Service Manual

Tektronix

CSA8000
Communications Signal Analyzer

TDS8000
Digital Sampling Oscilloscope

071-0438-01

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.

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WARRANTY

Tektronix warrants that the products that it manufactures and sells will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If this product proves defective during its warranty period, Tektronix, at its option, will either repair the defective product without charge for parts and labor, or provide a replacement in exchange for the defective product.

This warranty applies only to products returned to the designated Tektronix depot or the Tektronix authorized representative from which the product was originally purchased. For products returned to other locations, Customer will be assessed an applicable service charge. The preceding limitation shall not apply within the European Economic Area, where products may be returned for warranty service to the nearest designated service depot regardless of the place of purchase.

In order to obtain service under this warranty, Customer must provide the applicable office of Tektronix or its authorized representative with notice of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix or its representative, with shipping charges prepaid. Tektronix or its representative shall pay for the return of the product to Customer. Customer shall be responsible for paying any associated taxes or duties.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty:

a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product;
b) to repair damage resulting from improper use or connection to incompatible equipment;
c) to repair any damage or malfunction caused by the use of non-Tektronix supplies or consumables;
d) to repair a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product; or
e) to repair damage or malfunction resulting from failure to perform user maintenance and cleaning at the frequency and as prescribed in the user manual (if applicable).

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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. To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of the system. Read the *General Safety Summary* in other system manuals for warnings and cautions related to operating the system.

To Avoid Fire or Personal Injury

Use Proper Power Cord. Use only the power cord specified for this product and certified for the country of use. Power cord needed only in the mainframe, not modules.

Connect and Disconnect Properly. Do not connect or disconnect probes or test leads while they are connected to a voltage source.

Ground the Product. The mainframe is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Ground the Product. The modules are indirectly grounded through the grounding conductor of the mainframe power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

Use Proper Fuse. Use only the fuse type and rating specified for this product.

Avoid Exposed Circuitry. Do not touch exposed connections and components when power is present.

Wear Eye Protection. Wear eye protection if exposure to high-intensity rays or laser radiation exists.

Do Not Operate With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

Provide Proper Ventilation. Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

Symbols and Terms

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:

CAUTION
Refer to Manual

WARNING
High Voltage

Protective Ground
(Earth) Terminal

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.

Disconnect Power. To avoid electric shock, switch off the instrument power, then disconnect the power cord from the mains power.

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 CSA8000 Communications Signal Analyzer, TDS8000 Digital Sampling Oscilloscope and the sampling and other modules that install in both instruments. Read this preface to learn how this manual is structured, what conventions it uses, and where you can find other information related to servicing this product. Read the *Introduction* following this preface for safety and other important background information needed before using this manual for servicing this product.

Manual Structure

This manual is divided into chapters, which are made up of related subordinate topics. These topics can be cross referenced as sections.

Be sure to read the introductions to all procedures. These introductions provide important information needed to do the service correctly, safely, and efficiently.

Manual Conventions

This manual uses certain conventions that you should become familiar with before attempting service.

Modules

Throughout this manual, the term *module* appears. A module is composed of electrical and mechanical assemblies, circuit cards, interconnecting cables, and a user-accessible front panel. “Sampling modules,” such as electrical sampling and optical sampling modules, refer to products.

Replaceable Parts

This manual refers to any field-replaceable assembly or mechanical part specifically by its name or generically as a replaceable part. In general, a replaceable part is any circuit board or assembly, such as the hard disk drive, or a mechanical part, such as the I/O port connectors, that is listed in the replaceable parts list of Chapter 10.

Safety

Symbols and terms related to safety appear in the *Service Safety Summary* found at the beginning of this manual.

Related Documentation

The instrument, electrical sampling modules and optical sampling modules come with the following manuals:

- *CSA8000/TDS800 User manual.* Tektronix part number 071-0443-XX.
- *CSA8000/TDS800 Reference manual.* Tektronix part number 071-0437-XX.
- *80E01, 80E02, 80E03, and 80E04 Electrical Sampling Modules User manual.* Tektronix part number 071-0434-XX.
- *80C00 Series Optical Sampling Modules User manual.* Tektronix part number 071-0435-XX.
- *CSA8000/TDS800 Rackmount Kit Instructions.* Tektronix part number 071-0696-XX.
- *80A01 Trigger Prescale Preamplifier Module.* Tektronix part number 071–0438–XX.

Contacting Tektronix

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*** This phone number is toll free in North America. After office hours, please leave a voice mail message.**
Outside North America, contact a Tektronix sales office or distributor; see the Tektronix web site for a list of offices.

System Specifications

This section contains the specifications for the CSA8000 Communications Signal Analyzer~~,~~ and the TDS8000 Digital Sampling Oscilloscope. All specifications are guaranteed unless noted as “typical.” Typical specifications are provided for your convenience but are not guaranteed. Specifications that are marked with the ✓ symbol are checked in *Performance Verification* chapter of the service manual, an optional accessory.

All specifications apply to the instrument and sampling modules. unless noted otherwise. To meet specifications, three conditions must first be met:

- The instrument must have been calibrated/adjusted at an ambient temperature between +20° C and +30° C.
- The instrument must have been operating continuously for 20 minutes within the operating temperature range specified.
- The instrument must be in an environment with temperature, altitude, humidity, and vibration with the operating limits described in these specifications.

***NOTE**. “Sampling Interface” refers to both the small module compartments and the large module compartments, unless otherwise specified.*

Table 1–1: System – Signal acquisition

Description	Characteristics
Number of input channels	8 acquisition channels, maximum
Number of small sampling module compartments	4 compartments, for a total of 8 channels[1]
Number of large sampling module compartments	2 compartments, for a total of 2 channels[1]
Small Sampling Module Interface	Tekprobe-Sampling Level 3. Hot switching is not permitted on this interface.
Large Sampling Module Interface	Tekprobe-Sampling Level 3. Hot switching is not permitted on this interface.

[1] **Total channels ≤ 8.**

Table 1–2: System – Timebase

Description	Characteristics	
Sampling rate	DC-200 kHz maximum, dictated by trigger rate and actual holdoff setting. If trigger rate is less than the maximum, or the requested holdoff exceeds the minimum, the trigger rate and/or holdoff will dictate the sampling rate.	
Record length[1]	20, 50, 100, 250, 500, 1000, 2000 and 4000 samples.	
Horizontal scale range	1 ps/div to 5 ms/div in 1, 2, 5 steps or 1 ps increments. Maximum record lengths apply at certain ranges (per table, below).	
	Scale set to an integer multiple of:	*Maximum record length*
	1 ps/div	1000
	2 ps/div	2000
	4 ps/div	4000
Horizontal position range	50 ms maximum.	
Horizontal resolution	10 fs minimum	
Horizontal position setting resolution	1 ps minimum	
Horizontal modes[2]	Two modes, Short Term Optimized and Locked to 10 MHz Reference. The 10 MHz reference may be internal or external.	
✓ Time internal accuracy, short term optimized mode	Strobe placement accuracy for a given horizontal interval and position on same strobe line per table below. (Contribution from 80E04 sampling module is included in specification.)	
	Range	*Time Interval Accuracy*
	≤ 20 ps/div	1 ps + 1% of interval
	≥ 21 ps/div	8 ps + 0.1% of interval
✓ Time internal accuracy, locked to internal 10 MHz reference mode[2]	Strobe placement accuracy for a given horizontal interval and position on same strobe line per table below. Contribution from 80E04 sampling module is included in specification.	
	Range	*Time Interval Accuracy*
	≤ 20 ps/div	1 ps + 1% of interval
	≥ 21 ps/div	8 ps + 0.01% of interval
Horizontal deskew range and resolution	–500 ps to +100 ns on any individual channel in 1 ps increments.	

[1] **The total number of samples contained in a single acquired waveform record (memory length in IEEE 1057, 2.2.1).**

[2] **80E02 sampling module is included in this specification.**

Table 1–3: System – Trigger

Description	Characteristics
Trigger sources	External Direct Edge Trigger, External Precsaled Trigger, Internal Clock Trigger, and Clock Recovery (with appropriately equipped optical modules)
Auto/normal mode	Normal mode: wait for trigger Auto mode: Trigger automatically generated after 100 ms time-out
Slope + or – select	Edge + mode: Triggers on positive-slewing edge Edge – mode: Triggers on negative-slewing edge
High frequency on/off select	High Frequency ON mode: Removes trigger hysteresis and improves sensitivity. Should be used when trigger slew rate exceeds 1 V/ns. High Frequency OFF mode: Retains trigger hysteresis and improves noise rejection at low slew rates.
Metastability Reject On/Off select	Metastability Reject On mode: Upon detection of trigger and holdoff collision, time base will reject the sampled point. Metastability Reject Off mode: Allows metastable points caused by trigger/holdoff collisions to display.
Variable trigger hold off range and resolution	Adjustable 5 μs to 50 ms in 0.5 ns increments. When External Prescaled Trigger mode is used, holdoff period applies to the Prescaled circuit output.
External direct trigger capabilities and conditions	Direct edge triggering on signal applied to dedicated front panel connector with Holdoff, Level Adjust, Auto/Normal, High Frequency On/Off, and Enhanced Triggering On/Off controls. External direct trigger specifications apply only under the condition that no other trigger signal is applied to respective connectors. Short term optimized mode and locked to internal 10 MHz reference specifications only apply under the condition that there is no external 10 MHz reference applied to the front panel connector.
External direct trigger input characteristics[1]	50 Ω input resistance, DC coupled only
External direct trigger input range	±1.5 V (DC + peak AC) maximum input voltage
External direct trigger maximum operating trigger signal[2]	1 Vpp
External direct trigger level range	Adjustable between ±1.0 V
✓ External direct trigger sensitivity[3]	100 mV, DC-3 GHz
External direct trigger sensitivity	50 mV typical, DC-4 GHz
External direct trigger level resolution	1 mV

Table 1–3: System – Trigger (Cont.)

<table>
<tr><th>Description</th><th colspan="2">Characteristics</th></tr>
<tr><td>✓ External direct trigger level accuracy</td><td colspan="2">50 mV + 0.10 x level</td></tr>
<tr><td>✓ External direct trigger delay jitter, short term optimized mode</td><td colspan="2">1.5 ps RMS + 10 ppm of horizontal position, or better</td></tr>
<tr><td>External direct trigger delay jitter, short term optimized mode (typical)</td><td colspan="2">1.0 ps RMS + 5 ppm of horizontal position, typical</td></tr>
<tr><td>✓ External direct delay jitter, locked to internal 10 MHz reference mode</td><td colspan="2">2.5 ps RMS + 0.10 ppm of horizontal position, or better</td></tr>
<tr><td>External direct delay jitter, locked to internal 10 MHz reference mode (typical)</td><td colspan="2">1.6 ps RMS + 0.05 ppm of horizontal position, typical</td></tr>
<tr><td>External direct trigger minimum pulse width</td><td colspan="2">167 ps, typical</td></tr>
<tr><td>External direct trigger metastability</td><td colspan="2">Metastability Reject on: Zero, typical</td></tr>
<tr><td>External direct trigger real time accessory interface</td><td colspan="2">Tekprobe-SMA, Levels 1 and 2. Hot switching is permitted on this real time accessory interface.</td></tr>
<tr><td>External prescaled trigger capabilities</td><td colspan="2">Prescaled triggering on signal applied to dedicated front panel connector with Holdoff, Auto/Normal, Metastability Reject On/Off.
External prescaled trigger specifications apply only under the condition that no other trigger source is applied to respective connectors.
Short term optimized mode and locked to internal 10 MHz reference specifications only apply under the condition that there is no external 10 MHz reference applied to the front panel connector.</td></tr>
<tr><td>External prescaled trigger input characteristics</td><td colspan="2">50 Ω AC coupled input resistance; divide-by-eight prescaler ratio, fixed level zero volts</td></tr>
<tr><td>External prescaled trigger absolute maximum input</td><td colspan="2">2.5 Vpp</td></tr>
<tr><td rowspan="4">✓ External prescaled trigger sensitivity</td><td colspan="2">The limits are as follows:</td></tr>
<tr><td><i>Frequency range</i></td><td><i>Sensitivity</i></td></tr>
<tr><td>2-3 GHz</td><td>800 mV_{pp}</td></tr>
<tr><td>3-10 GHz</td><td>600 mV_{pp}</td></tr>
</table>

Table 1–3: System – Trigger (Cont.)

Description	Characteristics	
External prescaled trigger sensitivity (typical)	*Frequency range*	*Sensitivity*
	10-12.5 GHz	1000 mV_{pp}, typical
✓ External prescaled trigger delay jitter, Short term optimized mode	1.5 ps RMS + 10 ppm of horizontal position, or better	
External prescaled trigger delay jitter, Short term optimized mode (Typical)	1.0 ps RMS + 5 ppm of horizontal position, typical	
✓ External prescaled delay jitter, locked to internal 10 MHz reference mode	2.5 ps RMS + 0.10 ppm of horizontal position, or better	
External prescaled delay jitter, locked to internal 10 MHz reference mode (Typical)	1.6 ps RMS + 0.05 ppm of horizontal position, typical	
External prescaled trigger metastability	Enhanced Triggering, Metastability Reject on: Zero, typical	
Internal clock trigger rates	Rate selectable at 25, 50, 100, and 200 kHz internally and is provided to the trigger, to the TDR stimulus drives in the small sampling module interfaces, and to the Internal Clock Out connector on the front panel.	

[1] **The input resistance at the external direct trigger input and the maximum input voltage.**

[2] **Maximum signal input for maintaining calibrated time base operation.**

[3] **Section 4.10.2 in IEEE standard number 1057. The minimum signal levels required for stable edge triggering of an acquisition.**

Table 1–4: System – Environmental

Description	Characteristics
Dynamics	Random vibration (operating): 0.10 g rms, from 5 to 500 Hz, 10 minutes each axis, (3 axis, 30 minutes total) operating. Random vibration (nonoperating): 2.00 g rms, from 5 to 500 Hz, 10 minutes each axis, (3 axis, 30 minutes total) non-operating.
Atmospherics	Temperature: Operating: 10 °C to +40 °C Nonoperating: –22 °C to +60 °C
	Relative humidity: Operating: 20% to 80%, with a maximum wet bulb temperature of 29 °C at or below +50 °C (upper limits derates to 25% relative humidity at +50 °C, non-condensing) Nonoperating (no floppy disk in floppy drive): 5% to 90%, with a maximum wet bulb temperature of 29 °C at or below +60 °C (upper limits derates to 20% relative humidity at +60 °C, non-condensing)
	Altitude: Operating: 3,048 m (10,000 ft.) Nonoperating: 12,190 m (40,000 ft.)
Electrostatic discharge susceptibility	Up to 8 kV with no change to control settings, or impairment of normal operation Up to 15 kV with no damage that prevents recovery of normal operation

Table 1–5: CSA8000 and TDS8000 – Power consumption and cooling

Specifications	Characteristics
Power requirements	600 watts
Cooling requirements	Six fans with speed regulated by internal temperature sensors. A 2” (51 mm) clearance must be maintained on the bottom, left side, and right side of the instrument for forced air flow. It should never be operated on a bench with the feet removed, nor have any object placed nearby where it may be drawn against the air vents. No clearance is required on the front, back, and top.

Table 1–6: CSA8000 and TDS8000 – Display

Specifications	Characteristics
Display type	211.2 mm (wide) x 1.58.4 mm (high), 264 mm (10.4 inch) diagonal, liquid crystal active matrix color display (LCD).
Display resolution	640 horizontal by 480 vertical pixels.
Pixel pitch	Pixels are 0.33 mm (horizontal) and 0.22 mm (vertical)

Table 1–7: CSA8000 and TDS8000 – Ports

Specifications	Characteristics
Video outputs	Two 15-pin D-subminiature connectors on the rear panel. Useable to connect external monitors that provide a duplicate of the primary and/or a second monitor on which to view other applications. Support at least the basic requirements of the PC99 specification.
Parallel port (IEEE 1284)	25-pin D-subminature connector on the rear panel. Supports the following modes: Standard mode, output only Bi-directional, PS/2 compatible Bi-directional Enhanced Parallel Port (IEEE 1284 standard, Mode 1 or Mode 2, v1.7 Bi-directional high speed Extended Capabilities Port (ECP)
Serial Port	9-pin D-subminature serial port connector using NS16C550 compatible UARTs supporting transfer speeds up to 115.2 kbits/sec.
PS/2 Keyboard and Mouse Interface	PS/2 compatible keyboard and mouse connectors.
LAN interface	RJ-45 LAN connector supporting 10 base-T and 100 base-T
External audio connectors	External audio jacks for MIC IN and LINE OUT
USB interface	One USB connector (the second USB is disable because of internal use)
GPIB interface	Complies with IEEE 488.2
Interal clock trigger out	Square wave out from 50 Ω, back termination synchronized to the TDR internal clock drive signal, Refer to *Trigger System–Internal Clock*. Typical performance into 50 Ω termination: –0.20 to +0.20 V low level –0.90 to +1.10 V high level

Table 1–7: CSA8000 and TDS8000 – Ports (Cont.)

Specifications	Characteristics
DC calibration output	DC voltage from low impedance drive, programmable to 1 mV over ±1.25 V range maximum. Accuracy is 0.1 mV +0.1%
External 10 MHz reference input	±5 V maximum

Table 1–8: CSA8000 and TDS8000 – Data storage

Specifications	Characteristics
Floppy disk drive	3.5 in floppy disk, 1.44 Mbyte, compatable with DOS 3.3 or later format for storing reference waveforms, image files, and instrument setups.
Hard disk drive capacity	6 Gbytes

Table 1–9: CSA8000 and TDS8000 – Mechanical

Specifications	Characteristics
Construction material	Chassis: Aluminum alloy Cosmetic covers: PC/ABS thermoplastic Front panel: Aluminum alloy with PC/thermoplastic overlay Module doors: Nickel plated stainless steel Bottom cover: Vinyl clad sheet metal Circuit boards: Glass-laminate. Cabinet: Aluminum.
Weight	20.8 kg (45 lb. 12 oz.)
Overall Dimensions	Height 343 mm (13.5 in.) Width 457 mm (18.0 in.) Depth 419 mm (16.5 in.) The dimensions do not include feet, rack mount kit, or protruding connectors.
Overall mass, packaged product	36.3 kg (80 lb. 1 oz.)
Overall Dimensions, packaged product	Height 622 mm (24.5 in.) Width 711 mm (28.0 in.) Depth 787 mm (31.0 in.)

Certifications

Table 1–10: Certifications and compliances

Category	Standards or description
EC Declaration of Conformity – EMC	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility when configured with sampling head modules designed for use with this instrument as identified in this manual. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Union: EN 61326 EMC Requirements for Electrical Equipment for Measurement, Control and Laboratory use. Class A Radiated and Conducted Emissions IEC 1000-4-2 Performance Criterion B[1,2] IEC 1000-4-3 Performance Criterion A[1] IEC 1000-4-4 Performance Criterion B[1] IEC 1000-4-5 Performance Criterion B[1] IEC 1000-4-6 Performance Criterion A[1] IEC 1000-4-11 Performance Criterion B[1] [1] **Performance Criteria C for USB keyboard and mouse. Note that operation of the USB keyboard and mouse can be restored by unplugging and then reconnecting the USB connector at the rear panel of the main instrument.** [2] **Horizontal timing susceptibility of the optical sampling modules and their internal clock recovery trigger signals usually increase the horizontal timing jitter when external electromagnetic fields are applied. For fields up to 3 V/m, the increase in the horizontal high-frequency RMS jitter is typically less than 3 ps RMS of jitter, added using the square-root-of-the-sum-of-the-squares method. An example follows:** **If an 80C01-CR operating in clock-recovery trigger mode exhibits 3.5 ps RMS of edge jitter, with no EMC field applied and for an ideal jitterless input, then for applied fields up to 3 V/m the edge jitter, degradation would typically result in a total RMS jitter of:** $Jitter \le \sqrt{3.5ps^2 + 3ps^2} = 4.61ps$ EN 61000-3-2 AC Power Harmonic Current Emissions Radiated emissions may exceed the levels specified in EN 61326 when this instrument is connected to a test object.
Australia/New Zealand Declaration of Conformity – EMC	Complies with EMC Framework per the following standard: AS/NZS 2064.1/2 Class A Radiated and Conducted Emissions
General EMC	To ensure compliance with EMC requirements, only high quality shielded cables having a reliable, continuous outer shield (braid & foil) with full coverage, low impedance connections to shielded connector housings at both ends should be connected to this product.
EC Declaration of Conformity – Low Voltage	Compliance was demonstrated to the following specification as listed in the Official Journal of the European Union: Low Voltage Directive 73/23/EEC, amended by 93/69/EEC

Table 1–10: Certifications and compliances (cont.)

Category	Standards or description	
	EN 61010-1/A2:1995	Safety requirements for electrical equipment for measurement control and laboratory use.
U.S. Nationally Recognized Testing Laboratory Listing, mainframe	UL3111-1	Standard for electrical measuring and test equipment.
Canadian Certification, mainframe	CAN/CSA C22.2 No. 1010.1	Safety requirements for electrical equipment for measurement, control, and laboratory use.
Installation (Overvoltage) Category	Terminals on this product may have different installation (overvoltage) category designations. The installation categories are:	
	CAT III	Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location.
	CAT II	Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected.
	CAT I	Secondary (signal level) or battery operated circuits of electronic equipment.
Pollution Degree	A measure of the contaminates that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated.	
	Pollution Degree 1	No pollution or only dry, nonconductive pollution occurs. Products in this category are generally encapsulated, hermetically sealed, or located in clean rooms.
	Pollution Degree 2	Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.
	Pollution Degree 3	Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation. These are sheltered locations where neither temperature nor humidity is controlled. The area is protected from direct sunshine, rain, or direct wind.
	Pollution Degree 4	Pollution that generates persistent conductivity through conductive dust, rain, or snow. Typical outdoor locations.
Safety Certification Compliance		
Equipment Type	Test and measuring	
Safety Class	Class 1 (as defined in IEC 1010-1, Annex H) – grounded product	
Overvoltage Category	Overvoltage Category II (as defined in IEC 1010-1, Annex J)	
Pollution Degree	Pollution Degree 2 (as defined in IEC 1010-1). Note: Rated for indoor use only.	

80E00 Electrical Sampling Modules

This section contains specifications for the 80E01, 80E02, 80E03, & 80E04 Sampling Modules. All specifications are guaranteed unless noted as “typical.” Typical specifications are provided for your convenience but are not guaranteed. Specifications that are marked with the ✓ symbol are checked in *Performance Verification* in the service manual.

All specifications apply to all models of sampling module unless noted otherwise. To meet specifications, three conditions must first be met:

- The instrument must have been calibrated/adjusted at an ambient temperature between +20° C and +30° C.
- The oscilloscope must have been operating continuously for 20 minutes within the operating temperature range specified.
- The instrument must be in an environment with temperature, altitude, humidity, and vibration within the operating limits described in these specifications

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***NOTE**. “Sampling Interface” refers to both the electrical sampling module interface and the optical module interface, unless otherwise specified.*

Table 1–11: Electrical sampling modules – Descriptions

Sampling module	Description
80E01	1 channel 50 GHz/7 ps bandwidth, 50 Ω sampling module.
80E02	2 channel 12.5 GHz/28 ps bandwidth, 50 Ω, low noise sampling module.
80E03	2 channel 20 GHz/17.5 ps bandwidth, 50 Ω sampling module.
80E04	2 channel 20 GHz/17.5 ps bandwidth, 50 Ω TDR/sampling module with 35 ps single ended, common mode, and differential TDR capability.

Table 1–12: Electrical sampling modules – Signal acquisition

<table>
<tr><th>Specifications</th><th colspan="2">Characteristics</th></tr>
<tr><td>Real time accessory interface</td><td colspan="2">Tekprobe-SMA interface is provided through the electrical sampling-module interface, one per vertical channel.</td></tr>
<tr><td>Channel input connector</td><td colspan="2">80E02, 80E03, and 80E04: precision 3.5 mm connector.
80E01: precision 2.4 mm connector (2.4 mm male to 2.92 mm (K) female adapter, 011-0157-xx, is supplied).</td></tr>
<tr><td>Number of input channels</td><td colspan="2">80E01: 1
80E02, 80E03, 80E04: 2</td></tr>
<tr><td>✓ Input impedance</td><td colspan="2">50 Ω ±0.5 Ω</td></tr>
<tr><td>Vertical dynamic range</td><td colspan="2">1 V_{pp} (offset ±500 mV)</td></tr>
<tr><td>Vertical operating range[1], maximum</td><td colspan="2">±1.6 V</td></tr>
<tr><td>Vertical nondestruct range [2] (Maximum Input Voltage)</td><td colspan="2">80E01: 2.0 V (DC+peak AC)
80E02, 80E03, 80E04: 3.0 V (DC+peak AC)</td></tr>
<tr><td>Vertical number of digitized bits</td><td colspan="2">14 bits full scale</td></tr>
<tr><td>Vertical sensitivity range[3]</td><td colspan="2">The range of available full scale input settings.
10 mV to 1 V full scale</td></tr>
<tr><td>Compensation temperature range</td><td colspan="2">± 5° C about temperature where compensation was performed. If compartment is changed on the mainframe, a sampling module extender is employed, or the length of the sampling module extender is changed, the channel must be recompensated.</td></tr>
<tr><td>✓ DC voltage accuracy, single point, within ± 5°C of compensated temperature</td><td colspan="2">±2 mV ±0.007 (assigned offset)
±0.02 (vertical value – assigned offset)</td></tr>
<tr><td>✓ DC vertical voltage deviation from linear least squares fit</td><td colspan="2">±10 mV</td></tr>
<tr><td rowspan="4">✓ Rise time[4]</td><td><i>Sampling module</i></td><td><i>Rise time</i></td></tr>
<tr><td><i>80E01</i>:</td><td>7 ps, typical (0.35 bandwidth-risetime product)</td></tr>
<tr><td>80E02</td><td>≤ 28 ps</td></tr>
<tr><td>80E03 and 80E04</td><td>≤ 17.5 ps</td></tr>
</table>

Table 1–12: Electrical sampling modules – Signal acquisition (Cont.)

Specifications	Characteristics	
✓ Analog bandwidth[5]	*Sampling module*	*Bandwidth*
	80E01	50 GHz
	80E02	12.5 GHz, typical
	80E03 and 80E04	20 GHz, typical
Step response aberrations[6], typical	*Sampling module*	*Aberrations, step transition*[6]
	80E02, 80E03 and 80E04	±3% or less over the zone 10 ns to 20 ps before step transition +10%, –5% or less for the first 300 ps following step transition ±3% or less over the zone 300 ps to 5 ns following step transition ±1% or less over the zone 5 ns to 100 ns following step transition ±0.5% after 100 ns following step transition
	80E01	±3% or less over the zone 10 ns to 20 ps before step transition +12%, –5% or less for the first 300 ps following step transition +5.5%, –3% or less over the zone 300 ps to 3 ns following step transition ±1% or less over the zone 3 ns to 100 ns following step transition ±0.5% after 100 ns following step transition
Random noise, displayed	*Sampling module*	*Noise, typical*
	80E01	1.8 mV_{RMS}
	80E02	400 μV_{RMS}
	80E03 and 80E04	600 μV_{RMS}

Table 1–12: Electrical sampling modules – Signal acquisition (Cont.)

Specifications	Characteristics	
✓ Random noise, displayed	*Sampling module*	*Noise*
	80E01	$\leq 2.3\ \mathrm{mV_{RMS}}$
	80E02	$\leq 800\ \mathrm{mV_{RMS}}$
	80E03 and 80E04	$\leq 1.2\ \mathrm{mV_{RMS}}$
Offset range[1]	±1.6 V	

[1] **Vertical operating range defines the maximum range over which the offset plus peak input signal can operate. The offset may be limited as a function of vertical sensitivity and dynamic range, such that no signal exceeding the maximum operating range can be displayed.**

[2] **Vertical nondestruct range defines the maximum range over which offset plus peak input signal can operate without irreversible damage to the instrument. Operation to instrument specification is not guarantied outside of the vertical operating range.**

[3] ***Input Signal Ranges* in IEEE std 1057, section 2.2.1.**

[4] **IEEE std 1057, section 4.8.2, *Transition Duration of Step Response*. Calculated from 0.35 bandwidth-risetime product.**

[5] **IEEE std 1057, section 4.6, *Analog Bandwidth*.**

[6] **IEEE std 1057, section 4.8.4, *Overshoot and Precursors*. Step transition occurs at the point of minimum radius of the waveform curvature, after the 50% amplitude point of the step leading edge.**

Table 1–13: Electrical sampling module (80E04) – TDR system

Specifications	Characteristics
Number of TDR channels	80E04: 2, one per channel
TDR polarity and operation mode selections	80E04: Positive polarity, negative polarity, and TDR off are independently selectable for each channel.
Maximum input voltage	80E04: Do not apply input voltage during TDR operation.
TDR amplitude	80E04: 250 mV each polarity, typical

Table 1–13: Electrical sampling module (80E04) – TDR system (Cont.)

Specifications	Characteristics
✓ TDR system reflected rise time[1]	80E04: ≤ 35 ps each polarity
TDR system incident rise time	80E04: 28 ps, typical
TDR step maximum repetition rate	80E04: 200 kHz
✓ TDR system step response aberrations[2]	*80E04 Aberrations, step transition*[2]
	±3% or less over the zone 10 ns to 20 ps before step transition +10%, –5% or less typical for the first 400 ps following step transition ±3% or less over the zone 400 ps to 5 ns following step transition ±1% or less after 5 ns following step transition

[1] **IEEE std 1057, section 4.8.2, transition duration of step response.**

[2] **IEEE std 1057, section 4.8.4, overshoot and precursors.**

Table 1–14: Electrical sampling modules – Timebase system

Specifications	Characteristics
Sampling rate	DC-200 kHz maximum.
Horizontal position range, minimum (deskew adjust range between channels)	≤ 19 ns, no extender cable present, external direct trigger operation.

Table 1–15: Electrical sampling modules – Power consumption

Specifications	Characteristics	
Power dissipation	80E01	1.1 W
	80E02, 80E03	1.8 W
	80E04	3.2 W

Table 1–16: Electrical sampling modules – Mechanical

Specifications	Characteristics
Weight	80E01, 80E02, 80E03, and 80E04 0.4 kg (13 oz.)
Overall dimensions	Height: 25 mm (1.0 in) Width: 79 mm (3.1 in) Depth: 135 mm (5.3 in) Does not include connectors, connector savers, connector covers, push buttons, or lock-down hardware protruding from the front or rear panels.
Construction material	Chassis aluminum alloy; Front panel plastic laminate; Circuit boards glass-laminate; Cabinet sleeve aluminum Cabinet end covers aluminum

80C00 Optical Modules

This section contains specifications for the 80C01, 80C02, 80C03, 80C04, 80C05, and 80C06 Optical Sampling modules. All specifications are guaranteed unless noted as “typical.” Typical specifications are provided for your convenience but are not guaranteed. Except for limits noted “typical,” specifications that are marked with the ✓ symbol are checked in the *Performance Verification* section of the service manual.

All specifications apply to the 80C01, 80C02, 80C03, 80C04, 80C05, and 80C06 Optical Sampling modules unless noted otherwise. To meet specifications, three conditions must first be met:

- The instrument must have been calibrated/adjusted at an ambient temperature between +20° C and +30° C.
- The instrument must have been operating continuously for 20 minutes within the operating temperature range specified.
- The instrument must be in an environment with temperature, altitude, humidity, and vibration within the operating limits described in these specifications

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***NOTE**. “Sampling Interface” refers to both the electrical sampling module interface and the optical module interface, unless otherwise specified.*

Table 1–17: Optical modules – Descriptions

Name	Characteristics
80C01	Long wavelength 1100 nm - 1650 nm. Unamplified O/E converter with two user selectable optical bandwidths: 12.5 GHz, > 20 GHz, or three user selectable reference receiver responses: OC-12/STM-4 for 622.08 Mb/s Sonet/SDH standards, OC-48/STM-16 for 2.488 Gb/s Sonet/SDH standards, and OC-192/STM-64 for 9.953 Gb/s Sonet/SDH standards.
80C02	Long wavelength 1100 nm - 1650 nm. Unamplified O/E converter with three user selectable optical bandwidths: 12.5 GHz 20 GHz, > 30 GHz, or user selectable reference receiver response: OC-192/STM-64 for 9.953 Gb/s Sonet/SDH standards.

Table 1–17: Optical modules – Descriptions (Cont.)

Name	Characteristics
80C03	Broad wavelength 700 nm - 1650 nm. Amplified O/E converter with optical bandwidth of > 2.5 GHz. The 2.5 Gb/s, OC-48/STM-16, and 2.5 GHz modes all use a physical path that has OC48/STM-16 reference receiver type response. Two other selectable reference receiver responses: FC1063 for the 1.0625 Gb/s fibre channel standard and GBE for the 1.25 Gb/s gigabit ethernet standard.
80C04	Long wavelength 1100 nm - 1650 nm. Unamplified O/E converter with two user selectable optical bandwidths: 20 GHz, > 28 GHz, or two user selectable reference receiver responses: OC-192/STM-64 for 9.953 Gb/s Sonet/SDH standards 10.66 Gb/s for FEC10.664 Gb/s
80C05	Long wavelength 1520 nm - 1580 nm. Unamplified O/E converter with maximum optical bandwidth (in combination with the internal electrical sampler) > 40 GHz. Calibrated only at 1550 nm. There is one reference receiver setup selectable: OC-192 for 9.95328 Gb/s Sonet/SDH standards No clock recovery option available.
80C06	Long wavelength 1520 nm - 1580 nm. Unamplified O/E converter with maximum optical bandwidth (in combination with the internal electrical sampler) > 50 GHz. It is calibrated only at 1550 nm. Fixed bandwidth selection of 50 GHz. No reference receiver setups. No clock recovery option available.

Table 1–18: Optical modules – Acquisition

Name	Characteristics	
Number of input channels	1 optical	
Internal fiber diameter[1]	*Module*	*Characteristics*
	80C01	9 μm/125 μm single mode
	80C02	9 μm/125 μm single mode
	80C03	62.5 μm (Corning 62.5/125 CPC6 specs) multimode (compatible with single-mode fiber) cladding: 125 μm, buffer: 900 μm
Internal fiber diameter[1]	80C04, 80C05 & 80C06	9 μm/125 μm single mode
Fiber connector	Rifocs UCI (universal connector interface)[2] male connector	

Table 1–18: Optical modules – Acquisition (Cont.)

Name	Characteristics	
Optical return loss	*Module*	*Loss*
	80C01	> 30 dB for single-mode fiber
	80C02	> 30 dB for single-mode fiber
	80C03	> 14 dB for multimode fiber > 24 dB for single-mode fiber
	80C04, 80C05, and 80C06	> 30 dB for single-mode fiber
Absolute maximum nondestructive optical input[2]	80C01, 80C02, 80C03, and 80C04	5 mW average power, 10 mW peak power at wavelength with highest relative responsively.
	80C05	10 mW average power, 30 mW peak power at wavelength with highest relative responsively.
	80C06	20 mW average power, 60 mW peak power at wavelength with highest relative responsively.
Effective wavelength range[3], typical	*Module*	*Range*
	80C01	1100 nm to 1650 nm
	80C02	1100 nm to 1650 nm
	80C03	700 nm to 1650 nm
	80C04	1100 nm to 1650 nm
	80C05	1520 nm to 1580 nm
	80C06	1520 nm to 1580 nm
Calibrated wavelengths	*Module*	*Range*
	80C01	1550 nm and 1310 nm ± 20 nm
	80C02	1550 nm and 1310 nm ± 20 nm
	80C03	1550 nm, 1310 nm, 850 nm, and 780 nm (all ± 20 nm)
	80C04	1550 nm and 1310 nm ± 20 nm
	80C05 & 80C06	1550 nm ± 20 nm

Table 1–18: Optical modules – Acquisition (Cont.)

<table>
<tr><th>Name</th><th colspan="3">Characteristics</th></tr>
<tr><td>✓ Dark level</td><td>80C01:</td><td></td><td></td></tr>
<tr><td></td><td></td><td>OC-12/STM-4,
OC-48/STM-16,
OC192/STM-64,
12.5 GHz settings:</td><td>± [10 μW +2%|vertical offset|]</td></tr>
<tr><td></td><td></td><td>20 GHz settings:</td><td>± [10 μW +4%|vertical offset|]</td></tr>
<tr><td></td><td>80C02:</td><td></td><td></td></tr>
<tr><td></td><td></td><td>OC192/STM-64,
12.5 GHz settings:</td><td>± [10 μW +2%|vertical offset|]</td></tr>
<tr><td></td><td></td><td>20 GHz,
30 GHz settings:</td><td>± [10 μW +4%|vertical offset|]</td></tr>
<tr><td></td><td>80C03:</td><td></td><td></td></tr>
<tr><td></td><td></td><td>All settings:</td><td>± [500 nW +2%|vertical offset|]</td></tr>
<tr><td></td><td>80C04:</td><td></td><td></td></tr>
<tr><td></td><td></td><td>OC192/STM-64,
10.66 Gb/s settings:</td><td>± [10 μW +2%|vertical offset|]</td></tr>
<tr><td></td><td></td><td>20 GHz,
30 GHz settings:</td><td>± [10 μW +4%|vertical offset|]</td></tr>
<tr><td></td><td>80C05:</td><td></td><td></td></tr>
<tr><td></td><td></td><td>OC192</td><td>± [10 μW +2%|vertical offset|]</td></tr>
<tr><td></td><td></td><td>20 GHz settings;</td><td>± [30 μW +4%|vertical offset|]</td></tr>
<tr><td></td><td></td><td>30 GHz settings;</td><td>± [30 μW +4%|vertical offset|]</td></tr>
<tr><td></td><td></td><td>40 GHz settings;</td><td>± [30 μW +4%|vertical offset|]</td></tr>
<tr><td></td><td>80C06:</td><td></td><td></td></tr>
<tr><td></td><td></td><td>50 GHz settings;</td><td>± [25 μW +4%|vertical offset|]</td></tr>
<tr><td></td><td colspan="3">To achieve these levels, perform a dark level compensation, keep the trigger rate and vertical offset the same as during the compensation, and if the ambient temperature changes more than 1° C, perform another dark level compensation.</td></tr>
<tr><td>Main-instrument display vertical scale factors</td><td>Module</td><td>Maximum</td><td>Minimum</td></tr>
<tr><td></td><td>80C01:</td><td>1 mW per division</td><td>10 μW per division</td></tr>
<tr><td></td><td>80C02:</td><td>1 mW per division</td><td>10 μW per division</td></tr>
<tr><td></td><td>80C03:</td><td>100 μW per division</td><td>1 μW per division</td></tr>
<tr><td></td><td>80C04:</td><td>1 mW per division</td><td>10 μW per division</td></tr>
<tr><td></td><td>80C05:</td><td>3 mW per division</td><td>30 μW per division</td></tr>
<tr><td></td><td>80C06:</td><td>6 mW per division</td><td>60 μW per division</td></tr>
<tr><td></td><td colspan="3">Full scale vertical on the display of the main instrument is 10 divisions. Maximum full scale and minimum full scale are therefore 10 times the values listed above. Vertical scale is adjustable in a 1-2-5 sequence. Between those settings, the scale can be adjusted in smaller increments.</td></tr>
</table>

Table 1–18: Optical modules – Acquisition (Cont.)

Name	Characteristics
Vertical offset range	80C01: ± 8 mW 80C02: ± 6 mW 80C03: ± 1 mW 80C04: ± 6 mW 80C05: ± 15 mW 80C06: ± 40 mW
DC vertical accuracy[4], typical	80C01 12.5 GHz, OC-192/STM-64, OC-48/STM-16, OC-12/STM-4 settings: ± [25 µW +2% of [|vertical value – vertical offset|] 20 GHz setting: ± [25 µW +4% of [|vertical value – vertical offset|] 80C02 12.5 GHz: ± [25 µW +2% of [|vertical value – vertical offset|] OC-192/STM-64: ± [25 µW +2% of [|vertical value – vertical offset|] 20 GHz setting: ± [25 µW +4% of [|vertical value – vertical offset|] 30 GHz setting: ± [25 µW +6% of [|vertical value – vertical offset|] 80C03, all settings: ± [25 µW +2% of [|vertical value – vertical offset|] 80C04 10.66 Gb/s: ± [25 µW +2% of [|vertical value – vertical offset|] OC-192/STM-64: ± [25 µW +2% of [|vertical value – vertical offset|] 20 GHz setting: ± [25 µW +4% of [|vertical value – vertical offset|] 30 GHz setting: ± [25 µW +6% of [|vertical value – vertical offset|] 80C05 OC192: ± [25 µW +2% of [|vertical value – vertical offset|] 20 GHz setting: ± [25 µW +4% of [|vertical value – vertical offset|] 30 GHz setting: ± [25 µW +6% of [|vertical value – vertical offset|] 40 GHz setting: ± [25 µW +8% of [|vertical value – vertical offset|] 80C06 50 GHz setting: ± [25 µW +6% of [|vertical value – vertical offset|] Valid for calibrated wavelengths and for user calibration.

Table 1–18: Optical modules – Acquisition (Cont.)

Name	Characteristics	
DC vertical difference accuracy[4], typical The accuracy of the difference between two cursors in the vertical scale of the same channel.	10.66 Gb/s, 12.5 GHz, OC-192/STM-64, OC-48/STM-16, OC-12/STM-4 settings: ± 2% of difference reading 20 GHz setting: ± 4% of difference reading 30 GHz setting: ± 6% of difference reading 80C03, all settings: ± 2% of difference reading 80C05, 40 GHz setting: ± 8% of difference reading 80C06, 50 GHz setting: ± 2% of difference reading Valid for calibrated wavelengths and for user calibration.	
Offset capabilities	Open loop. User assigned, fixed offset value applied to channel.	
✓ Minimum optical bandwidth[5]	80C01 module, 20 GHz setting	> 20 GHz
	12.5 GHz setting	> 12.5 GHz
	80C02 module, 30 GHz setting	> 30 GHz, typical
	80C02-CR, 30 GHz setting	> 29 GHz, typical
	80C02 and 80C02-CR, 30 GHz setting	> 28 GHz
	80C02, 20 GHz setting	> 20 GHz
	80C02 CR, 12.5 GHz setting	> 12.5 GHz
	80C03 module, 2.5 GHz setting	> 2.3 GHz, typical
	80C04 module, 30 GHz setting	> 30 GHz, typical
	80C04-CR1, 80C04-CR2, 30 GHz setting	> 29 GHz, typical
	80C04 & 80C04-CR1, 80C04-CR2, 30 GHz setting	> 28 GHz
	80C04 20 GHz setting	> 20 GHz
	80C05 module, 20 GHz setting	> 20 GHz
	80C05 30 GHz setting	> 30 GHz
	80C05 40 GHz setting	> 40 GHz
	80C06 module, 50 GHz setting	> 50 GHz, typical

Table 1–18: Optical modules – Acquisition (Cont.)

Name	Characteristics	
Rise time, typical For peak optical signal input which creates < 2 mW_{pp} modulation depth, except <200 µWpp for 80C03.	*80C01 module*	
	OC-12/STM-4 setting:	750 ps ± 50 ps
	OC-48/STM-16 setting:	187 ps ± 15 ps
	OC-192/STM-64 setting:	47 ps ± 10 ps
	12.5 GHz setting:	< 40 ps
	20 GHz setting:	< 25 ps
	80C02 module	
	30 GHz setting:	< 16 ps
	20 GHz setting:	< 25 ps
	12.5 GHz setting:	< 40 ps
	OC-192/STM-64 setting:	47 ps ± 10 ps
	80C03 module	
	FC1063 setting:	440 ps ± 35 ps
	GBE setting:	373 ps ± 30 ps
	OC-48/STM-16 setting:	187 ps ± 15 ps
	80C04 module	
	30 GHz setting:	< 16 ps
	20 GHz setting:	< 25 ps
	10.66 Gb/s setting:	< 44 ps ± 10 ps
	OC-192/STM-64 setting:	47 ps ± 10 ps
	80C05 module	
	20 GHz setting:	< 12 ps
	30 GHz setting:	< 16 ps
	20 GHz setting:	< 25 ps
	OC-192 setting:	47 ps ± 10 ps
✓ Rise time, integrated, typical. For optical signal input displaying 15 mW peak impulse amplitude.	*80C06 module*	
	50 GHz setting:	< 9.6 ps

Table 1–18: Optical modules – Acquisition (Cont.)

Name	Characteristics			
Time domain vertical response aberrations. For peak optical signal input < 5 mW$_{pp}$, except: 80C03, < 200 µWpp	80C01	OC-12/STM-4 setting:	$< 5\%$	all typical
		OC-48/STM-16 setting:	$< 5\%$	
		OC-192/STM-64 setting:	$< 10\%$	
		12.5 GHz setting:	$< 10\%$	
		20 GHz setting:	$< 15\%$	
	80C02	OC-192/STM-64 setting:	$< 10\%$	all typical
		12.5 GHz setting:	$< 15\%$	
		20 GHz setting:	$< 20\%$	
		30 GHz setting:	$< 30\%$	
	80C03	All settings:	$< 5\%$ p-to-p typical	
	80C04	OC-192/STM-64 setting:	$< 10\%$	all typical
		10.66 Gb/s setting:	$< 10\%$	
		20 GHz setting:	$< 20\%$	
		30 GHz setting:	$< 30\%$	
	80C05	OC-192 setting:	$< 5\%$, 2.5% typical	
		20 GHz setting:	$< 10\%$, 5% typical	
		30 GHz setting:	$< 10\%$, 5% typical	
		40 GHz setting:	$< 15\%$, 10% typical	
	80C06	50 GHz setting:	$< 10\%$, 5% typical	

Table 1–18: Optical modules – Acquisition (Cont.)

Name	Characteristics		
✓ Vertical equivalent optical noise[7]	*80C01 module*	*Maximum RMS*[8]	*Typical RMS*[8]
	OC-12/STM-4 setting:	$< 12\ \mu W_{rms}$	$< 8\ \mu W_{rms}$
	OC-48/STM-16 setting:	$< 12\ \mu W_{rms}$	$< 8\ \mu W_{rms}$
	OC-192/STM-64 setting:	$< 12\ \mu W_{rms}$	$< 8\ \mu W_{rms}$
	12.5 GHz setting:	$< 12\ \mu W_{rms}$	$< 8\ \mu W_{rms}$
	20 GHz setting:	$< 25\ \mu W_{rms}$	$< 15\ \mu W_{rms}$
	80C01–CR module	*Maximum RMS*[8]	*Typical RMS*[8]
	OC-12/STM-4 setting:	$< 15\ \mu W_{rms}$	$< 10\ \mu W_{rms}$
	OC-48/STM-16 setting:	$< 15\ \mu W_{rms}$	$< 10\ \mu W_{rms}$
	OC-192/STM-64 setting:	$< 15\ \mu W_{rms}$	$< 10\ \mu W_{rms}$
	12.5 GHz setting:	$< 15\ \mu W_{rms}$	$< 10\ \mu W_{rms}$
	20 GHz setting:	$< 25\ \mu W_{rms}$	$< 15\ \mu W_{rms}$
	80C02 module		
	OC-192/STM-64 setting:	$< 10\ \mu W_{rms}$	$< 6\ \mu W_{rms}$
	12.5 GHz setting:	$< 10\ \mu W_{rms}$	$< 6\ \mu W_{rms}$
	20 GHz setting:	$< 15\ \mu W_{rms}$	$< 10\ \mu W_{rms}$
	30 GHz setting:	$< 30\ \mu W_{rms}$[6]	$< 20\ \mu W_{rms}$
	80C02–CR module		
	OC-192/STM-64 setting:	$< 12\ \mu W_{rms}$	$< 7\ \mu W_{rms}$
	12.5 GHz setting:	$< 12\ \mu W_{rms}$	$< 7\ \mu W_{rms}$
	20 GHz setting:	$< 20\ \mu W_{rms}$	$< 15\ \mu W_{rms}$
	30 GHz setting:	$< 40\ \mu W_{rms}$[6]	$< 30\ \mu W_{rms}$
	80C03 & 80C03–CR modules		
	FC1063 setting:	$< 1\ \mu W_{rms}$	$< 0.75\ \mu W_{rms}$
	GBE setting:	$< 1\ \mu W_{rms}$	$< 0.75\ \mu W_{rms}$
	OC-48/STM-16 setting:	$< 1.5\ \mu W_{rms}$	$< 1\ \mu W_{rms}$
	80C04 module		
	OC-192/STM-64 setting:	$< 10\ \mu W_{rms}$	$< 6\ \mu W_{rms}$
	FEC 10.66 Gb/s setting:	$< 10\ \mu W_{rms}$	$< 6\ \mu W_{rms}$
	20 GHz setting:	$< 15\ \mu W_{rms}$	$< 10\ \mu W_{rms}$
	30 GHz setting:	$< 30\ \mu W_{rms}$[6]	$< 20\ \mu W_{rms}$
	80C04–CR1 & 80C04–CR2 module		
	OC-192/STM-64 setting:	$< 12\ \mu W_{rms}$	$< 7\ \mu W_{rms}$
	FEC 10.66 Gb/s setting:	$< 12\ \mu W_{rms}$	$< 7\ \mu W_{rms}$
	20 GHz setting:	$< 20\ \mu W_{rms}$	$< 15\ \mu W_{rms}$

Table 1–18: Optical modules – Acquisition (Cont.)

Name	Characteristics			
✓ Vertical equivalent optical noise[7]	30 GHz setting:		$< 40\ \mu W_{rms}$	$< 30\ \mu W_{rms}$
✓ Vertical equivalent optical noise[7]	*80C05 module*		*Maximum RMS*[8]	*Typical RMS*[8]
	OC-192 setting:		$< 15\ \mu W_{rms}$	$< 10\ \mu W_{rms}$
	20 GHz setting:		$< 25\ \mu W_{rms}$	$< 15\ \mu W_{rms}$
	30 GHz setting:		$< 35\ \mu W_{rms}$	$< 25\ \mu W_{rms}$
	40 GHz setting:		$< 70\ \mu W_{rms}$[6]	$< 50\ \mu W_{rms}$
	80C06 module		*Maximum RMS*[8]	*Typical RMS*[8]
	50 GHz setting:		$< 192\ \mu W_{rms}$	$< 150\ \mu W_{rms}$
✓ OC-12/STM-4 622 Mb/s Reference Receiver setting frequency response[6]	In the 622.08 Mb/s NRZ setting, the scalar frequency response is verified to fall within fourth-order Bessel-Thompson reference receiver boundary limits. The OC-12/STM-4 nominal scalar frequency response matches the ITU 622.08 Reference Receiver Nominal curve with the following tolerance:			
	(MHz)		(dB)	
	Frequency	Lower	Nominal	Upper
	0.000	–0.50	0.00	0.50
	93.3	–0.61	–0.11	0.39
	186.6	–0.95	–0.45	0.05
	279.9	–1.52	–1.02	–0.52
	373.2	–2.36	–1.86	–1.36
	466.7	–3.50	–3.00	–2.50
	559.9	–5.67	–4.51	–3.35
	622.1	–7.25	–5.71	–4.17
	653.2	–8.08	–6.37	–4.66
	746.5	–10.74	–8.54	–6.35
	839.8	–13.55	–10.93	–8.31
	933.1	–16.41	–13.41	–10.41
	1244.2	–26.11	–21.45	–16.78

Table 1–18: Optical modules – Acquisition (Cont.)

<table>
<tr><th>Name</th><th>Characteristics</th></tr>
<tr><td>✓ OC48/STM-16 2.488 Gb/s Reference Receiver setting frequency response[6]</td><td>Scalar frequency response falls within Industry Standard, Bessel-Thompson reference receiver boundary limits.
SONET OC-48/STM-16 frequency response boundary limits are described in ITU-T G.957 Tables I.1 and I.2. For convenience, the scalar frequency response of the output amplitude (for sinusoidal swept optical input) has been interpreted from the Bessel-Thompson transfer function and listed below:
<table>
<tr><th>(MHz)</th><th></th><th>(dB)</th><th></th></tr>
<tr><th>Frequency</th><th>Lower</th><th>Nominal</th><th>Upper</th></tr>
<tr><td>0.000</td><td>–0.50</td><td>0.00</td><td>0.50</td></tr>
<tr><td>373.3</td><td>–0.61</td><td>–0.11</td><td>0.39</td></tr>
<tr><td>746.5</td><td>–0.95</td><td>–0.45</td><td>0.05</td></tr>
<tr><td>1119.7</td><td>–1.52</td><td>–1.02</td><td>–0.52</td></tr>
<tr><td>1493.1</td><td>–2.36</td><td>–1.86</td><td>–1.36</td></tr>
<tr><td>1866.3</td><td>–3.50</td><td>–3.00</td><td>–2.50</td></tr>
<tr><td>2239.5</td><td>–5.67</td><td>–4.51</td><td>–3.35</td></tr>
<tr><td>2488.3</td><td>–7.25</td><td>–5.71</td><td>–4.17</td></tr>
<tr><td>2612.8</td><td>–8.08</td><td>–6.37</td><td>–4.66</td></tr>
<tr><td>2986.0</td><td>–10.74</td><td>–8.54</td><td>–6.35</td></tr>
<tr><td>3359.3</td><td>–13.55</td><td>–10.93</td><td>–8.31</td></tr>
<tr><td>3732.6</td><td>–16.41</td><td>–13.41</td><td>–10.41</td></tr>
<tr><td>4976.7</td><td>–26.11</td><td>–21.45</td><td>–16.78</td></tr>
</table>
</td></tr>
</table>

Table 1–18: Optical modules – Acquisition (Cont.)

<table>
<tr><th>Name</th><th>Characteristics</th></tr>
<tr><td>✓ OC192/STM-64 9.953 Gb/s Reference Receiver setting frequency response[6]</td><td>Scalar frequency response falls within Industry Standard, Bessel-Thompson reference receiver boundary limits.
Tektronix manufactures and tests the 80C01, 80C02, 80C04, and 80C05 optical modules using 10 GByte reference receivers to have a new superior and tighter tolerance OC192/STM-64 Reference Receiver response. ITU experts recently agreed on the minimum performance specifications for 10 Gbit/s (STM-64/OC-192) optical reference receivers (San Antonio ITU Study Group 15 February 2000). These specifications are used to establish system interoperability and test conformance of optical interfaces to draft ITU-T Recommendation G.691 which is scheduled to be completed in April 200 (see ITU table A.1/G.691 from the WD 16-48 document from Study Group 15 dated February 2000). For convenience, the scalar frequency response of the output amplitude (for sinusoidal swept optical input) has been interpreted from the published Bessel-Thompson transfer function and listed below:
<table>
<tr><th>(MHz)</th><th></th><th>(dB)</th><th></th></tr>
<tr><th>Frequency</th><th>Lower</th><th>Nominal</th><th>Upper</th></tr>
<tr><td>0.000</td><td>–0.85</td><td>0.00</td><td>0.85</td></tr>
<tr><td>1493.2</td><td>–0.96</td><td>–0.11</td><td>+0.74</td></tr>
<tr><td>2986.0</td><td>–1.30</td><td>–0.45</td><td>+0.40</td></tr>
<tr><td>4478.8</td><td>–1.87</td><td>–1.02</td><td>+0.17</td></tr>
<tr><td>5972.4</td><td>–2.71</td><td>–1.86</td><td>–1.01</td></tr>
<tr><td>7465.0</td><td>–3.86</td><td>–3.00</td><td>–2.16</td></tr>
<tr><td>8958.0</td><td>–6.19</td><td>–4.51</td><td>–2.83</td></tr>
<tr><td>9953.28</td><td>–7.87</td><td>–5.71</td><td>–3.55</td></tr>
<tr><td>10451.2</td><td>–8.75</td><td>–6.37</td><td>–3.99</td></tr>
<tr><td>11944.0</td><td>–11.53</td><td>–8.54</td><td>–5.56</td></tr>
<tr><td>13437.2</td><td>–14.45</td><td>–10.93</td><td>–7.41</td></tr>
<tr><td>14930.4</td><td>–17.41</td><td>–13.41</td><td>–9.41</td></tr>
</table>
</td></tr>
</table>

Table 1–18: Optical modules – Acquisition (Cont.)

<table>
<tr><th>Name</th><th>Characteristics</th></tr>
<tr><td>✓ FEC 10.66 GByte Reference Receiver setting frequency response[6]</td><td>
<p>This Reference Receiver is essentially identical to that for the OC192 9.95328GByte/s rate with the following changes: the frequency scale for the tolerance curves and nominal –3dB breakpoints are scaled linearly by the ratio of (10.664 GByte/s)/(9.95328 GByte/s); for example: the 9.953GByte/s reference receiver has a nominal –3dB response at 0.75*9.95328GHz = 7.465GHz. This 10.66GByte reference receiver has a nominal –3dB response at (10.664/9.95328)*7.465GHz = 7.998GHz.</p>
<p>For convenience, the scalar frequency response of the output amplitude (for sinusoidal swept optical input) has been interpreted from the published Bessel-Thompson transfer function, the frequencies scaled as described above, and then listed below:</p>
<table>
<tr><th>(MHz)</th><th></th><th>(dB)</th><th></th></tr>
<tr><th>Frequency</th><th>Lower</th><th>Nominal</th><th>Upper</th></tr>
<tr><td>0</td><td>–0.85</td><td>0</td><td>0.85</td></tr>
<tr><td>1599.8</td><td>–0.96</td><td>–0.11</td><td>0.74</td></tr>
<tr><td>3199.2</td><td>–1.30</td><td>–0.45</td><td>0.40</td></tr>
<tr><td>4798.6</td><td>–1.87</td><td>–1.02</td><td>–0.17</td></tr>
<tr><td>6398.9</td><td>–2.71</td><td>–1.86</td><td>–1.01</td></tr>
<tr><td>7998.0</td><td>–3.86</td><td>–3.00</td><td>–2.16</td></tr>
<tr><td>9597.7</td><td>–6.19</td><td>–4.51</td><td>–2.83</td></tr>
<tr><td>10664.0</td><td>–7.87</td><td>–5.71</td><td>–3.55</td></tr>
<tr><td>11197.5</td><td>–8.75</td><td>–6.37</td><td>–3.99</td></tr>
<tr><td>12796.9</td><td>–11.53</td><td>–8.54</td><td>–5.56</td></tr>
<tr><td>14396.7</td><td>–14.45</td><td>–10.93</td><td>–7.41</td></tr>
<tr><td>15996.5</td><td>–17.41</td><td>–13.41</td><td>–9.41</td></tr>
</table>
</td></tr>
</table>

Table 1–18: Optical modules – Acquisition (Cont.)

