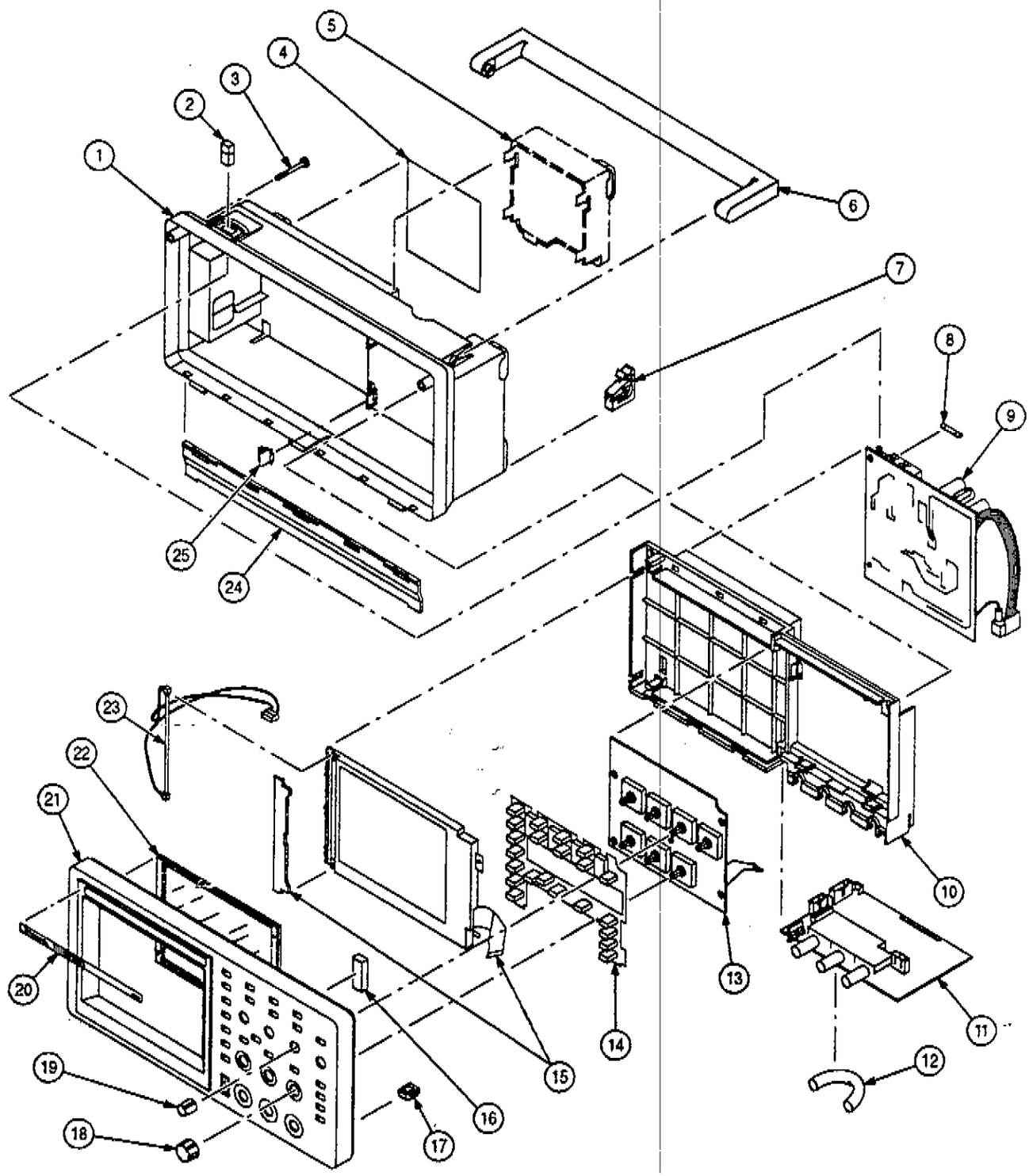


Figure 10–1: Exploded diagram

Table 10–1 lists the replaceable standard accessories for the TDS 210 and TDS 220 oscilloscopes and the instrument options that included them in the original shipment. These accessories are not shown in Figure 10–1.

Table 10–1: Replaceable standard accessories

Description of Accessory		Tektronix Part Number or Nomenclature
Passive 10X probes		P6112
Replacement TDS 210 and TDS 220 User Manual		
English		070-8483-XX
French		070-8520-XX*
German		070-8484-XX*
Italian		070-8980-XX*
Spanish		070-9560-XX*
Portuguese		070-9561-XX*
Japanese		070-9562-XX
Korean		070-9564-XX
Simplified Chinese		070-9563-XX
Traditional Chinese		070-9568-XX
		*These manuals contain a language overlay for the front-panel controls.
Replacement Power Cords		
North American	110 V	161–0230–01
North American	240 V	161–0104–08
Universal European	220 V	161–0104–06
United Kingdom	240 V	161–0104–07
Switzerland	220 V	161–0167–00
Australian	240 V,	161–0104–05

Table 10–2: Replaceable optional accessories

Description of Accessory	Tektronix Part Number or Nomenclature
Soft case	AC220
Communications Module	TDS2CM
Hardcopy Module	TDS2HM

Table 10–2: Replaceable optional accessories (Cont.)

Description of Accessory	Tektronix Part Number or Nomenclature
Replacement TDS2CM and TDS2HM Instructions	
English	070-9565-XX
French	070-9567-XX
German	070-9566-XX
Italian	070-9569-XX
Spanish	070-9570-XX
Portuguese	070-9571-XX
Japanese	070-9572-XX
Korean	070-9575-XX
Simplified Chinese	070-9573-XX
Traditional Chinese	070-9574-XX
Replacement TDS 210 and TDS 220 Programmer Manual	070-9576-XX