<table>
<tr><th>Name</th><th>Characteristics</th></tr>
<tr><td>✓ 2.50 Gb/s (2X GBE) Reference Receiver setting frequency response[6]</td><td>Scalar frequency response falls within Industry Standard, Bessel-Thompson reference receiver boundary limits.
2.50 Gb/s frequency response boundary limits are derived by simply scaling all frequency values by 2X as described in IEEE 802.3z section 38.6.5 (this section refers to ITU G.957 for tolerances). For convenience, the scalar frequency response of the output amplitude (for sinusoidal swept optical input) has been interpreted from the Bessel-Thompson transfer function and listed below:
<table>
<tr><td>(MHz)</td><td></td><td>(dB)</td><td></td></tr>
<tr><td>Frequency</td><td>Lower</td><td>Nominal</td><td>upper</td></tr>
<tr><td>0.000</td><td>–0.50</td><td>0.00</td><td>0.50</td></tr>
<tr><td>375</td><td>–0.61</td><td>–0.11</td><td>0.39</td></tr>
<tr><td>750</td><td>–0.95</td><td>–0.45</td><td>0.05</td></tr>
<tr><td>1125</td><td>–1.52</td><td>–1.02</td><td>–0.52</td></tr>
<tr><td>1500</td><td>–2.36</td><td>–1.86</td><td>–1.36</td></tr>
<tr><td>1875</td><td>–3.50</td><td>–3.00</td><td>–2.50</td></tr>
<tr><td>2250</td><td>–5.67</td><td>–4.51</td><td>–3.35</td></tr>
<tr><td>2500</td><td>–7.25</td><td>–5.71</td><td>–4.17</td></tr>
<tr><td>2625</td><td>–8.08</td><td>–6.37</td><td>–4.66</td></tr>
<tr><td>3000</td><td>–10.74</td><td>–8.54</td><td>–6.35</td></tr>
<tr><td>3375</td><td>–13.55</td><td>–10.93</td><td>–8.31</td></tr>
<tr><td>3750</td><td>–16.41</td><td>–13.41</td><td>–10.41</td></tr>
<tr><td>5000</td><td>–26.11</td><td>–21.45</td><td>–16.78</td></tr>
</table>
</td></tr>
<tr><td>✓ GBE (1.25 Gb/s) Reference Receiver setting frequency response[6]</td><td>Scalar frequency response falls within Industry Standard, Bessel-Thompson reference receiver boundary limits.
1.250 Gb/s frequency response boundary limits are described in IEEE 802.3z section 38.6.5 (this section refers to ITU G.957 for tolerances). For convenience, the scalar frequency response of the output amplitude (for sinusoidal swept optical input) has been interpreted from the Bessel-Thompson transfer function and listed below:
<table>
<tr><td>(MHz)</td><td></td><td>(dB)</td><td></td></tr>
<tr><td>Frequency</td><td>Lower</td><td>Nominal</td><td>Upper</td></tr>
<tr><td>0.000</td><td>–0.50</td><td>0.00</td><td>0.50</td></tr>
<tr><td>187.5</td><td>–0.61</td><td>–0.11</td><td>0.39</td></tr>
<tr><td>375</td><td>–0.95</td><td>–0.45</td><td>0.05</td></tr>
<tr><td>562.5</td><td>–1.52</td><td>–1.02</td><td>–0.52</td></tr>
<tr><td>750</td><td>–2.36</td><td>–1.86</td><td>–1.36</td></tr>
<tr><td>937.5</td><td>–3.50</td><td>–3.00</td><td>–2.50</td></tr>
<tr><td>1125</td><td>–5.67</td><td>–4.51</td><td>–3.35</td></tr>
<tr><td>1250</td><td>–7.25</td><td>–5.71</td><td>–4.17</td></tr>
<tr><td>1312.5</td><td>–8.08</td><td>–6.37</td><td>–4.66</td></tr>
<tr><td>1500</td><td>–10.74</td><td>–8.54</td><td>–6.35</td></tr>
<tr><td>1687.5</td><td>–13.55</td><td>–10.93</td><td>–8.31</td></tr>
<tr><td>1875</td><td>–16.41</td><td>–13.41</td><td>–10.41</td></tr>
<tr><td>2500</td><td>–26.11</td><td>–21.45</td><td>–16.78</td></tr>
</table>
</td></tr>
</table>

Table 1–18: Optical modules – Acquisition (Cont.)

<table>
<tr><th>Name</th><th colspan="4">Characteristics</th></tr>
<tr><td rowspan="17">✓ FC1063
(1.0625 Gb/s)
Reference Receiver setting frequency response[6]</td><td colspan="4">Scalar frequency response falls within Industry Standard, Bessel-Thompson reference receiver boundary limits.
Fiber Channel frequency response boundary limits are described in ANSI FC-PC. For convenience, the scalar frequency response of the output amplitude (for sinusoidal swept optical input) has been interpreted from the Bessel-Thompson transfer function and listed below:</td></tr>
<tr><td>(MHz)</td><td></td><td>(dB)</td><td></td></tr>
<tr><td>Frequency</td><td>Lower</td><td>Nominal</td><td>Upper</td></tr>
<tr><td>0.000</td><td>–0.50</td><td>0.00</td><td>0.50</td></tr>
<tr><td>159.5</td><td>–0.61</td><td>–0.11</td><td>0.39</td></tr>
<tr><td>318.9</td><td>–0.95</td><td>–0.45</td><td>0.05</td></tr>
<tr><td>478.4</td><td>–1.52</td><td>–1.02</td><td>–0.52</td></tr>
<tr><td>637.9</td><td>–2.36</td><td>–1.86</td><td>–1.36</td></tr>
<tr><td>797.4</td><td>–3.50</td><td>–3.00</td><td>–2.50</td></tr>
<tr><td>956.8</td><td>–5.67</td><td>–4.51</td><td>–3.35</td></tr>
<tr><td>1063</td><td>–7.25</td><td>–5.71</td><td>–4.17</td></tr>
<tr><td>1116</td><td>–8.08</td><td>–6.37</td><td>–4.66</td></tr>
<tr><td>1275</td><td>–10.74</td><td>–8.54</td><td>–6.35</td></tr>
<tr><td>1435</td><td>–13.55</td><td>–10.93</td><td>–8.31</td></tr>
<tr><td>1595</td><td>–16.41</td><td>–13.41</td><td>–10.41</td></tr>
<tr><td>2126</td><td>–26.11</td><td>–21.45</td><td>–16.78</td></tr>
</table>

[1] **Single-mode fiber (Corning SMF-28 specs).**

[2] **The optical input powers below nondestructive levels may exceed saturation and compression limits of the module.**

[3] **The optical wavelengths that the product accepts optical inputs and still provides a reasonable (25% of peak optimum) wavelength conversion gain.**

[4] **Vertical accuracy specifications are referenced to the internal optical power meter reading for a given optical input, and are limited to a temperature range within ±5° C of previous channel compensation and an ambient temperature within 20° C to 35° C.**

[5] **Optical bandwidth is the frequency at which the responsivity of the optical to electrical conversion process is reduced by 50% (6 dB).**

[6] **This specification is limited to the instrument operating in an ambient temperature between +20° C and +30° C. Nominal freq response is specified for optical input signals of modulation magnitude such that 2 mW_{pp} (200 uW_{pp} for 80C03) or less signal is applied at the sampler input. for 80C05 at 40 GHz.**

[7] **The optical channel noise with no optical noise input (Dark Level).**

[8] **Clock recovery versions reduce the power reaching the vertical channel (splitter to clock recovery produces loss). Therefore, the non-clock recovery modules more closely exhibit the typical noise performance.**

Table 1–19: Optical modules – Clock recovery option (CR)

Name	Characteristics		
Effective wavelength range	*Module*	*Range*	
	80C01	1270 nm to 1600 nm	
	80C02	1270 nm to 1600 nm	
	80C03	700 nm to 1650 nm	
	80C04	1270 nm to 1600 nm	
Operating data rates	80C01:	622.08 MHz ±1000 ppm (OC-12/STM-4) 2.48832 GHz ±1000 ppm (OC-48/STM-16)	
	80C02:	9.95328 Gb/s ± 1000 ppm (OC-192/STM-64)	
	80C03:	1.0625 Gb/s ± 1000 ppm (FC1063) 1.2500 Gb/s ± 1000 ppm (GBE) 2.48832 Gb/s ± 1000 ppm (OC-48/STM-16) 2.5000 Gb/s ± 1000 ppm (2X GBE)	
	80C04-CR1:	9.95328 Gb/s ± 1000 ppm (OC-192/STM-64)	
	80C04-CR2:	9.95328 Gb/s ± 1000 ppm (OC-192/STM-64), 10.664 Gb/s ± 1000 ppm (FEC)	
	The incoming data stream must be of non-return-to-zero format (NRZ) and, for OC-192/STM-64, must have a data sequence content which provides both isolated 1s and multi-consecutive mark sequences (that is 2,3,4 and so forth logical 1s in a consecutive row). NOTE: a fixed pattern of 10101010. . . does not meet that requirement; the 80C02-CR clock recovery function may not properly lock to such a pattern. The 80C02-CR will, however, typically lock to a 11001100. . . pattern (this is equivalent to a 2.48832 GHz optical square wave).		
✓Optical sensitivity range, clock recover (optical input power)[1]	Module	Maximum	Minimum
	80C01	+ 5.0 dBm (3.16 mW), typical	–10.0 dBm (100 μW), typical
	80C02	+7 dBm (5.0 mW), typical	–10.0 dBm (100 μW), typical –7.5 dBm, warranted
	80C03	–4.0 dBm (400 μW), warranted	–16.0 dBm (25 μW), warranted
	80C04	+7 dBm (5.0 mW), typical	–10.0 dBm (100 μW), typical –7.5 dBm, warranted
Clock and data electrical output amplitudes[2]	80C01:		> 300 mV$_{pp}$, typical
	80C02	Serial DATA output:	> 700 mV$_{pp}$, typical
		Serial CLOCK output:	1.5 V$_{pp}$, typical
		1/16th CLOCK output:	600 mV$_{pp}$, typical
	80C03:		> 350 mV$_{pp}$, typical
	80C04	Serial DATA output:	> 700 mV$_{pp}$, typical
		Serial CLOCK output:	1.5 V$_{pp}$, typical
		1/16th CLOCK output:	600 mV$_{pp}$, typical

Table 1–19: Optical modules – Clock recovery option (CR) (Cont.)

Name	Characteristics
Clock and data rise time and fall times[2]	80C01: < 200 ps 80C02 Serial DATA output: < 30 ps Serial CLOCK output: < 30 ps 1/16th CLOCK output: < 300 ps 80C03: < 250 ps 80C04 Serial DATA output: < 30 ps Serial CLOCK output: < 30 ps 1/16th CLOCK output: < 300 ps
✓Recovered clock timing jitter[3, 4]	80C01: < 8.0 ps RMS maximum < 4.0 ps RMS typical
	80C02: < 2.0 ps RMS maximum < 1.0 ps RMS typical[5]
	80C03: < 8.0 ps RMS maximum < 4.0 ps RMS typical
	80C04: < 2.0 ps RMS maximum < 1.0 ps RMS typical[5]
Optical power meter range	80C01, 80C02, 80C03, 80C04: +4 dBm to –30 dBm, typical
	80C05: +13 dBm to –21 dBm, typical
	80C06: +13 dBm to –21 dBm, typical
Optical power meter accuracy, typical	5% of reading + connector uncertainty, at the calibrated wavelengths. See Table 1–18, page 1–18.

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[1] These powers are the average optical input coupled into the external Optical Sampling Module optical input connector. The range is defined for recovered clock and data with a resulting BER of $1x10^{-10}$ or less, a 50% duty cycle of the incoming data (also referred to as 50% mark density), a PRBS pattern of 2^{23-1}, and an extinction ratio of $\geq$ 8.2 dB (at eye center).

[2] Output is 50 Ω AC coupled: specification is for output amplitude at the bulkhead outputs and does not include RF loss of attached cables.

[3] The clock jitter is applicable to both the external electrical output and the system jitter experienced when the recovered clock is the source of the waveform trigger for the system.

Table 1–19: Optical modules – Clock recovery option (CR) (Cont.)

Name	Characteristics

[4] Jitter performance of the system while using the optical module clock recovery as the trigger source is warranted only while no active signal is applied to the main instrument's External Trigger (or Prescaler) input.

[5] Internal use for trigger results in a total system jitter of

$$\geq \sqrt{sum\ of\ squares}$$

therefore the displayed waveform may normally exhibit slightly more than 1 ps RMS jitter.

Table 1–20: Optical modules – Mechanical

Name	Characteristics
Construction material	Chassis parts constructed of aluminum alloy; front panel constructed of plastic laminate; circuit boards constructed of glass-laminate. Cabinet is aluminum.
Weight	80C01: 1.13 kg (2.5 lbs) 80C01-CR: 1.34 kg (2.95 lbs) 80C02: 0.95 kg (2.1 lbs) 80C02-CR: 1.22 kg (2.70 lbs) 80C03: 1.13 kg (2.5 lbs) 80C03-CR: 1.34 kg (2.95 lbs) 80C04: 0.95 kg (2.1 lbs) 80C04-CR1: 1.22 kg (2.70 lbs) 80C04-CR2: 1.22 kg (2.70 lbs) 80C05: 1.22 kg (2.70 lbs) 80C06: 1.22 kg (2.70 lbs)
Overall dimensions	Height: 25.6 mm (1.0 in) Width: 166.7 mm (6.5 in) Depth: 307.7 mm (12.0 in)

Table 1–21: Optical modules – Environmental

Name	Characteristics
Temperature	Installed and operating: 10° C to +40° C Reference receivers frequency response tolerances, 30 GHz mode, and Optical power meter accuracy: +20° C to +30° C Installed and non-operating: –22° C to +60° C
Humidity	Installed and operating: 20% to 80% relative humidity with a maximum wet bulb temperature of 29° C at or below +40° C, (upper limit derates to 45% relative humidity at +40° C) non-condensing. Reference receivers frequency response tolerances: +20° C to +30° C Optical power meter accuracy: +20° C (80% RH) to +30° C (80% RH) Installed and non-operating: 5% to 90% relative humidity with a maximum wet bulb temperature of 29° C at or below +60° C, (upper limit derates to 20% relative humidity at +60° C) non-condensing.
Altitude: installed	Operating: 3,048 m (10,000 feet). Non-operating: 12,190 m (40,000 feet)

80A01 Trigger Prescale Preamplifier Module

This section contains specifications for the 80A01 Trigger Prescale Preamplifier Module. All specifications are guaranteed unless noted as “typical.” Typical specifications are provided for your convenience but are not guaranteed.

To meet specifications, three conditions must first be met:

- The instrument must have been calibrated/adjusted at an ambient temperature between +20° C and +30° C.
- The oscilloscope must have been operating continuously for 20 minutes within the operating temperature range specified.
- The instrument must be in an environment with temperature, altitude, humidity, and vibration within the operating limits described in these specifications

The 80A01 Trigger Prescale Preamplifier module is a single-channel 8-14 GHz AC coupled limiting preamplifier. It increases the trigger sensitivity of the 8000 Series instruments to $\leq 200\ \text{mV}_{\text{pk-pk}}$ up to 12.5 GHz (typical).

Table 1–22: Module characteristics

Specifications	Characteristics
Mainframe interface	Tekprobe-Sampling, Level 3. Hot switching is not permitted.
Input and output connectors	Female SMA
Input power[1]	–10 dBm to +5 dBm, AC coupled
Output power	+10 dBm maximum saturation
Frequency Range	8 GHz to 14 GHz (typical)
80A01 Enhancement toTrigger Sensitivity	$\leq$ 200 mV System Prescale Trigger Sensitivity[2]
Output voltage[3]	8-12.5 GHz, input voltage 200 $\text{mV}_{\text{pk-pk}}$ to 1 $\text{V}_{\text{pk-pk}}$: $\geq$ 1 $\text{V}_{\text{pk-pk}}$ 12.5-14 GHz, input voltage 200 $\text{mV}_{\text{pk-pk}}$ to 1 $\text{V}_{\text{pk-pk}}$: $\geq$ 1 $\text{V}_{\text{pk-pk}}$ (typical)
Input/output impedance	50 Ω AC coupled (typical)
Input/output VSWR	2.0:1 maximum from 8-14 GHz (typical)
Power requirements	2.35 W

Table 1–22: (Cont.)Module characteristics

Specifications	Characteristics
Maximum input voltage swing	1.1 V_{pk-pk}
Noise figure	5 dB maximum

[1] See Input Voltage Swing specification for more information.

[2] The minimum level of signal applied to the input of an 80A01 that has its output connected to the Trigger Prescale input of the main instrument. A coaxial cable Tektronix part number 015-0560-00 is recommended for the connection from the 80A01 output to the Trigger Prescale input of the instrument.

[3] Amplifier functions to 14 GHz but prescale trigger is nominally limited to 12.5 GHz for 200 mVpk-pk sensitivity.

Table 1–23: Environmental specifications

Specification	Characteristics
Temperature	Operating: +10° C to +40° C
Humidity	Non-operating: 5% to 90% relative humidity Operating: 20% to 80% relative humidity

Table 1–24: Mechanical specifications

Specifications	Characteristics	
Weight	0.37 kg (13 oz.)	
Overall dimensions	Height:	24 mm (0.95 in)
	Width:	74 mm (2.90 in)
	Depth:	114 mm (4.95 in)
	Does not include connectors, connector savers, connector covers, push buttons, or lock-down hardware protruding from the front or rear panels.	
Construction material	Chassis	aluminum alloy;
	Front panel	plastic laminate;
	Circuit boards	glass-laminate;
	Cabinet sleeve	aluminum
	Cabinet end covers	aluminum

Table 1–25: Electromagnetic specifications

Specification	Characteristic
Emissions	The instrument meets or exceeds the EMC requirements of the following standards: Emissions European Community Requirements (including EN 61326) EN55011 Class A Radiated Emissions EN55011 Class A Conducted Emissions IEC 1000–3–2 Power Harmonic Current Emissions
Susceptibility	The instrument meets or exceeds the EMC requirements of the following standards: EN61326–1 European Community Requirements IEC 1000–4–2 Electrostatic Discharge Immunity 4 kV contact discharge 8 kV air discharge Performance criteria B

Installation

NOTE. *The information found in this section is a subset of the Installation section found in the CSA8000 & TDS8000 User manual.*

This section covers installation of the instrument, addressing the following topics:

- *Check the Environment Requirements* on page 2–1
- *Install the Sampling Modules* on page 2–2
- *Connect the Peripherals* on page 2–4
- *Power On the Instrument* on page 2–5
- *Powering Off the Instrument* on page 2–7

The basic operating software is already installed on the hard disk. If reinstallation of software becomes needed, see the following topic:

- *Software Installation* on page 2–7

Check the Environmental Requirements

Read this section before attempting any installation procedures. This section describes site considerations, power requirements, and ground connections for your instrument.

Site Considerations

The instrument is designed to operate on a bench or on a cart in the normal position (on the bottom feet). For proper cooling, at least two inches (5.1 cm) of clearance is recommended on the rear and sides of the instrument.

You can also operate the instrument while it rests stood up on its rear feet. If you operate the instrument while it is resting on the rear feet, make sure that you properly route any cables coming out of the rear of the instrument to avoid damaging them.

⚠ **CAUTION.** *Keep the bottom of the instrument clear of obstructions to ensure proper cooling.*

Operating Requirements

Specifications in chapter 1 list the operating requirements for the instrument. Power source and temperature, humidity, and altitude are listed.

Rackmount Requirements

If this instrument is rackmounted, see the *TDS8000 & CSA8000 Rackmount Instructions* for additional site considerations or operating requirements. This document ships with the Option 1 R (rackmount kit).

Install the Sampling Modules

CAUTION. *Do not install or remove any sampling modules while the instrument is powered on.*

Always power the instrument down before attempting to remove or insert any sampling module.

WARNING. *Sampling modules are inherently vulnerable to static damage. Always observe static-safe procedures and cautions as outlined in your sampling module user manual.*

Check Your Sampling Module Manual(s)

The sampling modules that you order with your instrument ship with the appropriate sampling-module user manuals. Read these manuals for instructions on how to install your sampling modules, and then install them as outlined. (Sampling modules do not ship preinstalled.)

NOTE. *To find sampling module user manuals, check in the appendices of the* CSA8000 & TDS8000 User Manual *if user documentation is available. Users are instructed to insert their sampling-module user manuals there.*

NOTE. *After first installing a sampling module(s) or after moving a sampling module from one compartment to another, you should run compensation from the Utilities menu to ensure the instrument meets its accuracy specifications. You must run a compensation (accessed from the Utilities menu) whenever the extender configuration is changed from that present at the last compensation. In short, if you install or remove an 80E00 extender, run a compensation. If you exchange a extender for one of a different length, run a compensation. For instructions on running a compensation, see* Perform the Compensation *on page 4–5.*

Figure 2–1 shows compartments for both large and small sampling modules, along with the plug-in connector for the ESD wrist strap that you must use to install these modules.

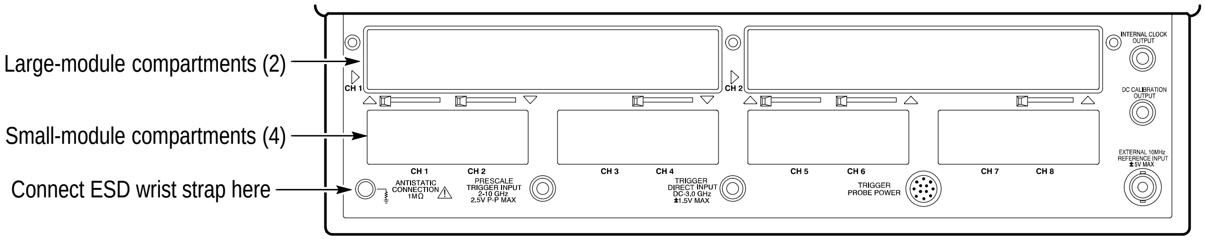


Figure 2–1: Compartments for sampling modules

Maximum Configuration

You can install up to two large sampling modules and four small modules for a total of 10 inputs. Of these 10 inputs, only eight inputs can be active at one time (see Figure 2–2, top two configurations). Also, note that installing a single large module in either compartment disables the first small-module compartment. This configuration (see Figure 2–2, bottom configuration) limits the input count to seven—one from the large, six from the small compartments.

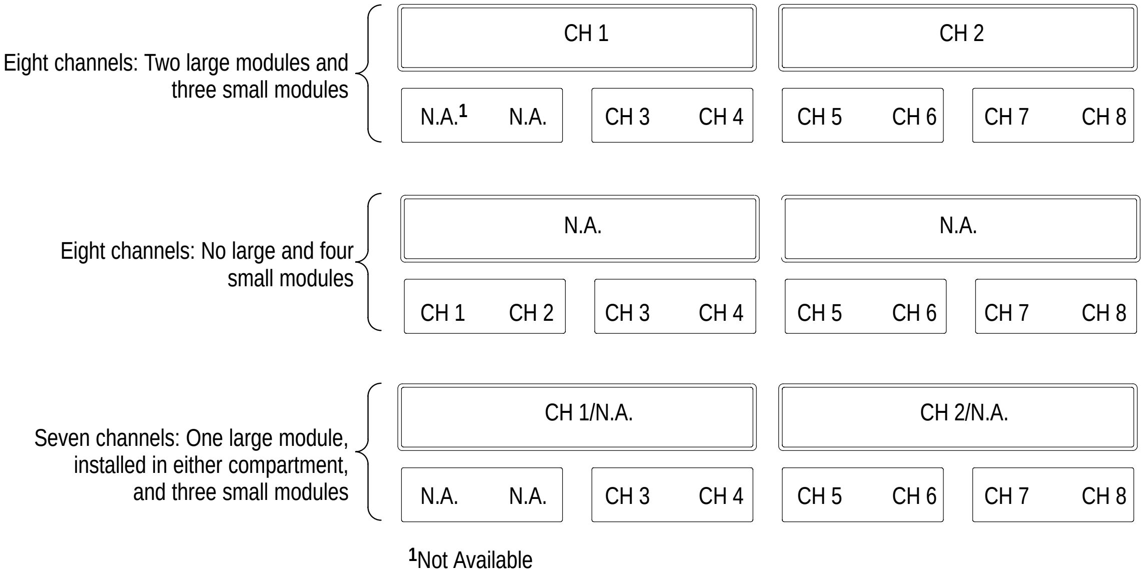


Figure 2–2: Maximum inputs in three configurations

Install probes, cables, and other connection accessories to your sampling modules as appropriate for your application and sampling module. Again, consult your sampling-module and connection-accessory manuals. Continue with the next section after installing the sampling modules.

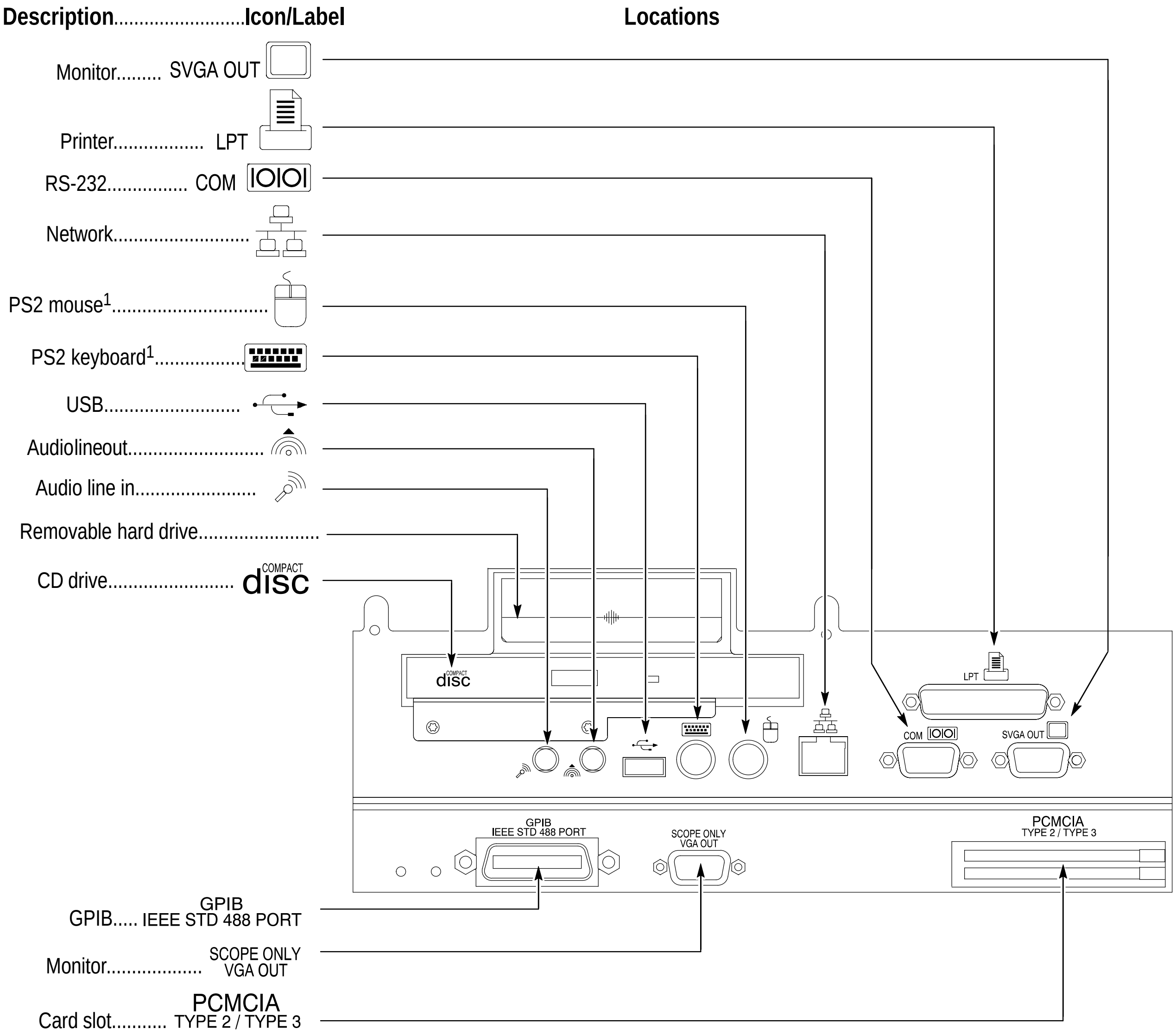
Connect the Peripherals

The peripheral connections are mostly the same as those you would make on a personal computer. The connection points are shown in Figure 2–3. See Table 2–1 on page 2–4 for additional connection information.

WARNING. *Before installing peripheral accessories to connectors (mouse, keyboard, etc.), power down the instrument. See* Powering Off the Instrument *on page 2–7.*

Table 2–1: Additional accessory connection information

Item	Description
Monitor	If you use a non-standard monitor, you may need to change the the Windows-98 display settings to achieve the proper resolution for your monitor.
Printer	Connect the printer to the EPP (enhanced parallel port) connector directly. If your printer has a DB-25 connector, use the adapter cable that came with your printer to connect to the EPP connector.
Rackmount	Refer to the *CSA8000 & TDS8000 Rackmount Installation Instructions* for information on installing the rackmount kit.
Other	Refer to the Application release notes (readme.txt) in the C:\Program Files\TDSCSA8000\System directory of the instrument for possible additional accessory installation information not covered in this manual.



[1] Product ships with a USB keyboard, that plugs into the USB port, and a USB mouse that plugs into the back of the keyboard

Figure 2–3: Locations of peripheral connectors on rear panel

Power On the Instrument

Follow these steps to power on the instrument for the first time.

1. Check that the line fuses are correct for your application. Both fuses must be the same rating and type. Fuse types require a unique cap and fuseholder. See Table 2–2 and Figure 2–4.

Table 2–2: Line fuses

Fuse type	Rating	Fuse part number	Cap & fuseholder part number
0.25 x 1.250 inch	8 A, fast blow, 250 V	159-0046-00	200-2264-00
5 x 20 mm	6.3 A, fast blow, 250 V	159-0381-00	200-2265-00

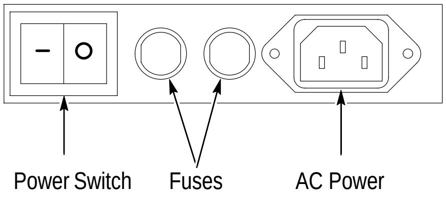


Figure 2–4: Line fuse and power cord connector locations, rear panel

CAUTION. *Connect the keyboard, mouse, and other accessories before applying power to the product. Connecting the accessories after powering on the instrument can damage the accessories. Two exceptions are the USB keyboard and mouse that ships with the instrument. Both can be plugged or unplugged without first turning power off.*

2. Connect the keyboard and mouse, observing the caution above. Note that the instrument ships with a USB keyboard, which plugs into the USB port (see Figure 2–3 on page 2–5 for location) and a USB mouse, which plugs into the back of the USB keyboard.

NOTE. *Connection of the keyboard and mouse is optional. You can operate most features without them, using the front-panel controls and the touchscreen.*

3. Connect the power cord.

4. If you have an external monitor, connect the power cord and power on the monitor.

5. Turn the Power switch on at the rear panel. (See Figure 2–4 on page 2–6 for switch location.)

6. Push the On/Standby switch to power on the instrument (see Figure 2–5 for the switch location).

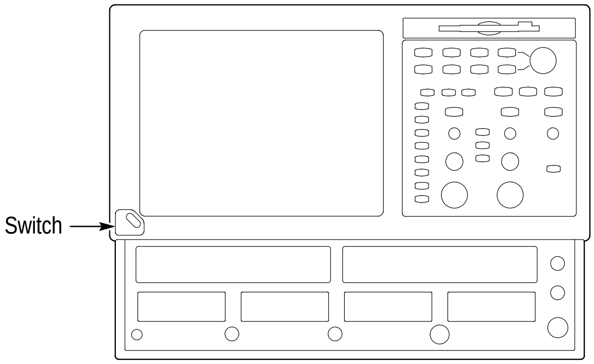


Figure 2–5: On/Standby switch location

7. Wait for the boot routine and low-level self test to complete.
8. Follow any instructions on the screen.

The internal setup software will automatically configure your instrument and install all required devices, depending on the installed accessories.

Powering Off the Instrument

The instrument has a built-in soft power-down function that safely powers down the instrument when you push the On/Standby button. You do not need to close the UI application or Windows 98 before using the On/Standby button.

To completely remove power to the instrument, first soft power-down the instrument using the On/Standby button, and then set the power switch on the rear panel to off.

You can restore the UI application to the screen by clicking its button in the Windows Task bar.

Software Installation

This section describes how to install the system software found on the CSA8000 & TDS8000 System Rebuild CD that accompanies this product. The instrument ships with the product software installed, *so only perform these procedures if reinstallation becomes necessary.*

Description

The product software comprises two parts:

- Window 98. Windows 98 comes preinstalled on the instrument. Windows 98 is the operating system on which the user-interface application of this product runs. The System Rebuild CD, which can be used to rebuild the instrument hard drive, includes the Window 98 operating system installation.

If you need to reinstall Windows 98, you may be able to do so without rebuilding the instrument hard drive. See *Operating System Reinstallation* on page 2–8 for more information.

- User Interface (UI) Application. The UI application complements the hardware controls of the front panel, allowing complete set up of all instrument features. The System Rebuild CD includes the UI application installation as part of a complete hard drive rebuild.

Software Release Notes

Read the software release notes README.TXT ASCII file if present on the System Rebuild CD before performing any installation procedures. This file contains additional installation and operation information that supercedes other product documentation.

To view the README.TXT file, open the Notepad Windows accessory and open the file on the System Rebuild CD. After installation, you can also read the copy from a directory on the product:

C:\Programs Files\TDSCSA8000\System

Operating System Reinstallation

Use the following procedure if reinstalling Windows 98 becomes necessary.

***NOTE**. Only do the reinstall if Windows 98 is missing or corrupted.*

There are two possibilities for reinstall:

- The instrument can reboot from the hard drive; if so, reinstall windows using the emergency startup disk and the procedure *Windows 98 Reinstall Only* on page 2–8.
- The instrument cannot reboot from the hard drive or you do not have an emergency startup disk available. In either case, you must rebuild your hard drive using the procedure *System Hard Drive Rebuild* on page 2–9. Any files or programs you have installed will be lost.

Windows 98 Reinstall Only. If you can reboot from the instrument hard drive and you have your emergency startup disk, you can reinstall Windows 98 from the hard drive. This procedure is preferred over rebuilding the hard drive, since the rebuild rewrites the entire hard drive.

1. Power off the instrument. Use the On/Standby switch if possible; if not, use the principle power switch found at the back of the instrument.

2. If a keyboard is not connected to the instrument, connect it.
3. Insert your emergency startup disk in the instrument floppy drive.
4. Power on the instrument. Make sure the principle power switch at the back of the instrument is set on. Push the On/Standby switch on the front panel.
5. The instrument should now boot from the emergency startup disk and present you with a selection menu. Use the arrow and enter keys to choose `Start the computer without CDROM support`.
6. At the a:\ prompt, type `c:`. Then type `cd windows\options\cabs`.
7. Type `setup`. Follow the instructions on screen.

***NOTE**. At the a:\ prompt, you can type* `help` *at anytime to read a file that may be helpful in getting the Windows 98 operating system up and running.*

System Hard Drive Rebuild. If you cannot reboot from the instrument hard drive, you must rebuild the instrument hard drive. This process will return the hard disk to the its original condition present when the instrument shipped.

Since data and programs you may have installed are lost with this rebuild, you should do the *Windows 98 Reinstall Only* procedure instead if you can. (See *Windows 98 Reinstall Only* on page 2–8.)

If you must rebuild the system hard drive, use the System Rebuild CD that shipped with the instrument. Follow the instructions in the booklet found in the CD case.

System Diagnostics

In case of instrument problems, you may wish to run the system diagnostics. If so, see the procedure *Perform the Diagnostics*, on page 4–3.

Windows Safe Mode

If the instrument is turned off before the operating system boots, or if you’ve installed a third-party product with a driver incompatible with instrument start up, Windows 98 will open in Safe mode. The touchscreen will be inoperable; therefore, you must install the standard-accessory mouse and keyboard to operate the instrument.

When you have finished investigating and removed any barrier to Windows start-up, you can reboot. If the instrument no longer boots to Safe mode, you can remove the keyboard and mouse if desired.

Operating Instructions

Before doing service, read the following operating instructions. These instructions are at the level appropriate for servicing these instrument, and assume you are familiar with Microsoft Windows-based products.

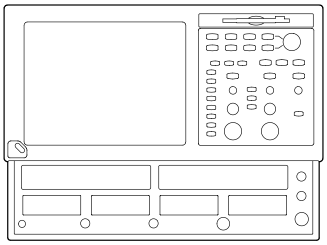
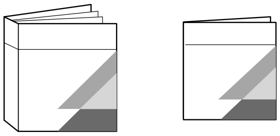
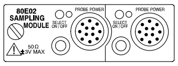
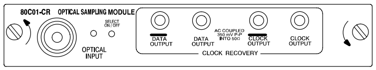
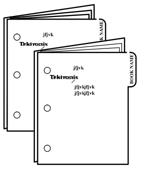
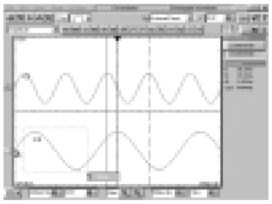
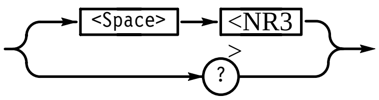
***NOTE**. These are not comprehensive operating instructions; consult the documentation map that follows to find other sources of operating instructions.*

Additional instructions are integrated into the service procedures found in later sections of this manual. For instance, the procedures found in the section *Performance Verification* contain instructions for making the front-panel settings required to check each instrument characteristic included there. Also, the general instructions for operating these instrument's internal diagnostic routines are found in Section 6, *Maintenance.* You may also find the *Product Description* in Section 1 useful for understanding how the instrument functions.

***NOTE**. Instructions for powering on and off of this instrument and installing its software are found in the section Installation, which precedes this section.*

Documentation Map

The instrument ships with documents individually tailored to address different aspects or parts of the product features and interface. These documents may be of use for some service tasks; the table below cross references each document to the instrument features and interfaces it supports. See *Related Documentation*, on page xvi, for part numbers of printed documents.

To read about...	Refer to these documents:	Description
Installation, Specification, & Operation (overviews) 	***Main User Manual*** ***Quick Reference Manual*** 	Read the *Reference* for a quick overview of instrument features and their usage. Read the *User Manual* for general information about your instrument — procedures on how to put it into service, specifications of its performance, maps of its user interface controls, overviews and background on its features. For more detailed usage information, see *Online Help System,* below.
All about the Sampling Modules  	***Electrical or Optical Sampling Module User Manual***[1] 	Read these manuals for complete information about the sampling modules you purchased — how to install them in the instrument, how to use them, and how to protect them from ESD. Depending on the modules ordered, one or both of these manuals ship with this product. Insert these manuals in back of the main user manual.
In Depth Operation and UI Help 	***Online Help System*** 	Access online help from the instrument for context-sensitive information on virtually all controls and elements on screen. Online help includes a setup guide of procedures for applying all instrument functions. See *How to Use Online Help* on page 2–17.
GPIB Commands 	***Online Programmers Guide*** 	Access this online guide from the instrument from its Help menu. Quickly find the syntax for any command, and copy the command if desired. Read about communication, error handling, and other information on GPIB usage.

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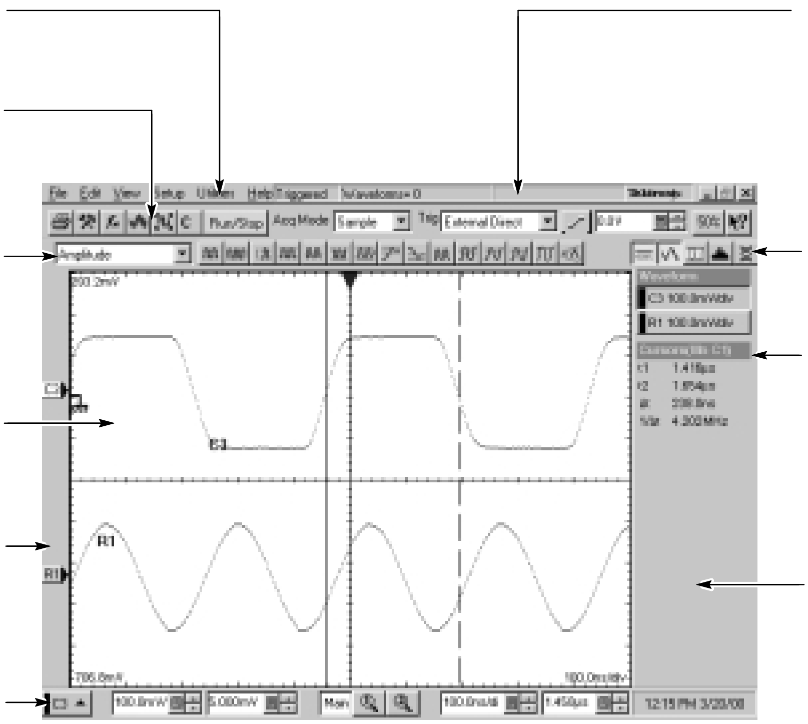
[1] **Modules other than sampling modules, such as the *80A01 Trigger Prescale Preamplifier Module User Manual*, also have individual user manuals that insert in the main user manual.**

User Interface Map – Complete Control and Display



Menu Bar: Access to data I/O, printing, online help system, and set-up functions

Tool Bar: Handy access to key features, including the setup dialogs, acquisition modes, triggering modes, and online help

Measurements Bar: Quick access to the automated measurements by category; click measurement buttons to measure the selected waveform

Display: Live, reference, and math waveforms display here, along with cursors, masks, etc. to analyze them

Waveform Bar: Access to waveform selection (click), waveform position (drag), and waveform properties (right-click)

Controls Bar: Quick access to waveforms and timebases for display, and to their scale, offset, and position controls for adjustment

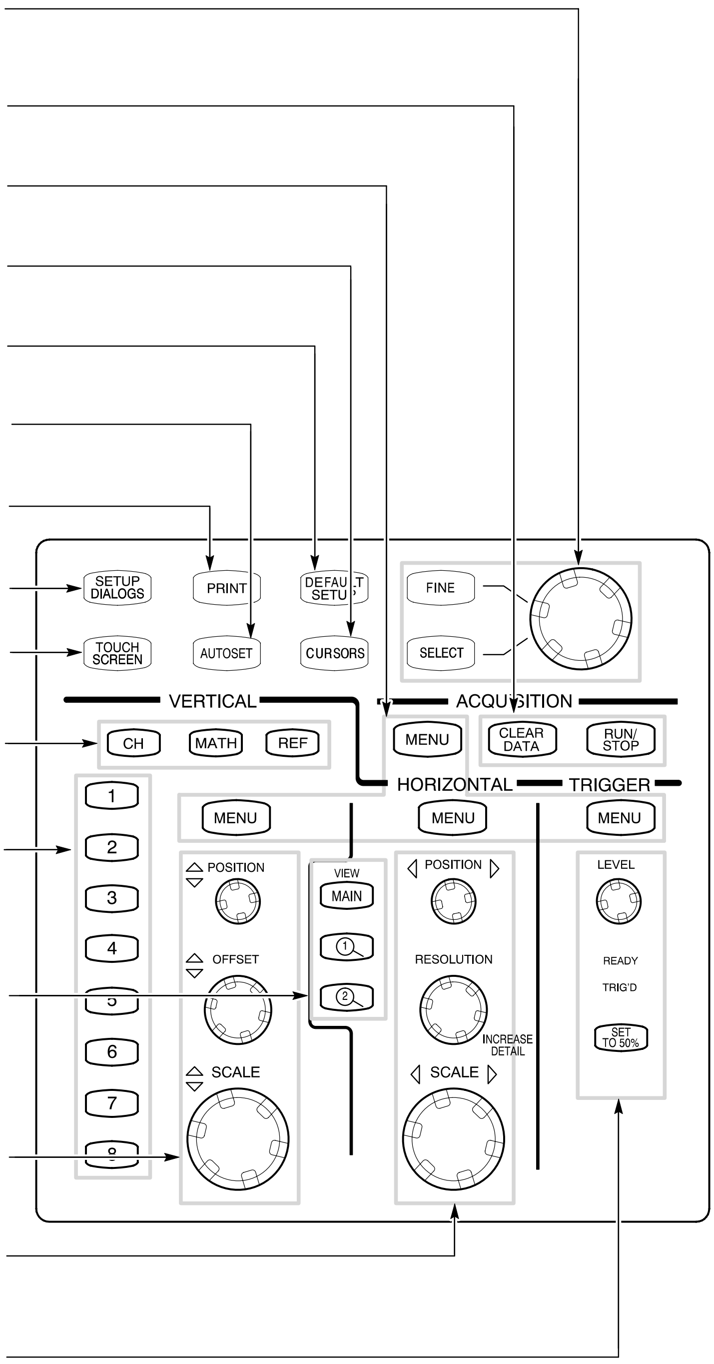
Status Bar. Trigger status and waveform count

Readout Bar. Toggle individual readouts on and off by clicking its button

A Readout. Right click any readout to display a short-cut menu providing handy access to often-used setup controls and properties for the feature associated with the readout

Readouts: Display up to five readouts in this area, selectable from the Readout Bar

Front Panel Map – Quick Access to Most Often Used Features



Turn knob to adjust most control fields in setup dialogs. Press the Select button to switch among fields. Press the Fine button to toggle between normal and fine adjustment.

Press to start and stop acquisition or clear all channel waveforms at once.

Press a Menu button to quickly access the setup dialog for its control group for more detailed set up.

Press to display measurement cursors and set the knob and Fine (adjust) and Select buttons to control them.

Press to quickly return to instrument-default control settings.

Press to automatically set up the instrument controls based on selected channels.

Press to access print dialog for printing the display.

Press to display the cluster of Setup Dialogs for comprehensive set up of the instrument.

Press to toggle the touch screen on and off. Use the touch screen to control UI when you haven't installed a mouse.

Select a waveform type, Channel, Reference, or Math, to display or adjust on screen (selected button lights).

Press to display and select a waveform not yet displayed; press to select among displayed waveforms; press again to turn a selected waveform off. Button lights indicate displayed and selected waveforms.

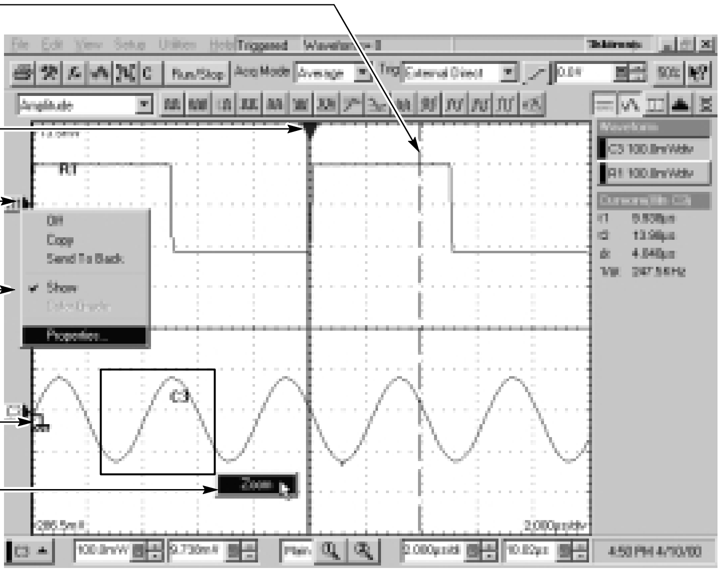
Press to display and select a time base view not selected, or to select among displayed views; press selected timebase again to toggle it off (except Main which is always on).

Turn knobs to vertically scale, position, and offset selected waveform.

Turn knobs to Horizontally scale, position, and set record length of selected waveform.

Use controls to set trigger level and lights to monitor trigger state.

Display Map – Single Graticule View



Drag cursors to measure waveforms on screen.

Drag the Horizontal Reference to move the point around which horizontal scaling expands and contracts the waveforms.

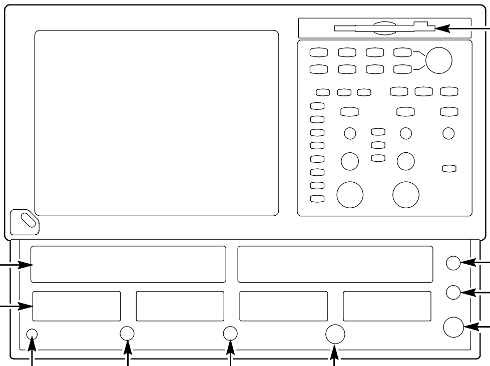
Drag the Waveform Icon vertically to position waveform.

Right click on a waveform or its icon for handy access to often used setup controls and properties.

Drag ground reference icon to add offset to a waveform.

Drag across the waveform area to zoom the boxed waveform segment to full screen width.

Front Panel I/O Map



Floppy disk drive accessible from Windows 98

Compartments for large modules, up to two channels

Compartments for small modules, up to eight channels

ANTISTATIC CONNECTION for wrist strap, 1 MΩ to ground

INTERNAL CLOCK OUTPUT

DC CALIBRATION OUTPUT

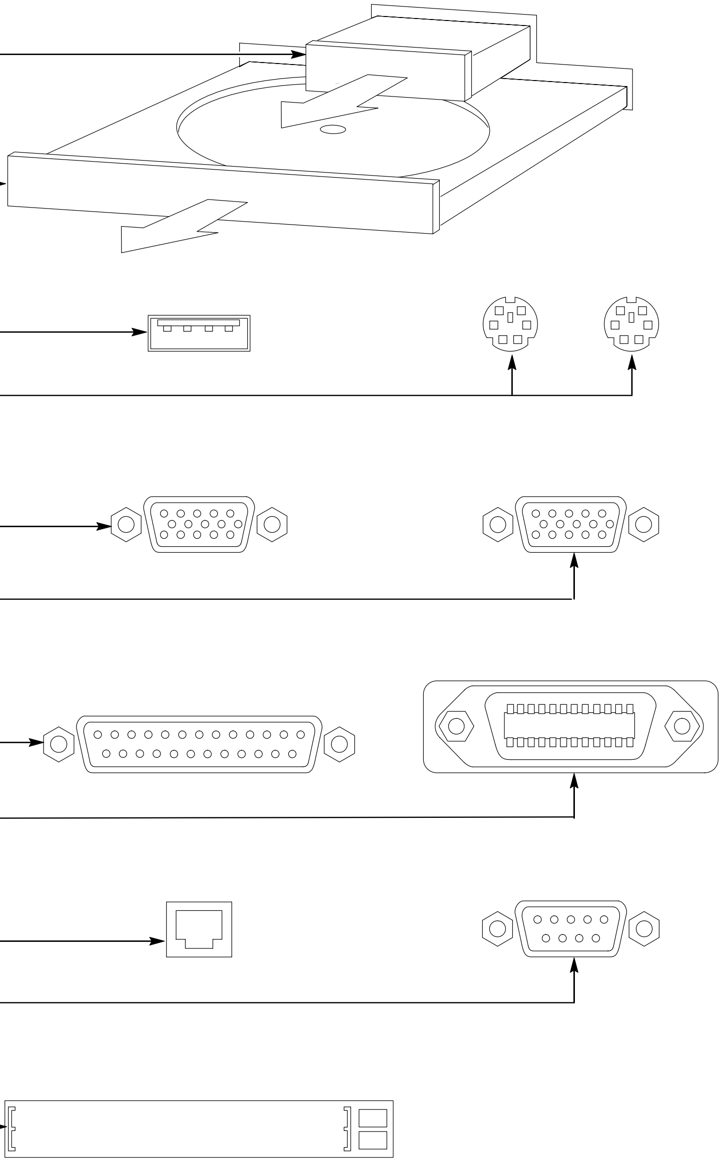
EXTERNAL 10 MHZ REFERENCE INPUT

TRIGGER PRESCALE input

TRIGGER DIRECT input

TRIGGER PROBE POWER

Rear Panel I/O Map



Removable hard disk drive to provide individual environment for each user or to secure data, press to release

CDROM drive accessible from Windows 98, press to open

USB connector for mouse or keyboard and mouse

PS-2 connectors for mouse and keyboard

Upper VGA port to connect a second monitor for side-by-side display

Lower VGA port to connect a monitor for oscilloscope display

Parallel port (Centronics) to connect printer or other device

GPIB port to connect to controller

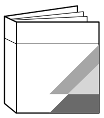
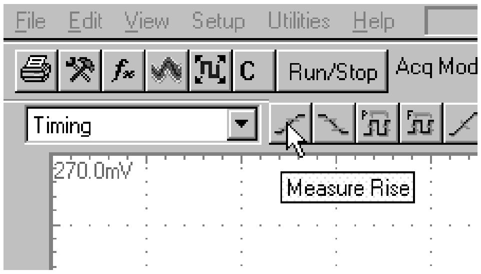
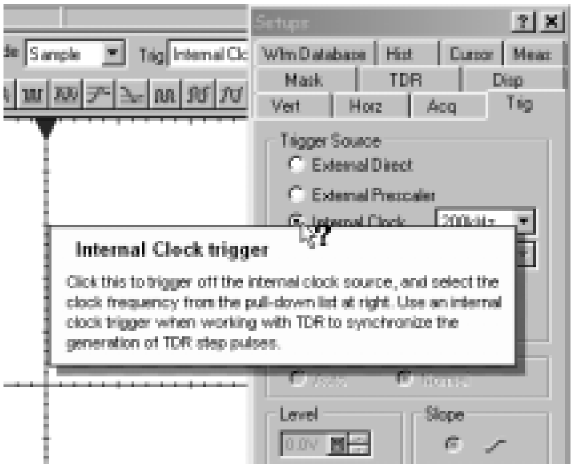
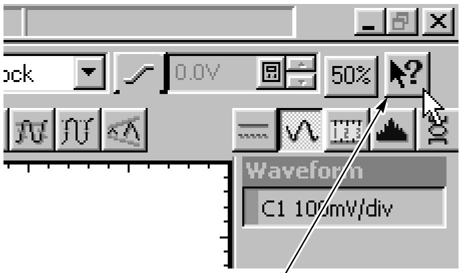
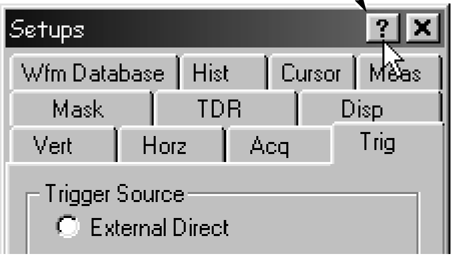
RJ-45 connector to connect to network

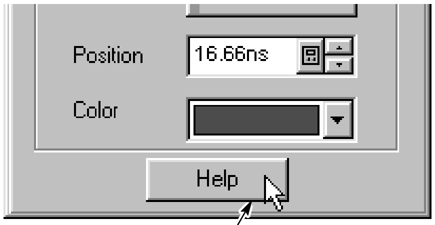
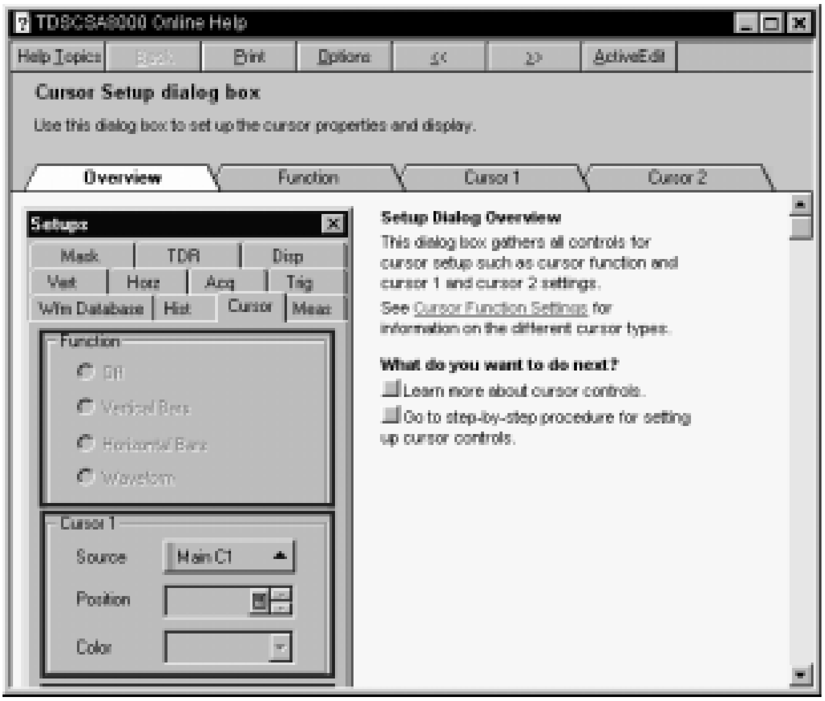
COM1 serial port

Card Bus slots for two PCMCIA type-1 cards, two type-2 cards, or one type-3 card

How to Use Online Help

A major part of documentation for the instrument you are servicing is the online help system. If your instrument is running, you may be able to use online help to quickly get operating information. To access, use the procedure steps that follow:

Overview	To use the online help	Control elements & resources
Prerequisites	**1.** The instrument must be powered up and running.	 ■ See *Installation*, page 2–1.
For a brief description of controls	**2.** Move your mouse pointer and let it rest over a control; that is, a menu name, a menu item, tool-bar button, tool-bar readout, etc. When you perform this step, the help system pops up a short definition or a label of the control. See right.	
For a more robust description	**3.** Click the What's This? button in the main display or in a dialog box. The button varies in form as shown at right. After clicking, the mouse pointer changes to the following icon: **4.** Now click the control you want described. A bubble pops up describing the control. See below.  Internal Clock trigger Click this to trigger off the internal clock source, and select the clock frequency from the pull-down list at right. Use an internal clock trigger when working with TDR to synchronize the generation of TDR step pulses.	 What's This? button for main display What's This? button for dialog boxes 

Overview	To use the online help (Cont.)	Control elements & resources
For in depth, contextual overviews	**5.** Most dialog boxes, whether setup or other types, have a Help button as shown right. Click the button to open the help system with an overview of the dialog box that's currently displayed. See below.	 Click or touch here
	 **Cursor Setup dialog box** Use this dialog box to set up the cursor properties and display. **Setup Dialog Overview** This dialog box gathers all controls for cursor setup such as cursor function and cursor 1 and cursor 2 settings. See Cursor Function Settings for information on the different cursor types. **What do you want to do next?** ☐ Learn more about cursor controls. ☐ Go to step-by-step procedure for setting up cursor controls.	

Overview | **To use the online help (Cont.)** | **Control elements & resources**

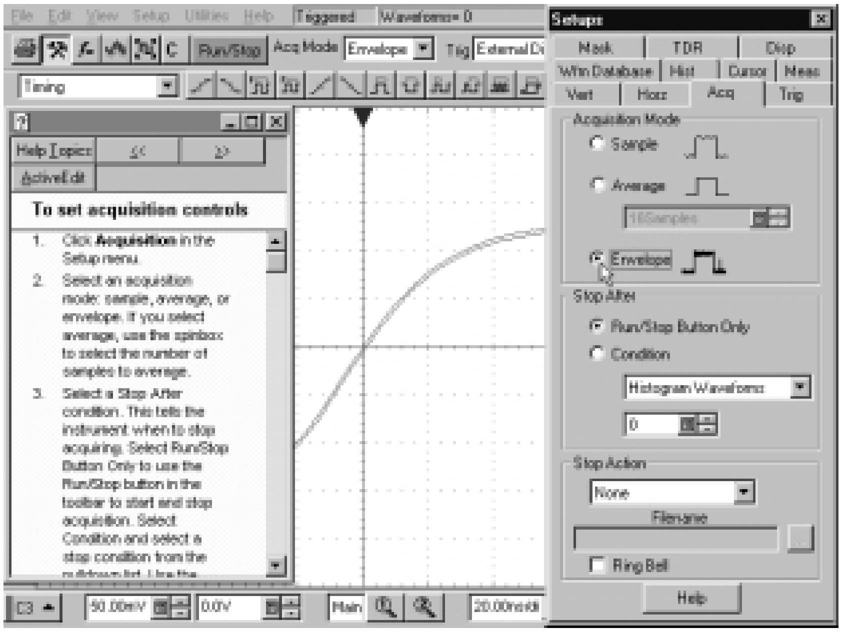
To dig deeper

6. You can search for in depth help using methods with which most users of PCs are familiar: from the application menu bar, select **Help**, and then select **Contents & Index**. See right.

7. From the online help finder (see below), choose from the three tabs.

8. Click the book icons to expose topic titles, and then click a topic to highlight it. Click the Display button to open the topic in a help window.

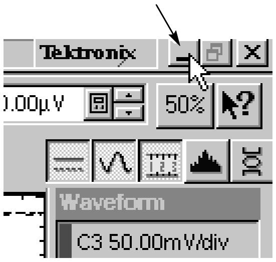
Overview	To use the online help (Cont.)	Control elements & resources
For instruction procedures	**9.** You can display step-by-step setup instructions for setups you want to make: From the application menu bar, select **Help**, and then select **Setup Guide**. See right. **10.** Select a procedure from the list that displays. The procedure will display in a help window that is sized and located to minimize interference with the controls needed to perform it. See below.	



To set acquisition controls

1. Click **Acquisition** in the Setup menu.
2. Select an acquisition mode: sample, average, or envelope. If you select average, use the spinbox to select the number of samples to average.
3. Select a Stop After condition. This tells the instrument when to stop acquiring. Select Run/Stop Button Only to use the Run/Stop button in the toolbar to start and stop acquisition. Select Condition and select a stop condition from the pulldown list. Use the

Overview	To use the online help (Cont.)	Control elements & resources
To enable full-text search	**11.** If you cannot find the information in the Contents or Index tabs of the online finder, you may want to enable full text search: From the application menu bar, select Help, and then select **Contents & Index**. See right. **12.** From the online help finder (see below), choose the **Find** tab.  Find enables you to search for specific words and phrases in help topics, instead of searching for information by category. Before you can use Find, Windows must first create a list (or database), which contains every word from your help file(s). To create this list now click Next. ● Minimize database size (recommended) ○ Maximize search capabilities ○ Customize search capabilities **13.** Choose the method for word list generation and select next or finish. Once the word list generation finishes, future accesses of the find tab will immediately access a pane for searching with full text search without requiring the word to be regenerated.	

Overview	To use the online help (Cont.)	Control elements & resources
To Access Operating System Help	**14.** Click the minimize button to reduce the User Interface Application to an icon on the operating system toolbar. See upper right. **15.** Click the **Start** button to pop up the Start menu, and then select **Help** from the menu. See lower right. The online help for the Windows operating system displays. **16.** When your done with the online help, you can dismiss it. To restore the user interface application to the screen, click its icon in the tool bar. **Tip.** To switch between online help and the application, you can hold down the ALT key while you press Tab repeatedly to alternate between bringing help to the front and the application.	Click to Minimize to the toolbar   Click for Windows 98 Help

End of Procedure

80E00 Electrical Sampling Module Operation

***NOTE**. These are not comprehensive operating instructions; consult the documentation map on page 2–12 to find other sources of operating instructions.*

Each sampling module contains two identical input channels (80E01 has one channel). This section describes channel controls, connectors, and indicators. Figure 2–6 shows the front panel of the sampling module and identifies the buttons, lights, and connectors.

***CAUTION.** To prevent damage to your sampling module or instrument, do not apply a voltage outside the Maximum Input Voltage (see page 1–12) for your sampling module.*

To prevent electrostatic damage to the instrument and sampling modules, follow the precautions described in this manual and the manuals accompanying your instrument.

Always use a wrist strap (provided with your instrument) when handling sampling modules or making signal connections.

The input circuitry in your sampling module is very susceptible to damage from overdrive signals and electrostatic discharge. Never apply a DC or peak voltage greater than the Maximum Input Voltage (see page 1–12) of your sampling module. Only operate the instrument and sampling module in a static-controlled environment.

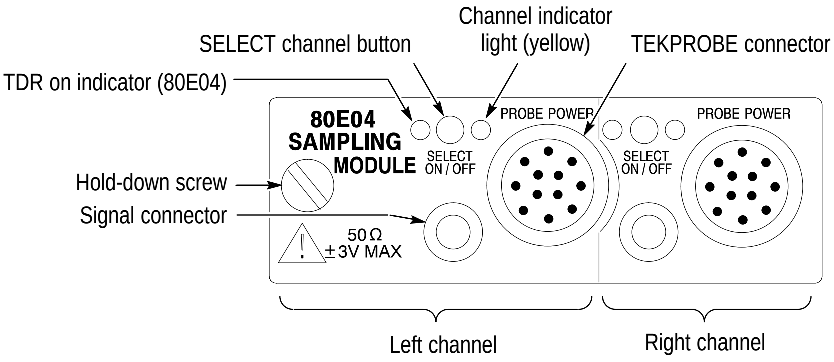


Figure 2–6: Sampling module, 80E04 shown

Signal Connector

The input signal connectors for each channel let you connect signals that you want to sample. To acquire a signal, connect the signal to the sampling module through the Signal Connector input.

Connector Care. Never attach a cable to a sampling-module connector if the cable has a worn or damaged connector because you may damage the sampling-module connector. Use extra care when attaching or removing a cable from the connectors. Turn only the nut, not the cable. When attaching a cable to a sampling-module connector, align the connectors carefully before turning the nut. Use light finger pressure to make this initial connection. Then tighten the nut lightly with a torque wrench.

***NOTE**. For best repeatability and to prolong connector life, use a torque wrench and tighten the connection to the range of 79–112 N·cm (7–10 lb·in).*

If the sampling-module connectors will receive heavy use, such as in a production environment, you should install adapters (such as a Tektronix 015-0549-xx for 3.5 mm connectors) on the sampling module to make connections to the device under test.

Channel Selection

Each channel has a SELECT channel button and a yellow channel light. The button operates as follows:

- If the yellow channel light is on, the channel is acquiring a waveform.
- If you press the button and the channel is not currently being acquired (for any channel or math waveform), then the instrument activates (turns on) the channel.
- If you press the button and the channel is currently active as a channel waveform, then the instrument selects the channel waveform.
- If the channel waveform is already selected when you press the channel button, the instrument turns the channel off.

TEKPROBE Connector

The TEKPROBE connector provides support for accessories requiring TEKPROBE SMA support at levels 1 and 2. The connector provides power and control to attached accessories, by the main instrument.

TDR On Indicator

On modules with TDR capability, the red TDR ON light indicates whether the step generator is sending out a step through the signal connector. The main instrument turns this on or off.

80C00 Optical Sampling Module Operation

***NOTE**. These are not comprehensive operating instructions; consult the documentation map on page 2–12 to find other sources of operating instructions.*

***NOTE**. Proper operation of 80C04 modules requires that the operating–system software installed on the main instrument is version 1.1.0 or greater. To display the version installed, select About TDS/CSA8000 from the Help menu of the main instrument.*

***CAUTION.** To avoid damaging your optical sampling module, handle your optical sampling module carefully at all times and take the following precautions:*

Do not drop your sampling optical since damage and misalignment of the photodiode optical assembly can result. Store the sampling optical in a secure location when not in use.

Replace the protective cap on the input connector when the sampling optical is not in use.

To prevent loss of optical power or damage to the optical connectors, keep the connectors clean at all times. Also insure that all connectors and jumpers attached to the inputs are clean prior to insertion.

Attenuating Optical Signals

To keep the optical input power to an appropriate level, it may be necessary to attenuate the optical signal.

***CAUTION.** To avoid damaging the optical input of the sampling optical, to maintain the levels within performance range, and to avoid clipping, attenuate optical signals to less than 5 mW average power or 10 mW peak power at the wavelength with highest relative responsivity.*

80C03 modules can have deteriorated response for signals larger than 200 μW_{pp}, and the vertical response will eventually saturate for levels approaching 1 mW.

The optical sampling module front panel is shown in Figure 2–7.

Channel Selection

Each channel has a SELECT channel button and a yellow channel light. The button operates as follows:

- If the yellow channel light is on, the channel is acquiring a waveform.
- If you press the button and the channel is not currently being acquired (for any channel or math waveform), then the instrument activates (turns on) the channel.
- If you press the button and the channel is currently active as a channel waveform, then the instrument selects the channel waveform.
- If the channel waveform is already selected when you press the channel button, the instrument turns the channel off.

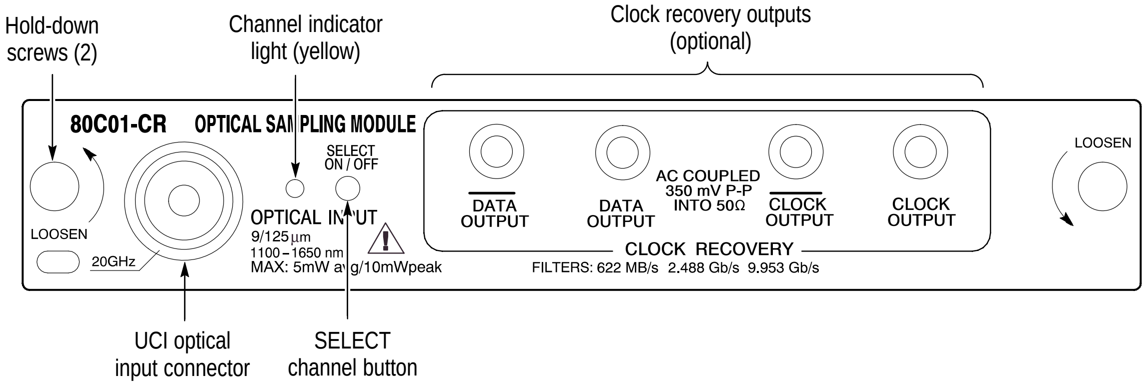


Figure 2–7: Sampling module, 80C01-CR shown

Optical Input Connector

The optical input connector uses a universal connector interface (UCI) that allows use of many standard fiber-optic female connector styles. Some of the standard UCI interfaces supported are FC, ST, SC, and DIN. (Refer to a current Tektronix catalog for details.)

Clock Recovery Outputs

Optional clock and data-recovery circuitry provides clock and data outputs; the recovered clock is also internally routed to the main-instrument trigger circuit. The circuitry also provides front-panel outputs: normal and complemented clock, and normal and complemented data (80C02 has data, clock, and 1/16 clock outputs). Use 50 Ω terminations, provided with your optical sampling module, on unused outputs.

You can disable the internal recovered clock from being used as the main instrument trigger by selecting external or internal clock triggering; select the recovered clock rate without actually selecting recovered clock as the trigger source in order to activate the front-panel clock recovery signals.

Hold-Down Screws

Hold-down screws secure the sampling optical module to the main instrument. Once the hold-down screws are loosened, use the eject levers to remove the sampling optical module from a powered-down main instrument. Indicators on the hold-down screws point in the direction that the latch is pointing.

80A01 Trigger Prescale Preamplifier Module Operation

***NOTE**. These are not comprehensive operating instructions; consult the documentation map on page 2–12 to find other sources of operating instructions.*

This module is a one channel preamplifier module that can be installed in a small module compartment of a CSA8000 or TDS8000 Digital Sampling Oscilloscope. The 80A01 is designed to increase the sensitivity of the prescale trigger input of these oscilloscopes to $\leq 200\ \mathrm{mV}_{\text{pk-pk}}$.

***CAUTION.** To prevent damage to your module or instrument, do not apply a signal outside the Maximum Input Voltage Swing for your module.*

To prevent electrostatic damage to the instrument and sampling modules, follow the precautions described in this manual and the manuals accompanying your instrument.

Always use a wrist strap (provided with your instrument) when handling modules or making signal connections.

The input circuitry in your module is very susceptible to damage from overdrive signals and electrostatic discharge. Never apply a DC or peak voltage greater than the Maximum Input Voltage Swing (see page 1–38) of your module. Only operate the instrument and module in a static-controlled environment.

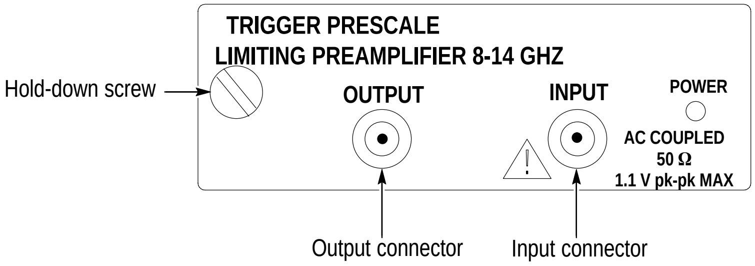


Figure 2–8: 80A01 module front panel

Signal Connector

Connect a trigger signal that you need to preamplify to the input connector. Connect the preamplified output signal from the output connector to the prescale trigger input of the oscilloscope.

Connector Care. Refer to *Connector Care* on page 2–24.

Theory of Operation

This section describes the electrical operation of the instrument and sampling modules. Figure 9–1 on page 9–1 shows the module interconnections.

Logic Conventions

The instrument contains many digital logic circuits. This manual refers to these circuits with standard logic symbols and terms. Unless otherwise stated, all logic functions are described using the positive-logic convention: the more positive of the two logic levels is the high (1) state, and the more negative level is the low (0) state. Signal states may also be described as “true” meaning their active state or “false” meaning their nonactive state. The specific voltages that constitute a high or low state vary among the electronic devices.

Mainframe Overview

This mainframe overview describes the basic operation of each functional circuit block as shown in Figure 9–1 on page 9–1.

General

The instrument control system is a dual Wintel/PowerPC based processor board. The platform features VGA resolution flat-panel display, transparent touch screen and user front-panel with direct access to commonly used scope functions. The instrument is also equipped with a mouse pointing device to facilitate access to more advanced scope functions

Input Signal Path

A signal enters the instrument through a direct coaxial connection to the input connector on a sampling module, or a real time probe connected to the sampling module channel.

Acquisition System. The acquisition system conditions the input signals, samples them, converts them to digital signals, and controls the acquisition process under direction of the processor system. The acquisition system includes the multi-source trigger, acquisition timebase, and acquisition mode generation and control circuitry. The acquisition board is located in the bottom compartment of the instrument and can accommodate four dual-channel sampling Plug-ins, two one-channel optical plug-ins and a trigger/holdoff subsystem. Up to 8 vertical channels are accommodated simultaneously. Channels 1 and 2 are either large or small slots. The presence of an module in one or both large slots displaces the small slot functionality in the leftmost Channel 1 - Channel 2 small slot. The external trigger and all small slot channels feature a Tekprobe Level 2 probe power connector for additional front end signal conditioning functions like high input-impedance real-time probes.

Processor System. The processor system contains a dual Wintel/Power PCC. The basic instrument configuration supports up to eight channels labeled Ch1 through Ch 8, provides two external trigger inputs for direct and prescaled triggering through built–in prescaler and is able to support two optional internal trigger sources associated with the large slot channels mapped onto electrical channels 1 and 2.

Display Panel

Color LCD display Active-matrix touch panel.

Display System. Text and waveforms are processed by different parts of the display circuitry. The display system sends the text and waveform information to the display panel.

Touch Panel. The Display board sends information to the processor. Any changes in their settings are reported to the processor system.

Front Panel

The front panel board reads the front-panel switches and knob sensors. Any changes in their settings are reported to the processor system. The front panel board also turns the LEDs on and off and generates the bell signal.

Front-panel menu switches are also read by the PPC processor board. The processor sends any changes in menu selections to the processor system. The ON/STBY switch is one of the menu switches. However, it is not read by the front panel board, but passes through the front panel board to the low voltage power supply.

Rear Panel

The hard drive and CD Rom provides access to stored waveform data and to load software to customized your instrument with your measurement needs. The GPIB allows for external control of the instrument.

You can make hardcopies on the GPIB, RS-232, and Centronics ports. Other ports from the front panel board: PC cardbus x 2, cal adjust lock.

Outputs from the NLX board: SVGA, USB (1), sound, serial (2), parallel, Ethernet, mouse, keyboard.

Low Voltage Power Supply

The low voltage power supply is a switching power converter with active power factor control. It supplies power to all of the circuitry in the instrument.

The principal POWER switch, located on the rear panel, controls all power to the instrument including the Low Voltage Power Supply. The ON/STBY switch, located on the front panel, also controls all of the power to the instrument except for part of the circuitry in the Low Voltage Power Supply.

The power supply sends a power fail (~PF) warning to the processor system if the power is going down.

Fans

The fan assembly provides forced air cooling for the instrument. The fans are controlled by the PPC processor.

80E01, 80E02, 80E03 and Electrical Sampling Modules

The 80E01, 80E02, and 80E03 and are two-channel, low-noise, 12.5, 20 and 50 GHz, samplers, respectively. The 80E02 sampling module has a 28 ps rise time, the 80E03 17.5 ps and the 80E01, 7 ps.

For the 80E02 and 80E03, a single strobe delivered from the instrument mainframe to both acquisition channels controls the timing of the strobe assertion to both channels. If channel-to-channel deskew is zero, the sampling coincidence between channels is very close. Acquisition deskew function is carried out by making separate acquisitions over individual acquisition windows.

For the 80E01, an individual strobe delivered from the instrument mainframe to the acquisition channel controls the timing of the strobe assertion to the channel. Acquisition deskew function is carried out by moving the strobe timing for the channel to a unique acquisition window.

Each electrical channel features a Tekpobe Level 2 probe power connector for attachment of a real time probe. The control of this probe is a mainframe function.

All module calibration signals are derived from a 2.5 V precision voltage reference internal to the sampling module. Settings derived from this reference are stored in a non-volatile EEPROM in the sampling module, although the responsibility for the execution of these settings is with the mainframe.

For major functional circuit blocks refer to (Figure 9–3).

80E04 Electrical TDR/Sampling Module

The 80E04 TDR/Sampling module is a two-channel, low noise, 17.5 ps rise time sampler. Each channel is also capable of generating its own Time Domain Reflectometry (TDR) step. The 80E04 sampling module risetime is 17.5 ps.

For the 80E04 a single strobe delivered from the instrument mainframe to both acquisition channels controls the timing of the strobe assertion to both channels. If channel-to-channel deskew is zero, the sampling coincidence between channels is very close. Acquisition deskew function is carried out by making separate acquisitions over acquisition windows.

Each electrical channel features a Tekpobe Level 2 probe power connector for attachment of a real time probe. The control of this probe is a mainframe function.

All module calibration signals are derived from a 2.5 V precision voltage reference internal to the sampling module. Settings derived from this reference are stored in a non-volatile EEPROM in the sampling module, although the responsibility for the execution of these settings is with the mainframe.

When used in the acquisition mode (that is, with the TDR step generator turned off) each channel functions as a normal sampling input. Both channels are strobed simultaneously from a single strobe generator contained within the sampling module, so time coincidence between the two channels is stable.

In the TDR mode, a fast rise time step is generated internally for each channel and applied to the input signal path for that channel. The acquisition portion of the TDR/sampling module remains functional for monitoring the primary step and its reflected components. The sampling module provides two self- contained TDR channels. The polarity of the output step can be selected independently for each channel. This allows differential or common mode testing of two coupled lines as well as independent testing of isolated lines.

For major functional circuit blocks refer to (Figure 9–4).

80C0X and 80C0X-CR Optical Sampling Modules

80C0X and 80C0X-CR optical modules share the same mechanical package and built with a common circuit board. Different functionality within the modules (current and future modules) is achieved by installing different O/E modules, filters and clock recovery boards along with setting the sampler bandwidth as demanded. The key features supported in the module are:

- A one channel, low noise, adjustable bandwidth sampler allowing multiple bandwidth settings for optimizing noise verses bandwidth demands.
- An amplified or non-amplified O/E converter.
- Support for a switch module with a straight through path and two filtered reference receiver paths between the O/E converter and the sampler.
- An average optical power meter.
- Integral clock recovery option with internal plumbing connection to the trigger, front panel clock and data output.
- I^2C communication with the mainframe for identification, control and calibration/compensation storage.

The “system response” depends on all of the components in the signal path from the front panel to the sampler. Bandwidth and reference receiver responses are calibrated at the factory with a sub-picosecond optical impulse applied to the front panel connector. This insures that all components are included, but also means that components can not be replaced without performing calibration.

Compensation performs a DC transfer curve characterization for each bandwidth/reference receiver setting. The curve data is stored in the module’s EEPROM and used to generate a look-up table in the mainframe. This data corrects for linearity, gain and offset errors in the sampler.

Reference receivers can be created in any of the following ways:

- A hardware filter inserted between the sampler and O/E.
- Adjust the sampler’s bandwidth.
- Adjust the O/E response with the sampler set to a higher bandwidth.

The available bandwidth and reference receiver selections, and the method used to set the bandwidth for 80C01, 80C02, and 80C03 optical modules:

The power monitor is a second measure of the photodiode current that is independent of the sampler signal path. Analog circuitry continuously senses the current flowing into the bias side of the photodiode. The signal is amplified by a programmable gain amplifier and input to an 8 bit AD converter. The AD converter and amplifier are controlled through the I^2C interface. Compensation performs two functions in the power meter: First, two offset inputs are adjusted in the amplifier so that the signal stays in range for all of the gain settings. Next, offset is measured for all gain settings and stored so it can be subtracted from the raw measured current. Because the measurements are made through independent paths the power monitor is useful in debugging module/mainframe problems.

The module's main board only provides power and control bits to the clock recovery board. A small fraction of the input signal is split off to applied to the clock recovery components. The splitter is optical in the 80C01-CR and 80C02-CR, and is electrical in the 80C03-CR. The recovered clock is routed in coaxial cable through the rear connector to the module to the Optical Front End board in the mainframe. The Optical Front End board has a switch that selects which modules clock will be applied to the trigger. The control signal for that switch comes from the optical module.

80C01 Optical Sampling Module

The 80C01 module supports conformance testing of long wavelength (1100-1650 nm) signals at 622, 2488, and 9953 Mbps as well as general purpose testing up to 20 GHz optical bandwidth. Bandwidth and reference receiver calibration is performed with a sub-picosecond and optical impulse and a fourier transform method.

- OC12: The electrical sampler is adjusted to approximately 7.5 GHz (–3dB) bandwidth and signal is routed through a hardware filter designed to result in the combined system having an OC12 (STM-4) Reference Receiver response.
- OC48: The electrical sampler is adjusted to 7.5 GHz (–3dB) bandwidth and signal is routed through a hardware filter designed to result in the combined system having an OC48 (STM-16) Reference Receiver response. These adjustments must be made at the factory.
- OC192: The electrical sampler is adjusted to give the desired response, and signal is not routed through any filter (signal is sent through the straight-through path). The sampler bandwidth and response is optimized during the calibration such that the combined system will have an OC192 (STM-64) Reference Receiver response.
- 12.5 GHz: The sampler bandwidth and response is set during the calibration such that the combined system will have an Optical Bandwidth (–6dB) > 12.5 GHz.
- 20 GHz: The sampler bandwidth and response is set during the calibration such that the combined system will have an Optical Bandwidth (–6dB) > 20 GHz.

For major functional circuit blocks refer to (Figure 9–5 on page 9–5).

80C02 Optical Sampling Module

The 80C02 module is optimized for testing of long-wavelength (1100-1650 nm) signals at (9.953 Gbps) SONET OC-192 / SDH STM-64 standards. With its high optical bandwidth (>30 GHz) it is also well suited to general purpose high-performance optical component testing.

- OC192: The electrical sampler is adjusted to give the desired response, and signal is not routed through any filter (signal is sent through the straight-through path). The sampler bandwidth and response is optimized during the calibration such that the combined system will have an OC192 (STM-64) Reference Receiver response.
- 12.5 GHz: The sampler bandwidth and response is set during the calibration such that the combined system will have an Optical Bandwidth (–6dB) > 12.5 GHz.
- 20 GHz: The sampler bandwidth and response is set during the calibration such that the combined system will have an Optical Bandwidth (–6dB) > 20 GHz.
- 30 GHz: The sampler bandwidth and response is set during the calibration such that the combined system will have an Optical Bandwidth (–6dB) > 30 GHz.

For major functional circuit blocks refer to (Figure 9–7 on page 9–7).

80C03 Optical Sampling Module

The 80C03 module supports conformance testing of both short and long bandwidth (700-1650 nm) signals at 1.063, 1.250, and 2.488 Mbps as well as general purpose testing with up to 2.3 GHz optical bandwidth. Its amplified optical to electrical converter design enables the user to examine very low-level optical signals.

- OC48: The electrical sampler is adjusted to approximately 12.5 GHz (–3dB) bandwidth and signal is not routed through any filter (signal is sent through the straight-through path). The O/E converter is designed by the vendor to match the OC48 reference receiver response curve. The span adjustment provides limited adjustment of the frequency response. It is adjustment at the factory such that the combined system will have during calibration such that the combined system will have an OC48 (STM-64) Reference Receiver response. This mode is synonymous with the 2.3 GHz maximum bandwidth setting.
- FC: The electrical sampler is adjusted and O/E converter span voltage are the same values as in the OC48 mode. The signal is routed through a hardware filter designed to result in the combined system having an FC1063 (1.0625 Gb/s Fibre Channel) Reference Receiver response.
- GBE: The electrical sampler is adjusted and O/E converter span voltage are the same values as in the OC48 mode. The signal is routed through a

hardware filter designed to result in the combined system having an GBE (1.25 Gb/s Gigabit Ethernet) Reference Receiver response.

For major functional circuit blocks refer to (Figure 9–9 on page 9–9).

The 80C03 module can be optionally configured with clock recovery that supports Fibre Channel 1063 (1.063 Gbps) and OC-48 / STM-16 (2.488 Gpbs) standards.

80C04 Optical Sampling Module

The 80C04 module is optimized for testing of long-wavelength (1100–1650 nm) signals at either 9.953 Gb/s or 10.664 Gb/s. With its high optical bandwidth >28 GHz, it is also well suited to general-purpose, high–performance optical component testing.

- OC192 or 10.664 Gb/s: The electrical sampler is adjusted to give the desired response, and signal is not routed through any filter (signal is sent through the straight-through path). The sampler bandwidth and response is optimized during the calibration such that the combined system will have an OC192 (STM-64) or 10.66 Gb Reference Receiver response.
- 20 GHz: The sampler bandwidth and response is set during the calibration such that the combined system will have an Optical Bandwidth (–6dB) > 20 GHz.
- 30 GHz: The sampler bandwidth and response is set during the calibration such that the combined system will have an Optical Bandwidth (–6dB) > 28 GHz.

The 80C04 can be optionally configured with clock recovery (Opt. CR-1) that supports 9.953 Gb/s telecom standards.

For major functional circuit blocks refer to (Figure 9–11 on page 9–11).

80C05 Optical Sampling Module

The 80C05 module is designed to test long wavelength (1520–1580nm) signals. This module is intended to be used as a test and measurement tool for high bandwidth telecommunications with its high optical bandwidth >40 GHz.

- OC192: There is one Reference Receiver setup selectable for 9.95328 Gb/s SONET/SDH standard.
- There is no clock recovery option available.

For major functional circuit blocks refer to (Figure 9–13 on page 9–13).

80C06 Optical Sampling Module

The 80C06 module is designed to test long wavelength (1100–1650nm) signals. This module is intended to be used as a test and measurement tool for high bandwidth telecommunications with its high optical bandwidth >50 GHz.

- 50 GHz: Ther is only a single lowpass bandwidth selection available, no Reference Receiver setups selectable.
- There is no clock recovery option available.

For major functional circuit blocks refer to (Figure 9–14 on page 9–14).

80A01 Trigger Prescale Preamplifier Modules

The 80A01 module is designed to increase the sensitivity of the prescale trigger input of the CSA8000/TDS8000 instruments to $\leq 200\ \text{mV}_{\text{pk-pk}}$.

The major function block of the module an high sensitivity, high gain RF amplifier. The input and output to this amplifier are routed to two identical SMA, female connectors, labelled Input and Output at the module front panel.

The module receives power from the main instrument through a single connector at the rear of the module. The power LED indicates the module is receiving power through the interface connector.

For major functional circuit blocks refer to (Figure 9–15 on page 9–15).

Performance Verification Procedures

Two types of Performance Verification procedures can be performed on this product: *Brief Procedures* and the more extensive *Performance Tests*. You may not need to perform all of these procedures, depending on what you want to accomplish:

- To rapidly confirm that the instrument functions and was adjusted properly, just do the *Perform the Diagnostics* and *Perform the Compensation* procedures, found under *Brief procedures* beginning on page 4–3.

  Advantages: These procedures are quick to do, require no external equipment or signal sources, and perform extensive functional and accuracy testing to provide high confidence that the instrument will perform properly. They can be used as a quick check before making a series of important measurements.

- To further check functionality, first do the procedures just mentioned, and then do the procedure *Perform the Functional Tests,* found under *Brief Procedures* on page 4–7.

  Advantages: These procedures require minimal additional time to perform, require no additional equipment other than connection hardware, and more completely test the internal hardware of the instrument. They can be used to quickly determine if the instrument is suitable for putting into service, such as when it is first received.

- If more extensive confirmation of performance is desired, do the *Performance Tests*, beginning on page 4–19, after doing the procedures just referenced.

  Advantages: These procedures add direct checking of warranted specifications. They require more time to perform and suitable test equipment is required. (See *Equipment Required* beginning on page 4–19).

If you are not familiar with operating this instrument, read the CSA8000/TDS8000 user manuals. These manuals contain instructions that will acquaint you with the use of the front-panel controls and the menu system.

Brief Procedures

There are three procedures in this section that provide a quick way to confirm basic functionality and proper adjustment:

- *Perform the Diagnostics*
- *Perform the Compensation*
- *Perform the Functional Tests*

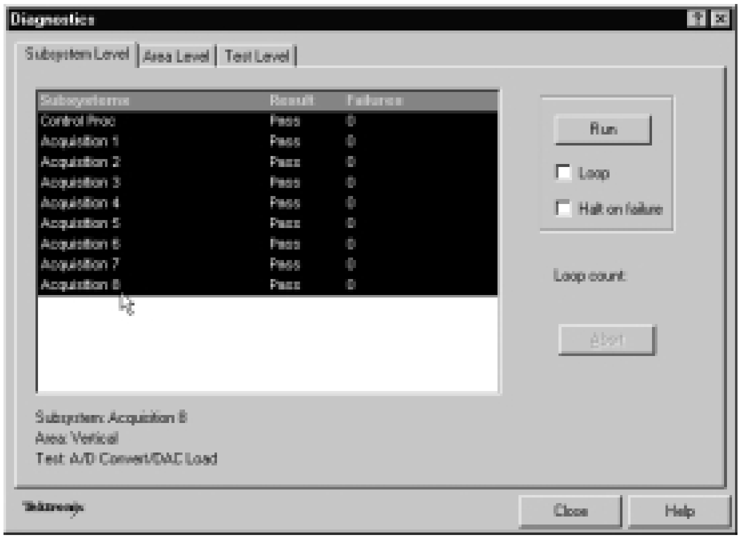
These procedures require little or no test equipment; see the description on page 4–1 for information on when to use these procedures.

Perform the Diagnostics

Do the following steps to run the internal routines that confirm basic functionality and proper adjustment.

Equipment required	None
Prerequisites	First, all sampling modules to be diagnosed must be installed as outlined in their user manuals. Second, power on the instrument and allow a 20 minute warm-up before doing this procedure.

1. *Set up the instrument:* From the application menu bar, select Utilities, and then select Diagnostics. The Diagnostics dialog box displays. See below.



Subsystems	Result	Failures
Control Proc	Pass	0
Acquisition 1	Pass	0
Acquisition 2	Pass	0
Acquisition 3	Pass	0
Acquisition 4	Pass	0
Acquisition 5	Pass	0
Acquisition 6	Pass	0
Acquisition 7	Pass	0
Acquisition 8	Pass	0

Subsystem: Acquisition 8
Area: Vertical
Test: A/D Convert/DAC Load

2. *Select a diagnostics suite:*

  a. In the dialog box, click the Subsytem Level tab.

  b. Select the all the entries by clicking the first entry Control Proc and dragging down to select the rest. All entries should be highlighted as shown above.

  c. In the Run box, leave Loop and Halt on Failure unchecked.

3. *Verify that the diagnostic suite passes:*

  a. Click the Run button to execute the diagnostics.

  b. The diagnostics may take several minutes to complete. Verify that Pass appears as Status in the dialog box when the diagnostics complete.

  c. If instead **a**n error number appears as Status, rerun the diagnostics. If Fail status continues after rerunning compensation and you have allowed warm up to occur, the module or main instrument may need service.

End of Procedure

Perform the Compensation

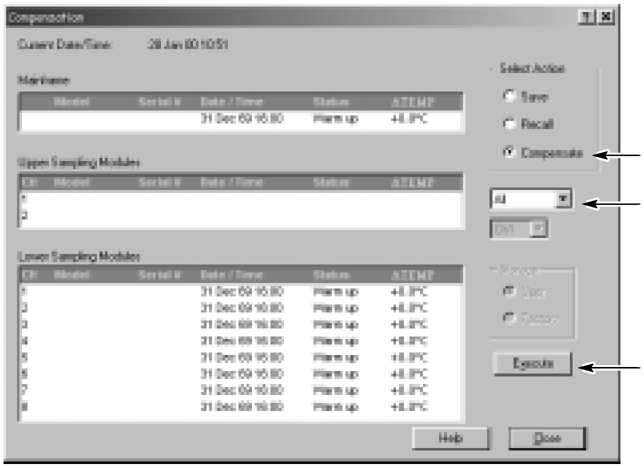
This procedure uses internal routines to verify that the instrument compensates properly.

Equipment required	For electrical sampling modules: ■ 50 ohm terminators, part number 015-1022-xx. (Quantity to match number of electrical channels to compensate.) The sampling modules ship from Tektronix with the 50 ohm terminator installed.
Prerequisites	First, all sampling modules to be diagnosed must be installed as outlined in their user manuals. Second, power on the instrument and allow a 20 minute warm-up before doing this procedure.

1. *Run the compensation routines:*

   a. From the application menu bar, select Utilities, and then select Compensation.

      In the Compensation dialog box, the main instrument (mainframe) and sampling modules are listed. The temperature change from the last compensation is also listed. See Figure 4–1 on page 4–5.



Current Date/Time: 28 Jan 00 10:51

Click to select compensate

Choose all as targets

Click to start compensation

Figure 4–1: Compensation dialog box

b. Wait until the Status for all items you wish to compensate changes from Warm Up to Pass**,** Fail, or **C**omp Req'd.

c. Under Select Action, click the Compensate option button.

d. From the top pulldown list, choose All (default selection) to select the main instrument and all its modules as targets to compensate.

e. Click the Execute button to begin the compensation.

f. Follow the instructions to disconnect inputs and install terminations that will appear on screen; be sure to follow static precautions (see the user manual for your sampling module) when following these instructions.

***NOTE**. Failing to install the 50 ohm terminations on 80E00 sampling-module input connectors can yield erroneous compensation failures or results.*

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2. *Verify that the compensation routines pass:*

a. The compensation may take several minutes to complete. Verify that Pass appears as Status for the main instrument and for all sampling modules listed in the Compensation dialog box when compensation completes.

b. If instead Fail appears as Status, rerun the compensation. If Fail status continues after rerunning compensation and you have allowed warm up to occur, the module or main instrument may need service.

c. If you want to save the compensation constants generated by this compensation, click the Save option button under Select Action. Click the Execute button to save the compensation.

End of Procedure

Perform the Functional Tests

These procedures use the DC CALIBRATION OUTPUT and the INTERNAL CLOCK OUTPUT connectors to further verify that the instrument functions properly. An SMA cable and a 10x attenuator are required to do these test procedures.

The purpose of these procedures is to confirm that the instrument functions properly. The equipment required is intentionally kept to a minimum.

STOP. *These procedures verify functions; that is, they verify that the instrument features operate. They do not verify that they operate within limits; therefore, do not interpret any quantities cited (such as "about five horizontal divisions") as limits.*

STOP. *DO NOT make changes to the front-panel settings that are not called out in the procedures. Each verification procedure will require you to set the instrument to default settings before verifying functions. If you make changes to these settings, other than those called out in the procedure, you may obtain invalid results. In this case, go back to step 1 and repeat the procedure.*

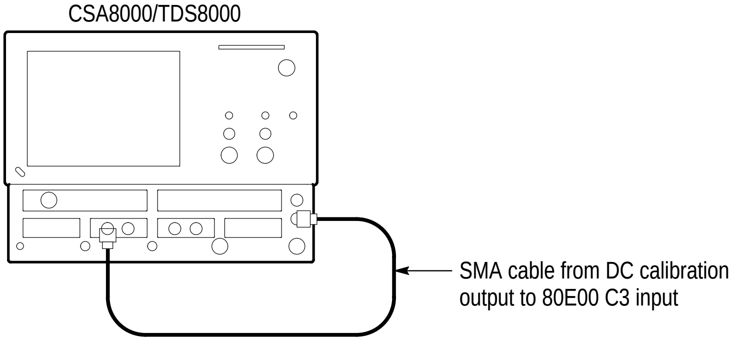
Verify Electrical Input Channels

Install the test hookup and preset the instrument controls:

Equipment required	One SMA cable, such as Tektronix part number 174-1427-00
Prerequisites	At least one electrical (80E00 series) sampling module must be installed as outlined in its user manual.

1. *Initialize the instrument:* Push the front-panel DEFAULT SETUP button.
2. *Set the Trigger System:* In the UI application toolbar, select Internal Clock from the Trig list box as shown below.

3. *Hook up the signal source:* Connect the SMA cable from the DC CALIBRATION output to the channel input that you want to test as shown in Figure 4–2.

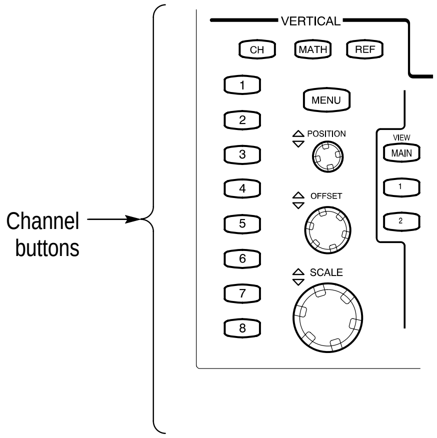


SMA cable from DC calibration output to 80E00 C3 input

Figure 4–2: Hookup for electrical functional tests

4. *Set the DC CALIBRATOR OUTPUT:*
   - **a.** Push the Vertical MENU front-panel button. This displays the Vert Setup dialog box.
   - **b.** Enter a level of 200 mV in the DC CAL box.
   - **c.** Push the Vertical MENU front-panel button again to dismiss the Vert Setup dialog box.

5. *Select the channel to test:* Push the channel button for the channel you want to test. The button lights and the channel display comes on. See Figure 4–3.



Channel buttons

Figure 4–3: Channel button location

6. *Verify that the channel is operational:* Confirm that the following statements are true:

   - The vertical scale readout for the channel under test shows a setting of 100 mV, and a DC level is at about 2 divisions above center screen.
   - The front-panel vertical POSITION knob (for the channel you are testing) moves the DC offset level up and down the screen when rotated. *Return the DC level to 2 divisions above center screen before continuing.*
   - Turning the vertical SCALE knob to 50 mV changes the amplitude of the DC level to about 4 divisions above center screen, and returning the knob to 100 mV returns the amplitude to about 2 divisions.

7. *Verify that the channel acquires in all acquisition modes:* Push the front-panel button Acquisition MENU to display the Acq Setup dialog box. Click each of the three acquisition modes, and confirm that the following statements are true:

   - Sample mode displays an actively acquiring waveform on-screen. (Note that there is a small amount of noise present on the DC level).
   - Average mode displays an actively acquiring waveform on-screen with the noise reduced.
   - Envelope mode displays an actively acquiring waveform on-screen with the upper and lower extremes of the noise displayed.

8. *Test all channels:* Repeat steps 2 through 7 until all input channels are verified.

9. *Remove the test hookup:* Disconnect the SMA cable from the channel input and the DC CALIBRATION output.

Verify Optical Input Channels

This verification is done without an input signal.

Equipment required	None
Prerequisites	At least one optical (80C00 series) sampling module must be installed as outlined in its user manual.

1. *Initialize the instrument:* Push the front-panel DEFAULT SETUP button.

2. *Set the Trigger System:* In the UI application toolbar, select Internal Clock from the Trig list box as shown below.

3. *Select the channel to test:* Push the channel button for the channel you want to test. The button lights amber and the channel displays. See Figure 4–4.

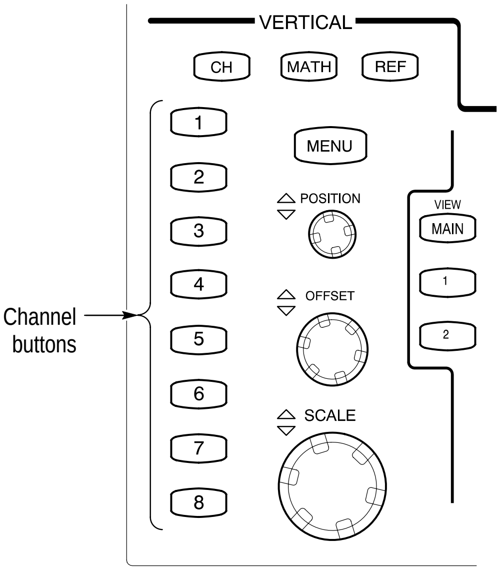


Figure 4–4: Channel button location

4. *Verify that the channel is operational:* Confirm that the following statements are true.

   - The vertical scale readout for the channel under test shows a setting of 1 mW, and a baseline trace at about center screen. See Figure 4–5 on page 4–11.
   - Turning the Vertical OFFSET front-panel knob counterclockwise offsets the baseline towards the bottom of the screen, turning the knob clockwise offsets the baseline towards the top of the screen, and returning the knob to 0.000 offset returns the baseline to center screen.

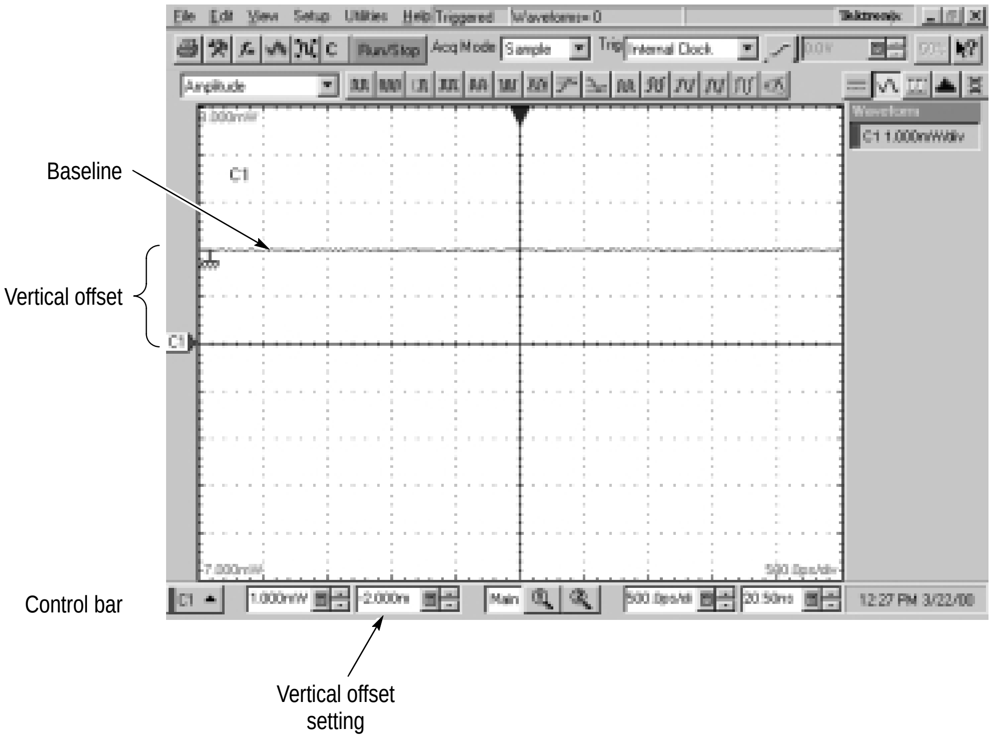


Figure 4–5: Optical channel verification

5. *Verify that the channel acquires in all acquisition modes:* Push the front-panel button Acquisition MENU to display the Acq Setup dialog box. Click each of the three acquisition modes and confirm that the following statements are true:

   - Sample mode displays an actively acquiring waveform on-screen. (Note that there may be a small amount of noise present on the baseline level).
   - Average mode displays an actively acquiring waveform on-screen with any noise present reduced.
   - Envelope mode displays an actively acquiring waveform on-screen with the upper and lower extremes of the noise displayed.

6. *Test all channels:* Repeat steps 3 through 5 until all optical input channels are verified.

Verify the Time Bases Work

After verifying the channels, you can now verify that the time bases function. This verification is done using a front-panel signal.

Equipment required	One SMA cable, such as Tektronix part number 174-1427-00. One 10x SMA attenuator, such as Tektronix 015-1003-00 One electrical (80E00-series) sampling module
Prerequisites	None

1. *Initialize the instrument*: Push the front-panel DEFAULT SETUP button.
2. *Hook up the signal source:* Connect the SMA cable from the Internal Clock output through a 10x attenuator to any 80E00 sampling module input channel as shown in Figure 4–6.

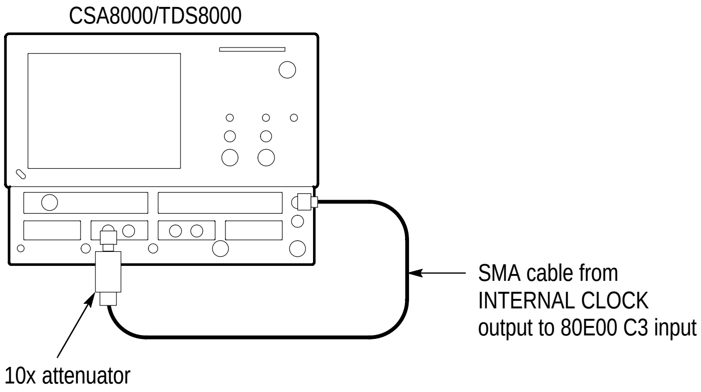


Figure 4–6: Hookup for the time base tests

3. *Set up the instrument:*
   - **a.** Push the Trigger MENU front-panel button to display the Trig Setup dialog box.
   - **b.** Click Internal Clock under Trigger Source in the Trig Setup dialog box. The Internal Clock rate should be set to 200kHz.
   - **c.** Push the Trigger MENU front-panel button again to dismiss the Trig Setup dialog box.
   - **d.** Push the channel button for the channel you connected to in step 2. The button lights and the channel display comes on. See Figure 4–7, page 4–13.
   - **e.** Turn the Vertical SCALE knob to set the vertical scale to 20 mV/div. The channel scale readout is displayed in the Control bar at the bottom of the graticule.

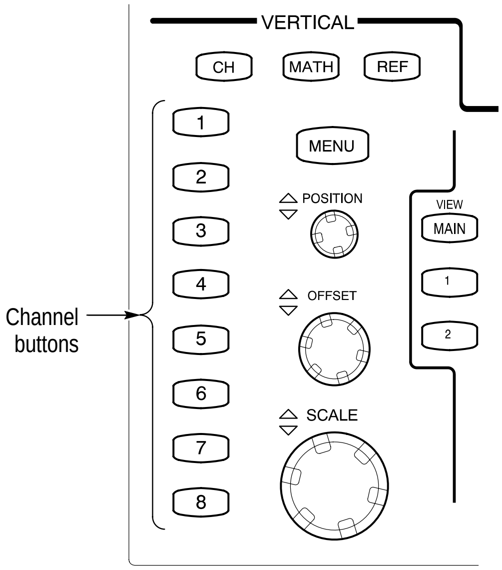


Figure 4–7: Channel button location

4. *Set the time base:* Set the Horizontal SCALE to 1 μs/div. The horizontal scale readout is displayed in the Control bar at the bottom of the graticule.

5. *Verify that the Main time base operates:* Confirm the following statements are true:

   - One period of the internal clock signal (a square wave) is about five horizontal divisions on-screen. See Figure 4–8 on page 4–14.

NOTE. *At some temperatures, there may be extraneous data points beyond the first half cycle when viewing the front-panel Internal Clock output (as is done in this step). This behavior may also occur when viewing multiple cycles in TDR mode. In both cases, this behavior is normal.*

   - Rotating the Horizontal SCALE knob clockwise expands the waveform on-screen (more horizontal divisions per waveform period), counter-clockwise rotation contracts it, and returning the horizontal scale to 1 μs/div returns the period to about five divisions. Leave the time base set to 1 us/div**.**
   - The horizontal POSITION knob positions the signal left and right on-screen when rotated.

NOTE. *The signal will not move past the minimum position setting.*

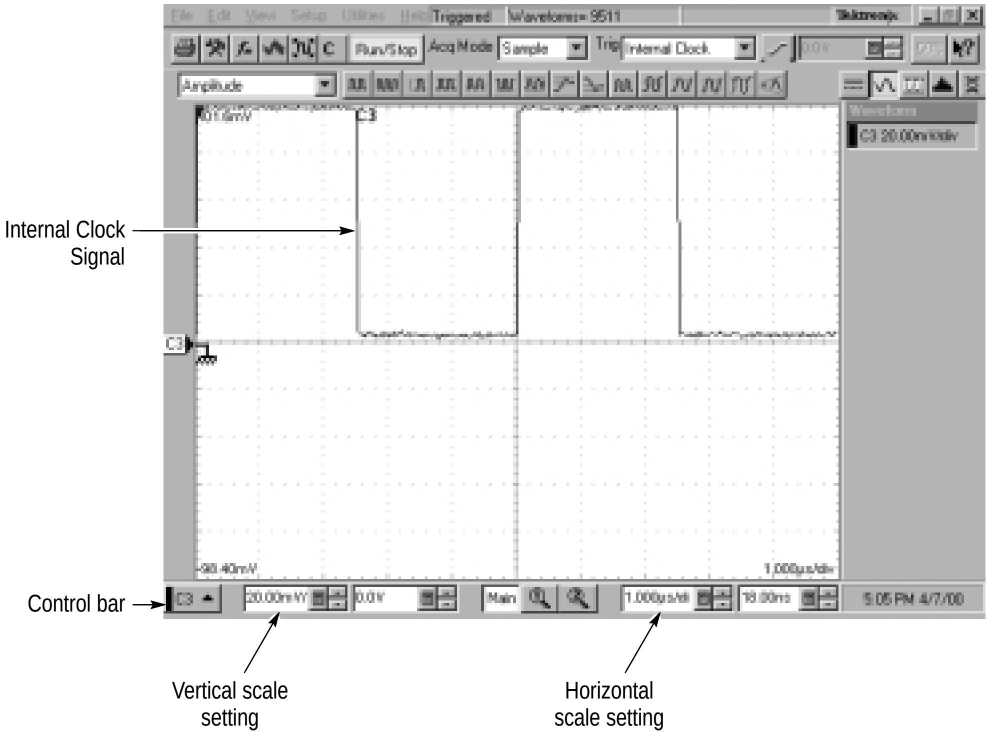


Figure 4–8: Main time base verification

6. *Set up the Mag1 time base:*

   a. Push the Horizontal View MAG1 button on the front panel. The Mag1 time base view will display under the Main time base view.

   b. Set the Horizontal SCALE to 1 μs/div. The horizontal scale readout is displayed in the Control bar at the bottom of the graticule and is now reading out the scale of the Mag1 time base view.

7. *Verify that the Mag1 time base operates:* Confirm the following statements.

   - The brackets on the Main View waveform *(top graticule)* are a full-screen width apart (10-divisions). See Figure 4–9 on page the 4–15.

   - One period of the internal clock signal (a square wave) in the Mag view (*bottom graticule*) is about five horizontal divisions on-screen. (Matches the waveform in the top graticule. See Figure 4–9.

   - Rotating the Horizontal SCALE knob clockwise to 500 ns/div expands the waveform *in the bottom graticule* to double the period (about 10-horizontal divisions per waveform period) and returning the Horizontal SCALE knob to 1 μs/div returns the period to about five divisions. Leave the Horizontal Scale set to 1 us/div**.**

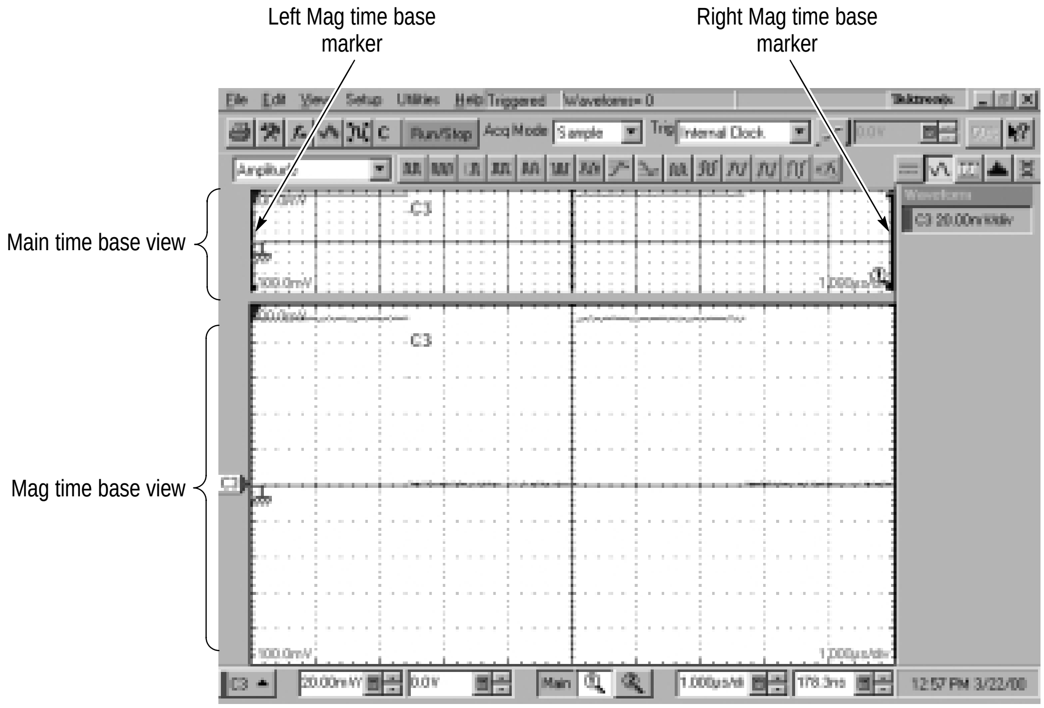


Figure 4–9: Mag time base verification

8. *Verify that the Mag2 time base operates:*
   - **a.** Push the Mag1 button to remove the display of the Mag1 time base.
   - **b.** Perform steps 6 and 7, but use the Mag2 button instead of the Mag1.

End of Functional Test Procedures

Perform the Hardware and Operating System Tests

These procedures verify the instrument hardware functions. A diagnostics program called QAPlus/Win is used to make the verifications. No equipment is required.

QAPlus/WIN

QAPlus/WIN is a comprehensive software application used to check and verify the operation of the PC hardware in the portable mainframe. This procedure use QAPlus/WIN in to run its Quick Test, to verify the instrument hardware. To run QAPlus/WIN, you must have either a working keyboard or a working mouse or other pointing device and have Windows 98 running.

CAUTION. Before running the QAPlus/WIN tests, be aware of the following problems and work-arounds.

- The QAPlus/WIN discrete memory test fails if the system being tested contains more than 16 megabytes of RAM.

  Since your product ships with more than 16 megabytes of RAM, do not run the memory test from the Memory icon. Use the Run Quick Test item from the Tests menu instead, or use the Quick Test icon in the QAPlus/WIN title box.

- The QAPlus/WIN hard drive test may report an incorrect number of tracks and cylinders for your hard drive.

  This is an internal mapping problem, but has no effect on the results of the test. Bad sectors on your hard drive are still found and marked.

- The installation program for QAPlus/WIN stalls at the end of installation.

  To continue after the installation stalls, press CTRL-ALT-DEL, highlight the QAPlus/WIN installation program, and then click End Task.

- The QAPlus/WIN keyboard test does not respond correctly to keys used by Windows 98.

  Keyboards made for use with Windows contain two or three keys specific to that operating system. These are usually located on either side of the space bar. QAPlus/WIN does not trap these keys when performing the keyboard test. Do not press them.

Checking the Cooling Fan Operation

Power on the instrument and visually inspect the left side panel of the instrument to verify that all six cooling fans are rotating.

Equipment required	None
Prerequisites	The instrument must be powered on and running.

Checking the Hardware and Operating System (Optional)

To check the hardware and Windows 98 operation system of this instrument, perform this procedure to run the QAPlus/Win diagnostics from the Windows 98 Start menu.

Equipment required	None
Prerequisites	The instrument must be powered on and warmed up for 20 minutes.

1. Exit the instrument User Interface (UI) application before running the external diagnostics: select Exit in the File menu.
2. Click Start, then click Programs, and then Sykes Diagnostics in the Start Menu. Finally, click QAPlus_Win.
3. Click the Quick Test button to run the diagnostics suite.
    a. Follow any instructions appearing on screen. Ignore nonapplicable tests; for example, ignore any Media tests that check speakers and wav (audio) files.
    b. When testing completes (several minutes) proceed to step 4.
4. Check test results in scrollable results listing in the lower left corner of the QAPlus test window. All tests should pass.
5. Dismiss the QAPlus/Win diagnostics: Select Exit in the File menu.
6. Restart your UI application: Select Program, then the Tektronix TDSCSA8000 User Application, and then the TDSCSA8000 Application in the Windows 98 Start menu.

End of Procedure

Performance Tests

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.

The procedures are arranged in three sections: *Main Instrument*, *Electrical Sampling Modules*, *Optical Sampling Modules*, and the *80A01 Trigger Prescale Limiting Preamplifier Module*. They check all the characteristics that are designated as checked in *Specifications*.

Prerequisites

The tests in this section comprise an extensive, valid confirmation of performance and functionality when the following requirements are met:

- The cabinet must be installed on the instrument.
- You must have performed and passed the procedure *Perform the Diagnostics*, found on page 4–3, and the procedure *Perform the Functional Tests*, found on page 4–7.
- A compensation must have been done within the recommended calibration interval and at a temperature within ±2° C of the present operating temperature. (If, at the time you did the procedures *Perform the Diagnostics* and *Perform the Functional Tests*, you also did the *Perform the Compensation procedure (page 4–5)* consider this prerequisite met).
- The instrument must have been last adjusted at an ambient temperature between +20° C and +30° C, must have been operating for a warm-up period of at least 20 minutes, and must be operating at an ambient temperatures as follows.

These procedures cover all instrument models. Please disregard checks that do not apply to the specific model you are testing.

Equipment Required

Procedures starting on page 4–33 use external, traceable signal sources to directly check warranted characteristics. Table 4–1 lists the required equipment.

Table 4–1: Equipment Required

Item number and description	Minimum requirements	Part number or model
1. Digital multimeter	Four wire ohm meter. <0.25% accuracy for volt and ohm measurements	Keithley 2000-20
2. DC power supply	Variable amplitude to ±104 V; accuracy to 0.1%	Data Precision 8200
3. Calibration step generator	Calibration fixture, sampling module cal unit	Tektronix part number 067-1338-0X
4. Terminator, cap	Shorting, 34 GHz, precision 3.5 mm, female	Tektronix part number 011-0150-00
5. Cable, delay, coaxial	Coaxial cable, 50 Ω., 500 ps, with 3.5 mm, male each end, 6.0 inch length	Tektronix part number 015-0564-00
6. Airline (80E04 only)	50 Ω, airline	Maury Microwave model number 8042D
7. Terminator	50 Ω, coaxial terminator, K male	Anritsu-Wiltron 28K50
8. Adapter	SMA “T” 1 male to 2 SMA female	Tektronix part number 015-1016-00
9. Power divider	50 Ω, 3 SMA female connectors	Tektronix Part number 015-0565-00
10. Cable, coaxial (2 each)	50 Ω, 20 in (0.5m), male-to-male SMA connectors	Tektronix Part number 174-1427-00
11. Cable, coaxial	50 Ω, 39.37 in (1.0m), male-to-male SMA connectors 50 Ω, 60 in (1.5m), male-to-male SMA connectors	Tektronix Part number 174-1341-00 Tektronix Part number 174-1428-00
12. Terminator, cap	Cap, short circuit 3.5 mm, SMA male	Tektronix Part number 015-1020-01
13. Synthesized signal generator	Signal generator 50 MHz to 50 GHz	Anritsu-Wiltron 69187B
14. Power meter (80E01 only)	Power meter	Anritsu-Wilton ML2437A
15. Power sensor (80E01 only)	Power sensor w/attached cable	Anritsu-Wilton ML2425A
16. Adapter (80E01 only)	2.4 mm, male-to-male connectors	HP11900A
17. Adapter (80E01 only)	2.4 mm, female-to-female connectors	HP11900B
18. Adapter (2 each)	SMA female to BNC male connectors	Tektronix Part number 015-0572-00
19. Adapter (2 each)	BNC to dual banana plugs	Tektronix Part number 103-0090-00
20. Attenuator (80E01 only)	10 dB, female to male SMA connectors	HP8490D w/option 10
21. Cable, special (80E01 only)	Phase and power stability	Gore-Tex FE0BM0BM025.0
22. Attenuator	2X attenuator 50 Ω, SMA connectors	Tektronix Part number 015-1001-00
23. Sampling module	Tektronix 80C02 Sampling Module	Tektronix 80C02 Sampling Module
24. Optical attenuator, variable	Single-mode input and output, 0 to 60 dB	Tektronix OA5002
25. Optical Impulser	1550 nm impulse	Calmar FPL-01 Optical Impulser
26. Laser transmitter	2.5 Gb/s SONET/SDH laser transmitter	JDS Uniphase Model 420B
27. Pulse pattern generator	>10 Gb/s pulse pattern generator	Advantest D3186 12 Gb/s Pulse Pattern Generator
28. Attenuator, optical	30mm, 10 dB, single-mode, FC to FC, female to male	Tektronix part number 119-5118-00
29. Cable, delay, coaxial	Coaxial cable, 50 Ω., 2 ns delay, with SMA male each end	Tektronix part number 015-0560-00

Table 4–1: Equipment Required (Cont.)

Item number and description	Minimum requirements	Part number or model
30. Cable, fiber-optic Qt.2	Single-mode, 2 m, FC/PC to FC/PC	Tektronix part number 174-1910-00
31. Cable, coaxial (80A01 only)Qt. 2	50 Ω, 4 ns delay, with SMA male at each end	Tektronix Part number 015-0561-00
32. Cable, coaxial (80A01 only)	50 Ω, 1 ns delay, with SMA male at each end	Tektronix Part number 015-0562-00

CSA8000/TDS8000 Test Records

This section contains test records that you can use to record the outcome of your performance verification checks. Four records exist:

TDS/CSA8000 Main Instrument	Checks the main frame
80E00 Electrical Sampling Modules	Checks all supported models of electrical sampling modules
80C00 Optical Sampling Modules	Checks all supported models of optical sampling modules
80A01 Trigger Prescale Limiting Preamplifier Module	Checks the module listed left.

Do not enter values into these records; rather make copies of the records and enter test results on the copies.

The test records provide entries for all checks found in the *Performance Tests* procedures.

CSA8000/TDS8000 Main-Instrument Test Record

For each channel tested, photocopy this page, and record the performance test results for your CSA8000/TDS8000 main-instrument test record.

CSA8000/TDS8000 Test Record Channel:____.

Instrument Model:__________ ☐ CSA8000 ☐ TDS8000
Instrument Serial Number: ________________ Certificate Number: ________________
Date of Calibration: ________________ Technician: ________________

Performance Test			**Minimum**	**Incoming**	**Outgoing**	**Maximum**
Time interval accuracy, short term optimized mode						
Horizontal Position	Set to:	19 ns	0.991 ns	________	________	1.009 ns
		100 ns	0.991 ns	________	________	1.009 ns
		1 µs	0.991 ns	________	________	1.009 ns
Time interval accuracy, locked to internal 10 MHz reference mode						
Horizontal Position	Set to:	19 ns	0.9919 ns	________	________	1.0081 ns
		100 ns	0.9919 ns	________	________	1.0081 ns
		1 µs	0.9919 ns	________	________	1.0081 ns
External direct trigger delay jitter, short term optimized mode						
Horizontal Position	Set to:	19 ns	none	________	________	1.5 ps
		100 ns	none	________	________	2.5 ps
		1 µs	none	________	________	11.5 ps
External direct delay jitter, locked to internal 10 MHz reference mode						
Horizontal Position	Set to:	19 ns	none	________	________	2.5s
		100 ns	none	________	________	2.51 ps
		1 µs	none	________	________	2.6 ps
External prescaled trigger delay jitter, Short term optimized mode						
Horizontal Scale	Set to:	20 ps	none	________	________	1.5 ps
External prescaled delay jitter, locked to internal 10 MHz reference mode						
Horizontal Scale	Set to:	20 ps	none	________	________	2.5 ps

80E00 Electrical Modules Test Record

Photocopy this and the next three pages, and use them to record the performance test results for your 80E00 Test Record.

Note that the designations C1 and C2 (channel 1/channel 2) in the test record may become C3/C4, C5/C6, or C7/CH8, depending on which compartment in the main instrument the module is installed.

80E00 Test Record

Module Model: ☐ 80E01 ☐ 80E02 ☐ 80E03 ☐ 80E04
Module Serial Number: ____________________ Certificate Number: ____________________
Date of Calibration: ____________________ Technician: ____________________

Performance Test		Minimum	Incoming	Outgoing	Maximum
Input Impedance					
C1	Impedance	49.5 Ω			50.5 Ω
	Baseline (80E04 only)	–1 mV			1 mV
C2	Impedance	49.5 Ω			50.5 Ω
	Baseline (80E04 only)	–1 mV			1 mV
DC Voltage accuracy, single point, within ± 5°C of compensated temperature					
C1 @ 100 mV/diV	Input level:				
Offset = –1100 mV	–1550 mV	– 18.7 mV			+ 18.7 mV
Offset = –1100 mV	–1350 mV	– 14.7 mV			+ 14.7 mV
Offset = –1100 mV	–1100 mV	– 9.7 mV			+ 9.7 mV
Offset = –1100 mV	–850 mV	– 14.7 mV			+14.7 mV
Offset = –1100 mV	–650 mV	– 18.7 mV			+ 18.7 mV
Offset = 0 mV	–450 mV	– 11 mV			+ 11 mV
Offset = 0 mV	–250 mV	– 7 mV			+ 7 mV
Offset = 0 mV	0 mV	– 2 mV			+ 2 mV
Offset = 0 mV	+250 mV	– 7 mV			+ 7 mV
Offset = 0 mV	+450 mV	– 11 mV			+ 11 mV
Offset = +1100 mV	+650 mV	– 18.7 mV			+ 18.7 mV
Offset = +1100 mV	+850 mV	– 14.7 mV			+ 14.7 mV
Offset = +1100 mV	+1100 mV	– 9.7 mV			+ 9.7 mV
Offset = +1100 mV	+1350 mV	– 14.7 mV			+ 14.7 mV
Offset = +1100 mV	+1550 mV	– 18.7 mV			+ 18.7 mV

80E00 Test Record (Cont.)

Performance Test		Minimum	Incoming	Outgoing	Maximum
C2 @ 100 mV/diV	Input level:				
Offset = –1100 mV	–1550 mV	– 18.7 mV			+ 18.7 mV
Offset = –1100 mV	–1350 mV	– 14.7 mV			+ 14.7 mV
Offset = –1100 mV	–1100 mV	– 9.7 mV			+ 9.7 mV
Offset = –1100 mV	–850 mV	– 14.7 mV			+14.7 mV
Offset = –1100 mV	–650 mV	– 18.7 mV			+ 18.7 mV
Offset = 0 mV	–450 mV	– 11 mV			+ 11 mV
Offset = 0 mV	–250 mV	– 7 mV			+ 7 mV
Offset = 0 mV	0 mV	– 2 mV			+ 2 mV
Offset = 0 mV	+250 mV	– 7 mV			+ 7 mV
Offset = 0 mV	+450 mV	– 11 mV			+ 11 mV
Offset = +1100 mV	+650 mV	– 18.7 mV			+ 18.7 mV
Offset = +1100 mV	+850 mV	– 14.7 mV			+ 14.7 mV
Offset = +1100 mV	+1100 mV	– 9.7 mV			+ 9.7 mV
Offset = +1100 mV	+1350 mV	– 14.7 mV			+ 14.7 mV
Offset = +1100 mV	+1550 mV	– 18.7 mV			+ 18.7 mV
DC Vertical Voltage deviation from linear least squares fit					
C1; Set the V_{in}	–450 mV	–10 mV			+10 mV
	–350 mV	–10 mV			+10 mV
	–250 mV	–10 mV			+10 mV
	–150 mV	–10 mV			+10 mV
	–50 mV	–10 mV			+10 mV
	+50 mV	–10 mV			+10 mV
	+150 mV	–10 mV			+10 mV
	+250 mV	–10 mV			+10 mV
	+350 mV	–10 mV			+10 mV
	+450 mV	–10 mV			+10 mV
DC Vertical Voltage deviation from linear least squares fit					
C2; Set the V_{in}	–450 mV	–10 mV			+10 mV
	–350 mV	–10 mV			+10 mV
	–250 mV	–10 mV			+10 mV
	–150 mV	–10 mV			+10 mV
	–50 mV	–10 mV			+10 mV
	+50 mV	–10 mV			+10 mV
	+150 mV	–10 mV			+10 mV
	+250 mV	–10 mV			+10 mV
	+350 mV	–10 mV			+10 mV
	+450 mV	–10 mV			+10 mV
Rise time					
C1 Model:	80E02	none			28 ps
	80E03, 80E04[1]	none			17.5 ps
C2 Model:	80E02	none			28 ps
	80E03, 80E04[1]	none			17.5 ps

80E00 Test Record (Cont.)

Performance Test	Minimum	Incoming	Outgoing	Maximum
Analog Bandwidth (80E01)				
C1 Max power (50 MHz ref)	none	____________	____________	+3 dB
Min power (50 MHz ref)	none	____________	____________	–3 dB
Random Noise Displayed				
C1 Vert scale: 2 mV (80E01)	none	____________	____________	2.3 mV
1 mV (80E02)	none	____________	____________	800 µV
1 mV (80E03 & 80E04)	none	____________	____________	1.2 mV
C2 Vert scale: 1 mV (80E02)	none	____________	____________	800 µV
1 mV (80E03 & 80E04)	none	____________	____________	1.2 mV
TDR system reflected rise time (80E04 models only)				
C1 TDR Polarity: set to +	none	____________	____________	35 ps
set to –	none	____________	____________	35 ps
C2 TDR Polarity: set to +	none	____________	____________	35 ps
set to –	none	____________	____________	35 ps
TDR system step response aberrations (80E04 models only)				
C1 positive polarity				
zone: from –10 ns to –20 ps[2]	– 3%	____________	____________	+ 3%
from 400 ps to 5 ns[3]	– 3%	____________	____________	+ 3%
from 5 ns on[3]	– 1%	____________	____________	+ 1%
C1 negative polarity				
zone: from –10 ns to –20 ps[2]	– 3%	____________	____________	+ 3%
from 400 ps to 5 ns[3]	– 3%	____________	____________	+ 3%
from 5 ns on[3]	– 1%	____________	____________	+ 1%
C2 positive polarity				
zone: from –10 ns to –20 ps[2]	– 3%	____________	____________	+ 3%
from 400 ps to 5 ns[3]	– 3%	____________	____________	+ 3%
from 5 ns on[3]	– 1%	____________	____________	+ 1%
C2 negative polarity				
zone: from –10 ns to –20 ps[2]	– 3%	____________	____________	+ 3%
from 400 ps to 5 ns[3]	– 3%	____________	____________	+ 3%
from 5 ns on[3]	– 1%	____________	____________	+ 1%

[1] The rise time of the 80E03, 80E03, and 80E04 module is computed from the measured rise time. See the procedure.

[2] Before step transition.

[3] After step transition.

80C00 Optical Modules Test Record

Photocopy this and the next three pages, and use them to record the performance test results for your 80C00 Test Record.

80C00 Test Record

Module Model: ☐ 80C01 ☐ 80C02 ☐ 80C03

Module Serial Number: ____________ Certificate Number: ____________

Temperature: ____________ RH %: ____________

Date of Calibration: ____________ Technician: ____________

Incoming	Performance Test		Minimum	Incoming	Outgoing	Maximum
Dark level						
C1 at 100 µW	80C01	OC-12/STM-4	–10 µW			+10 µW
		OC-48/STM-16	–10 µW			+10 µW
		OC-192/STM-64	–10 µW			+10 µW
		12.5 GHz	–10 µW			+10 µW
		20 GHz	–10 µW			+10 µW
	80C02,	OC-192/STM-64	–10 µW			+10 µW
		12.5 GHz	–10 µW			+10 µW
		20 GHz	–10 µW			+10 µW
		30 GHz	–10 µW			+10 µW
	80C04	OC–192/STM-64	–10 µW			+10 µW
		FEC10664	–10 µW			+10 µW
		20 GHz	–10 µW			+10 µW
		30 GHz	–10 µW			+10 µW
C1 at 5 µW	80C03	FC1063	–500 µW			+500 nW
		GBE	–500 µW			+500 nW
		OC-48/STM-16	–500 µW			+500 nW
C1 at 100 µW	80C05	OC-12/STM-4	–10 µW			+10 µW
		20 GHz	–30 µW			+30 µW
		30 GHz	–30 µW			+30 µW
		40 GHz	–30 µW			+30 µW
C1 at 200 µW	80C06	50 GHz	–25 µW			+25 µW

80C00 Test Record (Cont.)

Incoming	Performance Test		Minimum	Incoming	Outgoing	Maximum
Vertical equivalent optical noise						
C1 at 100 µW	80C01	OC-12/STM-4	none	__________	__________	12 μW_{rms}
		Clock Recovery	none	__________	__________	15 μW_{rms}
		OC-48/STM-16	none	__________	__________	12 μW_{rms}
		Clock Recovery	none	__________	__________	15 μW_{rms}
		OC-192/STM-64	none	__________	__________	12 μW_{rms}
		Clock Recovery	none	__________	__________	15 μW_{rms}
		12.5 GHz	none	__________	__________	12 μW_{rms}
		Clock Recovery	none	__________	__________	15 μW_{rms}
		20 GHz	none	__________	__________	25 μW_{rms}
		Clock Recovery	none	__________	__________	25 μW_{rms}
	80C02	OC-192/STM-64	none	__________	__________	10 μW_{rms}
		Clock Recovery	none	__________	__________	12 μW_{rms}
		12.5 GHz	none	__________	__________	10 μW_{rms}
		Clock Recovery	none	__________	__________	12 μW_{rms}
		20 GHz	none	__________	__________	15 μW_{rms}
		Clock Recovery	none	__________	__________	20 μW_{rms}
		30 GHz	none	__________	__________	30 μW_{rms}
		Clock Recovery	none	__________	__________	40 μW_{rms}
	80C04	OC–192/STM-64	none	__________	__________	10 μW_{rms}
		Clock Recovery	none	__________	__________	12 μW_{rms}
		FEC10664	none	__________	__________	10 μW_{rms}
		Clock Recovery	none	__________	__________	12 μW_{rms}
		20 GHz	none	__________	__________	15 μW_{rms}
		Clock Recovery	none	__________	__________	20 μW_{rms}
		30 GHz	none	__________	__________	30 μW_{rms}
		Clock Recovery	none	__________	__________	40 μW_{rms}
C1 at 5 µW	80C03	FC1063	none	__________	__________	1 μW_{rms}
		Clock Recovery	none	__________	__________	1 μW_{rms}
		GBE	none	__________	__________	1 μW_{rms}
		Clock Recovery	none	__________	__________	1 μW_{rms}
		OC-48/STM-16	none	__________	__________	1.5 μW_{rms}
		Clock Recovery	none	__________	__________	1.5 μW_{rms}
C1 at 100 µW	80C05	OC-192/STM-64	none	__________	__________	15 μW_{rms}
		Clock Recovery	none	__________	__________	15 μW_{rms}
		20 GHz	none	__________	__________	25 μW_{rms}
		Clock Recovery	none	__________	__________	25 μW_{rms}
		30 GHz	none	__________	__________	35 μW_{rms}
		Clock Recovery	none	__________	__________	35 μW_{rms}
		40 GHz	none	__________	__________	70 μW_{rms}
		Clock Recovery	none	__________	__________	70 μW_{rms}
C1 at 200 µW	80C06	50 GHz	none	__________	__________	192 μW_{rms}
		Clock Recovery	none	__________	__________	192 μW_{rms}

80C00 Test Record (Cont.)

Incoming	Performance Test	Minimum	Incoming	Outgoing	Maximum
Minimum Optical bandwidth					
80C01	Bandwidth Setting: 20 GHz	20 GHz	______	______	none
	12.5 GHz	12.5 GHz	______	______	none
80C02	30 GHz	28 GHz	______	______	none
	20 GHz	20 GHz	______	______	none
	>12.5 GHz	12.5 GHz	______	______	none
80C04	30 GHz	28 GHz	______	______	none
	20 GHz	20 GHz	______	______	none
80C05	Bandwidth Setting: 40 GHz	40 GHz	______	______	none
	30 GHz	30 GHz	______	______	none
	20 GHz	20 GHz	______	______	none
*OC-12/STM-4 622 Mb/s Reference Receiver setting frequency response (**80C01** module only)*					
Frequency (MHz): 0.000	Nominal response (dB): 0.00	–0.50	______	______	0.50
93.3	–0.11	–0.61	______	______	0.39
186.6	–0.45	–0.95	______	______	0.05
279.9	–1.02	–1.52	______	______	–0.52
373.2	–1.86	–2.36	______	______	–1.36
466.7	–3.00	–3.50	______	______	–2.50
559.9	–4.51	–5.67	______	______	–3.35
622.1	–5.71	–7.25	______	______	–4.17
653.2	–6.37	–8.08	______	______	–4.66
746.5	–8.54	–10.74	______	______	–6.35
839.8	–10.93	–13.55	______	______	–8.31
933.1	–13.41	–16.41	______	______	–10.41
1244.2	–21.45	–26.11	______	______	–16.78
*OC48/STM-16 2.488 Gb/s Reference Receiver setting frequency response (**80C01** and **80C03** modules only)*					
Frequency (MHz): 0.000	Nominal response (dB): 0.00	–0.50	______	______	0.50
373.3	–0.11	–0.61	______	______	0.39
746.5	–0.45	–0.95	______	______	0.05
1119.7	–1.02	–1.52	______	______	–0.52
1493.1	–1.86	–2.36	______	______	–1.36
1866.3	–3.00	–3.50	______	______	–2.50
2239.5	–4.51	–5.67	______	______	–3.35
2488.3	–5.71	–7.25	______	______	–4.17
2612.8	–6.37	–8.08	______	______	–4.66
2986.0	–8.54	–10.74	______	______	–6.35
3359.3	–10.93	–13.55	______	______	–8.31
3732.6	–13.41	–16.41	______	______	–10.41
4976.7	–21.45	–26.11	______	______	–16.78

80C00 Test Record (Cont.)

Incoming	Performance Test	Minimum	Incoming	Outgoing	Maximum
*OC192/STM-64 9.953 Gb/s Reference Receiver setting frequency response (**80C01**, **80C02, and 80C04 or 80C05** modules only)*					
Frequency (MHz): 0.000	Nominal response (dB): 0.00	–0.85			0.85
1493.2	–0.11	–0.96			+0.74
2986.0	–0.45	–1.30			+0.40
4478.8	–1.02	–1.87			+0.17
5972.4	–1.86	–2.71			–1.01
7465.0	–3.00	–3.86			–2.16
8958.0	–4.51	–6.19			–2.83
9953.28	–5.71	–7.87			–3.55
10451.2	–6.37	–8.75			–3.99
11944.0	–8.54	–11.53			–5.56
13437.2	–10.93	–14.45			–7.41
14930.4	–13.41	–17.41			–9.41
*FC10664 Reference Receiver setting frequency response (**80C04** module only)*					
Frequency (MHz): 0.000	Nominal response (dB) 0.00	–0.85			0.85
1493.2	–0.11	–0.96			+0.74
2986.0	–0.45	–1.30			+0.40
4478.8	–1.02	–1.87			+0.17
5972.4	–1.86	–2.71			–1.01
7465.0	–3.00	–3.86			–2.16
8958.0	–4.51	–6.19			–2.83
9953.28	–5.71	–7.87			–3.55
10451.2	–6.37	–8.75			–3.99
11944.0	–8.54	–11.53			–5.56
13437.2	–10.93	–14.45			–7.41
14930.4	–13.41	–17.41			–9.41
*2.50 Gb/s (2X GBE) Reference Receiver setting frequency response (**80C03** only)*					
Frequency (MHz): 0.000	Nominal response (dB): 0.00	–0.50			0.50
375	–0.11	–0.61			0.39
750	–0.45	–0.95			0.05
1125	–1.02	–1.52			–0.52
1500	–1.86	–2.36			–1.36
1875	–3.00	–3.50			–2.50
2250	–4.51	–5.67			–3.35
2500	–5.71	–7.25			–4.17
2625	–6.37	–8.08			–4.66
3000	–8.54	–10.74			–6.35
3375	–10.93	–13.55			–8.31
3750	–13.41	–16.41			–10.41
5000	–21.45	–26.11			–16.78

80C00 Test Record (Cont.)

Incoming	Performance Test	Minimum	Incoming	Outgoing	Maximum
*GBE (1.25 Gb/s) Reference Receiver setting frequency response (**80C03** module only)*					
Frequency (MHz): 0.000	Nominal response (dB) 0.00	–0.50			0.50
187.5	–0.11	–0.61			0.39
375	–0.45	–0.95			0.05
562.5	–1.02	–1.52			–0.52
750	–1.86	–2.36			–1.36
937.5	–3.00	–3.50			–2.50
1125	–4.51	–5.67			–3.35
1250	–5.71	–7.25			–4.17
1312.5	–6.37	–8.08			–4.66
1500	–8.54	–10.74			–6.35
1687.5	–10.93	–13.55			–8.31
1875	–13.41	–16.41			–10.41
2500	–21.45	–26.11			–16.78
*FC1063 (1.0625 Gb/s) Reference Receiver setting frequency response (**80C03** module only)*					
Frequency (MHz): 0.000	Nominal response (dB) 0.00	–0.50			0.50
159.5	–0.11	–0.61			0.39
318.9	–0.45	–0.95			0.05
478.4	–1.02	–1.52			–0.52
637.9	–1.86	–2.36			–1.36
797.4	–3.00	–3.50			–2.50
956.8	–4.51	–5.67			–3.35
1063	–5.71	–7.25			–4.17
1116	–6.37	–8.08			–4.66
1275	–8.54	–10.74			–6.35
1435	–10.93	–13.55			–8.31
1595	–13.41	–16.41			–10.41
2126	–21.45	–26.11			–16.78
Recovered clock timing jitter					
80C01–CR Rate: OC-12	Hor Scale: 500 ps	none			8 ps RMS
OC-48	100 ps	none			8 ps RMS
80C03–CR Rate: FC-1063	Hor Scale: 200 ps	none			8 ps RMS
GBE	200 ps	none			8 ps RMS
OC-48	100 ps	none			8 ps RMS
2.5 GB/s	100 ps	none			8 ps RMS

Main Instrument

These procedures check those characteristics that relate to the main instrument (system) that are listed as checked under *System* in *Specifications*. Refer to Table 1–1 on page 1–1.

Prerequisites

Be sure you have performed the *Prerequisites* on page 4–19 before doing any procedures in this section.

NOTE. *Use a torque wrench when connecting the terminators, adapters, attenuator, and power sensor in this setup. Use 8 ±0.3 inch pounds of torque.*

NOTE. *To perform the* External direct trigger delay jitter, short-term optimized and locked to internal 10 MHz reference modes *procedure you must upgrade to product software version 1.2.43 or higher. (Upgrade 1.2.43 is available as a download). You can determine the software version of the instrument under test by selecting About TDS/CSA8000 in the Help menu on screen. For upgrade information see "Contacting Tektronix" on page xvii.*

STOP. *Throughout these procedures, when steps call for the display of setup dialog boxes, you can display them from the Setup menu in the menu bar at the top of the screen. These procedures assume you will display and dismiss the setup dialog boxes as needed.*

Time interval accuracy, short-term optimized and locked-to-internal 10-MHz reference modes

Equipment required	Synthesized signal generator (Item 13) 0.5 meter precision SMA cable (Item 10) 1.0 meter precision SMA cable (Item 11) Power divider (Item 9) 80E0X sampling module
Prerequisites	As listed on page 4–19 and under *Prerequisites* on page 4–34.

Setup Install the test hookup:

1. Install the 80E0X module into the left-most small module compartment of the TDS8000 or CSA8000 instrument (see Figure 4–10 on page 4–34).
2. Connect the synthesized signal generator to a 1.0 meter cable.
3. Connect the remaining end of the 1.0 meter cable to a SMA power divider. Connect two 0.5 meter cables to the two remaining SMA power divider connectors.
4. Connect one of the 0.5 meter cables to Channel 1 of the 80E0X module. Connect the remaining 0.5 meter cable to the TRIGGER DIRECT INPUT.

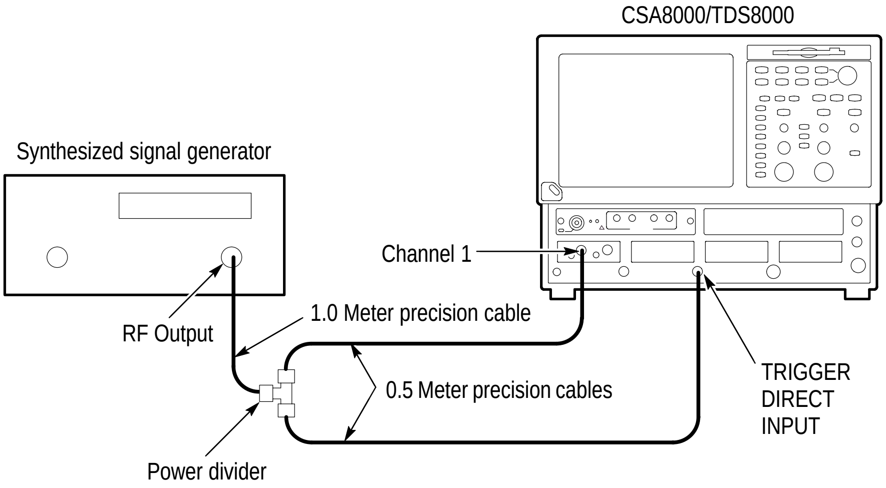


Figure 4–10: Time interval accuracy test hookup

5. Set the synthesized signal generator frequency to 1 GHz.
6. Set the Synthesized output to 800 mV peak to peak (400 mV displayed)

7. Set up the CSA8000/TDS8000 as follows:
   - **a.** Select Default Setup from the Utilities menu on the menu bar at top of display.
   - **b.** Select C1 from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
   - **c.** In the Trig Setup dialog box:
     - select External Direct.
     - select Metastablility Reject.
     - select Auto Mode.
   - **d.** In the Vert Setup dialog box:
     - set Scale to 100 mV/division.
     - set Offset to 0.
   - **e.** In the Horz Setup dialog box:
     - set Scale to 200 ps/division.
     - set Horizontal Reference to 0%.
     - set Position to 19 ns.
     - set All Timebases Mode to Short Term Jitter.
   - **f.** In the Acq Setup dialog box, set Acquisition Mode to Average.

Test: Follow this procedure to make the time internal accuracy check:

1. In the Meas Setup dialog box:
   - **a.** for the following measurements make sure the channel under test is selected in the Source menu.
   - **b.** select Meas 1, and then choose Select Meas > Amplitude > Amplitude.
   - **c.** select Meas 2, and then choose Select Meas > Timing > Period.
2. Adjust the synthesizer signal generator level until the amplitude measurement readout on the instrument screen indicates the amplitude is 400 mV.
3. Verify the period measurement readout indicates the period is 1 ns ±9 ps.
4. In the Horz Setup dialog box, set All Timebases Mode to Lock to Int. 10 MHz.

5. Verify the period measurement readout indicates the period is 1 ns ±8.1 ps.
6. In the Horz Setup dialog box: set All Timebases Mode to Lock to Short Term Jitter.
7. Set the Horizontal Position to 100 ns, and then repeat steps 3 through 6.
8. Set the Horizontal Position to 1μs, and then repeat steps 3 through 6.
9. Repeat the setup (from step 7e) and the test for all channels for all 80E00 series modules installed.

End of Procedure

External direct trigger level accuracy

These procedures check those characteristics that relate to the system trigger and are listed as checked under *Warranted Characteristics* in *Specifications.* Refer to Table 1–3 on page 1–3.

Equipment required	Synthesized signal generator (Item 13) 0.5 meter precision SMA cable (Item 10) 1.0 meter precision SMA cable (Item 11) Power divider (Item 9) 80E0X sampling module
Prerequisites	As listed on page 4–19 and under *Prerequisites* on page 4–34.

Setup

Install the test hookup:

1. Install the 80E0X module into the left-most small module compartment of the TDS8000 or CSA8000 instrument (see Figure 4–11 on page 4–37).
2. Connect the synthesized signal generator to a 1.0 meter cable.
3. Connect the remaining end of the 1.0 meter cable to a SMA power divider. Connect two 0.5 meter cables to the two remaining SMA power divider connectors.
4. Connect one of the 0.5 meter cables to Channel 1 of the 80E0X module. Connect the remaining 0.5 meter cable to the TRIGGER DIRECT INPUT.

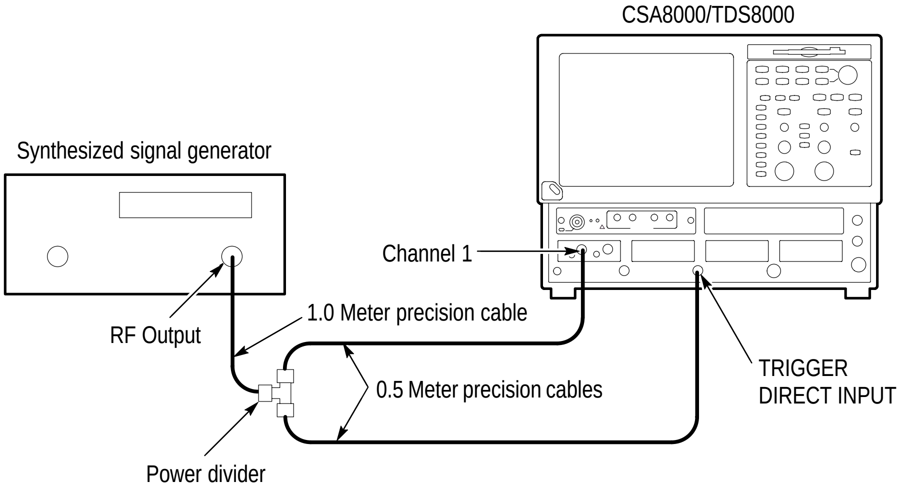


Figure 4–11: External direct trigger test hookup

5. Set the synthesized signal generator frequency to 2.5 GHz (400 ps period).

6. Set the synthesized output to 1600 mV peak-to-peak (800 mV displayed).
7. Set up the CSA8000/TDS8000 as follows:
    - a. Select Default Setup from the Utilities menu on the menu bar at top of display.
    - b. Select C1 from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
    - c. In the Trig Setup dialog box:
        - select External Direct.
        - select Metastablility Reject.
        - select Auto Mode.
    - d. In the Vert Setup dialog box:
        - set Scale to 100 mV/division.
        - set Offset to 0.
    - e. In the Horz Setup dialog box:
        - set Scale to 200 ps/division.
        - set Horizontal Reference to 0%.
        - set Position to 19 ns.
        - set All Timebases Mode to Short Term Jitter.

Test: Follow this procedure to make the direct trigger level accuracy check:

1. In the Meas Setup dialog box:
    - a. make sure the channel under test is selected in the Source menu.
    - b. select Meas 1, and then choose Select Meas > Amplitude > Amplitude.
2. Adjust the synthesizer signal generator level until the amplitude measurement readout on the instrument screen indicates the amplitude is 800 mV.

***NOTE**. A stable trigger is one that is consistent; that is, one that results in a uniform, regular display triggered on the selected slope (positive or negative). This display should not have its trigger point switching between opposite slopes, nor should it roll across the screen. The following step represents approximately 180° phase shift. Verify that the trigger is operating (stable).*

---

3. Set the slope to negative and verify the trigger is operating and that the waveform position changes by 150 ps to 250 ps.
4. Set the slope back to positive.
5. In the Trig Setup dialog box:
   - **a.** under Enhanced Triggering, set Metastablility Reject to off (unchecked).

     Verify that the trigger is operating.
   - **b.** Under Enhanced Triggering, set Metastablility Reject to on (checked), and set High Frequency Triggering to on (checked).

     Verify that the trigger is operating.
   - **c.** under Level, adjust the trigger level between –100 mV to +100 mV.

     Verify the waveform position changes between 25 ps and 40 ps as the level is changed between +100 mV to –100 mV. (With positive slope, the waveform shifts to the right.)

End of Procedure

External direct trigger sensitivity

These procedures check those characteristics that relate to the system trigger and are listed as checked under *Warranted Characteristics* in *Specifications.* Refer to Table 1–3 on page 1–3.

Equipment required	Synthesized signal generator (Item 13) 0.5 meter precision SMA cable (Item 10) 1.0 meter precision SMA cable (Item 11) Power divider (Item 9) 80E0X sampling module
Prerequisites	As listed on page 4–19 and under *Prerequisites* on page 4–34.

Setup

Install the test hookup:

1. Install the 80E0X module into the left-most small module compartment of the TDS8000 or CSA8000 instrument (see Figure 4–12 on page 4–40).
2. Connect the synthesized signal generator to a 1.0 meter cable.
3. Connect the remaining end of the 1.0 meter cable to a SMA power divider. Connect two 0.5 meter cables to the two remaining SMA power divider connectors.
4. Connect one of the 0.5 meter cables to Channel 1 of the 80E0X module. Connect the remaining 0.5 meter cable to the TRIGGER DIRECT INPUT.

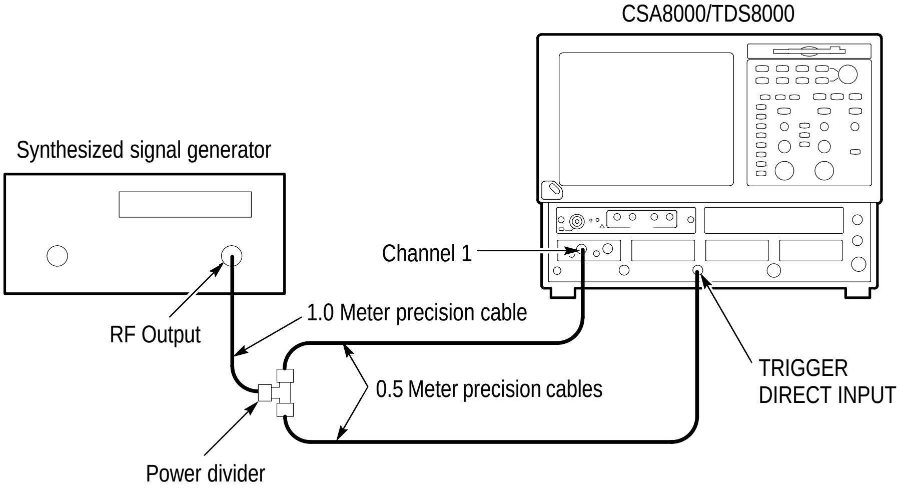


Figure 4–12: External direct trigger sensitivity test hookup

5. Set the synthesized signal generator frequency to 2.5 GHz (400 ps period).

6. Set the synthesized output to 400 mV peak-to-peak (200 mV displayed)
7. Make the following settings to the CSA8000/TDS8000:
   - **a.** Select Default Setup from the Utilities menu on the menu bar at top of display.
   - **b.** Select C1 from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
   - **c.** In the Trig Setup dialog box:
     - select External Direct.
     - select Metastablility Reject.
     - select Auto Mode.
   - **d.** In the Vert Setup dialog box:
     - set Scale to 20 mV/division.
     - set Offset to 0.
   - **e.** In the Horz Setup dialog box:
     - set Scale to 200 ps/division.
     - set Horizontal Reference to 0%.
     - set Position to 19 ns.

Test: Follow this procedure to make the direct trigger sensitivity check:

1. In the Meas Setup dialog box:
   - **a.** make sure the channel under test is selected in the Source menu.
   - **b.** select Meas 1, and then choose Select Meas > Amplitude > Amplitude.
   - **c.** select Meas 2, and then choose Select Meas > Timing > Frequency.
2. Adjust the synthesizer signal generator level until the amplitude measurement readout on the instrument screen indicates the amplitude is 100 mV.
3. Set the signal generator frequency to 100 MHz.
4. Adjust the Horizontal Scale to allow at least two full periods to be displayed.
5. Verify that the frequency read out on the instrument screen is within 10% from the true value.

6. Set the signal generator frequency to each of the following values, adjust the horizontal scale to the corresponding sec/div setting, and repeat steps 4 and 5:

   - 800 MHz at 500 ps/division
   - 1 GHz at 500 ps/division
   - 2 GHz at 200 ps/division
   - 3 GHz at 100 ps/division

End of Procedure

External direct trigger delay jitter, short term optimized and locked to internal 10 MHz reference modes

These procedures check those characteristics that relate to the system trigger and are listed as checked under *Warranted Characteristics* in *Specifications*. Refer to Table 1–3, page 1–3.

Equipment required	Synthesized signal generator (Item 13) 0.5 meter precision SMA cable (Item 10) 1.0 meter precision SMA cable (Item 11) Power divider (Item 9) 80E0X sampling module
Prerequisites	As listed on page 4–19 and under *Prerequisites* on page 4–34.

Setup Install the test hookup:

1. Install the 80E0X module into the left-most small module compartment of the TDS8000 or CSA8000 instrument (see Figure 4–13 on page 4–43).
2. Connect the synthesized signal generator to a 1.0 meter cable.
3. Connect the remaining end of the 1.0 meter cable to a SMA power divider. Connect two 0.5 meter cables to the two remaining SMA power divider connectors.
4. Connect one of the 0.5 meter cables to Channel 1 of the 80E0X module. Connect the remaining 0.5 meter cable to the TRIGGER DIRECT INPUT.

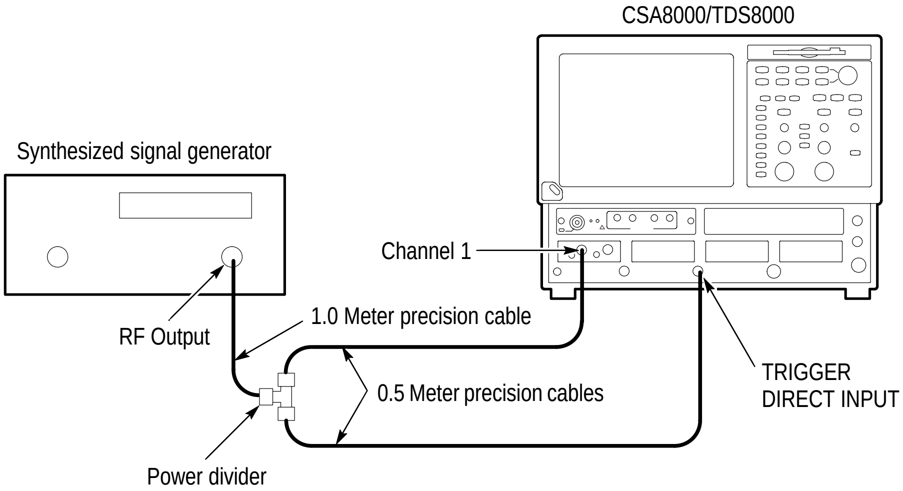


Figure 4–13: External direct trigger jitter test hookup

5. Set the synthesized signal generator frequency to 2.5 GHz.

6. Set the Synthesized output to 800 mV peak-to-peak (400 mV displayed)

7. Make the following settings to the CSA8000/TDS8000:

- **a.** Select Default Setup from the Utilities menu on the menu bar at top of display.
- **b.** Select C1 from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
- **c.** In the Trig Setup dialog box:
  - select External Direct.
  - select Metastablility Reject.
  - select Auto Mode.
- **d.** In the Vert Setup dialog box:
  - set Scale to 100 mV/division.
  - set Offset to 0.
- **e.** In the Horz Setup dialog box:
  - set Scale to 200 ps/division.
  - set Horizontal Reference to 0%.
  - set Position to 19 ns.
  - set All Timebase Mode to Short Term Jitter.

Test: Follow this procedure to make the direct trigger sensitivity check:

***NOTE**. To use this procedure you must upgrade to product software version 1.2.43 or higher. (Upgrade 1.2.43 is available as a download). You can determine the software version of the instrument under test by selecting About TDS/CSA8000 in the Help menu on screen. For upgrade information see “Contacting Tektronix” on page xvii.*

---

1. In the Meas Setup dialog box:

- **a.** for each of the following measurements make sure the channel under test is selected in the Source menu.
- **b.** select Meas 1, and then choose Select Meas > Amplitude > Amplitude.

   c. select Meas 2, and then choose Select Meas > Eye Pattern/Optical > RMS Jitter. Dismiss the database notification that pops up.

   d. check the Use Wfm Database box in the Source tab.

   e. check Display Database in the Wfm Database dialog box.

NOTE. *The CSA8000/TDS8000 will select whichever of the two databases that is not in use. Turn on Display Database for the database that shows the current channel in the Source box. Deselect Database On for the other database.*

---

2. Adjust the synthesizer signal generator level until the amplitude measurement readout on the instrument screen indicates the amplitude is 400 mV.

3. Set the Horizontal Scale to 20 ps/division, and position the rising edge until it goes through the center of the display (where the center horizontal and vertical graticules cross).

4. Verify that the the RMS Jitter read out on the instrument screen is less than 1.5 ps.

5. In the Horiz dialog box:

NOTE. *Position the rising edge until it goes through the center of the display applies to steps a through g in order to measure jitter.*

---

   a. set All Timebases Mode to Lock Int. 10 MHz.

   Verify that the RMS Jitter read out is less than 2.5 ps.

   b. set Timebase > Position to 100 ns.

   c. set All Timebases Mode to Short Term Jitter.

   Verify that the the RMS Jitter read out is less than 2.5 ps.

   d. set All Timebases Mode to Lock Int. 10 MHz.

   Verify that the the RMS Jitter read out is less than 2.51 ps.

   e. set Timebase > Position to 1 μs.

   f. set All Timebases Mode to Short Term Jitter.

   Verify that the the RMS Jitter read out is less than 11.5 ps.

   g. set All Timebases Mode to Lock Int. 10 MHz.

   Verify that the the RMS Jitter read out is less than 2.6 ps.

6. Repeat the setup (from step 7e) and the test for all channels for all 80E00 series modules installed.

End of Procedure

External prescaled trigger delay jitter, short term optimized mode and locked to internal 10 MHz reference mode

These procedures check those characteristics that relate to the system timebase and are listed as checked under *Warranted Characteristics* in *Specifications.* Refer to Table 1–2, page 1–2.

Equipment required	Synthesized signal generator (Item 13) 0.5 meter precision SMA cable (Item 10) 1.0 meter precision SMA cable (Item 11) Power divider (Item 9) 80E0X sampling module
Prerequisites	As listed on page 4–19 and under *Prerequisites* on page 4–34.

Setup Install the test hookup:

1. Install the 80E0X module into the left-most small module compartment of the TDS8000 or CSA8000 instrument (see Figure 4–14 on page 4–47).
2. Connect the synthesized signal generator to a 1.0 meter cable.
3. Connect the remaining end of the 1.0 meter cable to a SMA power divider. Connect two 0.5 meter cables to the two remaining SMA power divider connectors.
4. Connect one of the 0.5 meter cables to Channel 1 of the 80E0X module. Connect the remaining 0.5 meter cable to the TRIGGER PRESCALE INPUT.

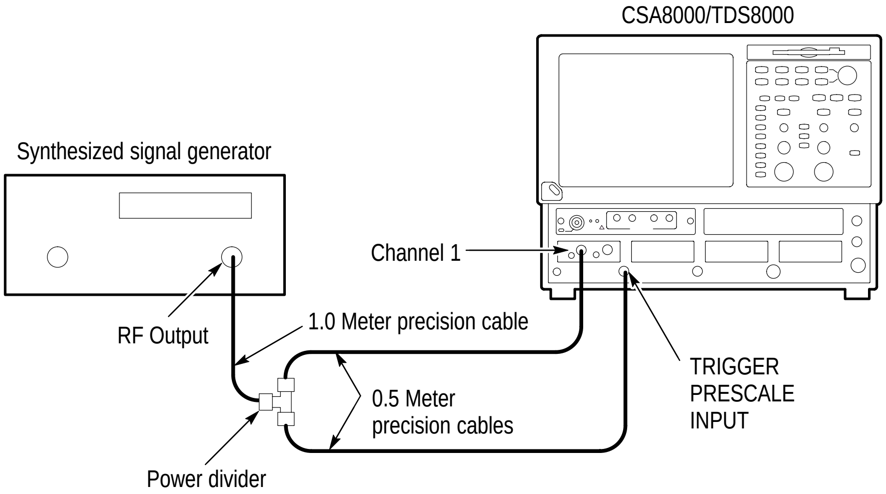


Figure 4–14: External prescaled test hookup

5. Set the synthesized signal generator frequency to 2.5 GHz.
6. Set the Synthesized output to 1600 mV peak-to-peak (800 mV displayed)
7. Set up the CSA8000/TDS8000 as follows:
   - **a.** Select Default Setup from the Utilities menu on the menu bar at top of display.
   - **b.** Select C1 from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
   - **c.** In the Trig Setup dialog box:
     - select External Prescaler.
     - select Metastablility Reject.
     - select Auto Mode.
   - **d.** In the Vert Setup dialog box:
     - set Scale to 100 mV/division.
     - set Offset to 0.
   - **e.** In the Horz Setup dialog box:
     - set Scale to 200 ps/division.
     - set Horizontal Reference to 0%.
     - set Position to 19 ns.
     - set All Timebases Mode to Short Term Jitter.

Test: Follow this procedure to make the external prescale check:

1. In the Meas Setup dialog box:
   - **a.** make sure the channel under test is selected in the Source menu.
   - **b.** select Meas 1, and then choose Select Meas > Amplitude > Amplitude.
   - **c.** select Meas 2, and then choose Select Meas > Eye Pattern/Optical > RMS Jitter. Dismiss the database notification that pops up.
   - **d.** check the Use Wfm Database box in the Source tab.
   - **e.** check Display Database in the Wfm Database dialog box.
2. Adjust the synthesizer signal generator level until the amplitude measurement readout on the instrument screen indicates the amplitude is 800 mV.

3. In the Horiz dialog box:

  a. set the Horizontal Scale to 20 ps/division and position the rising edge until it goes through the center line of the display.

  Verify that the the RMS Jitter read out on the instrument screen is less than 1.5 ps.

  b. under All Timebases, set Mode to Lock Int. 10 MHz and position the rising edge until it goes through the center of the display (crossing of the center horizontal and vertical graticule).

  Verify that the RMS Jitter is less than 2.5 ps.

4. Repeat the setup (from 7e) and test for all channels in all 80E00 series modules installed.

End of Procedure

External prescaled trigger sensitivity

These procedures check those characteristics that relate to the system trigger and are listed as checked under *Warranted Characteristics* in *Specifications.* Refer to Table 1–3 on page 1–3.

Equipment required	Synthesized signal generator (Item 13) 0.5 meter precision SMA cable (Item 10) 1.0 meter precision SMA cable (Item 11) Power divider (Item 9) 80E0X sampling module
Prerequisites	As listed on page 4–19 and under *Prerequisites* on page 4–34.

Setup Install the test hookup:

1. Install the 80E0X module into the left-most small module compartment of the TDS8000 or CSA8000 instrument (see Figure 4–15 on page 4–50).
2. Connect the synthesized signal generator to a 1.0 meter cable.
3. Connect the remaining end of the 1.0 meter cable to a SMA power divider. Connect two 0.5 meter cables to the two remaining SMA power divider connectors.
4. Connect one of the 0.5 meter cables to Channel 1 of the 80E0X module. Connect the remaining 0.5 meter cable to the TRIGGER PRESCALE INPUT.

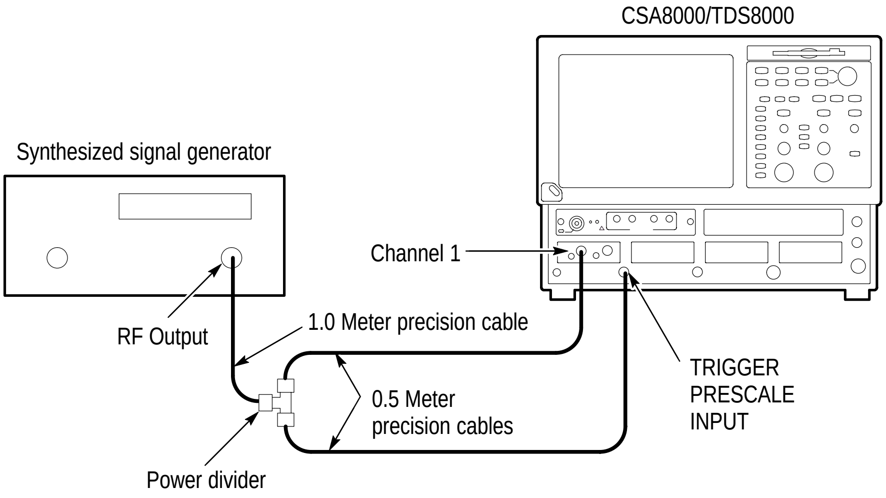


Figure 4–15: External prescaled trigger sensitivity test hookup

5. Set the synthesized signal generator frequency to 2 GHz (500 ps period).
6. Set the synthesized output to 1600 mV peak-to-peak (800 mV displayed)
7. Make the following settings to the CSA8000/TDS8000:
   a. Select Default Setup from the Utilities menu on the menu bar at top of display.
   b. Select C1 from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
   c. In the Trig Setup dialog box:
      - select External Prescaler.
      - select Metastablility Reject.
      - select Auto Mode.
   d. In the Vert Setup dialog box:
      - set Scale to 100 mV/division.
      - set Offset to 0.
   e. In the Horz Setup dialog box:
      - set Scale to 200 ps/division.
      - set Position to 19 ns.
      - set Horizontal Reference to 0%.
      - set All Timebases Mode to Short Term Jitter.

Test: Follow this procedure to make the prescaled trigger sensitivity check:

1. In the Meas Setup dialog box:
   a. make sure the channel under test is selected in the Source menu.
   b. select Meas 1, and then choose Select Meas > Amplitude > Amplitude.
   c. select Meas 2, and then choose Select Meas > Timing > Frequency.
2. Set the signal generator frequency to 2.0 GHz.
3. Adjust the synthesizer signal generator level until the amplitude measurement readout on the instrument screen indicates the amplitude is 800 mV for the 2 GHz check. For the 3, 5, and 10 GHz checks adjust for 600 mV.
4. Adjust the Horizontal Scale to allow two full periods to be displayed.

5. Verify that the frequency read out on the instrument screen is within 10% from the true value.

6. Set the signal generator frequency to each of the following frequencies and the horizontal scale to the corresponding sec/div, and repeat steps 3 through 5:

   - 3 GHz at 100 ps/division
   - 5 GHz at 50 ps/division
   - 10 GHz at 20 ps/division

End of Procedure

Electrical Sampling Modules

These procedures check those characteristics that relate to the electrical sampling modules and are listed as checked specifications. Refer to Table 1–11 on page 1–11.

Prerequisites

Be sure you have performed the following prerequisites and the *Prerequisites* on page 4–19 before doing any procedures in this section.

- Install the 80E0X modules in one of the electrical sampling slots in the CSA8000 or TDS8000 instrument.
- Check 80E0X module push buttons: Push the select buttons channels 1 and 2 and observe that the yellow indicators lights to Power on. Push them again and observe that the lights turn off.

***NOTE**. Use a calibrated torque wrench when connecting the terminators, adapters, attenuator, and power sensor in this setup. Use 8 ± 0.3 inch pounds of torque.*

***STOP**. Throughout these procedures, when steps call for the display of setup dialog boxes, you can display them from the Setup menu in the menu bar at the top of the screen. These procedures assume you will display and dismiss the setup dialog boxes as needed.*

Input impedance

These procedures check those characteristics that relate to the signal acquisition and are listed as checked under *Warranted Characteristics* in *Specifications.* Refer to Table 1–12, page 1–12.

Equipment required	Digital multimeter (Item 1) Cable, coaxial 50 Ω, 20 in (0.5m), male-to-male SMA (Item 10) Adapter, SMA female to BNC male connectors (Item 18) Adapter, BNC to dual banana plugs (Item 19)
Prerequisites	As listed on page 4–19 and under *Prerequisites on* page 4–53.

Setup Install the test hookup:

1. Install the 80E0X module into the left-most small module compartment of the TDS8000 or CSA8000 instrument (see Figure 4–16).
2. Connect the Digital multimeter to Channel 1 of the 80E0X module. See Figure 4–16.

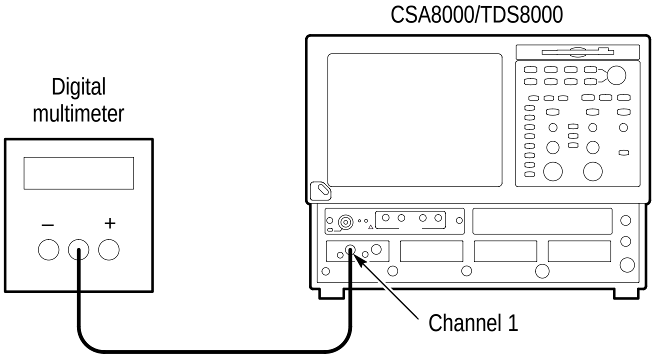


Figure 4–16: Input impedance test hookup

3. Set up the CSA8000/TDS8000 as follows:
   - **a.** Select C1 from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
   - **b.** In the Trig Setup dialog box, select Internal Clock (200 KHz).
   - **c.** In the Vert Setup dialog box, set Offset to 0.0 V.
   - **d.** In the Horz Setup dialog box:
     - set Scale to 2 ns/division.
     - set Position to 0 (this will revert to a minium non-zero value).
     - set Horizontal Reference to 0%.
   - **e.** In the Acq Setup dialog box, set Acquisition Mode to Sample.

Test: Follow this procedure to make the input impedance check:

1. Set the Digital multimeter to the ohm mode.
2. Record InputR reading on the Digital multimeter.
3. Reverse polarity and record InputR reading on the Digital multimeter.

4. Check average *of InputR and InputR reverse* ≤ 50.5 Ω and ≥ 49.5 Ω.
5. *80E04 Only:* Set the Digital multimeter to volt mode at the minimum range (≤ 100 mV).
6. *80E04 Only:* Record reading on the Digital multimeter as baseline voltage.
7. *80E04 Only:* Check baseline voltage for ≤ ±1 mV. Enter value on test record.
8. Make the following settings, and then repeat steps 1 through 7 to check channel 2.
    - **a.** Select the next channel to test (if any) from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
    - **b.** In the Vert Setup dialog box, set Offset to 0.0 V.

End of Procedure

DC voltage measurement accuracy

These procedures check those characteristics that relate to the signal acquisition and are listed as checked under *Warranted Characteristics* in *Specifications.* Refer to Table 1–12, page 1–12.

Equipment required	Digital Multimeter (Item 1) DC Power Supply (Item 2) SMA “T”, male to 2 SMA female (Item 8) Two 50 Ω, precision coaxial cables, SMA connectors (Item 10) Adapter, SMA female to BNC male connectors (Item 18) Adapter, BNC to dual banana plugs (Item 19)
Prerequisites	As listed on page 4–19 and under *Prerequisites on* page 4–53.

CAUTION. *To avoid damage to the electrical module, do not exceed 2 volts input.*

Setup

Install the test hookup:

1. Perform instrument and module compensation, see *Perform the Compensation* on page 4–1.
2. Set the output of a DC power supply to off or 0 volts.
3. Connect a SMA T to Channel 1 of the sampling module.
4. Connect a 50 Ω precision coaxial cable to one side of the SMA T. Connect a 50 Ω precision coaxial cable to the remaining side of the SMA T. See Figure 4–17.
5. Connect one 50 Ω precision coaxial cable to the output of a DC power supply through a dual-banana connector. Connect the remaining 50 Ω precision coaxial cable to a digital multimeter. See Figure 4–17.

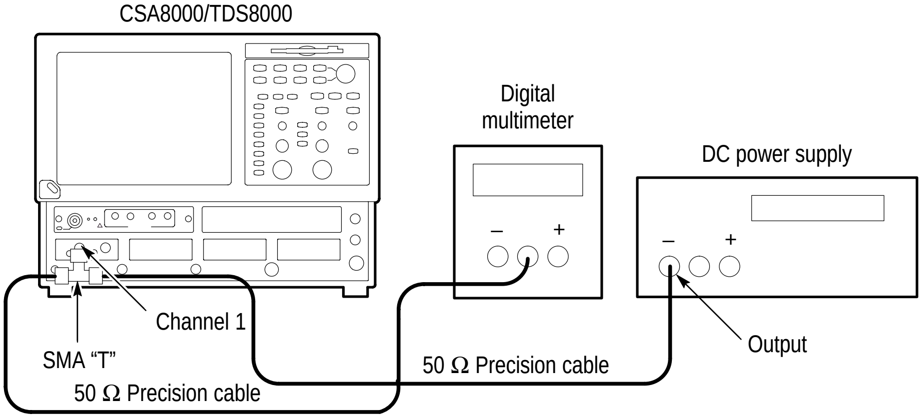


Figure 4–17: Vertical DC accuracy test hookup

6. Set up the CSA8000/TDS8000 as follows:
   a. Select C1 from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
   b. In the Trig Setup dialog box, set Trigger Source to Internal Clock.
   c. In the Acq Setup dialog box:
      - set Acquisition Mode to Average, 32 samples.
      - under Stop After, check the Condition box, and select Average Complete from the pull down menu.
   d. In the Horz Setup dialog box:
      - set Scale to 2 ns/division.
      - set Position to 0 (this will revert to a minium non-zero value).
      - set Horizontal Reference to 0%.

e. In the Meas Setup dialog box:

- make sure the channel under test is selected in the Source menu.
- select Meas 1, and then choose Select Meas > Amplitude > Mean.

f. In the Vert Setup dialog box:

- set Scale to 100 mV/division.
- set Offset to –1100 mV.

Table 4–2: DC Voltage measurement accuracy

DC power supply settings	Offset settings	Accuracy limits
–1550 mV	–1100 mV	±18.7 mV
–1350 mV	–1100 mV	±14.7 mV
–1100 mV	–1100 mV	±9.7 mV
–850 mV	–1100 mV	±14.7 mV
–650 mV	–1100 mV	±18.7 mV
–450 mV	0 mV	±11 mV
–250 mV	0 mV	±7 mV
0 mV	0 mV	±2 mV
+250 mV	0 mV	±7 mV
+450 mV	0 mV	±11 mV
+650 mV	+1100 mV	±18.7 mV
+850 mV	+1100 mV	±14.7 mV
+1100 mV	+1100 mV	±9.7 mV
+1350 mV	+1100 mV	±14.7 mV
+1550 mV	+1100 mV	±18.7 mV

Test

Follow this procedure to make the Vertical DC accuracy checks:

1. Select the DC supply voltage to the settings listed in Table 4–2, page 4–58.
2. Press the CLEAR DATA button on the front panel.
3. Press the RUN/STOP button on the front panel.
4. Record input voltage reading on the digital multimeter.
5. Record the voltage for the Mean measurement displayed on the CSA8000/TDS8000 screen.

6. Calculate DC voltage accuracy: *error = input V – meas V.*

7. CHECK that the error calculated in step 6 is within the limits listed Table 4–2 for the associated vertical scale and offset and DC voltage settings. Enter the value on test record.

8. Repeat steps 1 through 7 until all DC voltage and offset settings, listed in Table 4–2, are checked for the channel under test.

9. Change all settings in the setup to Channel 2, and then repeat steps 1 through 7 until all DC voltage settings and offset settings, listed in Table 4–2, are checked.

End of Procedure

Test

Follow this procedure to make the DC vertical voltage accuracy, single point, compensated checks:

The gain of the 80E00 is equal to the slope of a regression line of the paired measurement readings in Table 4–3, with the V_{in} values plotted along the x axis, and the measured values plotted along the Y axis.

Linear least squares fit algorithm:
$y=ax+b$ *where*
$a=(nS_{xy}-S_xS_y) / (nS_{xx}-S_x\hat{}2)$
$b=(S_{xx}S_y-S_{xy}S_x) / (nS_{xx}-S_x\hat{}2)$
$x=$*abscissa (controlled value)*
$y=$*ordinate (measured value)*
$S_x=Sum(x)$
$S_{xx}=Sum(x^2)$
$S_{xy}=Sum(xy)$
$S_y=Sum(y)$
$n=$*number of points*

1. Set up the CSA8000/TDS8000 as follows:
   a. Select C1 from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
   b. In the Acq Setup dialog box:
      - set Acquisition Mode to Average, 16 samples.
   c. In the Vert Setup dialog box:
      - set Scale to 100 mV/division.
      - set Offset to 0 mV.

- **d.** In the Meas Setup dialog box:
  - make sure the channel under test is selected in the Source menu.
  - select Meas 1, and then choose Meas > Amplitude > Mean.

2. Set the Vin = –450 mV.

3. Read DVM measurement and record it in the *Input Vin* and the *x* columns, Table 4–3 on page 4–61.

4. Read mean measurement and record it in the *Measured V, mV* and *y* columns, Table 4–3 .

5. Repeat steps 2-3 for all other V_{in}.

6. Calculate S_x, S_{xx}, S_y, and $S_{xy,}$ for each setting:

- **a.** Copy the *Input* V_{in} value to *x* column.
- **b.** Copy the *Measured V, mV* value to *y* column.
- **c.** Calculate x^2 and record in x^2 column.
- **d.** Calculate xy and record in *xy* column.
- **e.** Add the up the *x.* x^2*. y* and *xy* columns and record the sums in the S_x, S_{xx}, S_y and S_{xy} columns.

7. Calculate a, b.

- **a.** Calculate a = (see algorithm on page 4–59.
- **b.** Calculate b = (see algorithm on page 4–59.

8. Calculate Y = ax+b for all x.

9. Calculate the deviation of *Measured V – Y* for all x.

Table 4–3: Data for calculation of gain and linearity

V_{in} mV	Input V_{in}	Measured V, mV	x	x^2	y	xy	Y = ax+b	Deviation	lower limit	upper limit
–450									–10	+10
–350									–10	+10
–250									–10	+10
–150									–10	+10
–50									–10	+10
50									–10	+10
150									–10	+10
250									–10	+10
350									–10	+10
450									–10	+10
									–10	+10
n			S_x	S_{xx}	S_y	S_{xy}				

10. Change all settings in the setup to Channel 2, and then repeat steps 1 through 9 until all DC vertical voltage accuracy, single point, compensated calculations listed in Table 4–3 on page 4–61 are checked.

End of Procedure

Random noise, displayed

These procedures check those characteristics that relate to the signal acquisition and are listed as checked under *Warranted Characteristics* in *Specifications.* Refer to Table 1–12, page 1–12.

Equipment required	No external equipment required
Prerequisites	As listed on page 4–19 and under *Prerequisites on* page 4–53.

Setup No test equipment hook up is required.

1. Set up the CSA8000/TDS8000 as follows:
   - **a.** Select C1 from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
   - **b.** In the Trig Setup dialog box, set Trigger Source to Internal Clock (200 KHz).
   - **c.** In the Acq Setup dialog box:
     - set Acquisition Mode to Sample.
     - under Stop After, check Condition and select Number of Acquisitions from the pull down menu. Enter 96 for the number of acquisitions.
   - **d.** In the Horz Setup dialog box:
     - set Record length to 1000 points.
     - set Scale to 1 ps/division.
     - set Position to 0 (this will revert to a minium non-zero value).
     - set Horizontal Reference to 0%.
   - **e.** In the Vert Setup dialog box:
     - set Scale to 2 mV/division if testing with an 80E01 module; set to 1 mV/division for all other modules.
     - set Offset to 0 mV.

Test Follow this procedure to make the Random noise checks:

1. WfmDatabase menu, click Display Database, select C1
2. Histogram menu, select vertical, Enable Histogram.

3. Position the right and left side histogram window to the cover all the horizontal divisions.
4. Position the top histogram window three divisions above the center line.
5. Position the bottom histogram window three divisions below the center line.
6. Press the CLEAR DATA button on the front panel.
7. Press the RUN/STOP button on the front panel.
8. Record the noise V STD DEV reading.
9. Check noise V for the tested:
   - 80E01 ≤ 2.3 mV.
   - 80E02 ≤ 800 μV.
   - 80E03 ≤ 1.2 mV.
   - 80E04 ≤ 1.2 mV.
10. Repeat steps 1 through 7 for channel 2.

End of Procedure

Rise time (80E02, 80E03, & 80E04)

These procedures check those characteristics that relate to the signal acquisition and are listed as checked under *Warranted Characteristics* in *Specifications.* Refer to Table 1–12, page 1–12.

Equipment required	Step generator (Item 3) One 50 Ω, precision coaxial cable, SMA connectors (Item 10)
Prerequisites	As listed on page 4–19 and under *Prerequisites on* page 4–53.

Setup

Install the test hookup:

1. Install the 80E0X module into the left-most small module compartment of the TDS8000 or CSA8000 instrument. See Figure 4–18.
2. Connect one end of a 50 Ω coaxial cable to the INTERNAL CLOCK OUTPUT of the CSA8000/TDS8000. Connect the remaining end to the TRIGGER INPUT of a step generator.
3. Connect the OUTPUT of the Step generator to Channel 1 of the sampling module. See Figure 4–18. Turn on the step generator.

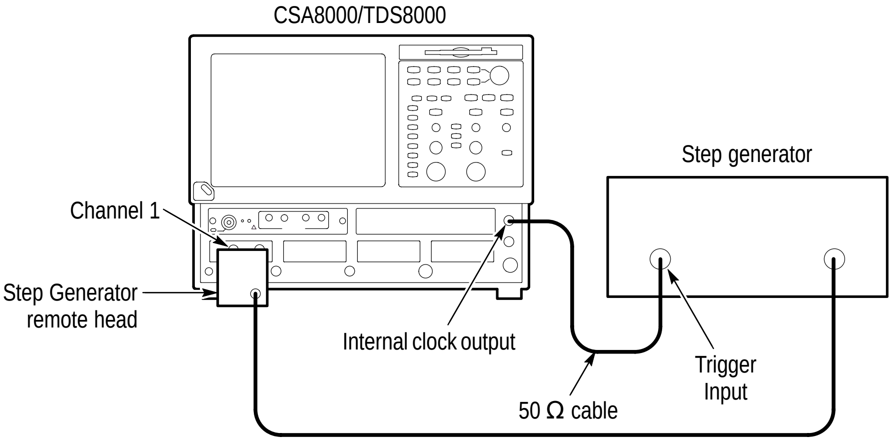


Figure 4–18: Rise Time hookup

4. Set up the CSA8000/TDS8000 as follows:
   - **a.** Press the DEFAULT Setup button.
   - **b.** Select C1 from the Waveform Selector menu on the controls bar at the bottom of the display (left corner) or press the Channel 1 push button on the front panel.

- **c.** In the Trig Setup dialog box set Source to Internal Clock (200 kHz).
- **d.** In the Acq Setup dialog box:
  - set Acquisition Mode to Average, 64 samples.
  - under Stop After, check Condition and select Average Complete from the pull down menu.
- **e.** In the Horz Setup dialog box:
  - set Record Length to 2000 points.
  - set Scale to 2 μs/division.
  - set Position to 0 (this will revert to a minimum non-zero value).
  - set Horizontal Reference to 0%.
- **f.** In the Meas Setup dialog box:
  - for each measurement, make sure the channel under test is selected in the Source menu.
  - select Meas 1, and then choose Select Meas > Amplitude > High.
  - select Meas 2, and then choose Select Meas > Amplitude > Low.
  - select Meas 3, and then choose Select Meas > Timing > Rise.
  - select Meas 3, turn on (check) Statistics (check box at bottom of dialog box) and set Weighting to 500.

Test Follow this procedure to make the rise time accuracy checks:

1. Press the CLEAR DATA button on the front panel.
2. Press the RUN/STOP button on the front panel.
3. Several cycles of a pulsed waveform should be displayed.
4. In the Meas Setup dialog box for Meas3 (Rise):
   - **a.** click the HiLo tab.
   - **b.** turn off (uncheck) Track High and Track Low.
   - **c.** set High to measured High value (in the Measurement box at the right of the display).
   - **d.** set Low to the measured Low value.

  - **e.** turn on (check) Annotations. There should be four dashed horizontal lines, with the top and bottom lines superimposed on the high and low levels of the waveform, showing that the high and low references are properly set for rise time measurement.
  - **f.** turn off (uncheck) Annotations.

5. In the Acq Setup dialog box, set Stop After to Run/Stop Button Only.

6. Press the CLEAR DATA button.

7. Press the RUN/STOP button to start acquisition.

8. Use the knobs in the front panel HORIZONTAL section to change the Scale to 10 ps/division, while adjusting the Position to keep the first rising edge of the step waveform centered on the display.

9. Press CLEAR DATA.

10. After about 20 seconds, note the Mean value of the Rise measurement. This is T_{sys}, the system rise time which is a combination of the step generator and the 80E0X module rise times.

11. Calculate T_{mod}, the 80E0X module rise time as follows:

$$T_{mod} = \sqrt{T^2_{sys} - T^2_{gen}}$$

Where T_{gen} is the step generator rise time.

12. Check that T mod meets the tolerances in Table 4–4.

13. Repeat the Setup and Test sections for Channel 2.

Table 4–4: Computed rise time

Module	T (computed)
80E02	≤ 28 ps
80E03, 80E04	≤ 17.5 ps

End of Procedure

Analog bandwidth (80E01)

These procedures check those characteristics that relate to the signal acquisition and are listed as checked under *Warranted Characteristics* in *Specifications.* Refer to Table 1–12, page 1–12. This check has two procedures that characterizes the reference signals. The last procedure characterizes the 80E01 sampling module.

Equipment required	Synthesized signal generator (Item 13) Power meter (Item 14) Power sensor (Item 15) Adapter, 2.4mm male-to-male (Item 16) Adapter, 2.4mm female-to-female (Item 17) Attenuator,10 dB pad (Item 20) Cable, special, power/phase stability (Item 21)
Prerequisites	As listed on page 4–19 and under *Prerequisites on* page 4–53.

Power-Reference Characterization Setup

Install the test hookup to measure the power reference:

***NOTE**. Use a torque wrench when connecting the terminators, adapters, attenuator, and power sensor in this setup. Use 8 ±0.3 inch pounds of torque.*

1. Connect the 10 dB attenuator to the Synthesized signal generator. Connect the remaining end to the power sensor. Connect the power sensor to the power meter. See Figure 4–19 on page 4–67.

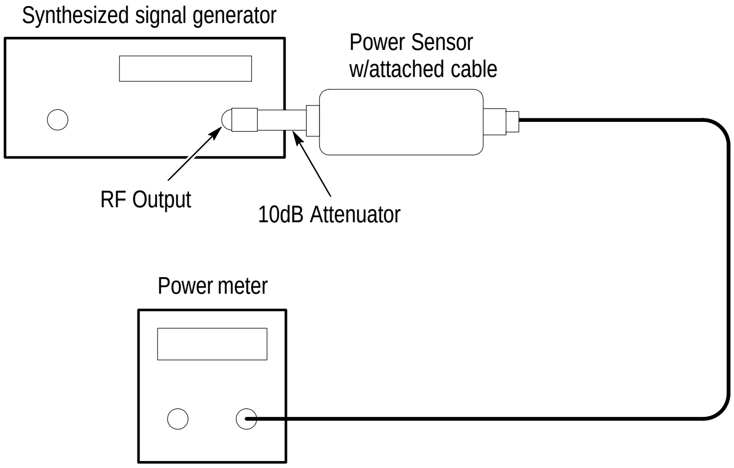


Figure 4–19: Power-reference hookup

Ref.-Characterization Measurements

Follow this procedure to characterize the reference signals:

2. Set the Synthesized signal generator to 0 dBm.

Table 4–5: Power reference

Frequency	Reference Level dBm	Reference level with adapters dBm	2.4 mm female to female adapter loss dB
50 MHz			
4 GHz			
8 GHz			
12 GHz			
16 GHz			
20 GHz			
24 GHz			
28 GHz			
32 GHz			
36 GHz			
40 GHz			
44 GHz			
48 GHz			
50 GHz			

3. Set the signal frequency and the power meter frequency to each of the frequencies listed in the *Frequency* column, Table 4–5.

4. Record the readings on the power meter in the *Reference Level dBm* column.

Adapter-Characterization Setup

Install the test hookup to characterize the adapter:

1. Connect the 10 dB attenuator to the Synthesized signal generator. Connect the remaining end of the cable to the 10dB attenuator. Connect the remaining end of the 10 dB attenuator to a 2.4 mm female-to-female adapter. Connect the remaining end of the 2.4 mm female-to-female adapter to the power sensor. Connect the remaining end of the power sensor to the power meter. See Figure 4–20 on page 4–69.

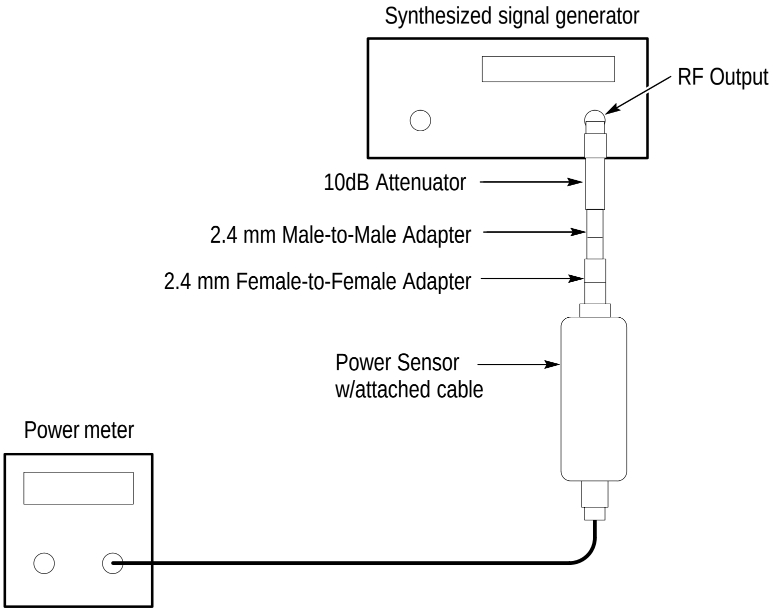


Figure 4–20: Adapter characterization hookup

Adapter-Characterization Measurements

Follow this procedure to characterize the reference level with the adapters:

1. Set the signal frequency and the power meter frequency to each of the frequencies listed in the *Frequency* column, Table 4–5 on page 4–68.
2. Record the readings on the power meter in the *Reference level with the adapters dBm* column, Table 4–5 on page 4–68.
3. Calculate and record the *2.4 mm female-to-female adapter loss dB* in Table 4–5 on page 4–68 for all frequencies listed as follows: *((Reference level with adapters dBm) – (Reference level dBm)) /2*

Setup Install the test hookup to measure reference signals:

***NOTE**. Use a torque wrench while connecting the adapters, power sensor in this setup. Use 8 ±0.3 inch pounds of torque.*

---

1. Connect the cable to the Synthesized signal generator. Connect the remaining end of the cable to the 10dB attenuator.
2. Connect the remaining end of the 10 dB attenuator to a 2.4 mm female-to-female adapter. Connect the remaining end of the 2.4 mm female-to-female adapter to the power sensor. Connect the remaining end of the power sensor to the power meter. See Figure 4–21 on page 4–70.

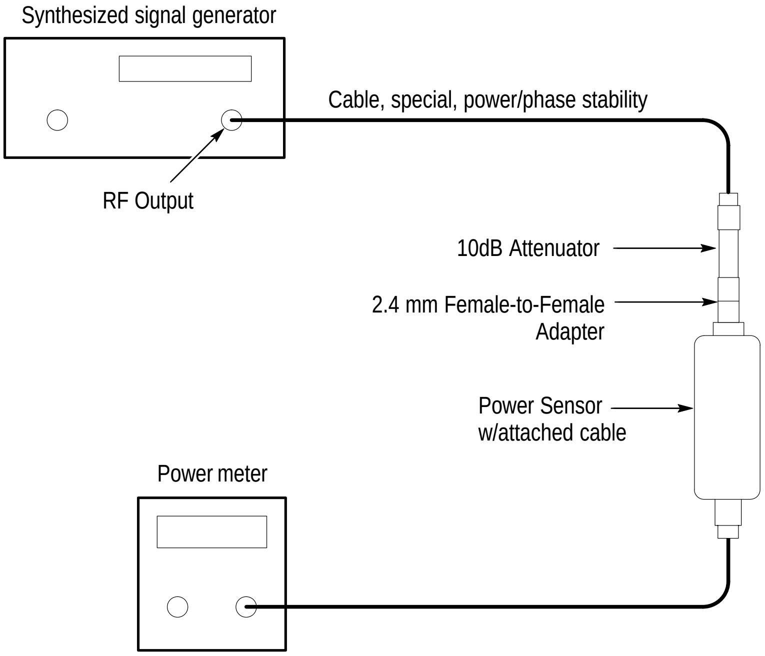


Figure 4–21: Measure reference signals

3. Set the synthesized signal generator to +3 dBm.
4. Set the signal frequency and the power meter frequency to each of the frequencies listed in the *Frequency* column, Table 4–6 on page 4–71.
5. Adjust the RF signal level until the reading on the power meter as close to –9 dBm as possible.
6. Record the Synthesized signal generator set level reading in the *Reference RF set level dBm* column, Table 4–6 on page 4–71.

7. Record the Power meter reading in the *Measured RF level dBm* column, Table 4–6 on page 4–71.

8. Calculate and record the *Reference RF level* in Table 4–6 for all frequencies listed as follows:
(Measured RF level) – (2.4mm female-to-female adapter loss dB) column, in Table 4–5 on page 4–68.

Table 4–6: DUT (device under test) reference response

Frequency	Reference set level dBm	Measured RF level dBm	Reference RF level	80E01 measured level	DUT response
50 MHz					
4 GHz					
8 GHz					
12 GHz					
16 GHz					
20 GHz					
24 GHz					
28 GHz					
32 GHz					
36 GHz					
40 GHz					
44 GHz					
48 GHz					
50 GHz					

80E01 Test Setup

Install the test hookup to measure the 80E01 performance:

1. Install the 80E01 module into the left-most small module compartment of the TDS8000 or CSA8000 instrument (see Figure 4–22).
2. Connect one end of the cable to the Synthesized signal generator. Connect the remaining end of the cable to the 10dB attenuator.
3. Connect the remaining end of the 10 dB attenuator to the 80E01 sampling module. See Figure 4–22 on page 4–72.

NOTE. *Use a torque wrench while connecting the adapters, power sensor in this setup. Use 8 ± 0.3 inch pounds of torque.*

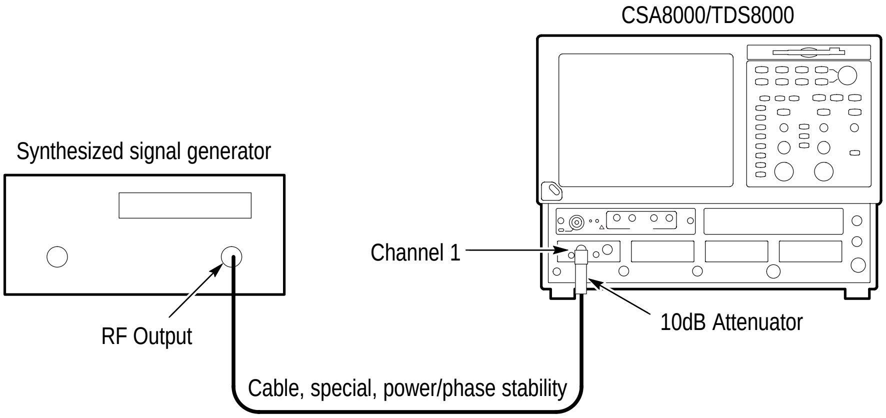


Figure 4–22: 80E01 reference signals hookup

4. Set up the CSA8000/TDS8000 as follows:
   - a. Select C1 from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
   - b. In the Trig Setup dialog box set Source to Internal Clock (200 KHz).
   - c. In the Acq Setup dialog box:
     - set Acquisition Mode to Envelope.
     - under Stop After, check Condition and select Average Complete from the pull down menu.

d. In the Horz Setup dialog box:

- set Record Length to 2000 points.
- set Position to 0 (this will revert to a minimum non-zero value).
- set Horizontal Reference to 0%.

e. In the Vert Setup dialog box:

- set Scale to 35 mV/division.
- set Offset to 0.

Tests

Follow this procedure for the 80E01 sampling module reference signals:

1. In the Meas Setup dialog box:

  a. make sure the channel under test is selected in the Source menu.

  b. select Meas 1, and then choose Meas > Amplitude > Amplitude.

2. Set the RF signal frequency listed in the *Frequency* column, Table 4–6 on page 4–71.

3. Set the RF signal level listed in the *Reference Set Level dBm* column, Table 4–6.

4. In the Horz Setup dialog box, set the CSA8000/TDS8000 Horizontal Scale to (*1/Frequency),* where Frequency is the RF signal frequency.

5. Press the CLEAR DATA button on the front panel of the CSA8000/TDS8000.

6. Press the RUN/STOP button on the front panel of the CSA8000/TDS8000.

7. Record amplitude reading readout and use the value as AMPLITUDE (Volts) in the step that follows.

8. Convert Volts to dBm as follows:

Vp=(AMPLITUDE/2)

Vrms=Vp/SQRT (2)

*P1=Vrms*Vrms/50*

*dBm=10*log(P1/0.001)*

9. Record dBm in the *80E01 Measured level* column, Table 4–6 on page 4–71.

10. Repeat steps 2 through 9 for all frequencies listed in the *Frequency* column, Table 4–6 on page 4–71.

11. Calculate the DUT response as the difference between the *80E01 Measured level* column and the *Reference RF level* column in Table 4–6 as:

    (80E01 Measured level) – (Reference RF level)

    Record the calculation results in the *DUT Response* column Table 4–6 on page 4–71.

12. Calculate all frequencies listed in the *Frequency* column, Table 4–6 on page 4–71.

13. Find the maximum and minimum power points between the 50 MHz and 50 GHz points in the *DUT Response* column, Table 4–6 on page 4–71.

14. The maximum power minus the power at 50 MHz should be greater than +2.3 dB. The minimum power minus the power at 50 MHz should be greater than –2.3 dB. The specification is ±3.0 dB referenced to the 50 MHz.

End of Procedure

TDR system reflected rise time (80E04)

These procedures check those characteristics that relate to the TDR system (80E04 only) and are listed as checked under *Warranted Characteristics* in *Specifications.* Refer to Table 1–13, page 1–14.

Equipment required	Airline (Item 6) Terminator, cap, shorting (Item 12)
Prerequisites	As listed on page 4–19 and under *Prerequisites on* page 4–53.

Setup

Install the test hookup:

1. Connect a shorting terminator cap to the female connector of the airline. See Figure 4–23.
2. Connect the airline to channel 1 of the module.

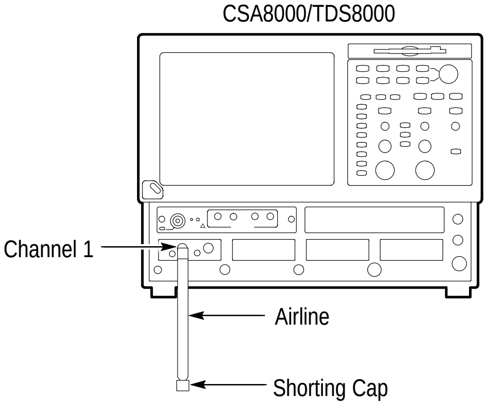


Figure 4–23: TDR reflected rise time hookup

3. Press the DEFAULT SETUP button on the CSA8000/TDS8000 front panel.
4. Set up the CSA8000/TDS8000 as follows:
   a. In the TDR Setup dialog box, click on C1 Preset.
   b. There should be a positive pulse, about 1 ns long for a 10 cm airline. The reflection from the short is located at the falling edge of the pulse. This is the edge to be measured. Adjust the horizontal position knob to bring the falling edge to the center vertical graticule.

c. In the Horz Setup dialog box:

- set Record Length to 2000 points.
- set Horizontal Reference to 50%.
- set Scale to 500 ps/division, while using the horizontal position knob to keep the falling edge centered.

d. In the Acq Setup dialog box:

- set Acquisition Mode to Average, 128 samples.
- under Stop After, check Condition and select Average Complete from the pull down menu.

e. In the Meas Setup dialog box:

- make sure the channel under test is selected in the Source menu.
- select Meas1, then choose Select Meas > Timing > Fall.

Tests

Follow this procedure to make the fall time checks:

1. Press the CLEAR DATA button on the CSA8000/TDS8000 front panel.
2. Press the RUN/STOP button on the CSA8000/TDS8000 front panel.
3. Check that the measured fall time (reflected rise time) is $\leq$35 ps, for the positive edge polarity.
4. In the TDR Setup dialog box change C1 polarity to negative edge (pictured as a falling slope).

***NOTE**. Since this display is in units of rho (ρ), the waveform will not invert when the edge polarity is changed, so the waveform will not appear to change significantly.*

---

5. Press the CLEAR DATA button.
6. Press the RUN/STOP button.
7. Check that the measured fall time (reflected rise time) is $\leq$35 ps, for the negative edge polarity.

Do not create a new hh file, add new methods to the existing files. Need to keep the same Topic IDs to make sure the they have the same IDs as the engineering's software.

8. Repeat the Setup and Test sections for channel 2.

End of Procedure

TDR system step response aberrations (80E04)

These procedures check those characteristics that relate to the TDR system (80E04 only) and are listed as checked under *Warranted Characteristics* in *Specifications.* Refer to Table 1–13, page 1–14.

Equipment required	Terminator, 50 Ω coaxial terminator, K male (Item 7)
Prerequisites	As listed on page 4–19 and under *Prerequisites on* page 4–53.

Setup Install the test hookup:

1. Install the 80E04 module into the left small module compartment of the CSA8000/TDS8000.
2. Check the aberrations of channel 1, positive TDR polarity as follows:
3. Connect a 50 Ω coaxial terminator to channel 1. See Figure 4–23.

NOTE*. To minimize extraneous aberrations, use the recommended terminator listed in the above Equipment required table; item 7.*

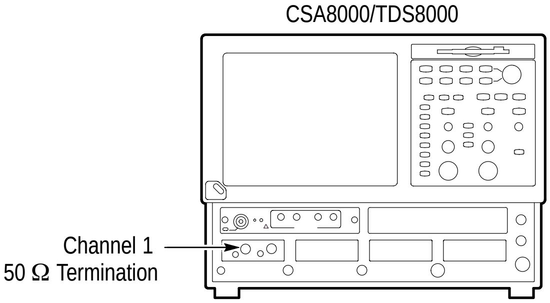


Figure 4–24: TDR system step response aberrations hookup

4. Press the DEFAULT SETUP button on the CSA8000/TDS8000 front panel.
5. Set up the CSA8000/TDS8000 as follows:
   a. In the TDR Setup dialog box click on C1 Preset.
   b. In the Acq Setup dialog box set the Acquisition Mode to Average, 128 samples.
   c. In the Horz Setup dialog box:

- set Record Length to 2000 points.
- set Position to 1 μs.
- set Scale to 100 ns/division.

d. In the Meas Setup dialog box:

- make sure the channel under test is selected in the Source menu.
- select Meas1, then choose Select Meas > Amplitude > Mean.

e. Record for later use the High measurement value in mρ, making sure to take down the proper sign. This will be used as HiRef, the high reference level for aberration measurements. The low reference level is -1.0 ρ (rho).

Tests Follow this procedure to make the aberration checks:

1. Check aberrations in the range of 10 ns to 20 ps before the edge (aberrations within ±3%.

a. Set the Horizontal Position to 0 (minimum).

b. Change the Horizontal Scale to 50 ps/division while adjusting Horizontal Position to keep the rising edge of the first step waveform on screen.

c. Press the front panel FINE button to turn it on.

d. Adjust the Horizontal Position knob so the waveform crosses the center vertical graticule at the 10% (amplitude) point of the rising edge. Since the waveform is 2 major divisions high at 500 mρ/div, the waveform should be crossing the center vertical graticule at 9 minor divisions below the center horizontal graticule. This defines the ending reference point for pre-transition aberration measurements.

e. Press the FINE button to turn it off.

f. In the Meas Setup dialog box:

- select Meas1, then choose Select Meas > Amplitude > Max.
- select the Region tab.
- set Gate G2 to 46%.
- turn Gates on (check).

g. In the Meas Setup dialog box:

- select Meas2.

- make sure the channel under test is selected in the Source menu.
- choose Select Meas > Amplitude > Min.
- select the Region tab.
- set Gate G2 to 46%.
- set Gates on (check).

h. The Max and Min measurements are now set to include the region of 250 ps to 20 ps before the edge. The aberration specification over this region is ±3%, which is ±30 mρ for a 1 ρ step. Since the reference is -1 ρ, the Max and Min values should be within -1.030 to -0.970 ρ to meet the ±3% specification.

i. Calculate and take down for later use the peak aberrations in percent using the formulas (with Max and Min in mρ units, not ρ):

- positive aberration (%) = (1000+Max) * 0.1
- negative aberration (%) = (1000+Min) * 0.1

For example: if Max = -989 mρ and Min = -1.003 ρ,
positive aberration (%) = (1000 + (-989)) * 0.1 = +1.1
negative aberration (%) = (1000 + (-1003)) * 0.1 = -0.3

***NOTE**. The aberration can have either a positive or negative sign. Both aberrations could have the same sign when the waveform does not cross the reference line in the region being checked.*

---

j. In the Horz Setup dialog box:

- set Horizontal Reference to 50%.
- set Horizontal Scale to 2 ns/division.

k. In the Meas Setup dialog box for Meas2 (Region tab selected), set Gate G2 to 49%.

l. Select Meas1, set Gate G2 to 49%.

m. The Max and Min measurements are now set to include the region of 10 ns to 200 ps before the edge. As before, the aberration specification over this region is ±3%, so the Max and Min values should be within -1.030 to -0.970 ρ.

n. Calculate the peak aberrations in percent using the formulas (with Max and Min in mρ units, not ρ):

- positive aberration (%) = (1000+Max) * 0.1

- negative aberration (%) = (1000+Min) * 0.1

o. Check that the aberrations for the entire 10 ns to 20 ps region before the edge (from steps i and n) are within ±3%. If recording data on the Test Record, enter the largest (positive or negative) value.

2. Check aberrations in the range of 400 ps to 5 ns after the edge (aberrations within ±3%).

a. Change the Horizontal Scale to 50 ps/division while adjusting Horizontal Position to keep the rising edge of the step waveform centered on the display.

b. Press the front panel FINE button to turn it on.

c. Adjust the Horizontal Position knob so the waveform crosses the center vertical graticule at the 90% (amplitude) point of the rising edge. The waveform should be crossing the center vertical graticule at 1 minor division below the center horizontal graticule. This defines the beginning reference for post-transition aberration measurements.

d. Press the front panel FINE button to turn it off.

e. In the Horz Setup dialog box:

- set Horizontal Reference to 50%.
- set Horizontal Scale to 1 ns/division.

f. In the Meas Setup dialog box, for Meas1:

- Set G1 to 54%.
- Set G2 to 100%.

g. In the Meas Setup dialog box, for Meas2:

- Set G1 to 54%.
- Set G2 to 100%.

h. The Max and Min measurements are now set to include the region of 400 ps to 5 ns after the edge. The aberration specification over this region is ±3%, which is ±30 mρ for a 1 ρ step. The reference level is HiRef, from step 5e on page 4–79 of the setup procedure.

i. Calculate the peak aberrations in percent using the formulas (with Max, Min, and HiRef in mρ, not ρ):

- positive aberration (%) = (Max - HiRef) * 0.1
- negative aberration (%) = (Min - HiRef) * 0.1

For example: if Max = +11 mρ and HiRef = -5 mρ,
positive aberration (%) = (+11 -(-5)) * 0.1 = +1.6

j. Check that the aberrations calculate in step i for the 400 ps to 5 ns region after the edge are within ±3%. If recording data on the Test Record, enter the largest (positive or negative) value.

3. Check the range >5ns after the edge (aberrations within ±1%).

a. Change the Horizontal Scale to 10 ns/division.

b. Adjust Horizontal Position so the waveform rising edge is at the second vertical graticule (assuming that the first graticule is the left edge of the display).

c. In the Meas Setup dialog box for Meas2 set Gate G1 to 15%.

d. In the Meas Setup dialog box for Meas1 set Gate G1 to 15%.

e. The Max and Min measurements are now set to include the region of 5 ns to 90 ns after the edge. The aberration specification over this region is ±1%, which is ±10 mρ for a 1 ρ step. The reference level is HiRef, from step 5e on page 4–79 of the setup procedure.

f. Calculate the peak aberrations in percent using the formulas (with Max, Min, and HiRef in mρ, not ρ):

- positive aberration (%) = (Max - HiRef) * 0.1
- negative aberration (%) = (Min - HiRef) * 0.1

g. Check that the aberrations calculated in step f for the region >5 ns after the edge are within ±1%. If recording data on the Test Record, record the largest (positive or negative) value.

4. Repeat the Setup and Test procedures for the TDR negative edge polarity. To do this check, select negative edge polarity after selecting TDR Preset in Setup step 5a on page 4–78. No other changes to the procedures are needed, since in rho (ρ) mode the display does not invert when the TDR edge polarity is changed.

5. Repeat the Setup and Test procedures for channel 2, both polarities.

End of Procedure

Optical Sampling Modules

The following performance verification procedures for the optical sampling modules check the characteristics that are shown as checked specifications (✓ symbol) in Table 1–18 and Table 1–19 of the *Optical Modules Specifications* starting on page 1–18.

Be sure you have performed the appropriate *Prerequisites* on page 4–19 before doing any procedures in this section.

Dark Level & Vertical Equivalent Optical Noise

This procedure checks the dark level, which is the offset in the optical channel caused by thermal variations or finite leakage current. This procedure also checks the vertical equivalent optical noise. The checks are made with vertical offset set to zero and no optical signal input to the optical sampling module (dustcap installed on the OPTICAL INPUT).

Equipment required	CSA8000/TDS8000 Terminator, 50 Ω coaxial, SMA male (item 7); used with optical sampling modules with clock recovery (CR)
Prerequisites	See page 4–19

Setup

Install the test hookup and preset the CSA8000/TDS8000 controls:

1. Install the 80C0X Optical Sampling Module into Channel 1 of the TDS8000 or CSA8000 instrument (see Figure 4–25).

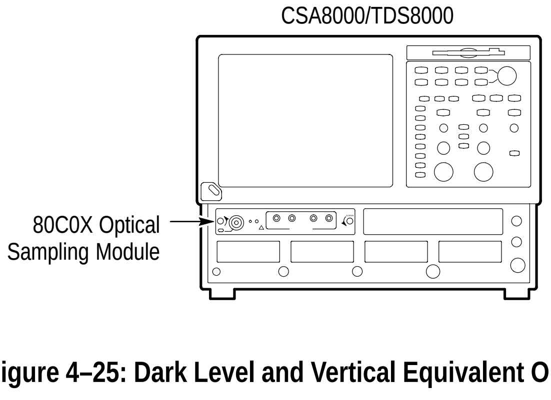


Figure 4–25: Dark Level and Vertical Equivalent Optical Noise test hookup

2. Install the black, fibre-optic dustcap onto the OPTICAL INPUT connector of the optical sampling module.
3. If the optical sampling module has clock recovery, install 50 Ω terminations on the outputs.
4. Press the DEFAULT SETUP button on the TDS8000 or CSA8000 front panel. Click Yes in the dialog box that appears.
5. Select C1 for the waveform source (use the waveform selector button in the lower left corner of the application display).
6. In the Trig Setup dialog box, select Internal Clock for the Trigger Source.

NOTE. *If the Scale, Position, and Channel Offset control boxes are not displayed in the following step, click the Basic button in the lower left part of the Vert Setup dialog box.*

---

7. In the Vert Setup dialog box, do the following:
    - **a.** Set the Scale to one of the following values:
        - 100 μW/div for an 80C01, 80C02, 80C04, 80C05 Optical Sampling Module
        - 5 μW/div for an 80C03 Optical Sampling Module
        - 200 μW/div for an 80C06 Optical Sampling Module
    - **b.** Set Position to 0.0div.
    - **c.** Set Channel Offset to 0.0W.
8. In the Horiz Setup dialog box do the following:
    - **a.** Set Scale to 1.000 ns/div.
    - **b.** Set Record Length to 500.
9. In the Hist Setup dialog box, do the following:
    - **a.** Select Main C1 as the Source.
    - **b.** Check Enable Histogram.
    - **c.** Select Vertical
    - **d.** Close the Hist Setup dialog box.

Procedure: Follow this procedure to make the Dark Level and Vertical Equivalent Optical Noise checks:

1. In the Utilities menu, select System Properties. Check that the Mainframe Current On-Time is greater than 0.33 hours (20 minutes).

***NOTE**. The values in System Properties dialog box do not update while the dialog box is open. Close the dialog box and reopen it to get updated values.*

---

2. Close the System Properties dialog box.
3. In the Utilities menu, select Compensation.
4. Make the following selections in the Compensation dialog box:
   - **a.** Under Select Action, select Compensate.
   - **b.** Select Module.
   - **c.** Select Ch1.
5. Click Execute, and then click OK to the message box that appears.
6. Wait until the compensation is completed (hour glass cursor reverts back to arrow cursor). It is recommended that you store this compensation result in the module as the Stored User values. To store the compensation results in the module, do the following procedure:
   - **a.** In the Select Action section of the Compensation dialog box, select Save.
   - **b.** In the Storage section, make sure User is selected.
   - **c.** Click the Execute button. This saves the compensation results in the module.
7. Click Close to close the Compensation dialog box.
8. In the Vert Setup dialog box, click the Optical>> button. This displays fields for setting up the vertical optical parameters.
9. Select a bandwidth or filter in the Vert Setup dialog box.
10. Press the CLEAR DATA button on the TDS8000 or CSA8000 front panel.

***NOTE**. If the Vert Setup dialog box covers the Histogram statistics readout at the right side of the display, click in the Setups title bar and drag the dialog box to the left until you can see the Histogram statistics.*

---

11. After a few seconds, note the Mean and the Std Dev results displayed on the right side of the display for the selected bandwidth or filter. The mean of the histogram is the dark level value and the standard deviation of the histogram is the maximum RMS vertical equivalent optical noise value. Compare these values to the bandwidth or filter, mean, and standard deviation listed in Table 4–7 for the optical sampling module that you are testing.
12. Repeat steps 9 through 11 for each bandwidth and filter available for the optical sampling module. Refer to Table 4–7.

***NOTE**. The filter and bandwidth settings for the optical sampling module you are testing are selected from the Filter or Bandwidth control boxes in the Vert Setup dialog box.*

End of Procedure

Table 4–7: Dark level and vertical equivalent optical noise limits

Optical sampling module	Bandwidth or filter	Dark level	Vertical equivalent optical noise, std	Vertical equivalent optical noise, CR
80C01	OC-12/STM-4	<10 µW	<12 μW_{RMS}	<15 μW_{RMS}
	OC-48/STM-16	<10 µW	<12 μW_{RMS}	<15 μW_{RMS}
	OC-192/STM-64	<10 µW	<12 μW_{RMS}	<15 μW_{RMS}
	12.5 GHz	<10 µW	<12 μW_{RMS}	<15 μW_{RMS}
	20 GHz	<10 µW	<25 μW_{RMS}	<25 μW_{RMS}
80C02	OC-192/STM-64	<10 µW	<10 μW_{RMS}	<12 μW_{RMS}
	12. GHz	<10 µW	<10 μW_{RMS}	<12 μW_{RMS}
	20 GHz	<10 µW	<15 μW_{RMS}	<20 μW_{RMS}
	30 GHz	<10 µW	<30 μW_{RMS}	<40 μW_{RMS}
80C03	FC1063	<500 nW	<1 μW_{RMS}	<1 μW_{RMS}
	GBE	<500 nW	<1 μW_{RMS}	<1 μW_{RMS}
	OC-48/STM-16/2.5 Gb	<500 nW	<1.5 μW_{RMS}	<1.5 μW_{RMS}
80C04	OC-192/STM-64	<10 µW	<10 μW_{RMS}	<12 μW_{RMS}
	FEC10664	<10 µW	<10 μW_{RMS}	<12 μW_{RMS}
	20 GHz	<10 µW	<15 μW_{RMS}	<20 μW_{RMS}
	30 GHz	<10 µW	<30 μW_{RMS}	<40 μW_{RMS}
80C05	OC-192/STM-64	<10 µW	<15 μW_{RMS}	<15 μW_{RMS}
	20 GHz	<30 µW	<25 μW_{RMS}	<25 μW_{RMS}
	30 GHz	<30 µW	<35 μW_{RMS}	<35 μW_{RMS}
	40 GHz	<30 µW	<70 μW_{RMS}	<70 μW_{RMS}
80C06	50 GHz	<25 µW	<192 μW_{RMS}	<192 μW_{RMS}

Minimum Optical Bandwidth & Reference Receiver Frequency Response

Before performing the checks for minimum optical bandwidth and reference receiver frequency response, you need to have an understanding of what optical bandwidth is and how it is measured.

Traditionally, the bandwidth of a device or system is defined as the frequency at which the power out of the same device or system is one half as compared with a frequency near DC. In the voltage domain, the power dissipated into a resistive load (for example, a 50 Ω termination of a sampler) is the V_{RMS}^2/R where V_{RMS} is the RMS of the voltage swing seen at the resistive load, and R is the resistance value. A logarithmic scale using decibels is typically used to describe a frequency dependent response of a system.

A value expressed in terms of a decibel relative to a reference is defined as:

$$dB = 10 \times \log\left(\frac{value}{reference}\right)$$

For electrical bandwidths, the power ratio is used so:

$$dB = 10 \times \log\left(\frac{Power_f}{Power_{DC}}\right)$$

when

$$\frac{Power_f}{Power_{DC}} = \frac{1}{2}$$

$$10 \times \log\left(\frac{1}{2}\right) = -3\ dB$$

In terms of voltage, and resistance, the bandwidth is expressed as:

$$-3\ dB = 10 \times \log\left[\frac{\frac{V_f^{\,2}}{R}}{\frac{V_{DC}^{\,2}}{R}}\right]$$

where V_f is the RMS of the voltage swing response at the bandwidth frequency and V_{DC} is the RMS voltage swing response at a frequency approaching DC. Further math yields that $V_f = 0.707 \times V_{DC}$. The expression is simplified by the cancellation of the R and the movement of the squared term inside the log expression to a multiple outside the log expression:

$$\log\left[\frac{\frac{V_f^{\,2}}{R}}{\frac{V_{DC}^{\,2}}{R}}\right] = 2 \times 10 \times \log\left(\frac{V_f}{V_{DC}}\right) = 20 \times \log\left(\frac{V_f}{V_{DC}}\right)$$

therefore at

$$-3\ dB\ \frac{V_f}{V_{DC}} = 0.707$$

In the CSA8000 and TDS8000 instruments, the vertical units displayed for an optical module are not in voltage, but are in watts, which is a unit of power. The O/E converter inside the module outputs a voltage swing whose amplitude is linearly dependent on the incoming optical power swing. In this condition the voltage applied at the electrical sampler already represents Optical Power in its linear form (as opposed to having to square the voltage and divide by R). For the optical sampling modules, then, the bandwidth where the displayed optical power is one half that approaching DC is:

$$dB = 10 \times \log\left(\frac{Power_f}{Power_{DC}}\right) = -3\ \ dB$$

The V_f in such a system is one half (0.5) the V_{DC} as opposed to 0.707. The optical bandwidth, therefore, corresponds to the traditional electrical bandwidth at –6 dB. During testing of optical modules via impulse testing, the resulting impulse waveform is converted to frequency via Fourier transform, and the bandwidth is defined as:

$$-\ 3\ \ dB = 10 \times \log\left(\frac{vertical\ swing\ @\ frequency}{vertical\ swing\ @\ DC}\right)$$

This definition is used for 2.5 GHz, 12.5 GHz, 20 GHz, and 30 GHz bandwidth settings.

During reference receiver curve calculation, however, the definition is changed to match the industry standard definition, which was authored assuming electrical bandwidths where:

$$-\ 3\ \ dB = 20 \times \log\left(\frac{vertical\ swing\ @\ frequency}{vertical\ swing\ @\ DC}\right)$$

This definition is used for reference receiver settings OC12, OC48, OC192, GBE, 2 ×GBE and FC 1063.

This procedure checks the minimum optical bandwidths and the reference receiver frequency responses of an 80C0X Optical Sampling Module.

***NOTE**. To optimize performance, make sure that all connections are clean and secure and that all components of the system are in good condition. Optical fiber can gradually degrade the system performance as it is repeatedly flexed over time.*

Equipment required	Tektronix CSA8000/TDS8000 Calmar FPL-01 optical impulser (item 25) Tektronix OA5002 variable optical attenuator (item 24) Single-mode fiber-optic cable, 2 m, FC to FC connectors (item 30) Optical attenuator, 10 dB, FC-FC, female-male connectors (item 28) Cable, coaxial, 1 m, male to male SMA connectors (item 11)
Prerequisites	See page 4–19

Before performing this procedure, be sure you have completed the *Dark level & Vertical Equivalent Optical Noise* procedure on page 4–83.

Setup

Install the test hookup (see Figure 4–26) and preset the CSA8000/TDS8000 controls:

1. Install the 80C0X Optical Sampling Module into Channel 1 of the TDS8000 or CSA8000 instrument.

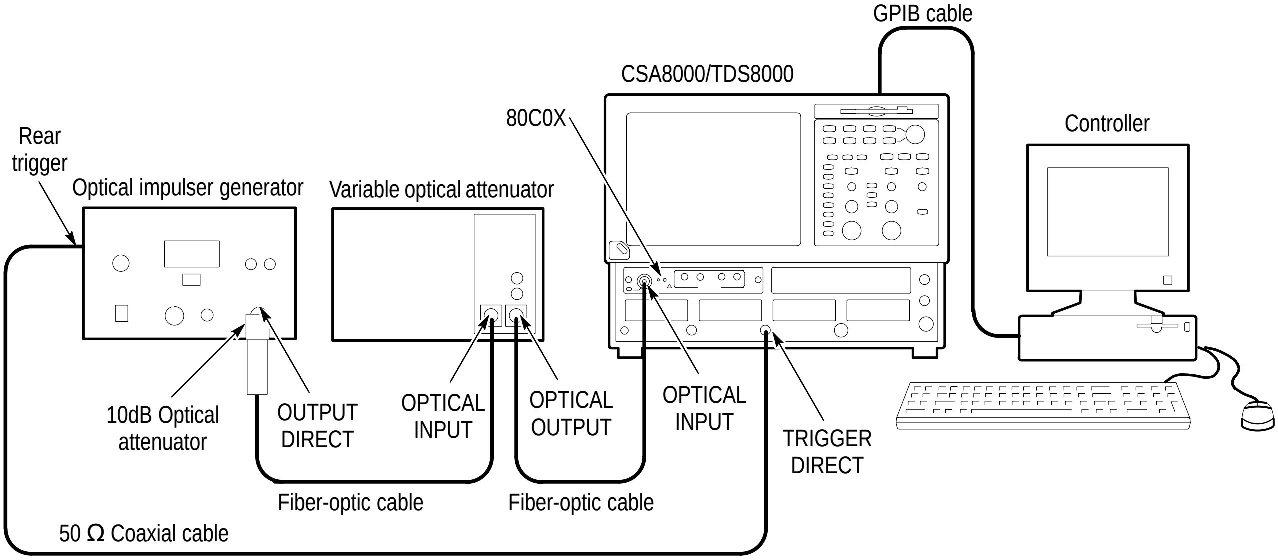


Figure 4–26: Minimum optical bandwidth and reference receiver frequency response hookup

2. Connect the 10 dB optical attenuator to the output of the optical impulse generator.
3. Connect a fiber-optic cable between the 10 dB optical attenuator and the input of the OA5002 variable optical attenuator.
4. Connect a fiber-optic cable between the output of the variable optical attenuator and the OPTICAL INPUT of the optical sampling module.
5. Connect a 50 Ω coaxial cable from the rear trigger (SYN) on the optical impulse generator to the TRIGGER DIRECT input on the TDS8000 or CSA8000.
6. Start with about 30 dB of attenuation on the variable attenuator.

***NOTE**. To avoid dispersing the narrow optical impulse signal, keep all fiber lengths as short as possible. Lengths that are 2 to 3 meters long are acceptable.*

7. Press the SELECT ON/OFF button on the 80C0X Optical Sampling Module so that the adjacent indicator lights. This turns on Channel 1 (C1) on the 80C0X-CR Optical Sampling Module.
8. In the Setup menu, select Acquire and make the following changes in the Acq Setup dialog box:
   a. Select Average as the acquisition mode.
   b. Set the number of samples to 64 Samples
9. In the Trig Setup dialog box, do the following:
   a. Select External Direct for the trigger source.
   b. Select Auto for Mode.
   c. Select the rising edge for Slope.
   d. Click the Set to 50% button to set the trigger point midway on the rising signal.
10. In the Horiz Setup dialog box, do the following;
    a. Set the Scale to 1.000 ns/div. (This setting will make it easier to initially locate the optical pulse later in the procedure.)
    b. Set the Position to 18.000 ns. (This setting will make it easier to locate the first optical pulse later in the procedure.)
    c. Set the Record Length to 2000.

11. In the Disp Setup dialog box, do the following:

  a. In the Style section, select Normal.

  b. Check Show Vectors.

***NOTE**. If the Scale, Position, and Channel Offset control boxes are not displayed in the following step, click the Basic>> button in the lower left part of the Vert Setup dialog box.*

---

12. In the Vert Setup dialog box, do the the following:

  a. Set the Scale to 500.0 μW/div.

  b. Set Position to 0.0 div.

  c. Set Channel Offset to 0.0 W.

  d. Click the Optical>> button in the lower left part of the Vet Setup dialog box.

  e. Set Wavelength to 1550 nm.

  f. Set the Bandwidth or Filter to the highest bandwidth setting available for the optical sampling module that you are testing:

80C01	Filter to None	Bandwidth to 20.000 GHz
80C02	Filter to None	Bandwidth to 30.000 GHz
80C03	Filter to 2XGBE	Bandwidth inactive
80C04	Filter to None	Bandwidth to 30.000 GHz
80C05	Filter to None	Bandwidth to 40.000 GHz

  g. Position the cursor in the title bar of the Setups dialog box and drag the box to the right side of the display.

13. Use the Horizontal POSITION control to position the impulse at the first horizontal division. (This ensures that post-impulse aberrations are included in the record.) See Figure 4–27.

14. Adjust the attenuation of the variable optical attenuator until it produces an impulse pulse amplitude of 1.5 $\text{mW}_{\text{p-p}}$ to 2.5 $\text{mW}_{\text{p-p}}$ if you are testing an 80C01, 80C02, or 80C04 Optical Sampling Module. Adjust the attenuator until a 200 $\mu\text{W}_{\text{p-p}}$ pulse amplitude is achieved if you are testing an 80C03 Optical Sampling Module. Adjust the attenuator until a 10 mW p-p pulse amplitude is achieved if you are testing an 80C05 optical sampling module.

Procedure

Follow this procedure to make the minimum optical bandwidth and reference receiver frequency response checks:

***NOTE**. The minimum optical bandwidth is not checked for the 80C03 Optical Sampling Module. If testing this module, go to step 10 in this procedure and continue with this procedure to check the reference receiver frequency responses.*

---

1. In the Vert Setup dialog box, set Bandwidth to 12.5 GHz, for an 80C01 and 80C02 optical sampling module. Set bandwidth to 20 GHz for an 80C04 and 80C05 optical sampling module.
2. Use the Horizontal POSITION control to position the impulse at the first horizontal division. (This ensures that post-impulse aberrations are included in the record.) See Figure 4–27.

   You may experience signal jitter if you try to display a signal that is not the first impulse and is late in relation to time zero.
3. Adjust the Horizontal SCALE control so that the width of the impulse at its base is approximately 1/4 to 3/4 of a horizontal division on the display. See Figure 4–27.

***NOTE**. If the width of the impulse is much greater than 3/4 of a horizontal division, the resulting Fourier transform will not have enough frequency resolution; if the width is much smaller that 1/4 of a horizontal division, the amount of samples that fall on the impulse may be too coarse, resulting in quantum errors in the resulting Fourier transform.*

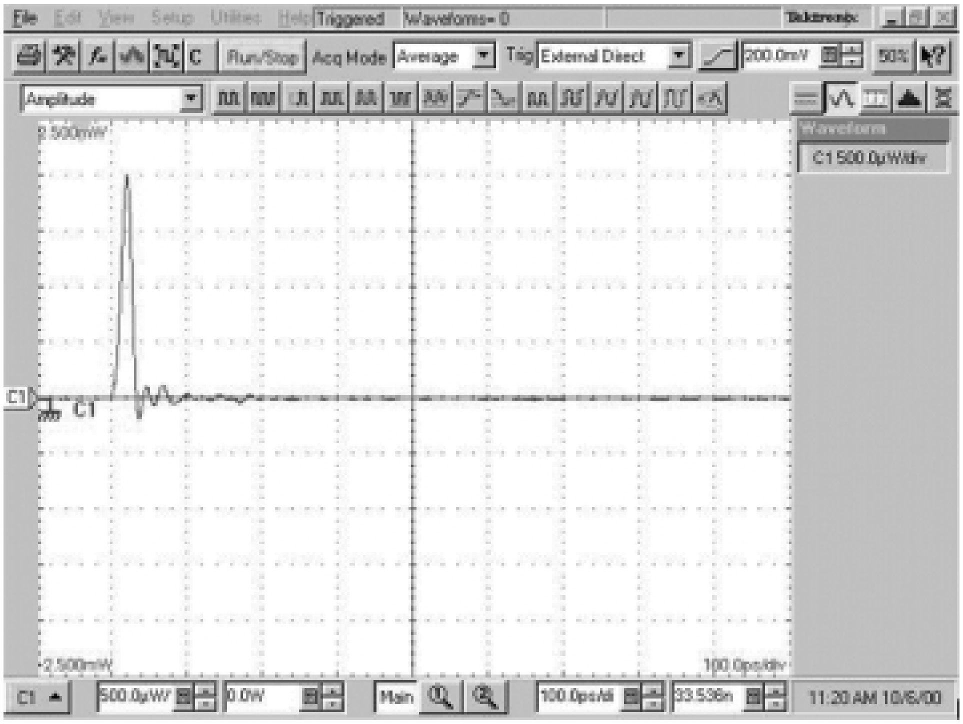


Figure 4–27: Proper positioning of the impulse for optimum curve download

4. Using a controller (such as a PC, Macintosh, or workstation) attached to the TDS8000 or CSA800 instrument via GPIB, download the waveform.

***NOTE**. Alternatively, you can use the Save Waveform, Copy Waveform, or a network connection to transfer a waveform curve to a spreadsheet, ASCII file, or other application. Refer to the* CSA8000 Communications Signal Analyzer & TDS8000 Digital Sampling Oscilloscope User Manual *for more information about these methods of transferring waveform data.*

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5. Using the available controller software, such as Labview, perform an Fourier Transform on the waveform; this transforms the time-domain impulse response to a scalar frequency response.

6. Normalize the Fourier Transform result such that DC or low frequency is 0 dB.

7. Plot the frequency response.

8. Check that the optical sampling module meets the performance requirements for the bandwidth setting chosen.

9. Repeat steps 2 through 8 for the remaining bandwidth settings for the optical module under test (refer to Table 4–8 for the settings that match the module model).

Table 4–8: Minimum optical bandwidth limits

Optical sampling module	Bandwidth setting	Bandwidth limit
80C01	20 GHz	>20 GHz
	12.5 GHz	>12.5 GHz
80C02	30 GHz	>28 GHz
	20 GHz	>20 GHz
	12.5 GHz	>12.5 GHz
80C04	30 GHz	>28 GHz
	20 GHz	>20 GHz
80C05	40 GHz	>40 GHz
	30 GHz	>30 GHz
	20 GHz	>20 GHz

10. In the Vert Setup dialog box, select a Filter (see the Table 4–9 for filters available for the various optical sampling modules).

11. Do steps 2 through 7.

12. Refer to Table 4–9 and check that the optical sampling module meets the limits listed for the tested filter.

13. Repeat steps 10 through 12 for each of the filters available for the optical sampling module that you are testing.

End of Procedure

Table 4–9: Reference receiver frequency response limits

Optical sampling module	Filter	Limits			
80C01	OC-12/STM-4	(MHz)		(dB)	
		Frequency	Lower	Nominal	Upper
		0.000	–0.50	0.00	+0.50
		93.3	–0.61	–0.11	+0.39
		186.6	–0.95	–0.45	+0.05
		279.9	–1.52	–1.02	–0.52
		373.2	–2.36	–1.86	–1.36
		466.7	–3.50	–3.00	–2.50
		559.9	–5.67	–4.51	–3.35
		622.1	–7.25	–5.71	–4.17
		653.2	–8.08	–6.37	–4.66
		746.5	–10.74	–8.54	–6.35
		839.8	–13.55	–10.93	–8.31
		933.1	–16.41	–13.41	–10.41
		1244.2	–26.11	–21.45	–16.78
80C01, 80C03	OC-48/STM-16	(MHz)		(dB)	
		Frequency	Lower	Nominal	Upper
		0.000	–0.50	0.00	+0.50
		373.3	–0.61	–0.11	+0.39
		746.5	–0.95	–0.45	+0.05
		1119.7	–1.52	–1.02	–0.52
		1493.1	–2.36	–1.86	–1.36
		1866.3	–3.50	–3.00	–2.50
		2239.5	–5.67	–4.51	–3.35
		2488.3	–7.25	–5.71	–4.17
		2612.8	–8.08	–6.37	–4.66
		2986.0	–10.74	–8.54	–6.35
		3359.3	–13.55	–10.93	–8.31
		3732.6	–16.41	–13.41	–10.41
		4976.7	–26.11	–21.45	–16.78
80C01, 80C02, 80C04, 80C05	OC-192/STM-64	(MHz)		(dB)	
		Frequency	Lower	Nominal	Upper
		0.000	–0.85	0.00	+0.85
		1493.2	–0.96	–0.11	+0.74
		2986.0	–1.30	–0.45	+0.40
		4478.8	–1.87	–1.02	+0.17
		5972.4	–2.71	–1.86	–1.01
		7465.0	–3.86	–3.00	–2.16
		8958.0	–6.19	–4.51	–2.83
		9953.28	–7.87	–5.71	–3.55
		10451.2	–8.75	–6.37	–3.99
		11944.0	–11.53	–8.54	–5.56
		13437.2	–14.45	–10.93	–7.41
		14930.4	–17.41	–13.41	–9.41

Table 4–9: Reference receiver frequency response limits (Cont.)

Optical sampling module	Filter	Limits			
80C04	FEC10664	(MHz)		(dB)	
		Frequency	Lower	Nominal	Upper
		0.000	–0.85	0.00	+0.85
		1493.2	–0.96	–0.11	+0.74
		2986.0	–1.30	–0.45	+0.40
		4478.8	–1.87	–1.02	+0.17
		5972.4	–2.71	–1.86	–1.01
		7465.0	–3.86	–3.00	–2.16
		8958.0	–6.19	–4.51	–2.83
		9953.28	–7.87	–5.71	–3.55
		10451.2	–8.75	–6.37	–3.99
		11944.0	–11.53	–8.54	–5.56
		13437.2	–14.45	–10.93	–7.41
		14930.4	–17.41	–13.41	–9.41
80C03	FC1063	(MHz)		(dB)	
		Frequency	Lower	Nominal	Upper
		0.000	–0.50	0.00	+0.50
		159.5	–0.61	–0.11	+0.39
		318.9	–0.95	–0.45	+0.05
		478.4	–1.52	–1.02	–0.52
		637.9	–2.36	–1.86	–1.36
		797.4	–3.50	–3.00	–2.50
		956.8	–5.67	–4.51	–3.35
		1063	–7.25	–5.71	–4.17
		1116	–8.08	–6.37	–4.66
		1275	–10.74	–8.54	–6.35
		1435	–13.55	–10.93	–8.31
		1595	–16.41	–13.41	–10.41
		2126	–26.11	–21.45	–16.78

Table 4–9: Reference receiver frequency response limits (Cont.)

Optical sampling module	Filter	Limits			
80C03	GBE	(MHz)		(dB)	
		Frequency	Lower	Nominal	Upper
		0.000	–0.50	0.00	+0.50
		187.5	–0.61	–0.11	+0.39
		375	–0.95	–0.45	+0.05
		562.5	–1.52	–1.02	–0.52
		750	–2.36	–1.86	–1.36
		937.5	–3.50	–3.00	–2.50
		1125	–5.67	–4.51	–3.35
		1250	–7.25	–5.71	–4.17
		1312.5	–8.08	–6.37	–4.66
		1500	–10.74	–8.54	–6.35
		1687.5	–13.55	–10.93	–8.31
		1875	–16.41	–13.41	–10.41
		2500	–26.11	–21.45	–16.78
80C03	2X GBE (2.50 Gb/s)	(MHz)		(dB)	
		Frequency	Lower	Nominal	upper
		0.000	–0.50	0.00	+0.50
		375	–0.61	–0.11	+0.39
		750	–0.95	–0.45	+0.05
		1125	–1.52	–1.02	–0.52
		1500	–2.36	–1.86	–1.36
		1875	–3.50	–3.00	–2.50
		2250	–5.67	–4.51	–3.35
		2500	–7.25	–5.71	–4.17
		2625	–8.08	–6.37	–4.66
		3000	–10.74	–8.54	–6.35
		3375	–13.55	–10.93	–8.31
		3750	–16.41	–13.41	–10.41
		5000	–26.11	–21.45	–16.78

NOTE. *Because of interpolation errors in the FFT calculation of the impulse response, the 80C06 module is not tested like the modules in the previous section. Instead, we intergrate the impulse response to generate a step and then measure the 10% to 90% risetime of this step response. The procedure to do this follows.*

Integrated Rise Time 80C06

This procedure checks the Integrated rise time of an 80C06 Optical Sampling Module.

***NOTE**. To optimize performance, make sure that all connections are clean and secure and that all components of the system are in good condition. Optical fiber can gradually degrade the system performance as it is repeatedly flexed over time.*

Equipment required	Tektronix CSA8000/TDS8000 Calmar FPL-01 optical impulser (item 25) Tektronix OA5002 variable optical attenuator (item 24) Single-mode fiber-optic cable, 2 m, FC to FC connectors (item 30) Cable, coaxial, 1 m, male to male SMA connectors (item 11)
Prerequisites	See page 4–19

Before performing this procedure, be sure you have completed the *Dark level & Vertical Equivalent Optical Noise* procedure on page 4–83.

Setup

Install the test hookup (see Figure 4–26) and preset the CSA8000/TDS8000 controls:

1. Install the 80C0X Optical Sampling Module into Channel 1 of the TDS8000 or CSA8000 instrument.

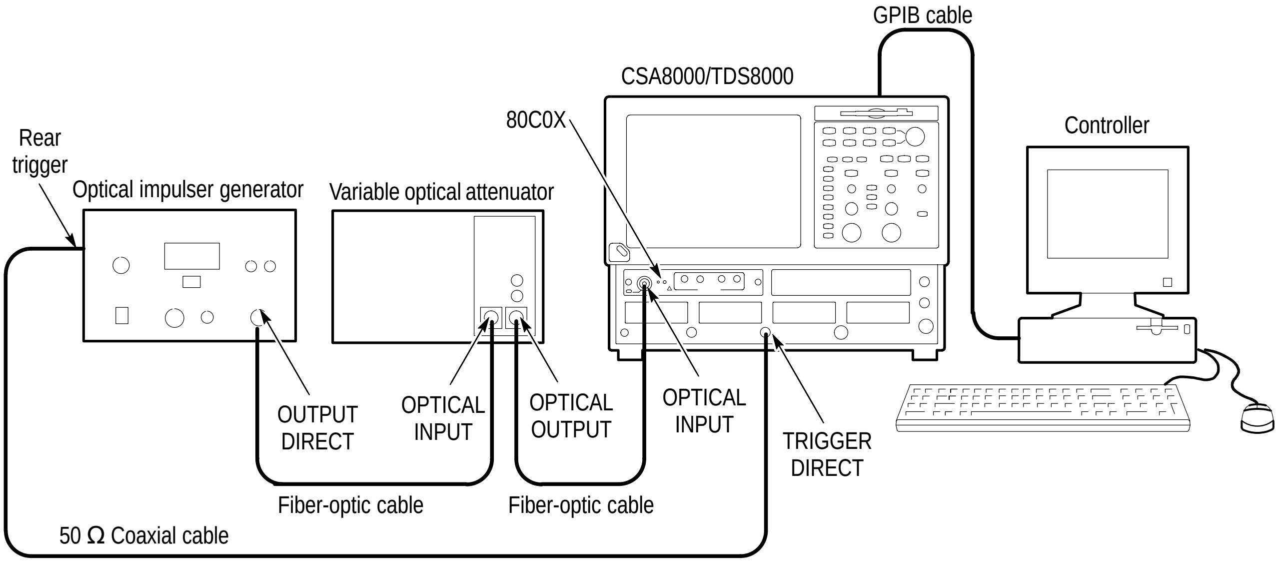

Figure 4–28: Minimum optical bandwidth and reference receiver frequency response hookup

2. Connect a fiber-optic cable between the output of the optical impulse generator and the input of the OA5002 variable optical attenuator.
3. Connect a fiber-optic cable between the output of the OA5002 variable optical attenuator and the optical output of the optical sampling module.
4. Connect a 50 Ω coaxial cable from the rear trigger (SYN) on the optical impulse generator to the TRIGGER DIRECT input on the TDS8000 or CSA8000.
5. Start with about 30 dB of attenuation on the variable attenuator.

NOTE. *To avoid dispersing the narrow optical impulse signal, keep all fiber lengths as short as possible. Lengths that are 2 to 3 meters long are acceptable.*

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6. Press the SELECT ON/OFF button on the 80C06 Optical Sampling Module so that the adjacent indicator lights. This turns on Channel 1 (C1) on the 80C06 Optical Sampling Module.
7. In the Setup menu, select Acquire and make the following changes in the Acq Setup dialog box:
   a. Select Sample as the acquisition mode.
8. In the Trig Setup dialog box, do the following:

   - **a.** Select External Direct for the trigger source.
   - **b.** Select Normal for Mode.
   - **c.** Select the rising edge for Slope.
   - **d.** Click the Set to 50% button to set the trigger point midway on the rising signal.

9. In the Horiz Setup dialog box, do the following;

   - **a.** Set the Scale to 1.000 ns/div. (This setting will make it easier to initially locate the optical pulse later in the procedure.)
   - **b.** Set the Position to 30.000 ns. (This setting will make it easier to locate the first optical pulse later in the procedure.)
   - **c.** Set the Record Length to 2000.
   - **d.** Set the timebase to short term jitter.

10. In the Disp Setup dialog box, do the following:

   - **a.** In the Style section, select Normal.
   - **b.** Check Show Vectors.

11. In the Vert Setup dialog box, do the the following:

   - **a.** Set the Scale to 500.0 μW/div.
   - **b.** Set Position to 0.0 div.
   - **c.** Set Channel Offset to 0.0 W.
   - **d.** Click the Optical>> button in the lower left part of the Vet Setup dialog box.
   - **e.** Set Wavelength to 1550 nm.
   - **f.** Set the Bandwidth to 50 GHz.

12. Use the Horizontal POSITION control to position the impulse at the second horizontal division.

13. Use the Horizontal POSITION and SCALE controls to decrease the Horizontal SCALE to 20 ps/div to position the impulse at the second horizontal division.

14. Use the Vertical SCALE control to increase the vertical scale to 2 mW/div.

15. Adjust the attenuation of the variable optical attenuator to an impulse amplitude of 8 mW p-p to 10 mW p-p.

16. Select Meas Dialog box and make the following changes:
    - **a.** Select Meas1.
    - **b.** Click the Select Meas, select Amplitude, then select Mean.
    - **c.** Select MainC1, as the source.
    - **d.** Click the Region.
    - **e.** Enter 0% for G1 and 5% for G2.
17. Press the MATH button on the front panel. (This will bring up the menu to define math functions on the waveforms.)
18. Using the supplied symbols in the menu, enter the following formula: *100*Avg(Intg(C1-Meas1))*
19. In the Num Avgs field enter 100.
20. Check the box M1 On.
21. Click OK at the bottom of the menu.
22. Select Meas Dialog box and make the following changes:
    - **a.** Select Meas2.
    - **b.** Click the Select Meas, select Timing, then select RISE.
    - **c.** Make sure the box by ON is checked.
    - **d.** Select Math M1 as the source.

NOTE*. The math M1 rise time measurement displayed in the right-hand margin.*

- **e.** Set the Bandwidth 50 GHz and note the risetime measurement displayed in the right-hand margin.
  Rise time should be <9.6 ps (typical).

Clock Recovery Optical Sensitivity Range and Recovered Clock Timing Jitter

This procedure checks the clock recovery optical sensitivity range for an 80C03 Optical Sampling Module and the recovered clock timing jitter on the 80C01 and 80C03 Optical Sampling Modules.

NOTE. *The clock recovery optical sensitivity range and recovered clock timing jitter for the 80C02 and the 80C04 Optical Sampling modules currently cannot be checked by the user. If you want these parameters checked, you must return the optical sampling module to Tektronix, Inc. for verification.*

Equipment required	Tektronix CSA8000/TDS8000 Tektronix 80E02 Sampling Module (item 23) Tektronix OA5002 variable optical attenuator (item 24) Advantest D3186 12 Gb Pattern Generator (item 27) JDS Uniphase 420B Laser Transmitter (item 26) Single-mode fiber-optic cable, 2 m, FC to FC connectors (item 30) Attenuator, 2X (6 dB pad), 50 Ω, SMA (item 22) Cable, coaxial, 2 ns delay SMA, male connector on each end (item 29)
Prerequisites	See page 4–19

Before performing this procedure, be sure you have completed the *Dark level & Vertical Equivalent Optical Noise* procedure on page 4–83.

Setup

Install the test hookup (see Figure 4–29) and preset the CSA8000/TDS8000 controls:

1. Install the 80C0X Optical Sampling Module into Channel 1 of the TDS8000 or CSA8000 instrument.
2. Install the 80E02 Sampling Module into Channels 3 and 4 of the TDS8000 or CSA8000 instrument. (Channel 1 and Channel 2 are disabled when an optical sampling module is installed in the upper Channel 1.)
3. Install 2X SMA electrical attenuators on the inputs of the 80E02 Sampling Module (to prevent saturation).
4. Connect a less than 2 ns delay, 50 Ω coaxial cable between the 1/32 CLK signal output of the pattern generator and the TRIGGER DIRECT connector on the TDS8000 or CSA8000.
5. Connect a less than 2 ns delay, 50 Ω coaxial cable between the DATA output of the pattern generator and the DIGITAL IN DC-COUPLED input on the laser transmitter.
6. Connect a single-mode fiber-optic cable between the OPTICAL output of the laser transmitter and the OPTICAL INPUT on the variable optical attenuator.

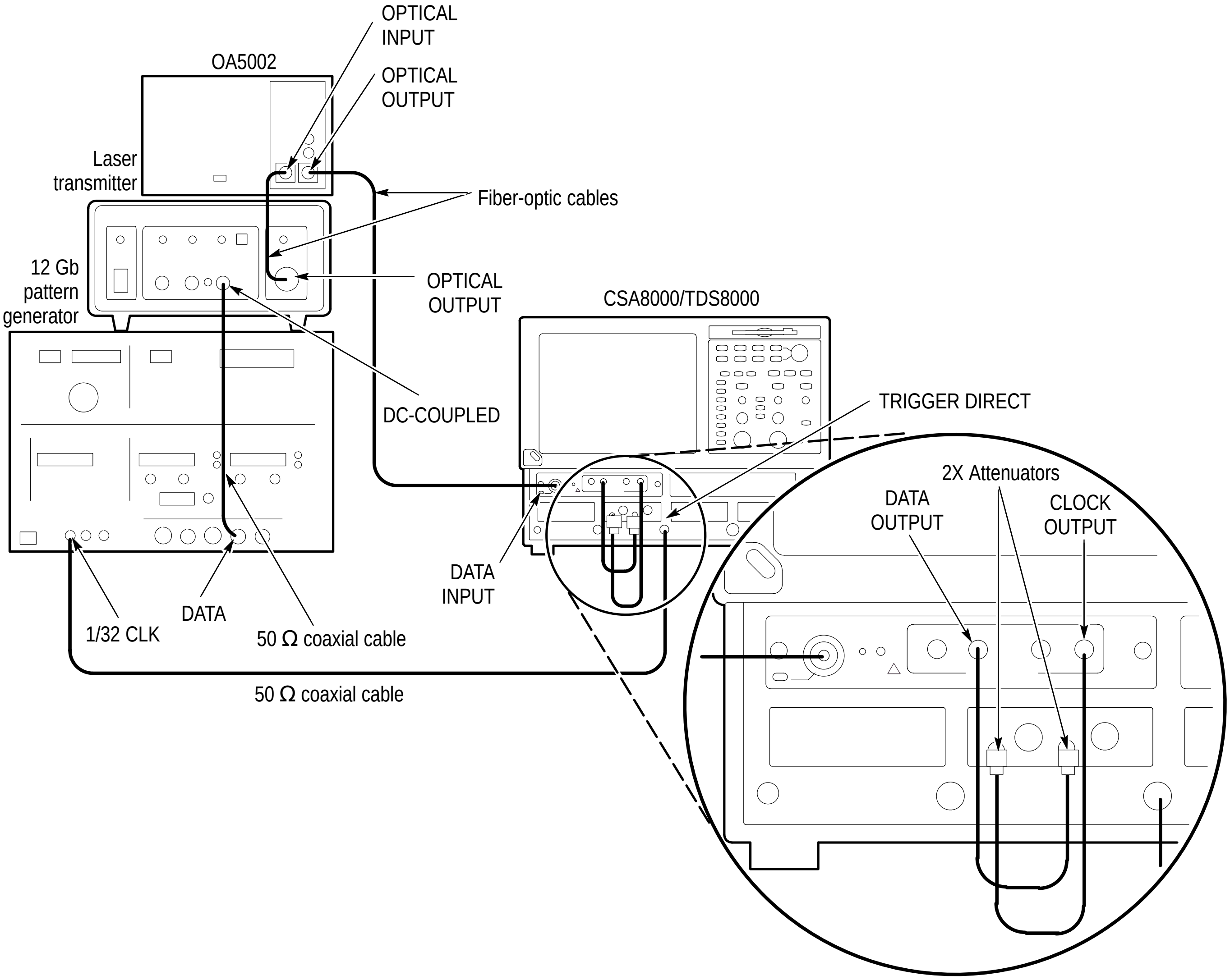


Figure 4–29: 80C01 and 80C03 clock recovery optical sensitivity range and recovered clock timing jitter hookup

7. Connect a single-mode fiber-optic cable between the OPTICAL OUTPUT of the variable optical attenuator and the OPTICAL INPUT of the 80C0X-CR Optical Sampling Module.

8. Connect a less than 2 ns delay, 50 Ω coaxial cable between the CLOCK OUTPUT of the 80C0X-CR Optical Sampling Module and the Channel 3 input on the 80E02 Sampling Module.

9. Connect a less than 2 ns delay, 50 Ω coaxial cable between the DATA OUTPUT of the 80C0X-CR Optical Sampling Module and the Channel 4 input on the 80E02 Sampling Module.

10. The D3186 Pulse Pattern Generator must use its own reference clock. Set the following data signal parameters on the pattern generator:

- AC coupled
- DATA output mode –2 V
- Amplitude 0.700 V
- Offset –1.00 V
- PRBS23 pattern
- NRZ data format
- Balanced duty cycle (crossing set to the default 50% level)
- Data rate to 2.48832 Gb/s (the data rate will be changed, depending on each specific data rate to be tested later in the procedure)

11. Set the variable optical attenuator for minimum attenuation.

12. Allow the TDS8000 or CSA8000 and its modules to warm up for at least 20 minutes in an environment that has had less than 1 °C variation throughout the warm-up cycle.

13. Press the DEFAULT SETUP button on the TDS8000 or CSA8000 instrument.

14. Press the SELECT ON/OFF button on the 80C0X Optical Sampling Module so that the adjacent indicator lights. This turns on Channel 1 (C1) on the 80C0X-CR Optical Sampling Module.

15. Press the SELECT ON/OFF button on the 80E02 Sampling Module so that the adjacent indicator lights. This turns on Channel 3 (C3), which displays the CLOCK signal.

16. From the Setup Menu, select the Trig Setup dialog box. Make the following changes:

  a. Select External Direct as the Trigger Source.

  b. In the Level section, click the Set to 50% button.

  c. Select positive edge for the Slope.

17. Select the Meas Setup dialog box. Make the following changes:

  a. Select Meas 1 in the scroll-down control box.

  b. Click the Select Meas button.

   c. Select Eye Pattern/Optical>Average Optical Power as the measurement for C1. (Be sure Main C1 is selected as the Source.)

18. Select the Vert Setup dialog box and make the following changes:

    a. Select C1 for Waveform.

    b. Set the Wavelength to match the wavelength of the laser transmitter.

19. Select the Wfm Database Setup dialog box.

    a. In the Database1 section, select Main C3 as the Source.

    b. Check On for Database1.

20. Select the Meas Setup dialog box and make the following changes:

    a. Select Main C3 as the Source.

    b. Select Meas 2 in the scroll-down control box.

    c. Check the Use Wfm Database selection.

Procedure

Follow this procedure to make the clock recovery optical sensitivity range and recovered clock timing jitter checks:

1. In the Trig Setup dialog box, select the clock recovery rate for C1 that you want to test (see Table 4–10).

***NOTE**. Leave External Direct selected as the Trigger Source, even though you are selecting a rate other than None. In this preliminary setup, the clock recovery circuitry is enabled for the 80C0X-CR Optical Sampling Module, but the TDS8000 or CSA8000 instrument timebase receives its trigger events from the TRIGGER DIRECT input signal and not the actual recovered clock.*

---

2. Set the data rate of the D3186 Pulse Pattern Generator to the rate setting for the clock recovery rate that you selected in step 1 (see Table 4–10).

3. Adjust the Horizontal SCALE control on the front panel of the TDS8000 or CSA8000 instrument to the setting listed in the table for the clock recovery rate that you selected in step 1 (see Table 4–10).

Table 4–10: Clock recovery settings

Optical sampling module	Clock recovery rate	D3186 rate setting	TDS8000 or CSA8000 scale setting
80C01-CR	OC-12	0.62208 Gb/s	500 ps/div
	OC-48	2.48832 Gb/s	100 ps/div
80C03-CR	FC-1063	1.0625 Gb/s	200 ps/div
	GBE	1.2500 Gb/s	200 ps/div
	OC-48	2.48832 Gb/s	100 ps/div
	2.5 Gb/s	2.5000 Gb/s	100 ps/div

At this point in the procedure, the TDS8000 or CSA8000 instrument is triggered from the 1/32 clock from the D3186 Pulse Pattern Generator. The clock signal from the 80C0X-CR Optical Sampling Module that is connected to C3 on the 80E02 Sampling Module should be synchronous with the signal from the pulse pattern generator (see Figure 4–31).

If the signals are not synchronous (see Figure 4–30), check that the D3186 data rate is set to a data rate that matches the clock recovery rate set for the 80C0X-CR Optical Sampling Module (see Table 4–10).

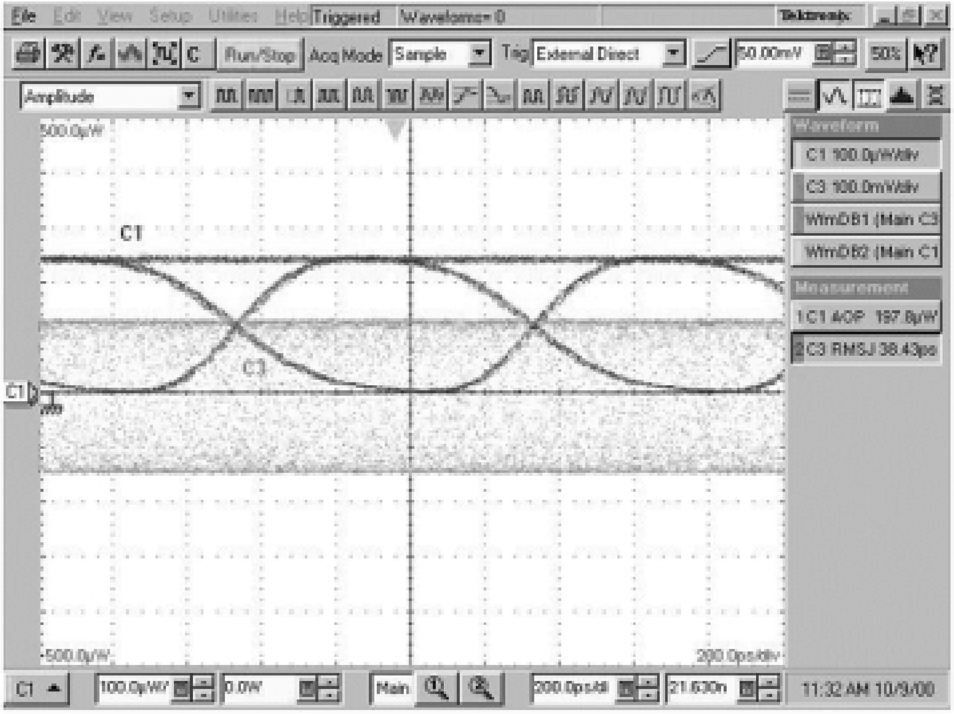


Figure 4–30: Example of the display when the clock signal from the 80C0X-CR Optical Sampling Module is not synchronous with the data rate input from the pulse pattern generator. Note the unstable ("washed out") clock signal. Compare this with Figure 4–31, in which the clock signal is synchronized.

4. Once you have verified that the recovered clock signal (C3) is locked with the incoming data, select the Trig Setup dialog box, and select Clock Recovery as the Trigger Source.
5. If you are checking an 80C03 Optical Sampling Module, do the following procedure to check the clock recovery optical sensitivity range:
   - **a.** Adjust the variable optical attenuator until the Average Optical Power (AOP) measurement for C1 is 400 µW (–4.0 dBm).
   - **b.** Check that the clock signal remains stable.
   - **c.** Adjust the variable optical attenuator until the Average Optical Power (AOP) measurement for C1 is 25 µW (–16.0 dBm).
   - **d.** Check that the clock signal remains stable.
   - **e.** Skip to step 7.
6. If you are checking an optical sampling module other than an 80C03, set the Average Optical Power (AOP) to 125 µW (–9.0 dBm).

7. Zoom into the 50% crossing point of the first rising edge on the C3 clock signal until the Horizontal SCALE is 10 ps/div and the Vertical SCALE is 10 mV/div. See Figure 4–32

NOTE. *You can most easily zoom in on the 50% crossing point by click dragging a rectangle around this edge (using the mouse), and then using the SCALE and FINE control knobs to adjust the settings to 10 mV/div and 10 ps/div.*

---

8. Check that the RMS jitter measurement for C3 is less than 8 ps RMS.
9. Repeat this procedure from step 1 to check the recovered clock timing jitter for each of the clock recovery rates of the optical sampling module you are testing. See Table 4–10.

End of Procedure

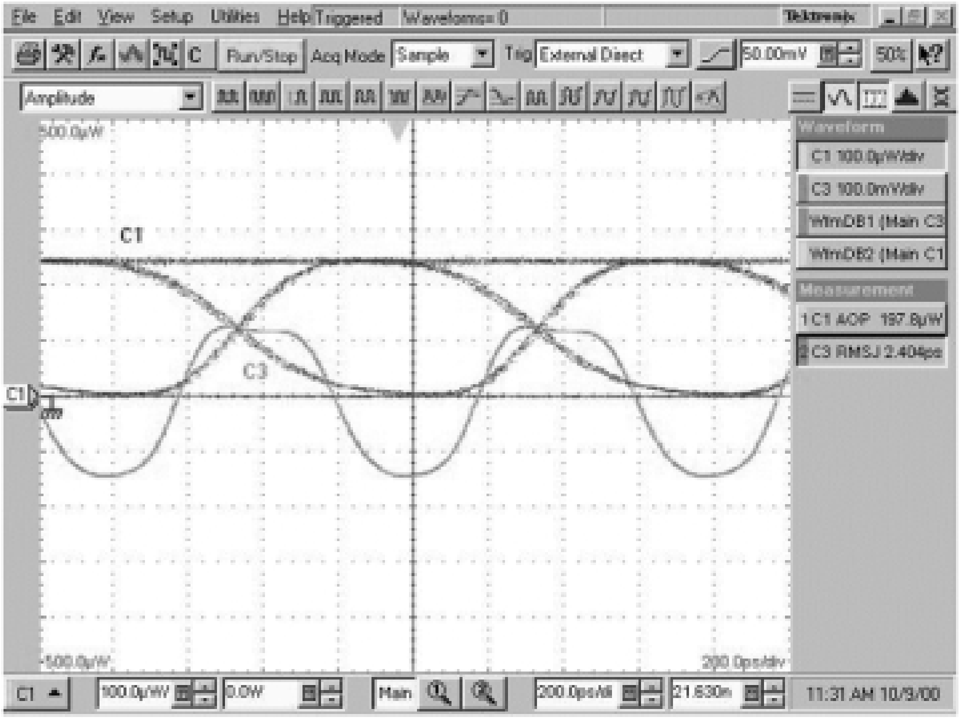


Figure 4–31: Example of the display when the clock signal from the 80C0X-CR Optical Sampling Module is synchronous with the data rate input from the pulse pattern generator. Note the stable clock signal waveform. Compare this with Figure 4–30, in which the clock signal is not synchronized.

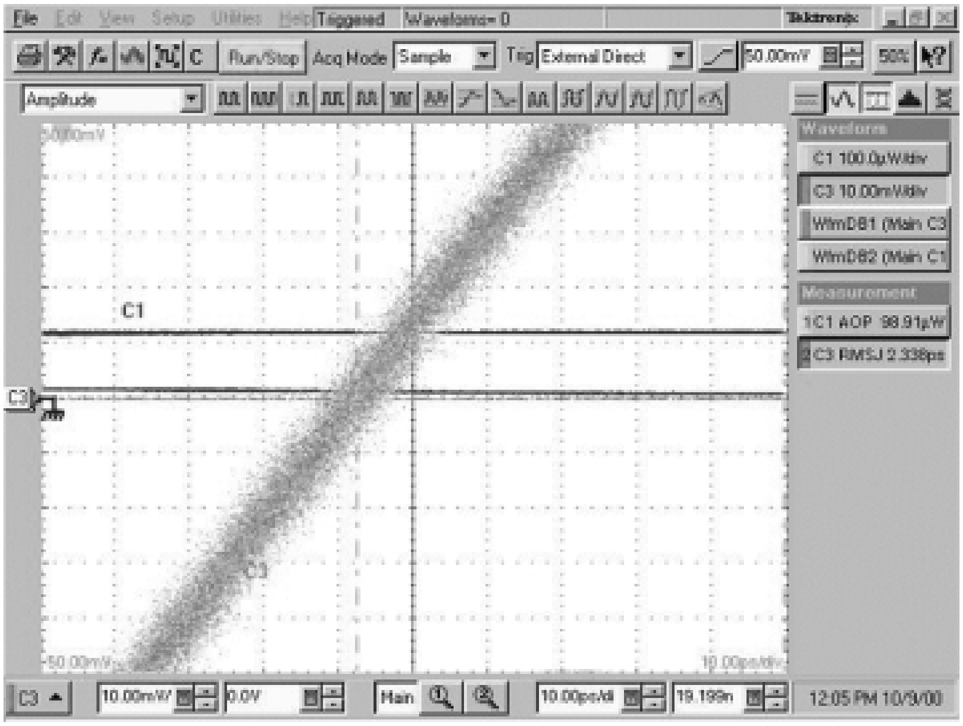


Figure 4–32: Example of the display zoomed in to 10 mV/div and 10 ps/div at the crossing point (50%) on the recovered clock signal (C3).

80A01 Trigger Prescale Limiting Preamplifier Module

These procedures check those characteristics that relate to 80A01 module and are listed as checked specifications. Refer to Table 1–11 on page 1–11.

Prerequisites

Be sure you have performed the following prerequisites and the *Prerequisites* on page 4–19 before doing any procedures in this section.

- Install the 80A01 module in left most of the small compartments in the front panel of the CSA8000 or TDS8000 instrument.
- Install a 80E0X module in the small module compartment immediately to the right of the installed 80A01 module.

***NOTE**. Use a calibrated torque wrench when connecting the terminators, adapters, attenuator, and power sensor in this setup. Use 8 ± 0.3 inch pounds of torque.*

***STOP**. Throughout these procedures, when steps call for the display of setup dialog boxes, you can display them from the Setup menu in the menu bar at the top of the screen. These procedures assume you will display and dismiss the setup dialog boxes as needed.*

System Trigger Sensitivity

These procedures check those characteristics that relate to the signal acquisition and are listed as checked under *Warranted Characteristics* in *Specifications.* Refer to Table 1–12, page 1–12.

Equipment required	Cable, coaxial 50 Ω, 20 in (0.5m), male-to-male SMA (Item 31) Cable, coaxial 50 Ω’ , male-to-male SMA (Item 32) Attenuator, 20 dB, female to male SMA connectors Generator, sinewave (Item 27)
Prerequisites	As listed on page 4–19 and under *Prerequisites on* page 4–53.

Setup Install the test hookup:

1. Install the 80A01 module into the left-most small module compartment of the TDS8000 or CSA8000 instrument (see Figure 4–33).
2. Install an 80E00 module into the small module compartment next to the 80A01 module of the TDS8000 or CSA8000 instrument (see Figure 4–33).
3. Connect the clock output of a pattern generator (item 27) (item 31).to the 80A01 input using a coaxial cable (item 31).
4. Connect the 1/32 clock output of a pattern generator (item 27) (item 31) to the Trigger Prescale input of the oscilloscope front panel using a coaxial cable (item 32)(item 31).
5. Connect the 80A01 output to a 6 db attenuator (item 32)using a coaxial cable (item 32).
6. Connect the output of the 6 db attenuator to the input of the 80E0X sampling head as shown in Figure 32.

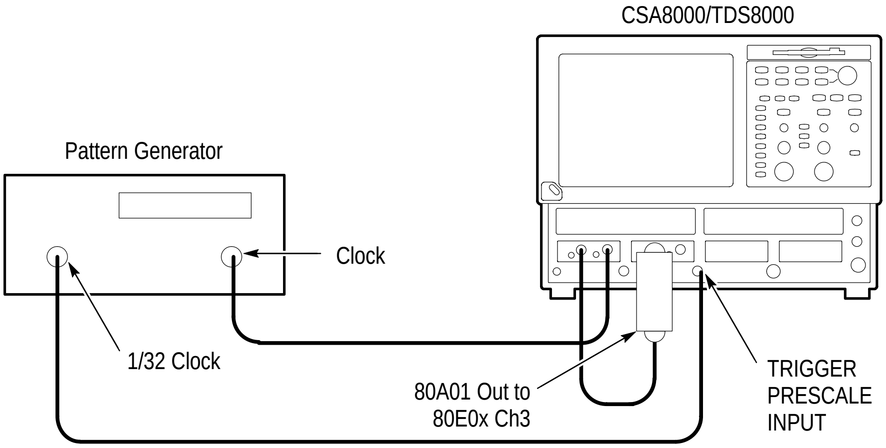


Figure 4–33: 80A00 test hookup

7. Power on the CSA8000/TDS8000 and set it up as follows:
   a. Select C3 from the Waveform Selector menu on the controls bar at the bottom of the display (left corner).
   b. In the Vert Setup dialog box, set External Attenuation to 6 dB. Then set Scale to 100 mV/div and Offset to 0.0V.
   c. In the Trig Setup dialog box, select External Prescale Clock.
   d. In the Horz Setup dialog box:

- set Scale to 50 ps/division.
- set Position to 0.
- set Horizontal Reference to 0%.

e. In the Acq Setup dialog box, set Acquisition Mode to Average and the average count to 16 samples.

Test: Follow this procedure to make the enhanced trigger sensitivity check:

1. Set the sinewave generator output voltage to –10 dBm. Set the generator output to on.
2. For each frequency in the list that follows, check that the amplitude readout is as listed.

Frequency Setting	Meas. Pk–Pk Readout
8 GHz	≥ 779 mV
9 GHz	≥ 800 mV
10 GHz	≥ 800 mV
11 GHz	≥ 1.05 V
12 GHz	≥ 1.05 V

End of Procedure

Adjustment Procedures

This chapter contains an adjustment procedure for your instrument. The purpose of this procedure is to return the instrument conformance to its specifications.

Adjustment Interval

The voltage and timing references inside the instrument are very stable over time and should not need routine adjustment. The only time you should perform the *Adjustment Procedures* is if the instrument fails any of the Mainframe performance verification checks starting on page 4–33.

Adjustment Environment

The instrument must be adjusted in a 20 °C to 30 °C ambient temperature environment. The instrument and signal source must warm up at least 20 minutes in this environment before you begin the adjustment procedure.

Adjustment After Repair

After removal and replacement of a module due to electrical failure, you must either perform the adjustment procedure or not, depending on the module replaced. See Table 5–1.

Table 5–1: Adjustments required for module replaced

Module replaced	Adjustment required
Front panel assembly	No
Acquisition board	Yes
Processor board	No
NLX processor assembly	No
Display panel or display system	No
Power supply	No
Interconnect boards	No
Fans	No

Required Equipment

The adjustment procedure requires the specific test equipment and materials listed in Table 5–2.

Table 5–2: Required equipment and materials

Category	Specific equipment required	Quantity
Signal source	Signal generator 50 MHz to 1 GHz, $\leq$ 1 ppm frequency accuracy	1 ea
Meter	Digital Multimeter, with 6.5 plus digits	1 ea
Instrument controller (only one of these configurations required)	PC-compatible computer with National Instruments GPIB Controller card and software, running Windows 95/98 or NT	1 ea
	National Instruments USB GPIB Controller card for Windows 98 and National Instruments NI-488.2 for Windows software (to install in the instrument) [1]	1 ea
Divider	Power, 50 Ω, SMA "T". male Tektronix 015-0565-00	1 ea
Adapter	SMA "T", male to 2 SMA female Tektronix 015-1016-00	1 ea
Adapter	SMA male to BNC female, Tektronix 015-0554-00	1 ea
Adapter	BNC to dual banana plug, Tektronix 103-0095-00	1 ea
Coaxial cables	50 Ω, male-to-male SMA connectors	3 ea
GPIB cables	GPIB cable, 1 m minimum length, Tektronix 002-0991-01	1 ea

[1] **Depending on other USB devices attached to the instrument, a USB hub may also be required. Consult your National Instruments documentation for more information.**

Instrumentation Setup

Set the National Instruments GPIB Interface command software to allow GPIB communications between the PC controller and CSA8000/TDS8000, device under test (DUT).

Before you can execute the adjustment program, you need to set up and configure the instrumentation. Make connections according to the following diagrams. See Figure 5–1.

To perform this procedure you must have the specific equipment listed in Table 5–2.

Main Instrument Adjustments

Once the instrumentation is connected and GPIB configured, allow the instrumentation to warm up for at least 20 minutes before starting the *DC Calibrator Adjust procedures*.

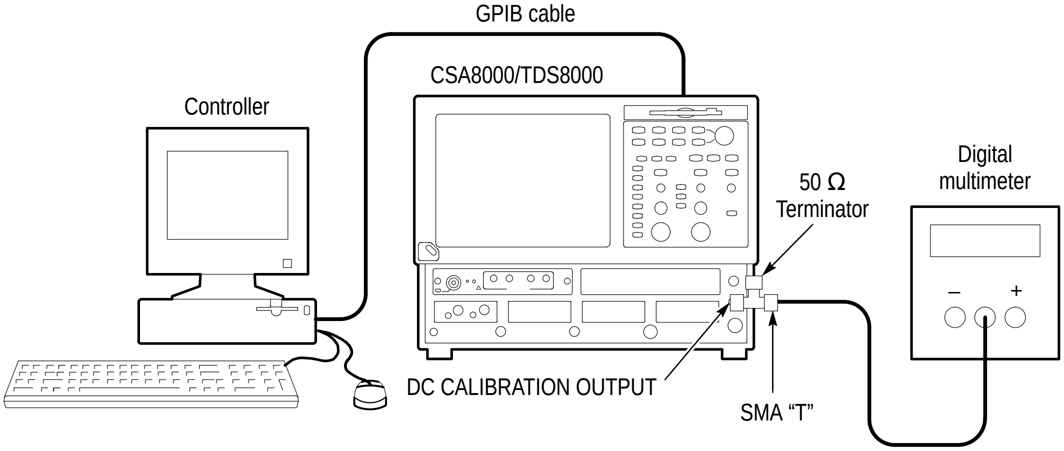


Figure 5–1: Adjustment setup using the DMM

DC Calibrator Adjust

Connect the instrument to a DMM as shown in Figure 5–1.

1. Run the compensation routine, described in *Brief Procedures* section on page 4–5.
2. Enter the following GPIB command to verify communication between the controller and DUT.
   *IDN?
   Should respond with Tektronix and Firmware Version.
3. Enter the following GPIB command to turn the instrument's cal constant protection off:
   SYST:PROT OFF
4. Enter the following GPIB command to set the instrument's DC calibrator offset cal constant to 0:
   CALCOMP:DOUBLE "DcCalOffsetAdj",0.0
5. Wait 8 seconds then enter the following GPIB command to set the instrument's DC calibrator Lsb cal constant
   to 1.0:
   CALCOMP:DOUBLE "DcCalLsbAdj",1.0
6. Wait 8 seconds then enter the following GPIB command to set the instrument's DC calibrator output to 0 Volts:

CALIBRATE:DCCALIBRATOR 0.0
Record DMM reading.

7. Enter the following GPIB command to set the instrument's DC calibrator offset cal constant to –1 * DMM reading:
   CALCOMP:DOUBLE "DcCalOffsetAdj",(–1.0 * the DMM reading)

   Example: CALCOMP:DOUBLE "DcCalOffsetAdj", 3.2e–4

8. Enter the following GPIB command to set the instrument's calibrator to 1.0 V:
   CALIBRATE:DCCALIBRATOR 1.0
   Record the DMM reading (*reading1*).

9. Enter the following GPIB command to set the instrument's calibrator to –1.0 V:
   CALIBRATE:DCCALIBRATOR –1.0
   Record the DMM reading (*reading2*).
   Calculate cal constant as follows:

$$\frac{(-1.0\ *\ Reading2\ +\ Reading1)}{2}$$

10. Enter the following GPIB command to set the instrument's calibrator Lsb cal constant:
    CALIBRATE:DOUBLE "DcCalLsbAdj",calculated result from Step 9.

11. Wait 8 seconds then enter the following GPIB command to save the DC adjustments as follows:
    CAL:SAVE:FACT:MAI

12. Enter the following GPIB command to turn the instrument's cal constant protection on:
    SYST:PROT ON

DC Calibrator Adjust Verification

To verify that the DC calibration adjustment was successful complete the following procedures:

1. Set the instrument's DC calibrator to –1.0 V and verify as follows:
   CALIBRATE:DCCALIBRATOR –1.0

2. Verify that the DMM reads –1.0 V ± 1 mV

3. Set the instrument's DC calibrator to 1.0 V and verify as follows:
   CALIBRATE:DCCALIBRATOR 1.0

4. Verify that the DMM reads 1.0 V ± 1 mV

5. Set the instrument's DC calibrator to 0.0 V and verify as follows:
   CALIBRATE:DCCALIBRATOR 0.0

6. Verify that the DMM reads 0.0 V ±0.1 mV

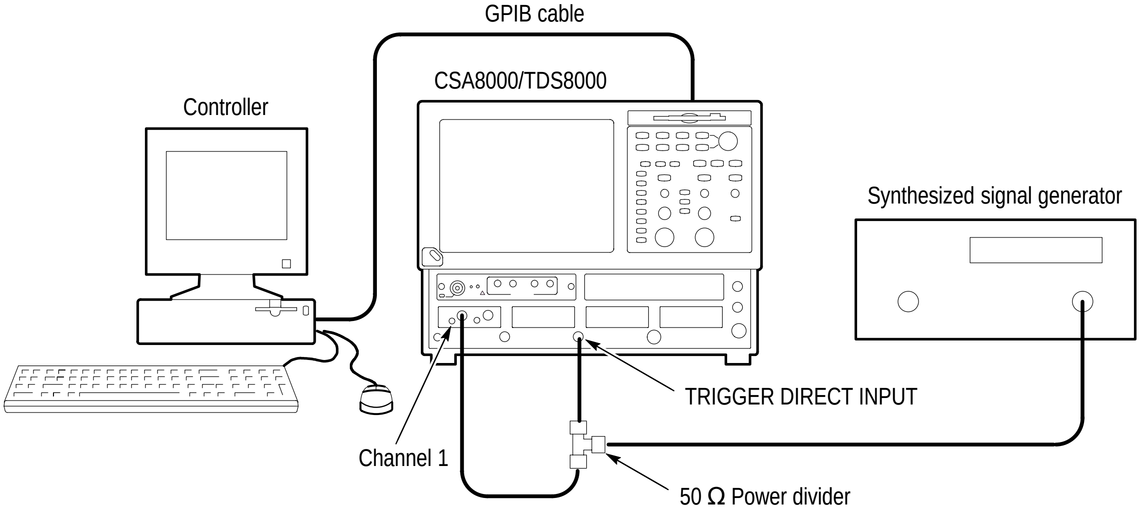


Figure 5–2: Adjustment setup using the signal generator

Internal 10 MHz Adjust

Connect the instrument to a signal generator as shown in Figure 5–2.

Setup

Set the signal generator as follows:

- Frequency to 1 GHz
- Amplitude to 1.0 V peak to peak
- Output to on

Preset the CSA8000/TDS8000 controls:

***NOTE**. CSA8000/TDS8000 settings; Acquisition, Horizontal, Measurement, Trigger, or Vertical menus are located in the Setups dialog, which can be popped up by selecting the Setup Menu.*

- Select C1 in the Waveform Selector.
- Acquisition menu, Acquisition to, Average, 64 samples.
- Horizontal menu, Timebase, Scale to 250 ps/division.
- Horizontal menu, All Timebases Mode, Lock to Int 10MHz.
- Measurement menu, Select Meas, Timing, + Cross.

- Measurement menu, select Statistics.

1. Set the calibration value to default by sending the following GPIB command:
   CALCOMP:DOUBLE “Internal10MHzRefFreq”,*10e6*

2. Enter the following GPIB command to turn the instrument’s cal constant protection off:
   SYST:PROT OFF

3. Click Run/Stop (button should be green).

4. Measurement menu, click Show Stats.

5. Record *target value = (Mean value +1 μs)*; where *Mean* is from the Statistics window.

6. Horizontal menu, Timebase, Position, enter *target value* recorded in step 5.

7. Click Run/Stop (button should be gray).

8. Measurement menu, click Clear Stats.

9. Click Run/Stop (button should be green), wait 8 seconds then click Run/Stop again (button should be gray).

10. Using the present *Mean* value from the Statistics window, and the *target value* calculated in step 5,. Calculate the error and the new cal constant:
    Error = (mean – target value) / 1 μs
    *New Cal Const = Error * 10e6 + 10e6*

11. Input the new calibration constant into the instrument by sending the following GPIB command:
    CALCOMP:DOUBLE “Internal10MHzRefFreq”, *New Cal Const* where *New Cal Const* is from Step 10.

12. Wait 8 seconds then save the mainframe factory calibration constants by entering the following GPIB commands:
    CAL:SAVE:FACT:MAI

13. Update the mainframe calibration time/date/temperature stamp by entering the following GPIB command:
    CAL:UPDATEINFO:MAI

14. Enter the following GPIB command to turn the instrument’s cal constant protection on:
    SYST:PROT ON

End of Procedure

Maintenance

This section contains the information needed to do periodic and corrective maintenance on the Mainframe, Sampling Heads and Optical modules. The following subsections are included:

- *Preparation* — Introduction plus general information on preventing damage to internal modules when doing maintenance.
- *Inspection and Cleaning* — Information and procedures for inspecting the instrument and cleaning its external and internal modules.
- *Removal and Installation Procedures* — Procedures for the removal of defective modules and replacement of new or repaired modules. Also included is a procedure for disassembly of the instrument for cleaning.
- *Troubleshooting* — Information for isolating failed modules. Included are instructions for operating the instrument's internal diagnostic routines and troubleshooting trees. Most of the trees make use of these internal diagnostic routines to speed fault isolation to a module.

Preventing ESD

Before servicing this product, read the *Safety Summary* and *Introduction* at the front of the manual and the ESD information below.

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

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).

1. Minimize handling of static-sensitive circuit boards and components.
2. Transport and store static-sensitive modules in their static protected containers or on a metal rail. Label any package that contains static-sensitive boards.
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 circuit boards over any surface.
7. Avoid handling circuit boards in areas that have a floor or work-surface covering capable of generating a static charge.

Inspection and Cleaning

Inspection and Cleaning describes how to inspect for dirt and damage. It also describes how to clean the exterior and interior of the instrument. Inspection and cleaning are done as preventive maintenance. Preventive maintenance, when done regularly, may prevent instrument malfunction and enhance its 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 instrument adjustment.

General Care

The cabinet helps keep dust out of the instrument and should normally be in place when operating the instrument.

⚠ ***WARNING.*** *Before performing any procedure that follows, power down the instrument and disconnect it from line voltage.*

Interior Cleaning

Use a dry, low-velocity stream of air to clean the interior of the chassis. Use a soft-bristle, non-static-producing brush for cleaning around components. If you must use a liquid for minor interior cleaning, use a 75% isopropyl alcohol solution and rinse with deionized water.

Exterior Cleaning

Clean the exterior surfaces of the chassis with a dry lint-free cloth or a soft-bristle brush. If any dirt remains, use a cloth or swab dipped in a 75% isopropyl alcohol solution. Use a swab to clean narrow spaces around controls and connectors. Do not use abrasive compounds on any part of the chassis that may damage the chassis.

Clean the On/Standby switch using a dampened cleaning towel. Do not spray or wet the switch directly.

⚠ ***CAUTION.*** *Avoid the use of chemical cleaning agents which might damage the plastics used in this instrument. Use only deionized water when cleaning the menu buttons or front-panel buttons. Use a 75% isopropyl alcohol solution as a cleaner and rinse with deionized water. Before using any other type of cleaner, consult your Tektronix Service Center or representative.*

Inspection — Exterior. Inspect the outside of the instrument for damage, wear, and missing parts, using Table 6–1 as a guide. Immediately repair defects that could cause personal injury or lead to further damage to the instrument.

Table 6–1: External inspection check list

Item	Inspect For	Repair Action
Cabinet, front panel, and cover	Cracks, scratches, deformations, damaged hardware.	Repair or replace defective module.
Front-panel knobs	Missing, damaged, or loose knobs.	Repair or replace missing or defective knobs.
Connectors	Broken shells, cracked insulation, and deformed contacts. Dirt in connectors.	Repair or replace defective modules. Clear or wash out dirt.
80C0X male fiber connections	Lint or dust on all male fiber connections.	Clean all male fiber connections with a lint-free cleaning cloth.
Carrying handle, and cabinet feet.	Correct operation.	Repair or replace defective module.
Accessories	Missing items or parts of items, bent pins, broken or frayed cables, and damaged connectors.	Repair or replace damaged or missing items, frayed cables, and defective modules.

Flat Panel Display Cleaning

The portable mainframe display is a soft plastic display and must be treated with care during cleaning.

⚠ ***CAUTION.*** *Improper cleaning agents or methods can damage the flat panel display.*
Avoid using abrasive cleaners or commercial glass cleaners to clean the display surface.
Avoid spraying liquids directly on the display surface.
Avoid scrubbing the display with excessive force.

Clean the flat panel display surface by gently rubbing the display with a clean-room wipe (such as Wypall Medium Duty Wipes, #05701, available from Kimberly-Clark Corporation).

If the display is very dirty, moisten the wipe with distilled water or a 75% isopropyl alcohol solution and gently rub the display surface. Avoid using excess force or you may damage the plastic display surface.

CAUTION. *To prevent getting moisture inside the instrument during external cleaning, use only enough liquid to dampen the cloth or applicator.*

Inspection — Interior. To access the inside of the instrument for inspection and cleaning, refer to the *Removal and Installation Procedures* in this section.

Inspect the internal portions of the instrument for damage and wear, using Table 6–2 as a guide. Defects found should be repaired immediately.

If any circuit board is replaced, check Table 5–1 on page 5–1, in Section 5 to see if it is necessary to adjust the instrument.

CAUTION. *To prevent damage from electrical arcing, ensure that circuit boards and components are dry before applying power to the instrument.*

Table 6–2: Internal inspection check list

Item	Inspect for	Repair action
Circuit boards	Loose, broken, or corroded solder connections. Burned circuit boards. Burned, broken, or cracked circuit-run plating.	Remove and replace damaged circuit board.
Resistors	Burned, cracked, broken, blistered condition.	Remove and replace damaged circuit board.
Solder connections	Cold solder or rosin joints.	Resolder joint and clean with isopropyl alcohol.
Capacitors	Damaged or leaking cases. Corroded solder on leads or terminals.	Remove and replace damaged circuit board.

Table 6–2: Internal inspection check list (Cont.)

Item	Inspect for	Repair action
Semiconductors	Loosely inserted in sockets. Distorted pins.	Firmly seat loose semiconductors. Remove devices that have distorted pins. Carefully straighten pins (as required to fit the socket), using long-nose pliers, and reinsert firmly. Ensure that straightening action does not crack pins, causing them to break off.
Wiring and cables	Loose plugs or connectors. Burned, broken, or frayed wiring.	Firmly seat connectors. Repair or replace modules with defective wires or cables.
Chassis	Dents, deformations, and damaged hardware.	Straighten, repair, or replace defective hardware.

Cleaning Procedure — Interior. To clean the instrument interior, do 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 doing steps 1 and 2, a module is clean upon inspection, skip the remaining steps.*

---

3. If steps 1 and 2 do not remove all the dust or dirt, the instrument may be spray washed using a solution of 75% isopropyl alcohol by doing steps 4 through 8.
4. Gain access to the parts to be cleaned by removing easily accessible shields and panels (see *Removal and Installation Procedures*).
5. Spray wash dirty parts with the isopropyl alcohol and wait 60 seconds for the majority of the alcohol to evaporate.
6. Use hot (120° F to 140° F) deionized water to thoroughly rinse them.
7. Dry all parts with low-pressure, deionized air.
8. Dry all components and assemblies in an oven or drying compartment using low-temperature (125° F to 150° F) circulating air.

Removal and Installation Procedures

This subsection contains procedures for removal and installation of all mechanical and electrical modules.

Preparation

WARNING. *Before doing this or any other procedure in this manual, read the Safety Summary found at the beginning of this manual. Also, to prevent possible injury to service personnel or damage to this instrument's components, read* Installation *in Section 2, and* Preventing ESD *in this section.*

This subsection contains the following items:

- Preparatory information that you need to properly do the procedures that follow.
- A list of tools required to remove all modules.
- Procedures for removal and reinstallation of the electrical and mechanical modules.
- A disassembly procedure for removal of all the major modules from the instrument at one time and for reassembly of those modules into the instrument. Instructions for doing the actual cleaning are found under *Inspection and Cleaning* at the beginning of this section.

WARNING. *Before doing any procedure in this subsection, disconnect the power cord from the line voltage source. Failure to do so could cause serious injury or death.*

NOTE*. Read* Equipment Required *for a list of the tools needed to remove and install modules in this instrument. See Table 6–3, page 6–8.*
Read the cleaning procedure before disassembling the instrument for cleaning.

Equipment Required. Most modules in this instrument can be removed with a screwdriver handle mounted with a size T-15, Torx® screwdriver tip. *Use this tool whenever a procedure step instructs you to remove or install a screw unless a different size screwdriver is specified in that step.* All equipment required to remove and reinstall each module is listed in the first step of its procedure.

Table 6–3: Tools required for module removal

Item No.	Name	Description	Part Number
1	Screwdriver handle	Accepts Torx®-driver bits	General Tool: 620-440
2	Screwdriver handle, extended length, 10.5 to 12 inches	Accepts Torx®-driver bits and $^3/_{16}$ socket tip. Used for removing the T-10 screws and $^3/_{16}$ inch hex posts from the electrical and optical module slots.	Standard tool or Xcelite 99X10V N/S#48706
3	T-10 Torx tip	Used for removing the electrical or optical module chassis. Torx®-driver bit for T-10 size screw heads.	General Tool: 640-235
4	T-15 Torx tip	Used for removing most the instrument's screws. Torx®-driver bit for T-15 size screw heads.	General Tool: 640-247
5	T-20 Torx tip	Used for removing the handle hardware. Torx®-driver bit for T-20 size screw heads.	General Tool: 640-250
6	$^3/_{16}$ inch socket tip	Used for removing the $^3/_{16}$ inch hex posts from the electrical and optical module slots.	Standard tool
7	$^1/_8$ inch flat-bladed screwdriver	Screwdriver for unlocking cable connectors.	Standard tool
8	#0 phillips screwdriver	Screwdriver for removing small phillips screws, CD, floppy & hard drive.	Standard tool
9	Angle-Tip Tweezers	Used to remove front panel knobs	Standard tool
10	$^3/_{16}$ inch open-end wrench	Used to remove the rear panel nut posts.	Standard tool
11	$^5/_{16}$ inch open-end wrench	Used to remove the rear panel nut posts.	Standard tool
12	Coaxial cable connector tool	Used to remove coaxial connectors from d-subminiature connector housings.	Amp: 58095-1

Procedures for External Modules

The following procedures are found here and are listed in order presented.

- Front Panel Knobs
- Trim (all)
- Bottom cover
- Left and Right covers
- Line Fuse and Line Cord

Front-Panel Knobs

1. *Assemble equipment and locate modules to be removed:* Use an angled-tip tweezers (Item 9) and locate the the front panel see Figure 6–2 on page 6–11.
2. *Orient the instrument:* Set the instrument so its bottom is down on the work surface and its front is facing you.
3. *Remove the knob(s):* Grasp any knob you want to remove and pull it straight out from the front panel about a $^{1}/_{4}$ inch to create some clearance between the base of the knob and the front panel. Insert the tweezers between the knob and front panel and use them to remove the knob. See Figure 6–1.
4. *Reinstallation:* To reinstall, align knob to shaft and push it in until it snaps.

CAUTION. *To prevent damage to the encoders located onto the circuit board, apply pressure to the backs of the encoders while pushing the knob on the shaft.*

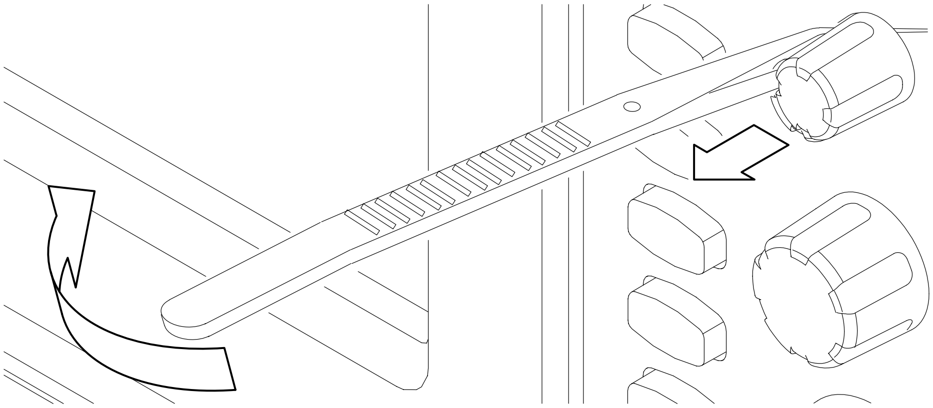
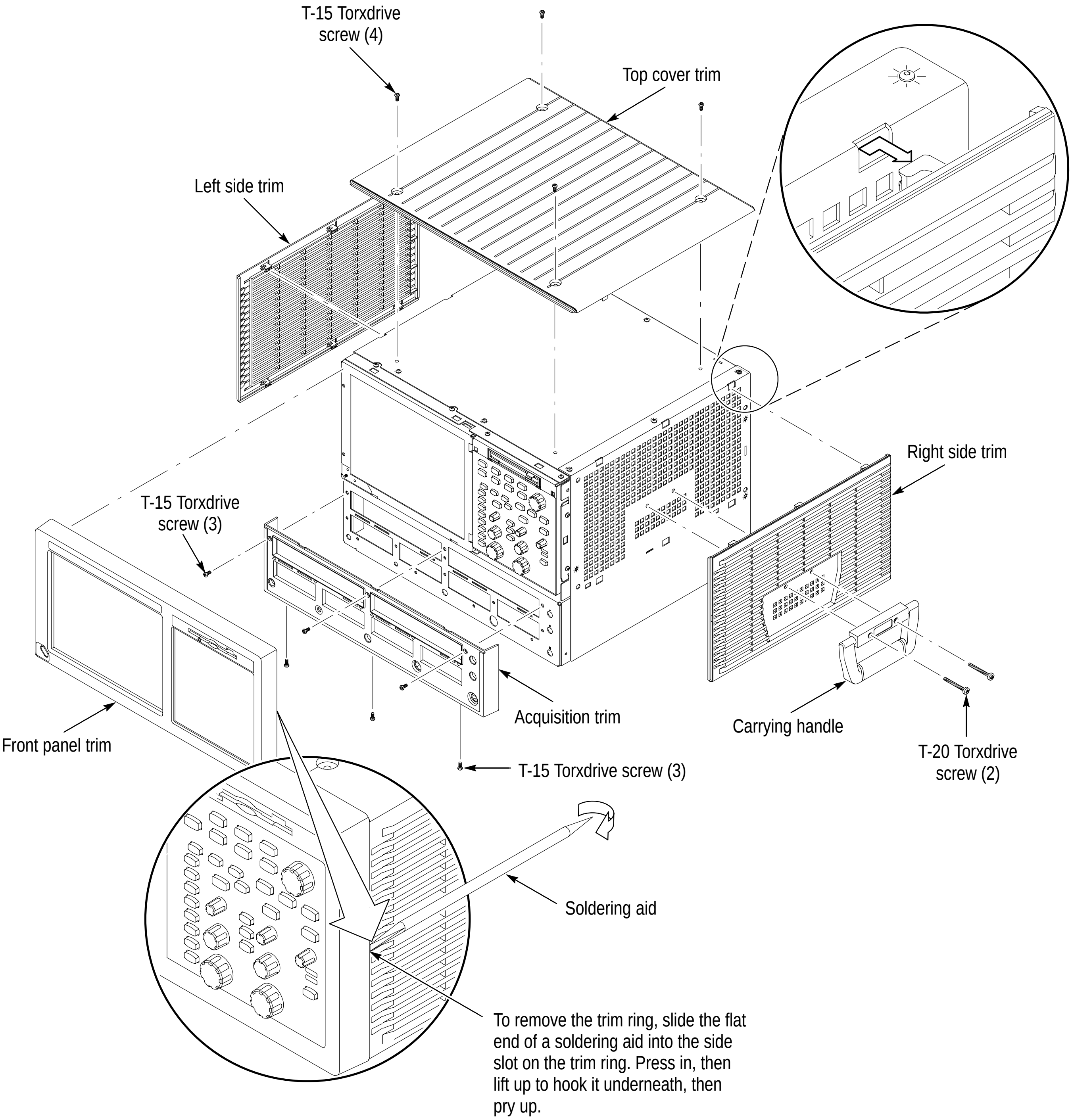


Figure 6–1: Knob removal

Trim and Carrying Handle

1. *Locate module to be removed:* Locate the Trim in the locator diagram, See Figure 6–7, page 6–18.
2. *Remove the front panel trim:* Use Figure 6–2, page 6–11, as a guide.
    - **a.** Grasp the trim ring by its top edge and pull toward you to detach the three plastic snaps. (Alternatively, you can use a flat-bladed screwdriver or other small prying tool to help you detach the snaps.)
    - **b.** Swing the bottom of the ring upward and off the front panel.
3. *Remove the acquisition trim:* Use Figure 6–2, page 6–11 as a guide.
    - **a.** Remove the six T-15 Torxdrive screws that secure the acquisition trim to the instrument.
    - **b.** Remove the knobs from the electrical and optical ejector levers. Grasp the knobs with your fingers and pull straight out.
    - **c.** Remove the acquisition trim from the instrument.
4. *Remove the carrying handle and the right/left side trim panels:* Use Figure 6–2, page 6–11 as a guide.
    - **a.** Remove the two T-20 Torxdrive screws that secure the handle to the instrument. Remove the handle from the instrument.
    - **b.** Slide the side trim panels towards the rear of the instrument allowing the tabs to clear the cover openings, then pull out to remove the panels from the instrument.
5. *Remove the top cover trim:* Use Figure 6–2, page 6–11 as a guide.
    - **a.** Remove the accessory pouch; it snaps off.
    - **b.** Remove the four T-15 Torxdrive screws that secure the top cover trim to the instrument. The T-15 Torxdrive screws also secure the snap studs to the top cover.
    - **c.** Remove the top cover trim from the instrument.
6. *Reinstallation:* Do in reverse steps 2 through 5 to reinstall the appropriate trim.



To remove the trim ring, slide the flat end of a soldering aid into the side slot on the trim ring. Press in, then lift up to hook it underneath, then pry up.

Figure 6–2: Trim removal

Bottom Cover

1. *Remove the bottom cover:* See Figure 6–3, page 6–12.

2. *Orient the instrument:* Set the instrument so its top is down on the work surface and its bottom is facing you.

   a. Remove the five T-15 Torxdrive screws that secure the bottom cover to the instrument.

   b. Remove the bottom cover from the instrument.

3. *Reinstallation:* Do in reverse steps a and b to reinstall the cabinet feet.

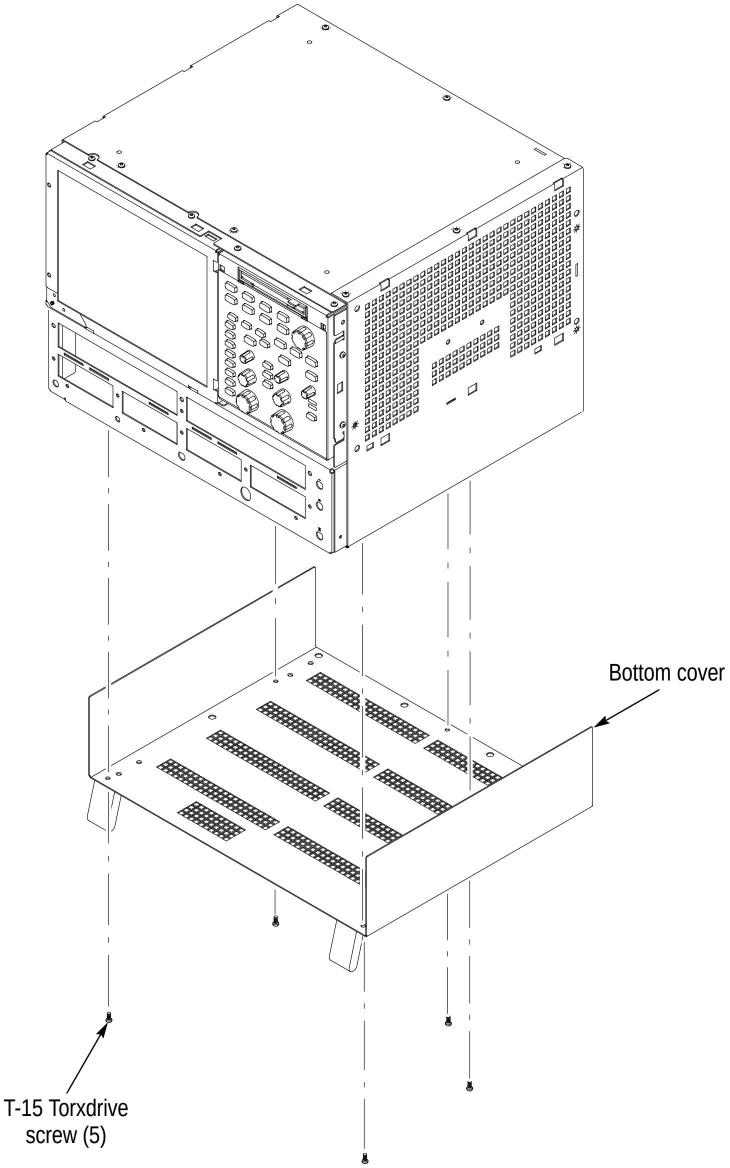


Figure 6–3: Bottom cover removal

Covers

1. *Remove the left and right covers:* See Figures 6–4 and 6–5, pages 6–14 and 6–15.
   - Trim (all)
   - Bottom cover
2. *Orient the instrument:* Set the instrument so its rear is on the work surface and the front of the instrument facing the technician.

***NOTE**. All mounting screw holes are indicated by a star etched around the mounting hole.*

---

   a. Remove the thirteen T-15 Torxdrive screws that secure the covers to the top and both sides of the chassis.

   b. Remove the nine T-15 Torxdrive screws that secure the covers to the bottom of the chassis.

   c. Pull the bottom-right cover down and slide to the right to remove from the instrument. Pull the top-left cover upward and slide to the left to remove from the instrument.

***CAUTION.** Take care not to bind or snag the covers on the instrument's internal cabling as you remove or install.*

---

3. *Reinstallation:* Do in reverse steps a through c to reinstall the cabinet.

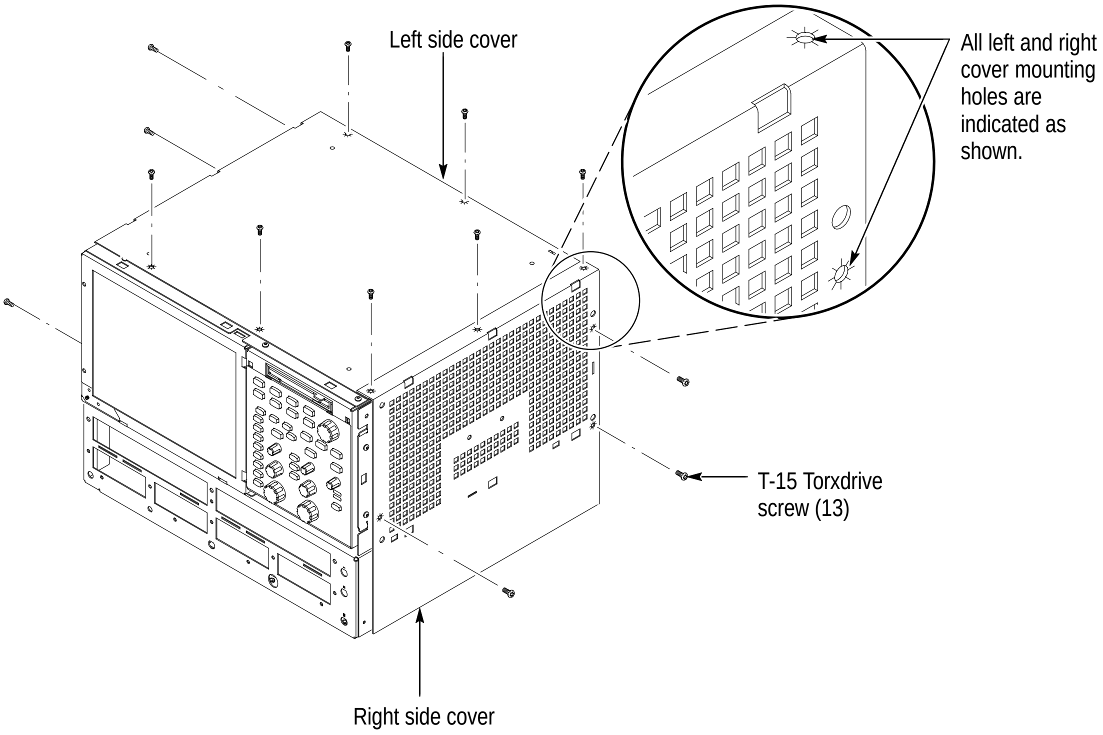


Figure 6–4: Cover removal

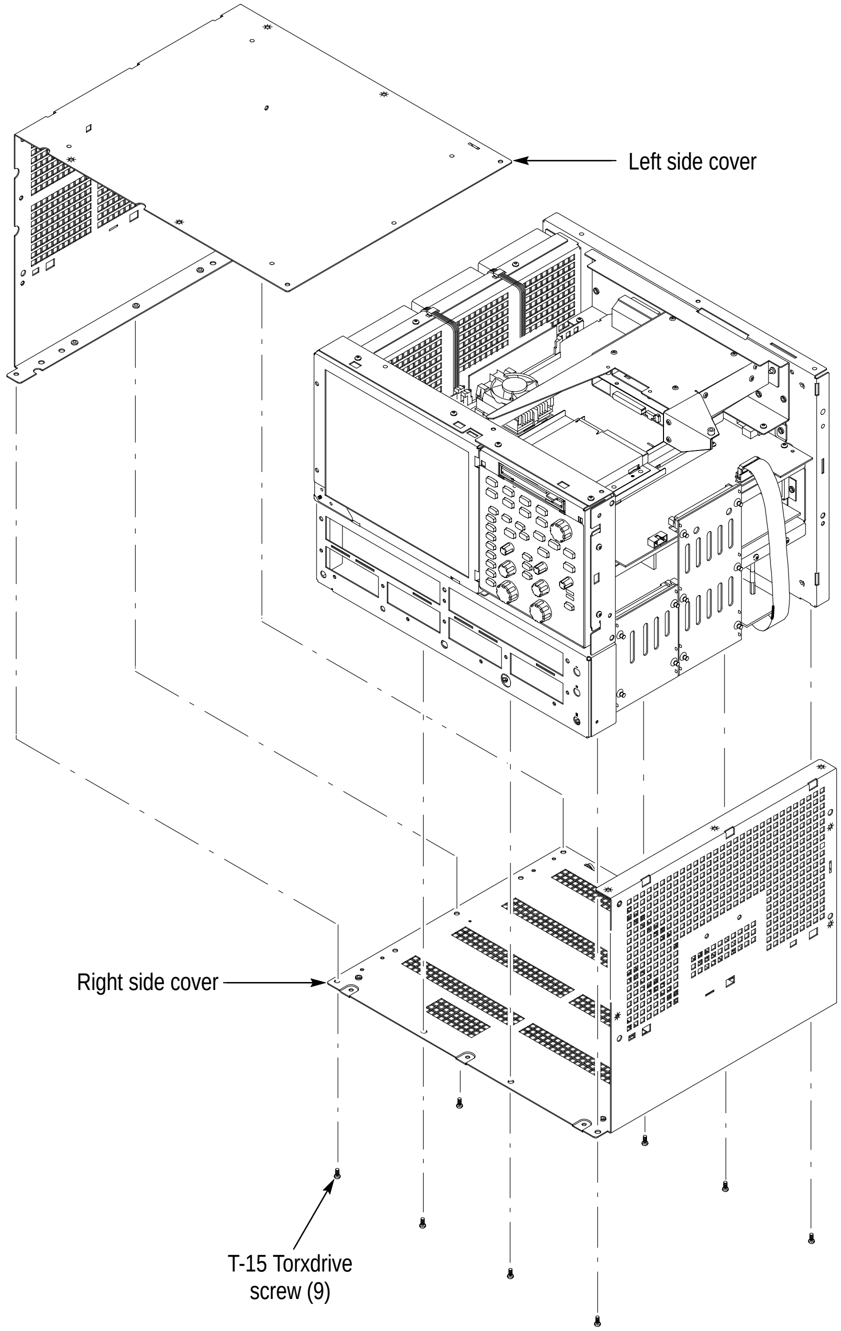


Figure 6–5: Cover removal

Line Fuses and AC power cord connector

1. *Assemble equipment and locate modules to be removed:* Locate the power switch, line fuses and AC power cord connector in Figure 6–6, page 6–17.
2. The instrument has a built-in soft power-off function that safely powers off the instrument when you press the On/Standby switch. You must power off the instrument using the Windows 98 shutdown process before depressing the front panel On/Standby switch.
3. Power off the rear panel power switch before servicing the line fuses or power cord.

CAUTION. *When powering off the instrument, use the Windows 98 shut down procedure. (Choose Shutdown from the Start menu.)*

Powering down the instrument without using the Windows 98 shut down procedure can corrupt the software on the hard disk.

---

4. *Orient the instrument:* Set the instrument so its bottom is down on the work surface and its rear is facing you. If you are servicing the line fuses, do the next step; if you are servicing the line cord, skip to step 6.
5. *Remove line fuses:* Find the fuse caps on the rear panel. Now, remove both fuse caps by turning them counterclockwise using a flat-bladed screwdriver, and remove the line fuses. Reverse procedure to reinstall.
6. *Remove line cord:* Find the line cord on the rear cover. Pull the line cord away to remove from the AC power connector. Reverse procedure to reinstall.
7. *Reinstallation:* Do in reverse steps 5 and 6 to reinstall the line cord and then the line fuse.

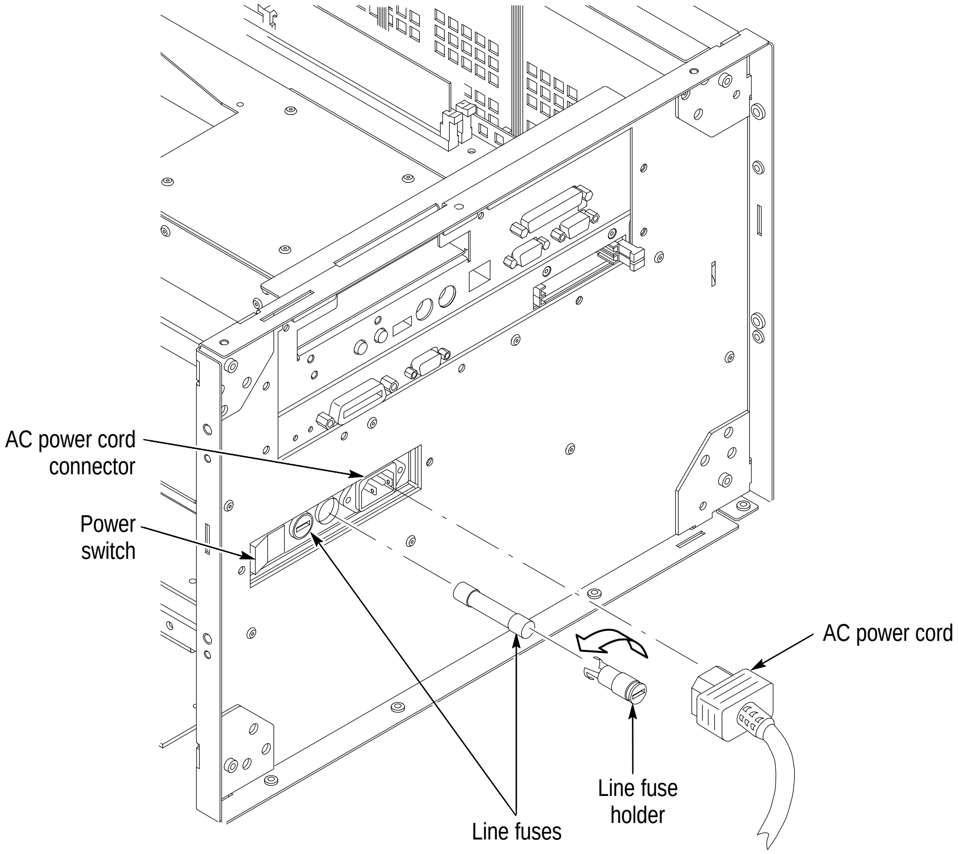


Figure 6–6: Line fuses and line cord removal

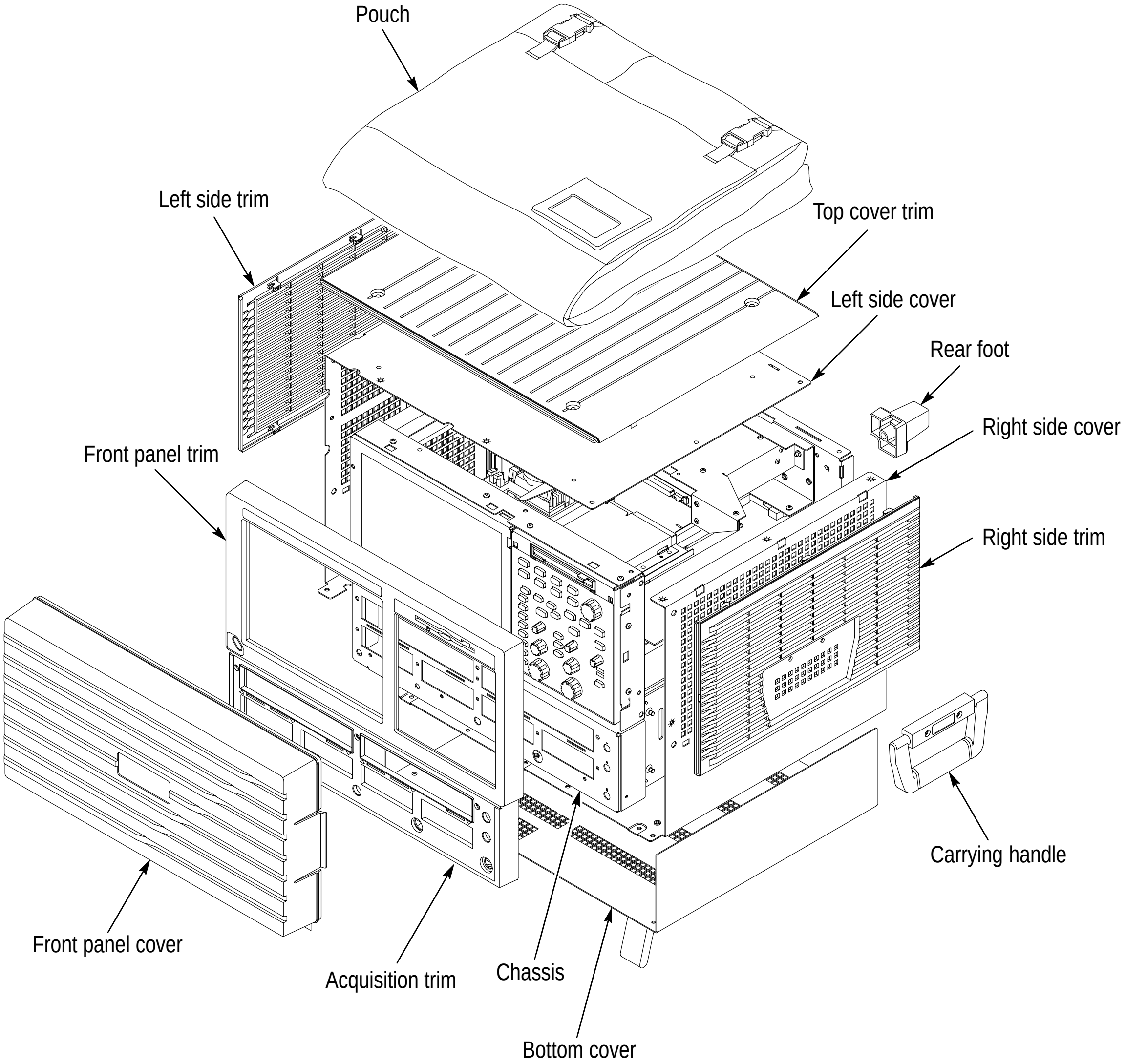


Figure 6–7: External modules

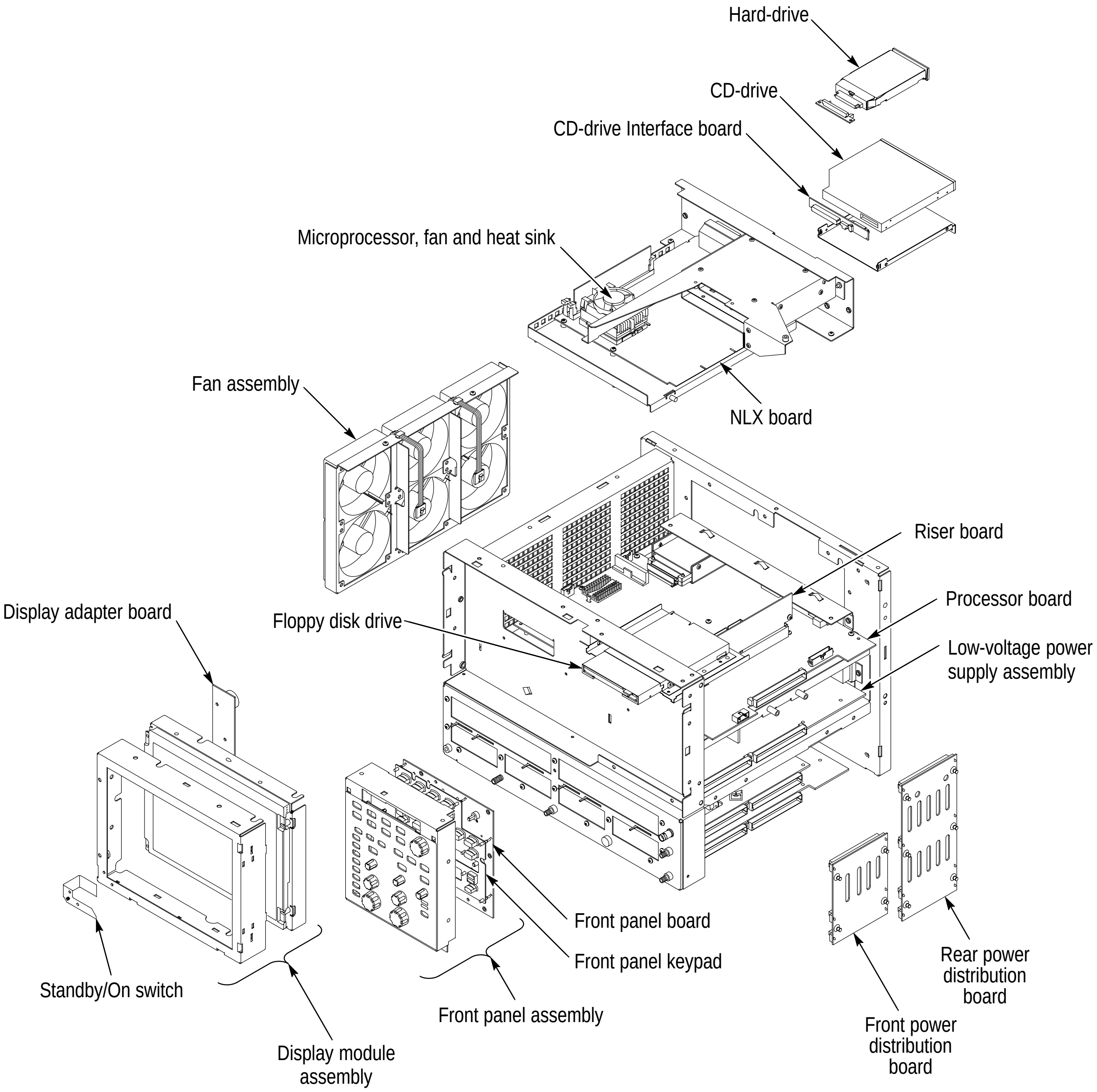


Figure 6–8: Internal modules

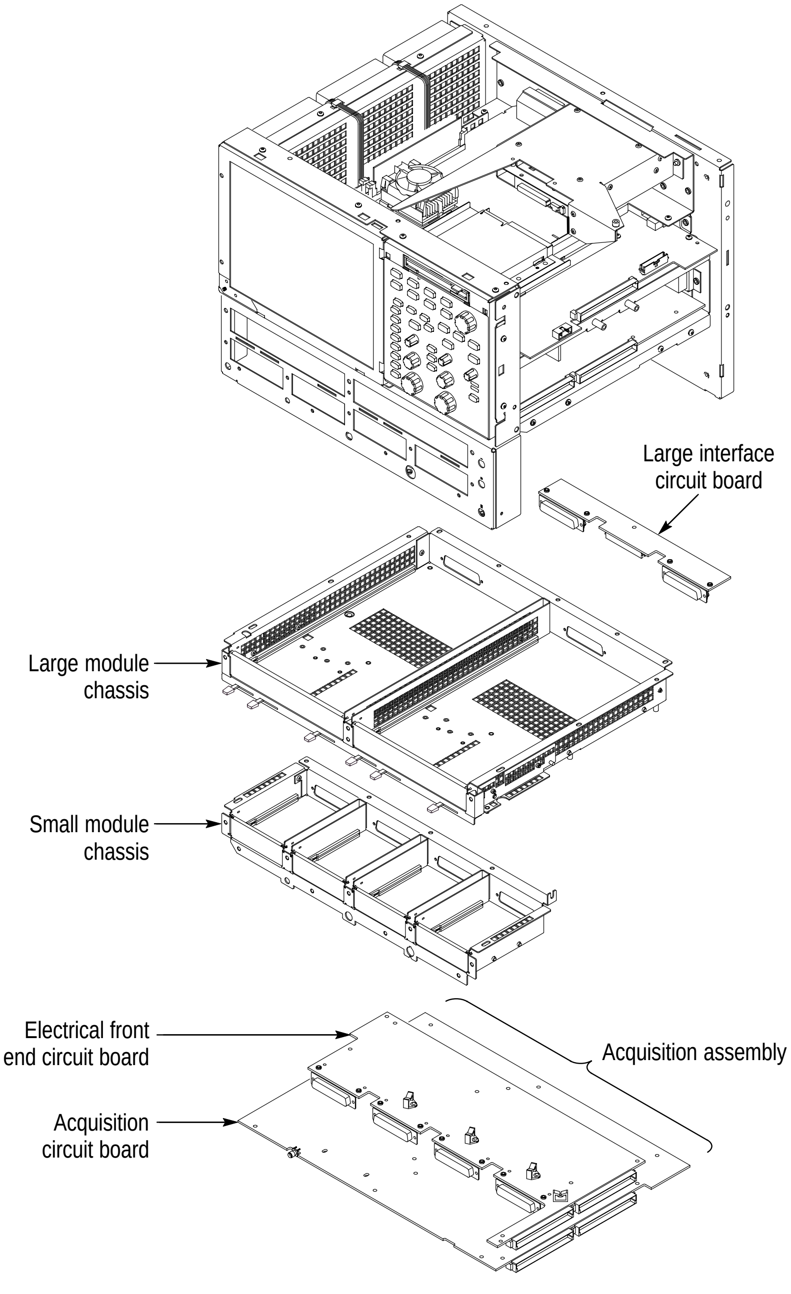


Figure 6–9: Acquisition modules

Procedures for Modules

You should have completed the Procedures for external modules before doing many of the procedures in this collection. The procedures found here are listed in disassembly order:

- Front Panel assembly
- Front Panel Board
- Front Panel Keypad
- Display assembly
- Display Adapter Board
- Standby/On Switch Flex Circuit
- Floppy Disk Drive
- Hard Disk Drive
- CD Drive
- Front and Rear Power Distribution Boards
- Low-Voltage Power Supply
- NLX Board
- Microprocessor
- PC Processor Board
- Fan assembly
- Acquisition assembly
- Large Module Interface Board
- Module Slot Doors
- Electrical Modules
- Optical Modules
- 80A01 Module

Front Panel Assembly

1. *Locate module to be removed:* Locate the Front Panel assembly Figure 6–10, page 6–23. Additional modules to be removed:
    - Trim (Front panel)

2. *Remove the Front Panel assembly:* See Figure 6–10, page 6–23.

3. *Orient the instrument:* Set the instrument so its bottom is down on the work surface and its front panel is facing you.

   a. Remove the six T-15 Torxdrive screws that secure the Front panel assembly to the front chassis.

   b. Grasp the top of Front Panel assembly and pull forward to allow access to the ribbon cable connector on the front panel board.

   c. Use the $\frac{1}{8}$ inch flat-bladed screwdriver to carefully lift J1 cable connector lock up to disconnect J1 flex cable from the display module assembly. See Figure 6–11, page 6–24. Note the connector's pin 1 index mark and the black stripe on the cable for later reassembly.

   d. Pull the Front Panel assembly forward and remove from the instrument.

4. *Reinstallation:* Do in reverse steps a through d to reinstall the front panel assembly.

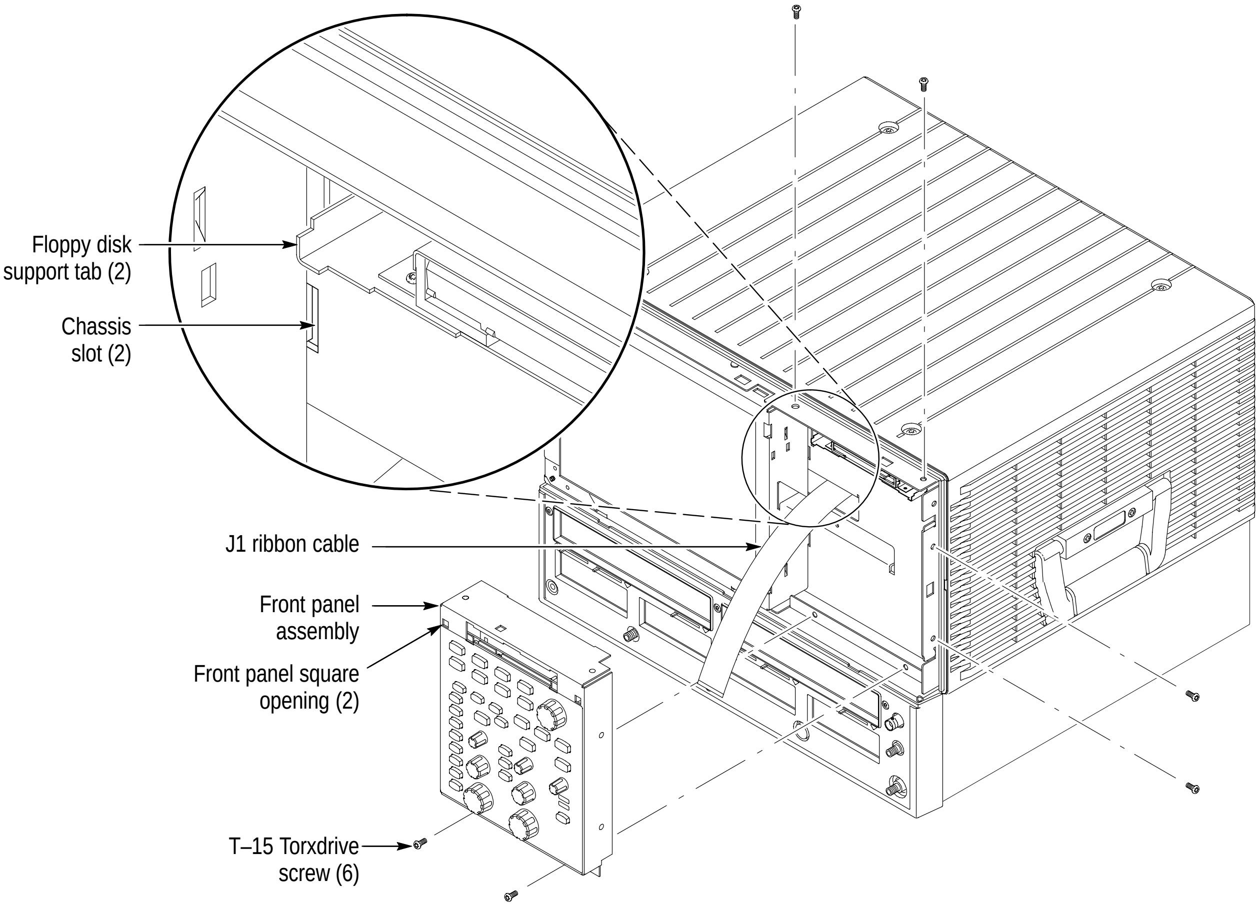


Figure 6–10: Front panel assembly removal

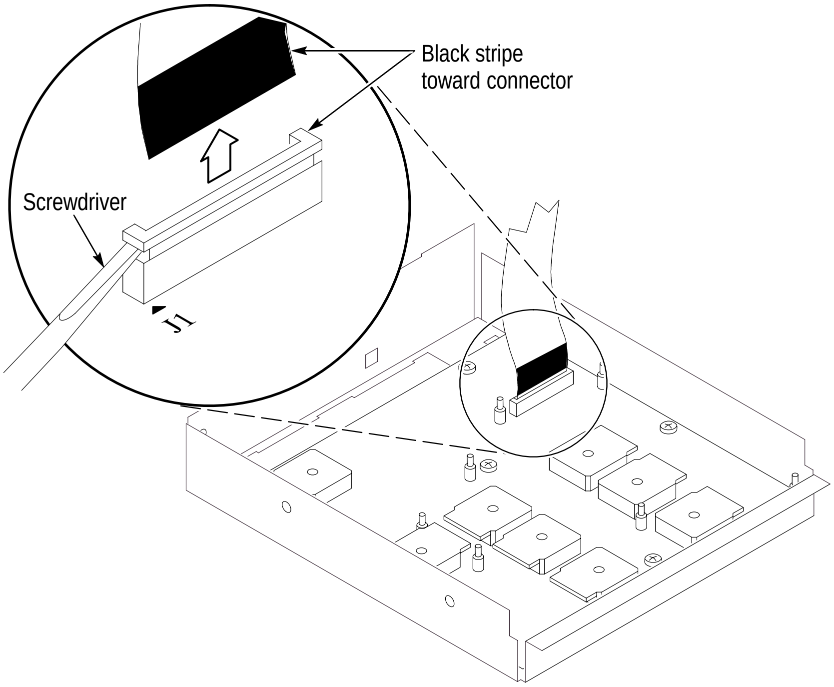


Figure 6–11: J1 flex cable connector removal

Front Panel Board

1. *Locate module to be removed:* Locate the Front Panel assembly Figure 6–10, page 6–23. Additional modules to be removed:
   - Front Panel Knobs
   - Trim (front panel)
   - Front Panel assembly
2. *Remove the Front Panel board:* See Figure 6–12, page 6–25.
   - **a.** Remove the eight T-15 Torxdrive screws that secure the Front panel board to the Front panel assembly.
   - **b.** Pry the board up off the alignment studs. Place a flat bladed screwdriver in the pry point access holes to pry the board up from the assembly.
   - **c.** Remove the board from the assembly.
3. *Reinstallation:* Do in reverse steps a through c to reinstall the front panel board.

Front Panel Keypad

1. *Locate module to be removed:* Locate the Front Panel assembly Figure 6–10, page 6–23. Additional modules to be removed:

- Front Panel Knobs
- Trim (front panel)
- Front Panel assembly
- Front Panel Board

2. *Remove the Front Panel keypad:* See Figure 6–12, page 6–25.

a. Pull on each of the keypad support guides to separate the keypad from the Front panel board. Use a pair of tweezers or equivalent tool to pull the keypad support guides.

b. Remove the keypad from the front panel board.

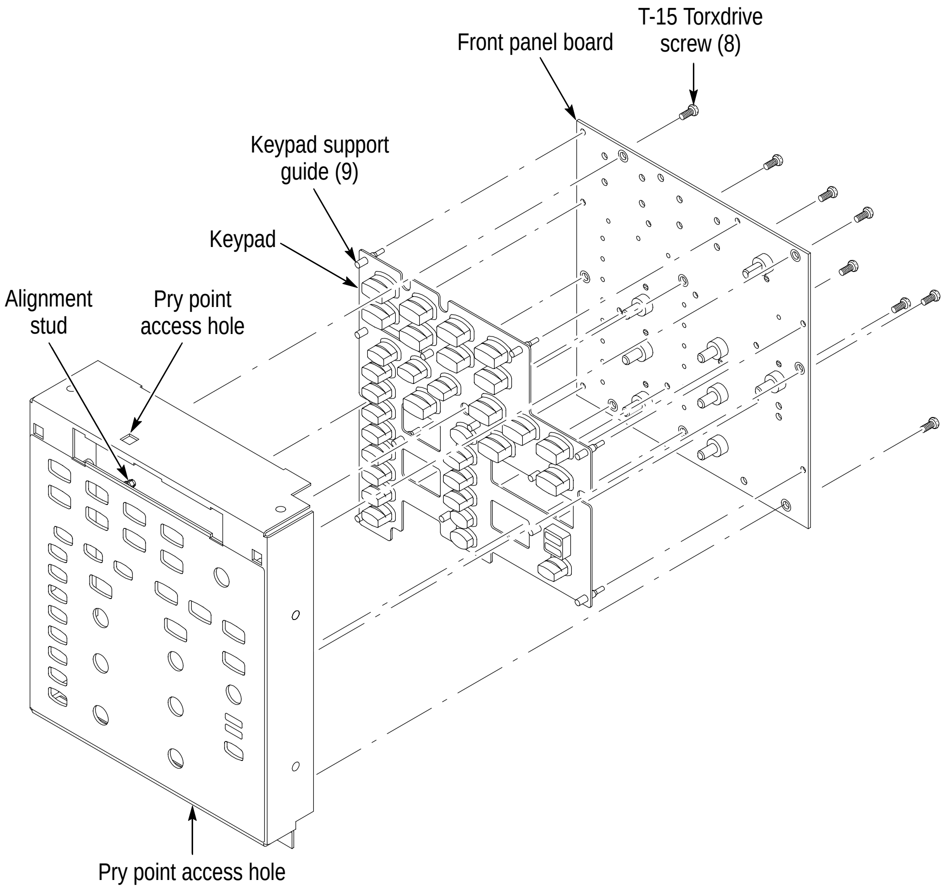


Figure 6–12: Front panel board & keyboard removal

CAUTION. *When removing or installing the keypad, make sure you do not touch the switch contact with your fingers. The oils in your fingers will degrade or damage the switch contacts. To help prevent damage to the keypad use cotton gloves when removing or installing the keyboard pad.*

3. *Reinstallation:* Do in reverse steps to reinstall the Keypad, front panel board, and the front panel assembly. Then see the following instructions:

    a. Make sure the keypad is aligned properly on the Front Panel board.

    b. Make sure the ribbon cable is routed correctly when installing the Front Panel into the chassis.

    c. Insert the two floppy disk support tabs into the front panel square openings. Both left front panel tabs must go into the chassis slots. See Figure 6–10, page 6–23.

Display Assembly

1. *Locate module to be removed:* Locate the Display assembly, Figure 6–13, page 6–27. Additional modules to be removed:

    - Trim (front panel & top)

2. *Orient the instrument:* Set the instrument so its bottom is down on the work surface and its front panel is facing you.

CAUTION. *To avoid damage to the front panel Standby/On switch assembly, do not set the Display module assembly on a work surface. Sliding the instrument over the edge of the work surface could break off the Standby/On switch assembly.*

3. *Remove the Display assembly:* See Figure 6–13, page 6–27.

    a. Remove the four T-15 Torxdrive screws that secure the Display assembly to the chassis.

    b. Grasp the top edge of the Display assembly and pull forward far enough to allow access to the flex cable connector.

    c. Disconnect J8 flex cable from the display assembly. Remove the display module assembly from the instrument. See Figure 6–13, page 6–27.

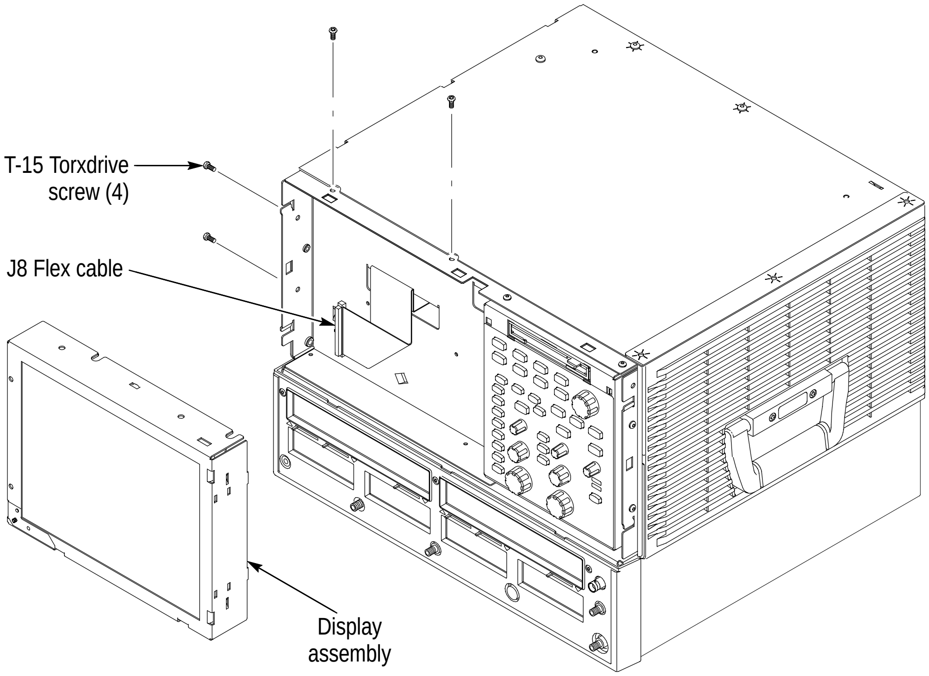


Figure 6–13: Display removal

4. *Remove the Touch panel from the Display assembly:* See Figures 6–14 & 6–15, pages 6–28 and 6–29.

CAUTION. *To prevent degradation of the display sharpness, this procedure must be performed in a dust free environment. The service technician should wear cotton gloves to prevent finger oils from contaminating all surfaces of the display glass.*

---

   a. Disconnect J1, J9 and J10 cables from the Display Adapter circuit board.

   b. Separate the assembly by carefully prying the Touch panel (outer) assembly from the Display (inner) assembly. Insert a flat-bladed screwdriver in the access notches to push out on the Touch panel assembly.

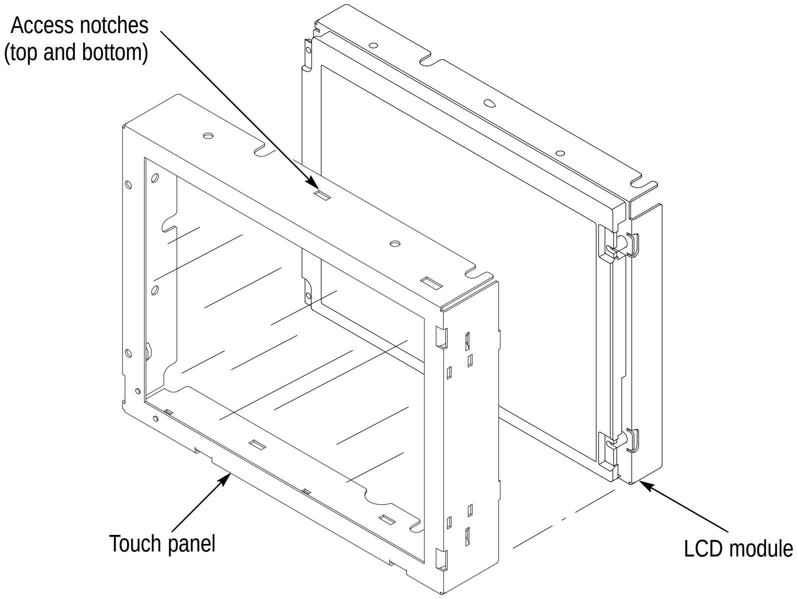


Figure 6–14: Touch panel & LCD assembly removal

5. *Reinstallation:* Do in reverse steps 1 through 5 to reinstall the Display assembly.

Display Adapter Board

1. *Locate module to be removed:* Locate the fan assembly in the locator diagram *Internal Modules*, Figure 6–7, page 6–18. Additional modules to be removed:
   - Trim (front panel & top)
   - Display assembly
2. *Remove the Display Adapter Board:* See Figure 6–15, pages 6–28.
   a. Disconnect J1, J7, J8, J9, and J10 cable from the Display Adapter board.
   b. Remove the two T-15 Torxdrive screws that secure the Display Adapter circuit board to the Display assembly. Remove the Display Adapter from the assembly.
3. *Reinstallation:* Do in reverse steps a and b to reinstall the board.

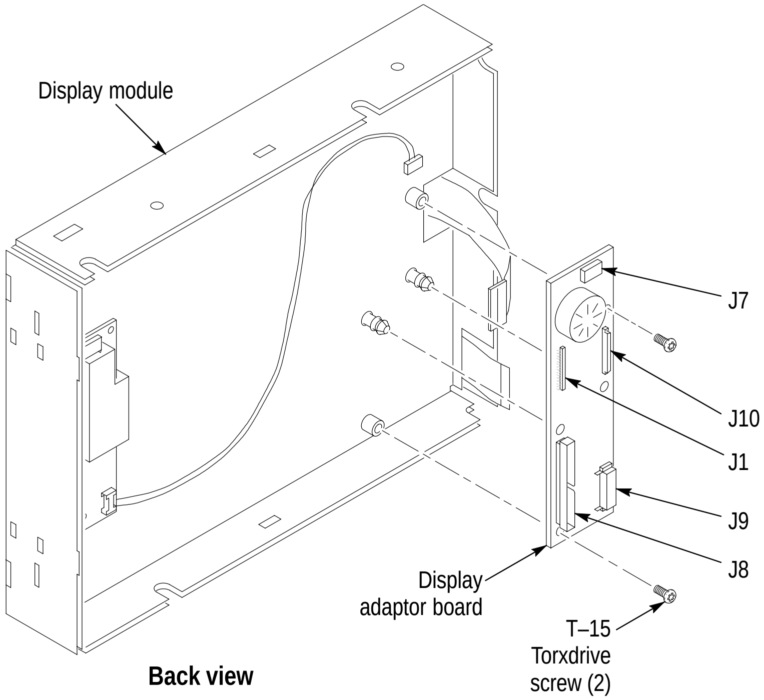


Figure 6–15: Display adaptor board removal

Standby/On Switch Flex Circuit Removal

1. *Locate module to be removed:* Locate the Standby/On Switch flex circuit in the locator diagram *Internal Modules*, Figure 6–8, page 6–19. Additional modules to be removed:

- Trim (front panel & top)
- Display assembly

2. *Orient the oscilloscope:* Set the oscilloscope so its bottom is down on the work surface and its front is facing you.

3. *Remove the Standby/On Switch flex circuit:* See Figure 6–16, page 6–30.

a. Peel the Standby/On switch flex circuit away from the front of the display assembly.

b. Disconnect the flex circuit from J9 on the Display Adapter circuit board.

c. Grasp the flex circuit and pull it out of the Display assembly.

4. *Reinstallation:* Do following procedure to reinstall the Standby/On Switch.

a. Remove the protective backing on the Standby/On switch flex circuit.

b. Slide the connector end of the Standby/On switch flex circuit through the slot in the Display assembly. Make sure the flex circuit connector aligns with J9 on the Display Adapter circuit board.

c. Align the holes in the flex circuit to the two index posts on the front side of the Display assembly.

d. Firmly press the flex circuit to the Display assembly chassis surface.

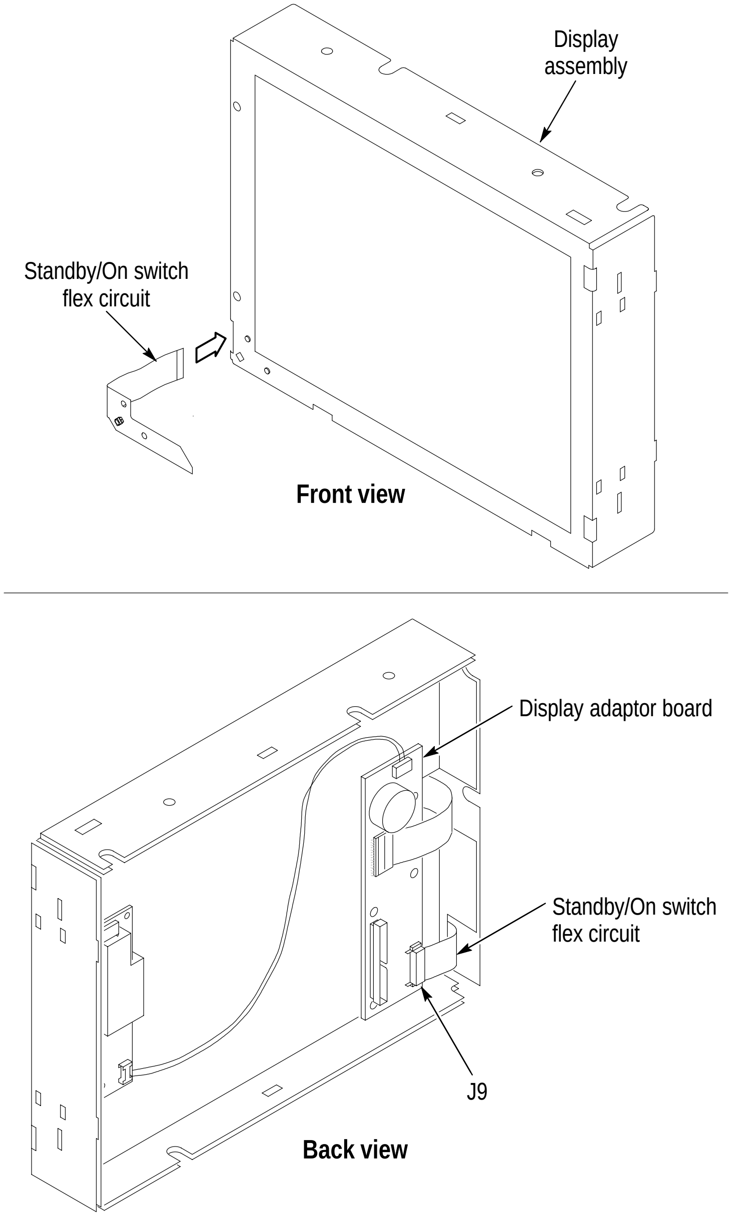


Figure 6–16: Standby/On switch flex circuit removal

Floppy Disk Drive

1. *Locate modules to be removed:* Locate the Floppy Disk Drive in the locator diagram *Internal Modules*, Figure 6–8, page 6–19. Additional modules to be removed:

   - Trim (front panel & top)
   - Front Panel assembly
   - Display assembly

2. *Remove the floppy disk drive:* Use Figure 6–17, page 6–32 as a guide.
   A #0 phillips screwdriver is required for this procedure.

3. *Orient the instrument:* Set the instrument so its bottom is down on the work surface and its front panel is facing you.

   a. Remove the two small phillips screws that secure floppy disk drive assembly to the bracket. Use the access hole located on the outer chassis to remove one of the small phillips screws.

   b. Slide the floppy drive out toward the front of the instrument far enough to allow you to disconnect the ribbon cable connector.

   c. Remove the floppy drive from the instrument.

4. *Reinstallation:* Do in reverse steps a through c to reinstall the floppy disk drive.

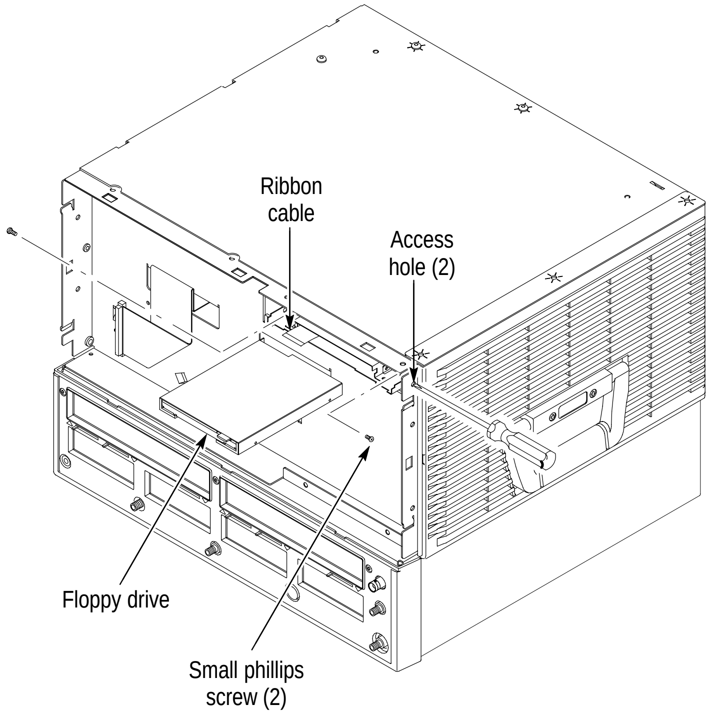


Figure 6–17: Floppy disk drive removal

Hard Disk Drive

1. *Locate module to be removed:* Locate the Hard Disk Drive in the locator diagram *Internal Modules*, Figure 6–8, page 6–19.

CAUTION. *Do not remove the replaceable hard disk drive when the mainframe is powered on.*

The replaceable hard disk drive may be permanently damaged if it is removed while the mainframe is powered on.

Always power down the mainframe before removing the replaceable hard disk drive.

---

2. *Orient the instrument:* Set the instrument so its bottom is down on the work surface and its rear panel is facing you.

3. *Remove the hard disk drive:* See Figure 6–18, page 6–33.

   a. Verify that the chassis is powered down.

   b. Push the hard disk drive cover in and the hard drive will disconnect from the latch.

   c. Grasp the hard disk drive assembly and slide it out of the instrument.

4. *Reinstallation:* Do in reverse steps a and b to reinstall the hard disk drive assembly. The hard disk drive will push in to lock and push in again to unlock.

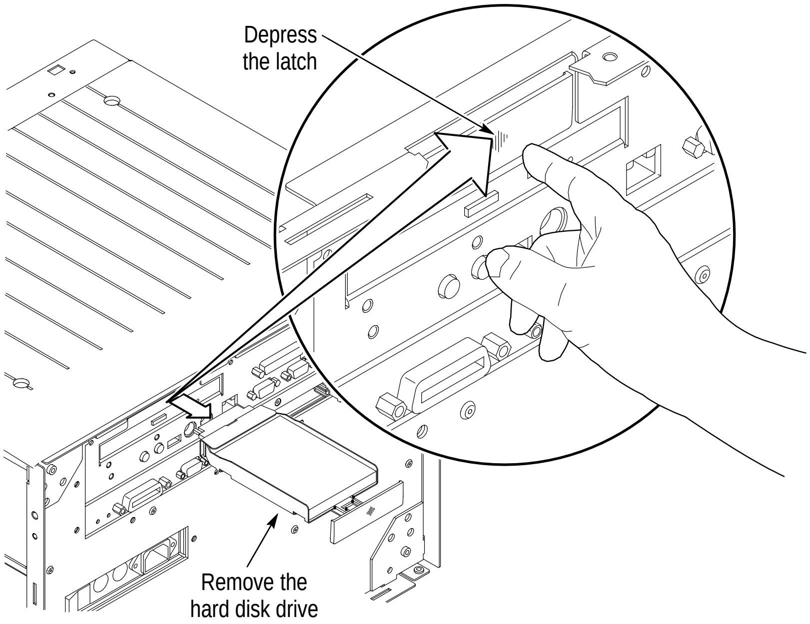


Figure 6–18: Hard drive disk removal

5. *Remove the hard disk drive from the cartridge:* See Figure 6–19, page 6–33.

   a. Remove the four #0 phillips screws that fasten the hard disk drive to the cartridge.

   b. Carefully remove the hard disk drive from the cartridge, and remove the cable assembly from the connector on the hard disk drive.

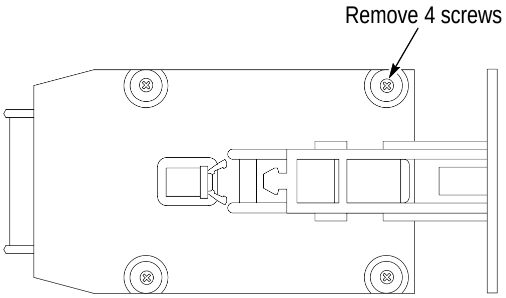


Figure 6–19: Removing the hard disk drive from the cartridge

CD Drive

1. *Locate module to be removed:* Locate the CD Drive in the locator diagram *Internal Modules*, Figure 6–8, page 6–19. Additional modules to be removed:
   - Trim (all)
   - Bottom cover
   - Left and Right covers
2. *Remove the CD Drive assembly:* See Figure 6–20, page 6–35.
3. *Orient the instrument:* Set the instrument so its bottom is down on the work surface and its rear panel is facing you.
   - **a.** Remove the two T-15 Torxdrive screws that secure CD Drive assembly to the rear chassis.
   - **b.** Disconnect the CD Drive ribbon cable J230, from Riser board.
   - **c.** Slide the CD Drive assembly (with the cable attached) toward the rear of the chassis and remove it from the instrument.
4. *Remove the CD Drive bracket and Rom interface board:* See Figure 6–20, page 6–35.
   - **a.** Remove the four #0 phillips screws that secure the bracket to the CD Drive. Remove the CD Drive from the bracket.
   - **b.** Remove the Interface board from the CD Drive by pulling the Interface board straight back until they separate.
5. *Reinstallation:* Do in reverse steps 3 and 4 to reinstall the CD Drive assembly.

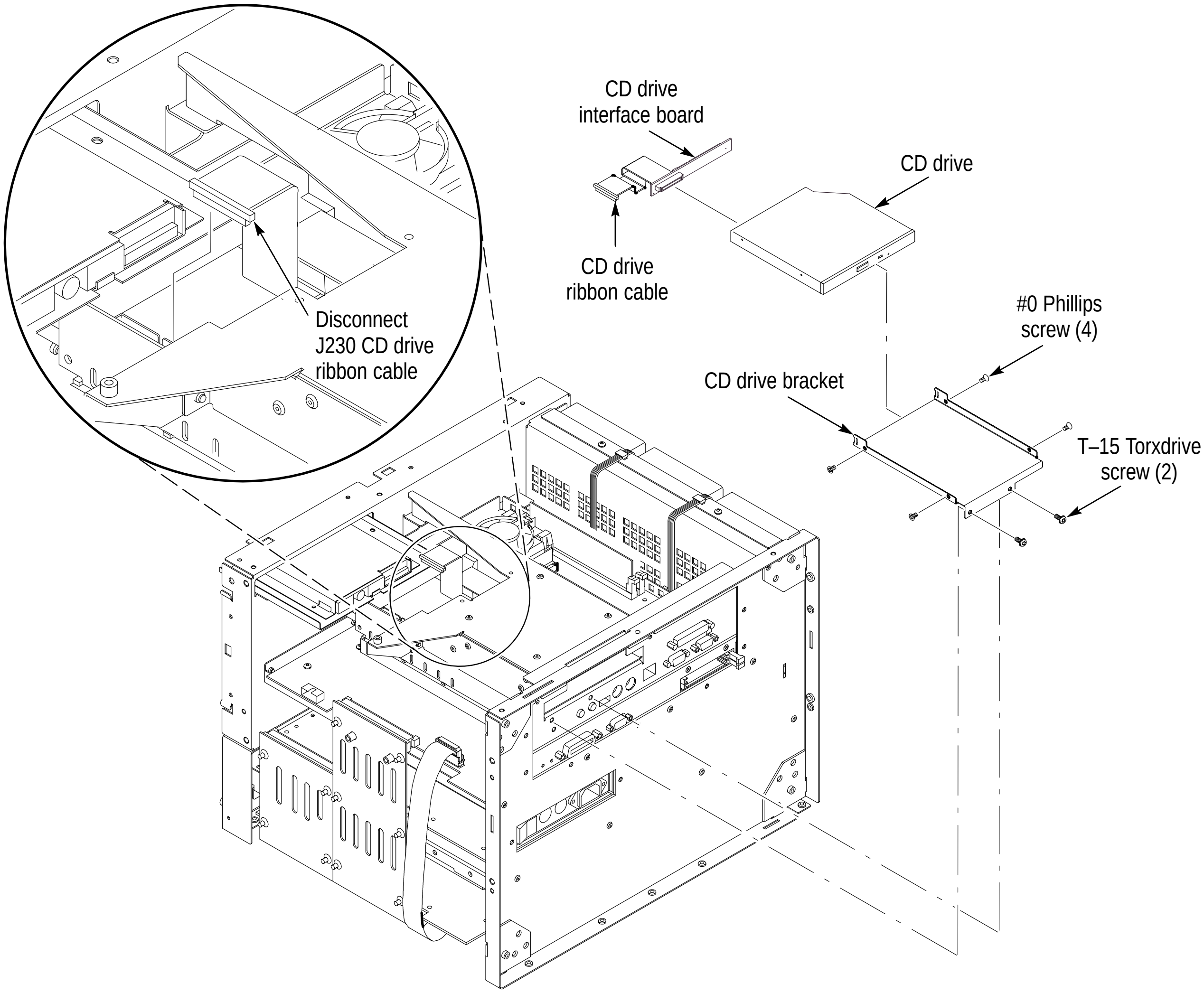


Figure 6–20: CD drive & bracket removal

Fan Assembly Removal

1. *Locate module to be removed:* Locate the Fan assembly in the locator diagram *Internal Modules*, Figure 6–8, page 6–19. Additional modules to be removed:
   - Trim (all)
   - Bottom cover
   - Left and Right covers
2. *Orient the instrument:* Set the instrument so its bottom is down on the work surface and its left side is facing you.

3. *Remove the fan assembly:* See Figure 6–21, page 6–36.

CAUTION. *Take care when handling the fan assembly, the fan blades are brittle and can be easily damaged .*

- **a.** *Disconnect the fan from processor/display board:* Disconnect the fan's two power cables J130 and J170 located on the processor board.
- **b.** Remove the two T-15 Torxdrive screws securing the fan assembly to the top main chassis.
- **c.** Lift the fan assembly up and out from the chassis.

4. *Reinstallation:* Do in reverse steps a through c to reinstall the fan assembly.

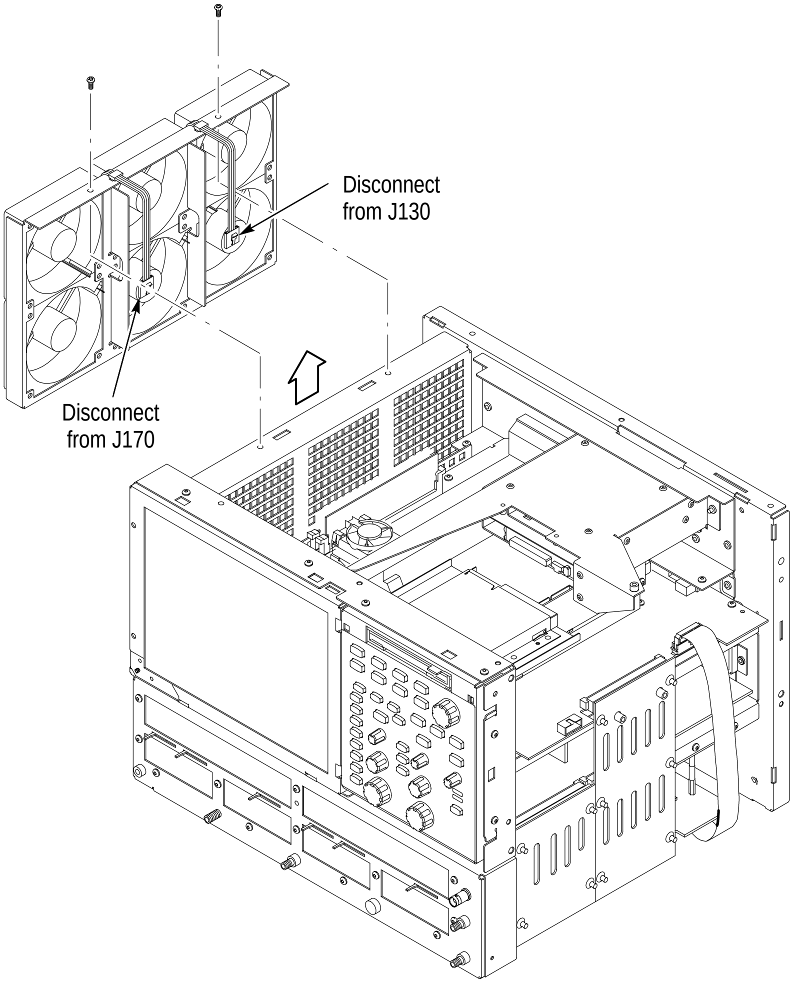


Figure 6–21: Fan assembly removal

Front and Rear Power Distribution Boards

1. *Assemble equipment and locate modules to be removed:* Find the modules to be removed in the locator diagram *Internal Modules*, Figure 6–8, page 6–19. Additional modules to be removed:
   - Trim (all)
   - Bottom cover
   - Left and Right covers
2. *Orient the instrument:* Set the instrument so its left side is down on the work surface and its right side is facing you.
3. *Remove the Front power distribution board:* See Figure 6–22, page 6–37.
   a. Grasp the Front power distribution board and pull it out from the instrument to disconnect it from the following connectors; J2 Power supply board, J102 Electrical front-end board, and J202 Acquisition board.

   b. *Remove the Rear power distribution board:* Grasp the Rear Power Distribution board and pull it out from the instrument to disconnect it from the following connectors; J201 Processor board, J1 Power supply board, J301 Electrical front-end board, and J102 Acquisition board.
4. *Reinstallation:* Do in reverse steps a and b to reinstall the front and rear power distribution circuit boards.

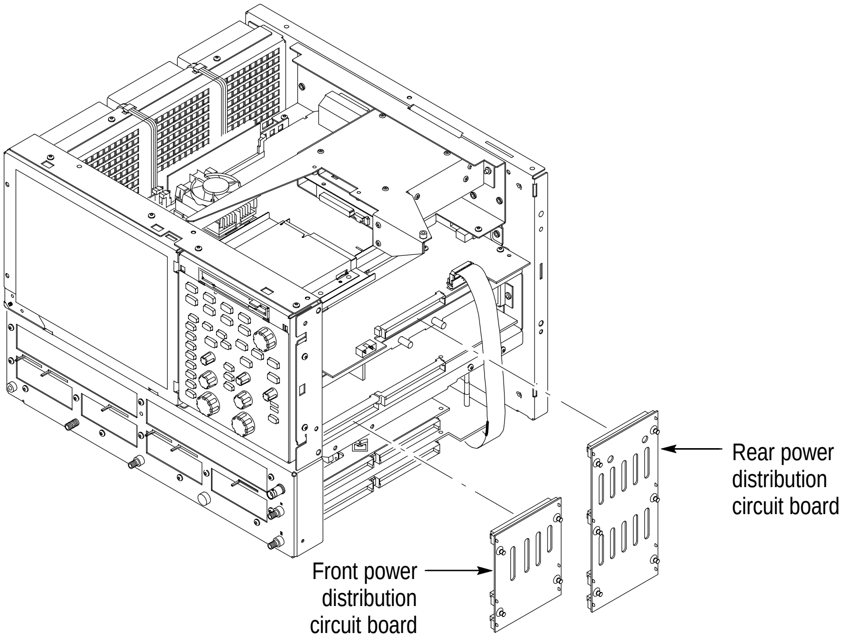


Figure 6–22: Front & rear power distribution board removal

Low-Voltage Power Supply

1. *Assemble equipment and locate modules to be removed:* Locate the modules to be removed in the locator diagram *Internal Modules*, Figure 6–8, page 6–19. Additional modules to be removed:
    - Trim (all)
    - Bottom cover
    - Left and Right covers
    - Front and Power rear distribution boards
2. *Orient theinstrument:* Set the instrument so its bottom is down on the work surface and its right-side is facing you.
3. *Remove the low-voltage power supply:* See Figure 6–23, page 6–39.
    - **a.** Disconnect J930 ribbon cable connector from the PC processor board.
    - **b.** Remove the two T-15 Torxdrive screws securing the low-voltage power supply to the right-side chassis support.
    - **c.** Remove the three T-15 Torxdrive screws securing the low-voltage power supply to rear chassis.
    - **d.** Grasp the low-voltage power supply and carefully slide the assembly out of the mainframe.
4. *Reinstallation:* Do in reverse steps a through c to reinstall the low-voltage power supply.

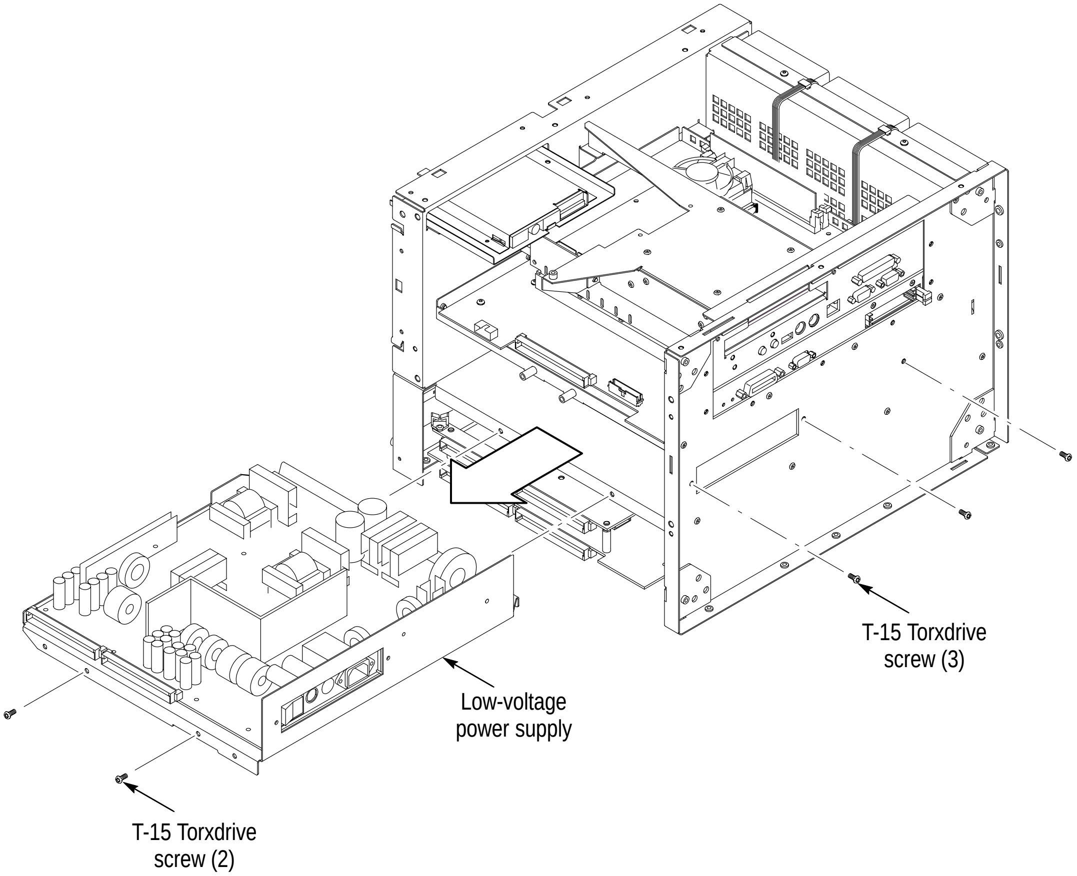


Figure 6–23: Low-voltage power supply removal

NLX Board

1. *Locate module to be removed:* Locate the NLX Board in the locator diagram *Internal Modules*, Figure 6–8, page 6–8. Additional modules to be removed:
   - Trim (all)
   - Bottom cover
   - Left and Right covers
2. *Remove the NLX Board assembly:* See Figure 6–24, page 6–41.
3. *Orient the instrument:* Set the instrument so its bottom is down on the work surface and its top panel is facing you.
   - **a.** Remove the two T-15 Torxdrive screws that secure the floppy disk drive assembly into the front chassis.
   - **b.** Slide the floppy drive assembly, with cable attached, out toward the rear of the instrument. Place floppy drive assembly on top of the hard/CD drive bracket.
   - **c.** Remove the five T-15 Torxdrive screws that secure NLX board assembly to the chassis.
   - **d.** Remove the five T-15 Torxdrive screws that secure NLX board assembly to the rear chassis.
   - **e.** Grasp the front edge of the NLX board assembly and pull up on the assembly to disconnect the Riser Adapter from the PC Processor board's edge connector.
   - **f.** Remove the NLX board assembly from the instrument.

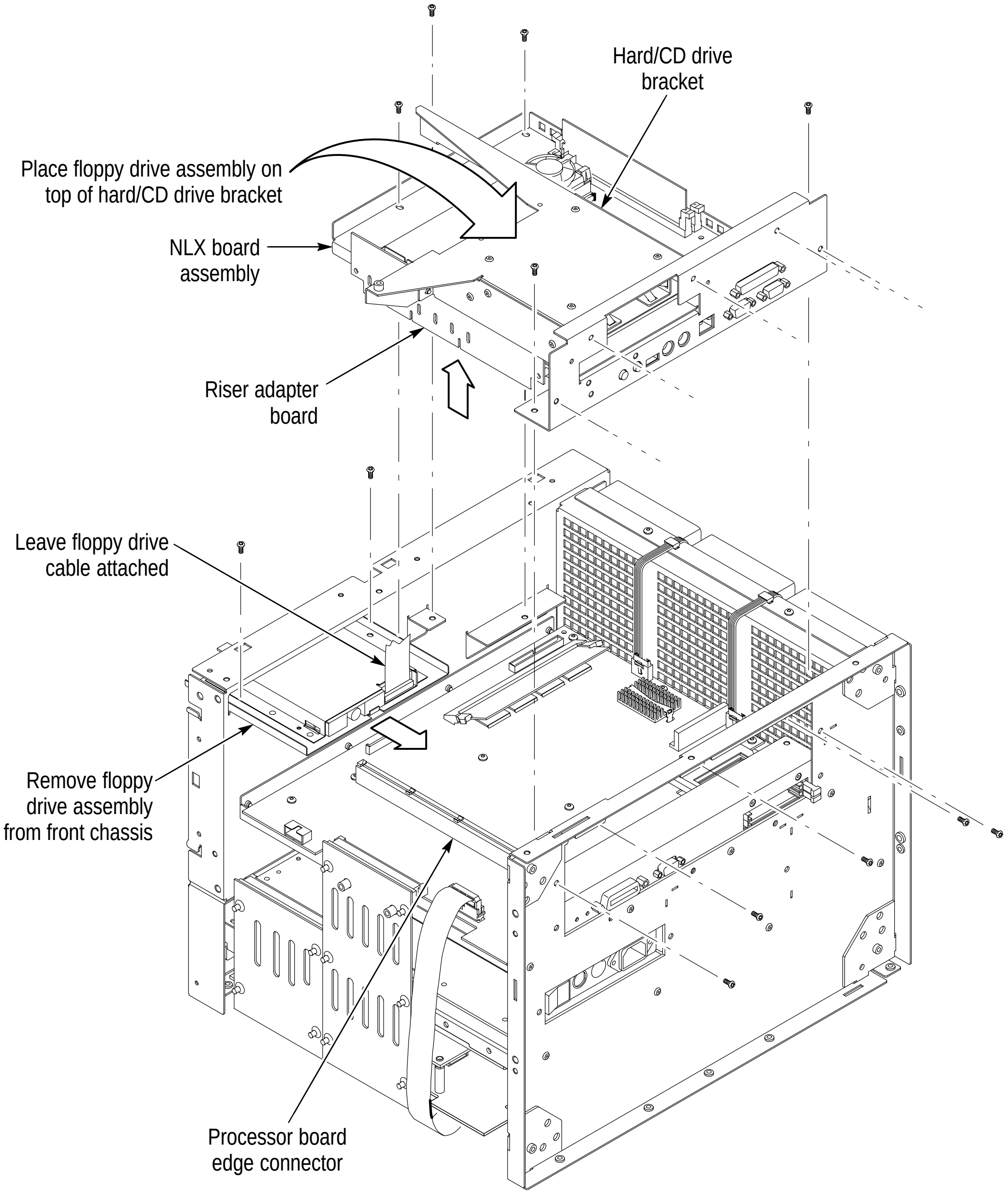


Figure 6–24: NLX assembly removal

4. *Remove the Riser Adapter and NLX boards:* See Figure 6–25, page 6–43.

   a. Remove the two T-15 Torxdrive screws that secure Riser Adapter board to the NLX support bracket.

   b. Disconnect the ribbon cable connectors from the floppy drive, hard drive and CD drive.

  - **c.** Remove the floppy drive assembly from the NLX board assembly.
  - **d.** Grasp the Riser board and pull it straight out to disconnect J510 edge card connector from the NLX board. Remove the Riser Adapter board from the NLX board assembly.
  - **e.** Remove the four T-15 Torxdrive screws that secure NLX board to the NLX support bracket.
  - **f.** Remove the six 3/16 nut posts that secure the three connectors to the rear of the support bracket. Then remove the NLX board from the support bracket.
  - **g.** Remove the NLX board from the support bracket.

5. *Reinstallation:* Do in reverse steps 3 and 4 to reinstall the NLX board.

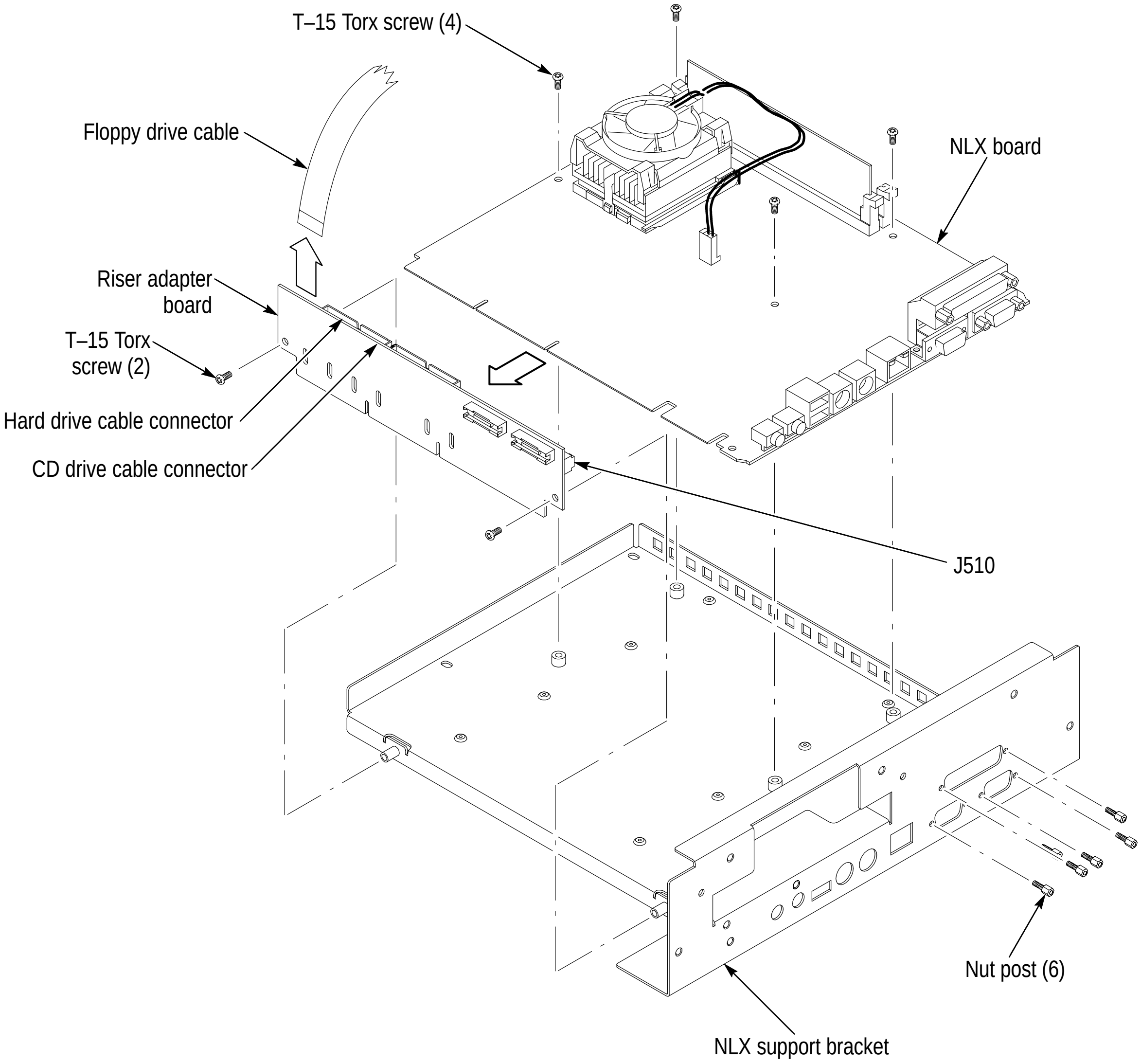


Figure 6–25: Riser adapter & NLX board removal

Microprocessor

1. *Locate module to be removed:* Locate the Front Panel board in the locator diagram *Internal Modules*, Figure 6–8, page 6–19. Additional modules to be removed:
   - Trim
   - Bottom cover
   - Left and Right covers

CAUTION. *The microprocessor is susceptible to static-discharge damage. Service this component only in a static-free environment. Observe standard handling precautions for static-sensitive devices while servicing the chassis. Always wear a grounded wrist and foot straps while servicing the microprocessor, NLX or processor boards.*

2. *Remove the microprocessor:* See Figure 6–26, page 6–45.
   - **a.** Disconnect the fan power cable J401 from the NLX board.
   - **b.** Push down and pull out on the holding bracket located nearest to the outer edge of the circuit board.
   - **c.** Pull out and unlatch the remaining bracket. Lift the fan/heatsink assembly out from the microprocessor.
   - **d.** Lift the microprocessor socket locking lever upward. Remove the microprocessor.
3. *Reinstallation:* To reinstall the microprocessor to the NLX board as follows:
   - **a.** Install the microprocessor in the socket.
   - **b.** Lower the socket locking lever.
   - **c.** Make sure the fan/heatsink assembly is positioned with the fan cable toward the outer edge of the circuit board.
   - **d.** Place the fan/heatsink assembly on the microprocessor to allow you to latch the bracket to the tab that is nearest to the center of the circuit board.
   - **e.** Set the remaining edge of the fan/heatsink down on the microprocessor and fasten the remaining bracket to the assembly.
   - **f.** Connect the fan power cable J401 from the NLX board.

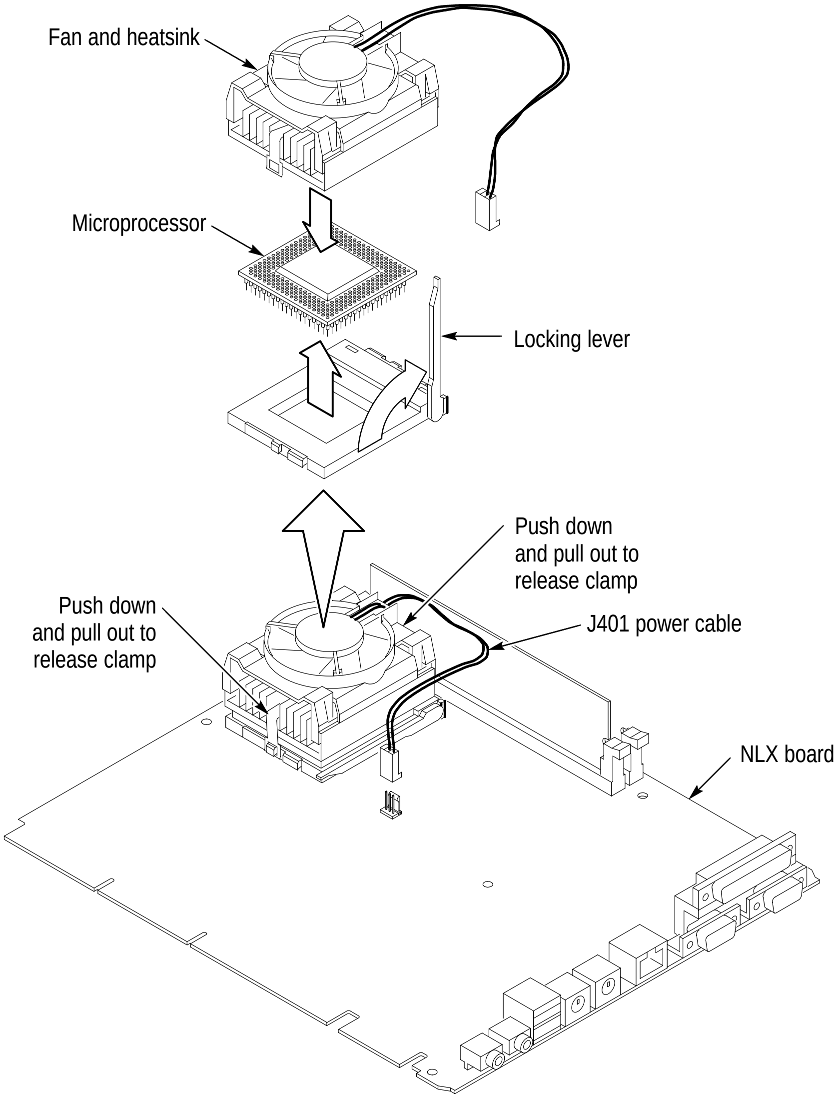


Figure 6–26: Microprocessor removal

PC Processor Board

1. *Locate module to be removed:* Locate the PC Processor Board assembly in the locator diagram *Internal Modules*, Figure 6–8, page 6–19. Remove the following in this order:
   - Trim (all)
   - Bottom cover
   - Left and Right covers
   - Hard Disk and CD Drive
   - Floppy Disk Drive
   - NLX Board
   - Front and Rear Power Distribution Boards
2. *Orient the instrument:* Set the instrument so its bottom is down on the work surface and its top panel is facing you.
3. *Remove the PC Processor board assembly:* See Figure 6–27, page 6–47.
   - **a.** Disconnect J190 and J691 ribbon cables from the PC processor board.
   - **b.** Remove the nine T-15 Torxdrive screws securing the PC processor board to the chassis support.
   - **c.** Remove the five T-15 Torxdrive screws securing the PC processor board assembly to the rear chassis.
4. *Remove the PC Processor Board:* See Figure 6–27, page 6–47.
   - **a.** Remove the two $^{3}/_{16}$ nut posts that secure the RS–232 connector to the rear of the support bracket.
   - **b.** Remove the two $^{5}/_{16}$ nut posts that secure the sub-D connector to the rear of the support bracket.
   - **c.** Remove the two phillips screws that secure the PCMCIA (Personal card, memory card interface adapter) to the pc processor board. Remove the PCMCIA from the PC processor board.
   - **d.** Disconnect J930 ribbon cable connector from the PC processor board.
   - **e.** Then remove the PC processor board from the instrument.
5. *Reinstallation:* Do in reverse steps 3 and 4 to reinstall the PC processor assembly.

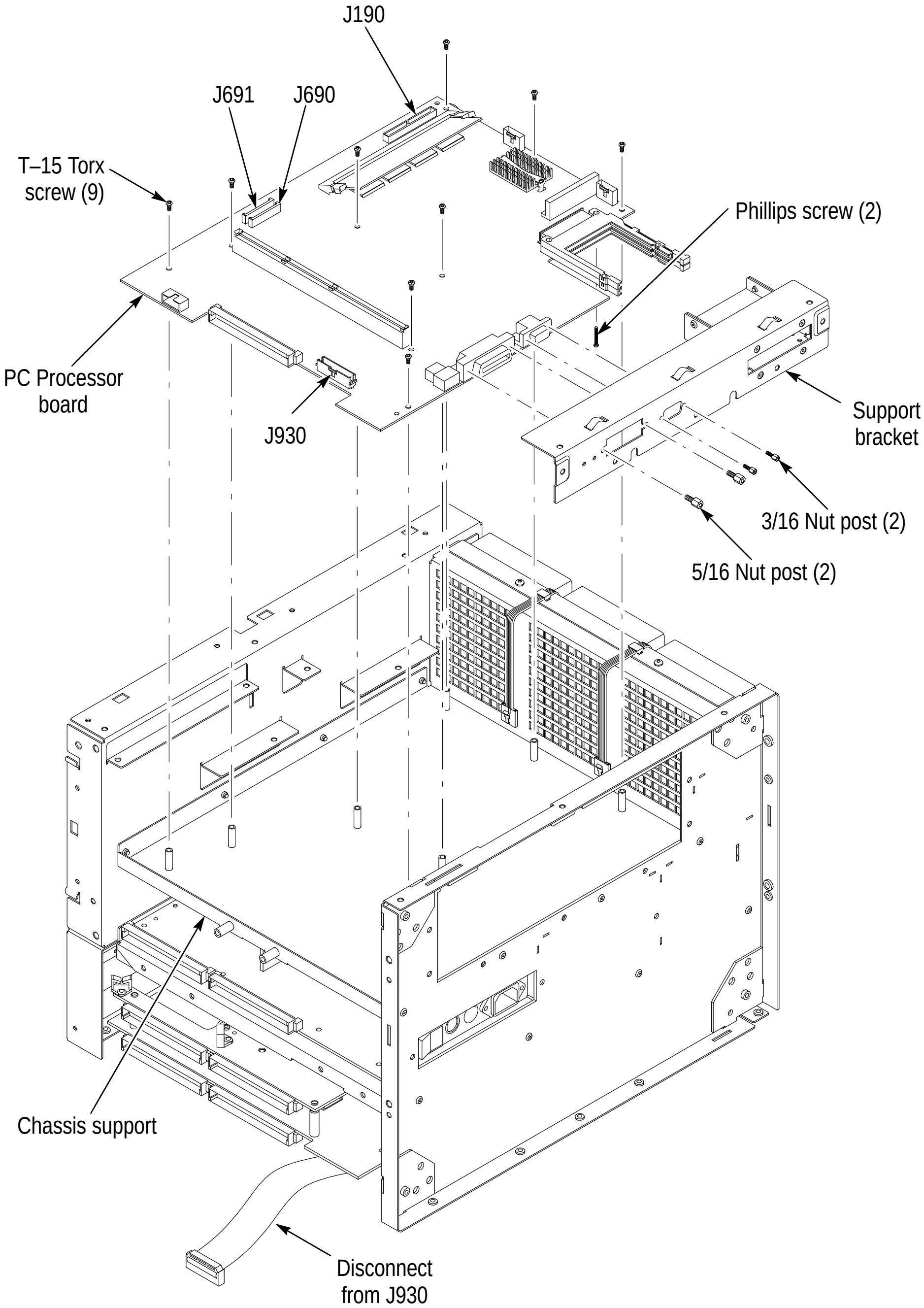


Figure 6–27: Processor board removal

Acquisition Assembly

1. *Locate module to be removed:* Locate the Acquisition assembly in the locator diagram, Figure 6–9, page 6–20. Remove the Acquisition assembly following in this order:

- Trim
- Bottom cover
- Left and Right covers
- Front and Rear Power Distribution Boards

2. *Orient the instrument:* Set the instrument so its top is down on the work surface and its bottom is facing you.

3. *Remove the Acquisition assembly:* The Acquisition assembly includes, the Acquisition board and Electrical Front End board. See Figure 6–29, page 6–50.

   a. Remove the $^{5}/_{16}$ inch nut that secures the TRIGGER PRESCALE SMA cable to the front panel.

   b. Remove the nine T-15 Torxdrive screws securing the Acquisition assembly to the chassis.

***NOTE**. Six Acquisition assembly screws are 0.312 inch long. Three Acquisition assembly screws are 1.750 inch long. The 1.750 inch screw locations are marked on the circuit board.*

   c. Disconnect the two SMB connectors that are connected to the trigger hybrid, located on the front edge of the Acquisition circuit board.

   d. Disconnect two coaxial cables from J8 and J16, located on the Acquisition circuit board.

   e. Disconnect J10 ribbon cable connector.

   f. *Orient the instrument:* Set the instrument so its front panel surface is facing you. Push the module slot covers in to access the slot connectors and attaching hardware.

***CAUTION.** Note the locations of the T-10 Torxdrive screws and the $^{3}/_{16}$ inch hex threaded posts for later reassembly. Make sure you reinstall the Torxdrive screw and threaded posts in the correct position. The $^{3}/_{16}$ inch hex threaded posts have etched lines around their mounting holes. Interchanging the threaded posts with the Torxdrive screws could cause damage to your module connector. See refer to Figure 6–28 for hardware locations.*

CAUTION. *Do not interchange the small and large sampling module threaded posts. The large slot sampling module threaded posts are single threaded posts and the small slot sampling module posts are double threaded posts. Installing the double threaded posts into the large module slot could damage the large module connector.*

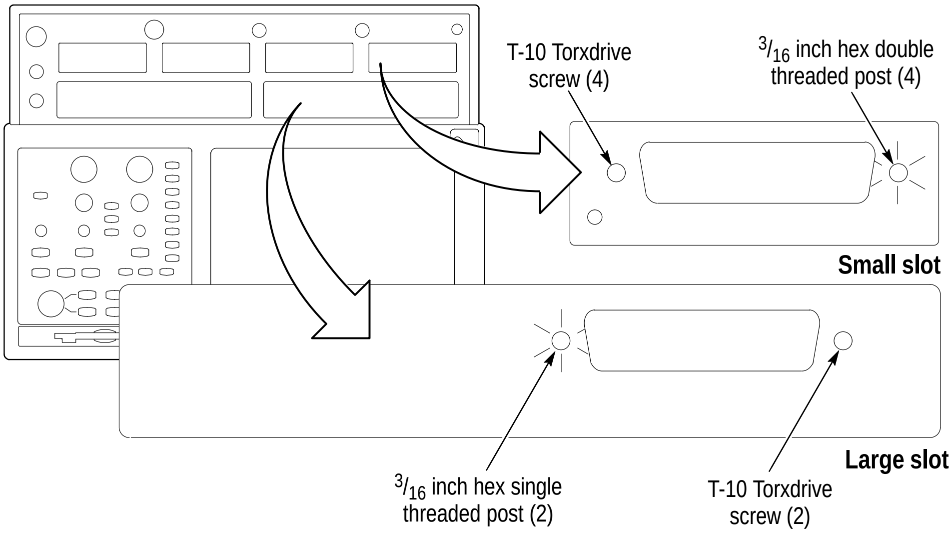


Figure 6–28: T-10 screws and threaded posts

- **g.** Remove the four 3/16 inch hex threaded post from each small module slot.
- **h.** Remove the four T-10 Torxdrive screws from each small module slot.
- **i.** Disconnect J6 ribbon cable connector from the large module circuit board.
- **j.** Disconnect the three coaxial cables connected to the front panel; INTERNAL CLOCK OUTPUT, DE CALIBRATION OUTPUT, AND EXTERNAL 10 MHz REFERENCE INPUT.
- **k.** Disconnect the TRIGGER PROBE POWER ribbon connector from J25 on the Electrical front end board.
- **l.** Slide the Acquisition assembly back toward the rear of the instrument then lift up and out of the instrument.

4. *Reinstallation:* Do, in reverse order, substeps g through l.

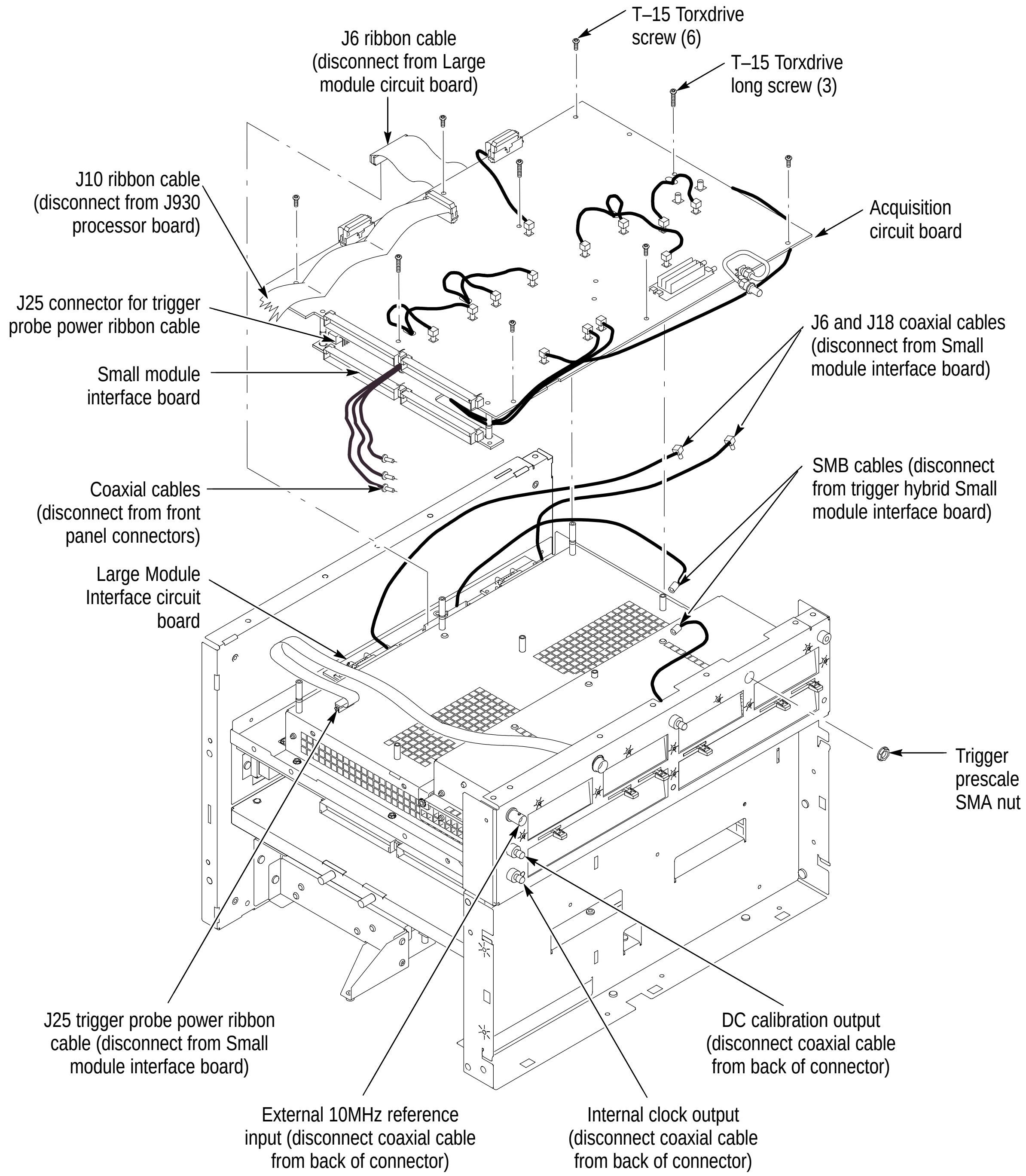


Figure 6–29: Acquisition circuit board assembly removal

Large Module Interface Circuit Board

1. *Locate module to be removed:* Locate the Large module Interface circuit board in the locator diagram, Figure 6–9, page 6–20. Remove the Large Module Interface circuit board following in this order:
   - Trim
   - Bottom cover
   - Left and Right covers
   - Front and Rear Power Distribution boards
   - Acquisition assembly
2. *Orient the instrument:* Set the instrument so its top is down on the work surface and its bottom is facing you.
3. *Remove the Large Module Interface circuit board:*
   - **a.** Remove the two $^{3}/_{16}$ inch hex threaded post from each optical module slot. See Figure 6–28, page 6–49
   - **b.** Remove the two T-10 Torxdrive screws from each optical module slot.
   - **c.** Remove the T-15 Torxdrive screw located on the Large Module Interface circuit board. See Figure 6–30, page 6–52.
   - **d.** Lift up on the rear of the Large Module Interface circuit board and lift the board out of the instrument.
4. *Reinstallation:* Do, in reverse order, substeps a through d.

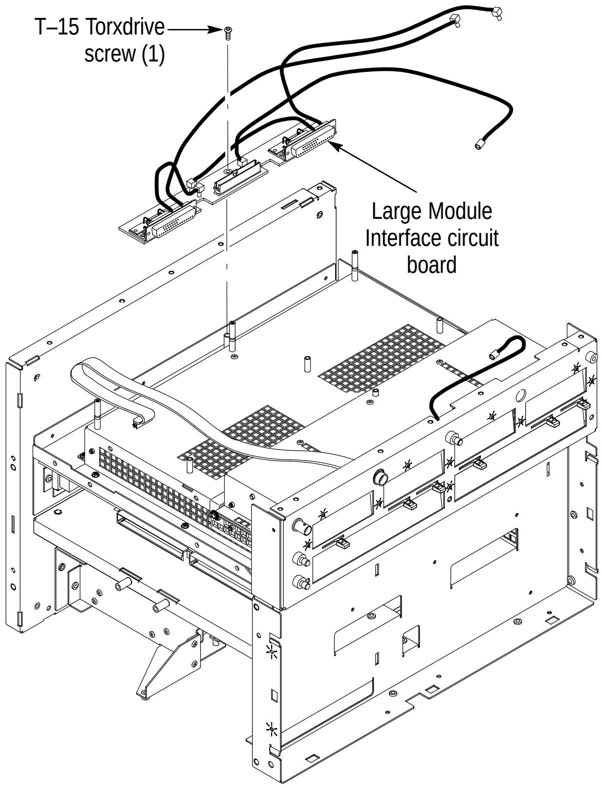


Figure 6–30: Large module interface circuit board removal

Module Slot Doors

1. *Assemble equipment and locate modules to be removed:* Locate the Module Slot Doors in the locator diagram. Figure 6–9, page 6–20. Additional modules to be removed:

   - Trim
   - Bottom cover
   - Left and Right covers
   - Front and Rear Power Distribution boards
   - Acquisition assembly

2. *Orient the instrument:* Set the instrument so its top is down on the work surface and its front is facing you.

3. *Remove the small module chassis:* See Figure 6–31, page 6–54.

   a. Remove the nine T-10 Torxdrive screws from front panel.

CAUTION. *One of these Torxdrive screws secures a* $^{5}/_{16}$ *inch hex nut and grounding lug to the inside chassis. When removing the top right T-10 Torxdrive screw, make sure this ground nut is retained for later reassembly.*
See Figure 6–31, page 6–54.

---

   b. Remove the seven $^{5}/_{16}$ inch hex nuts that secures the small module chassis to the instrument.

   c. Lift the chassis up and out of the instrument.

4. *Remove the large module chassis:* See Figure 6–31, page 6–54.

   a. Remove the four T-10 Torxdrive screws from the front panel.

   b. Remove the eleven $^{5}/_{16}$ inch hex nuts that secure the optical module chassis to the instrument.

   c. Remove all the snap-on ejector lever handles.

   d. Lift the back of the chassis up over the studs, then slide the chassis to the rear and out of the instrument.

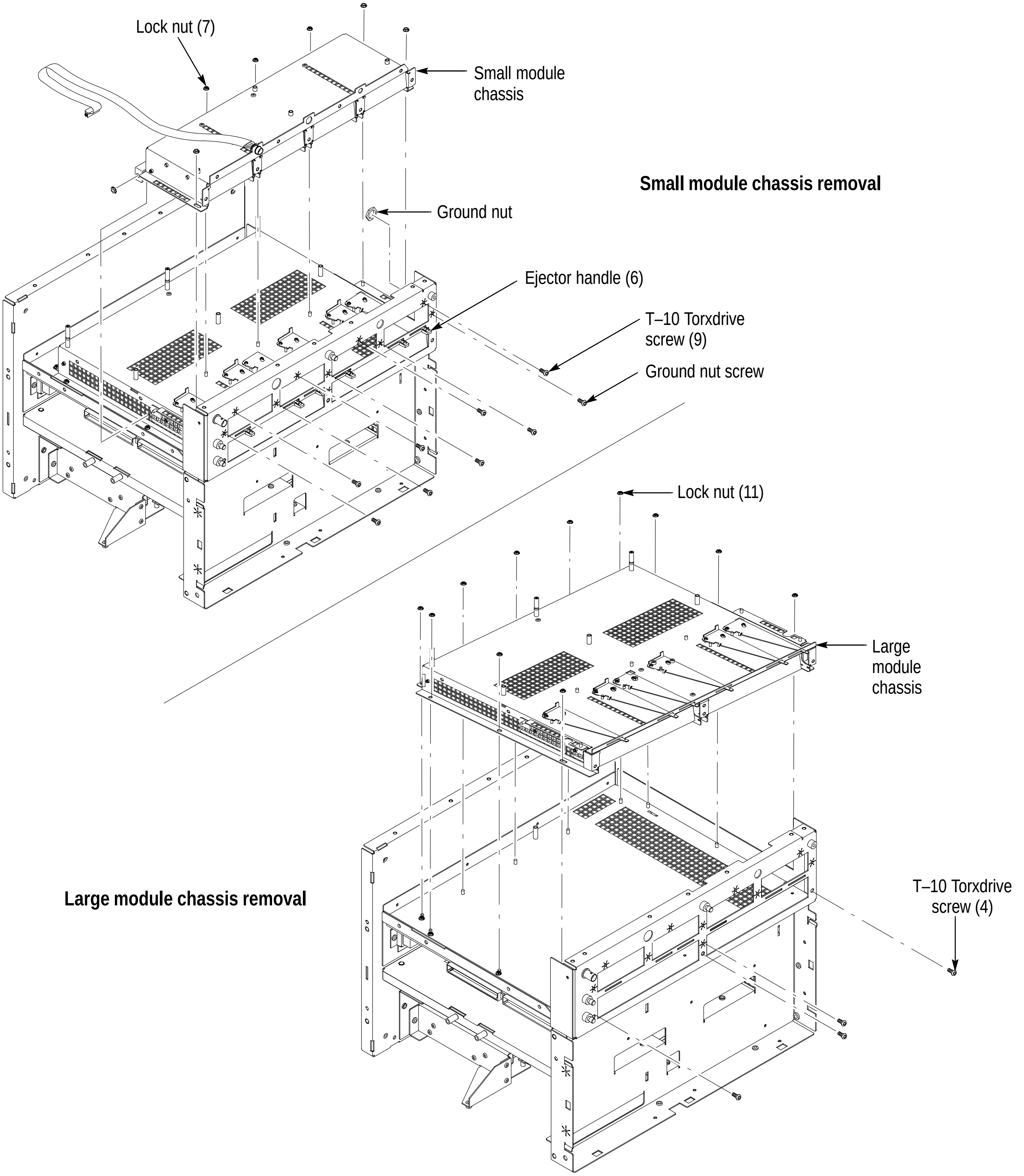


Figure 6–31: Small and Large module chassis removal

5. *Remove the module slot doors:* See Figures 6–32 & 6–33, pages 6–56 & 6–57.

6. *Orient the small or large module chassis:* Set the chassis so the module slot cavities with springs and slot guides are facing you.

  a. Remove both slot door springs by prying the spring arm from the small slots located on the sides of the module slot. Use a pair of tweezers to pull the spring arms out from the slot.

***NOTE**. There is a right and left spring, note locations of the springs for later reassembly.*

  b. Push the module slot door slighting in while lifting the door out of the chassis.

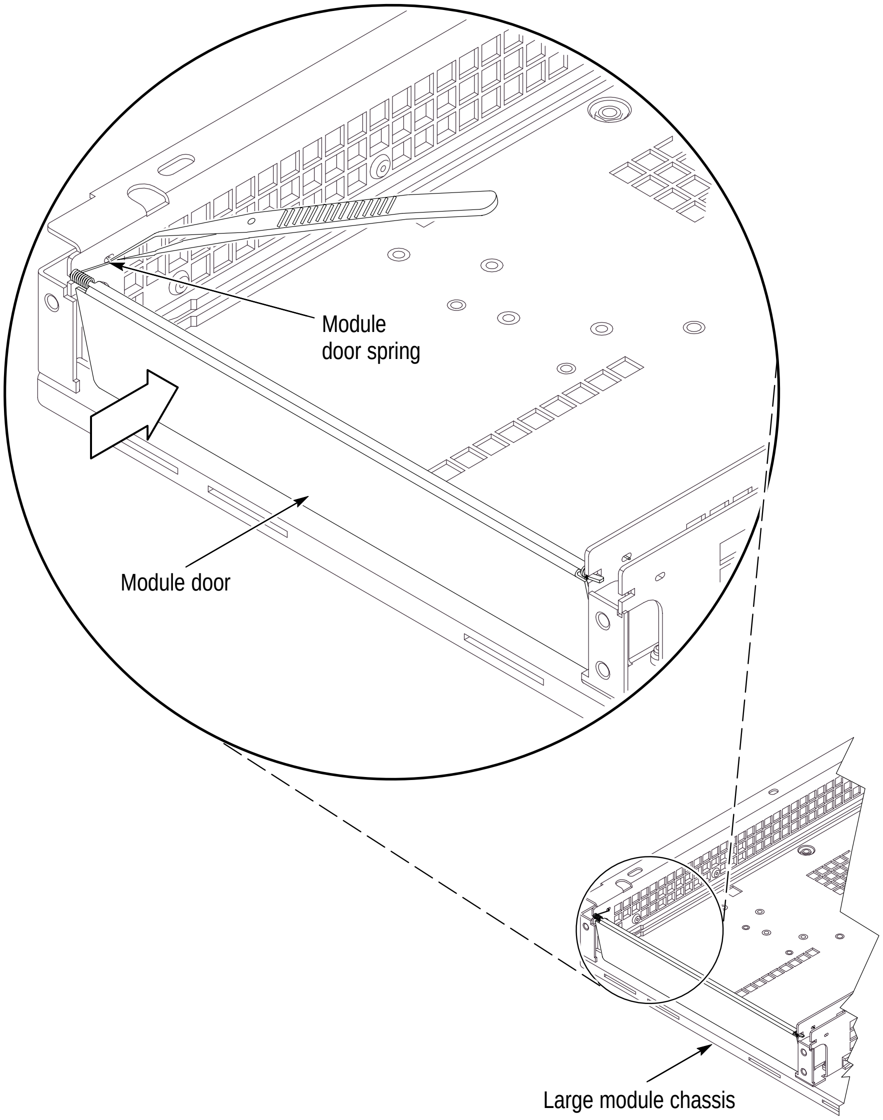


Figure 6–32: Module door spring removal

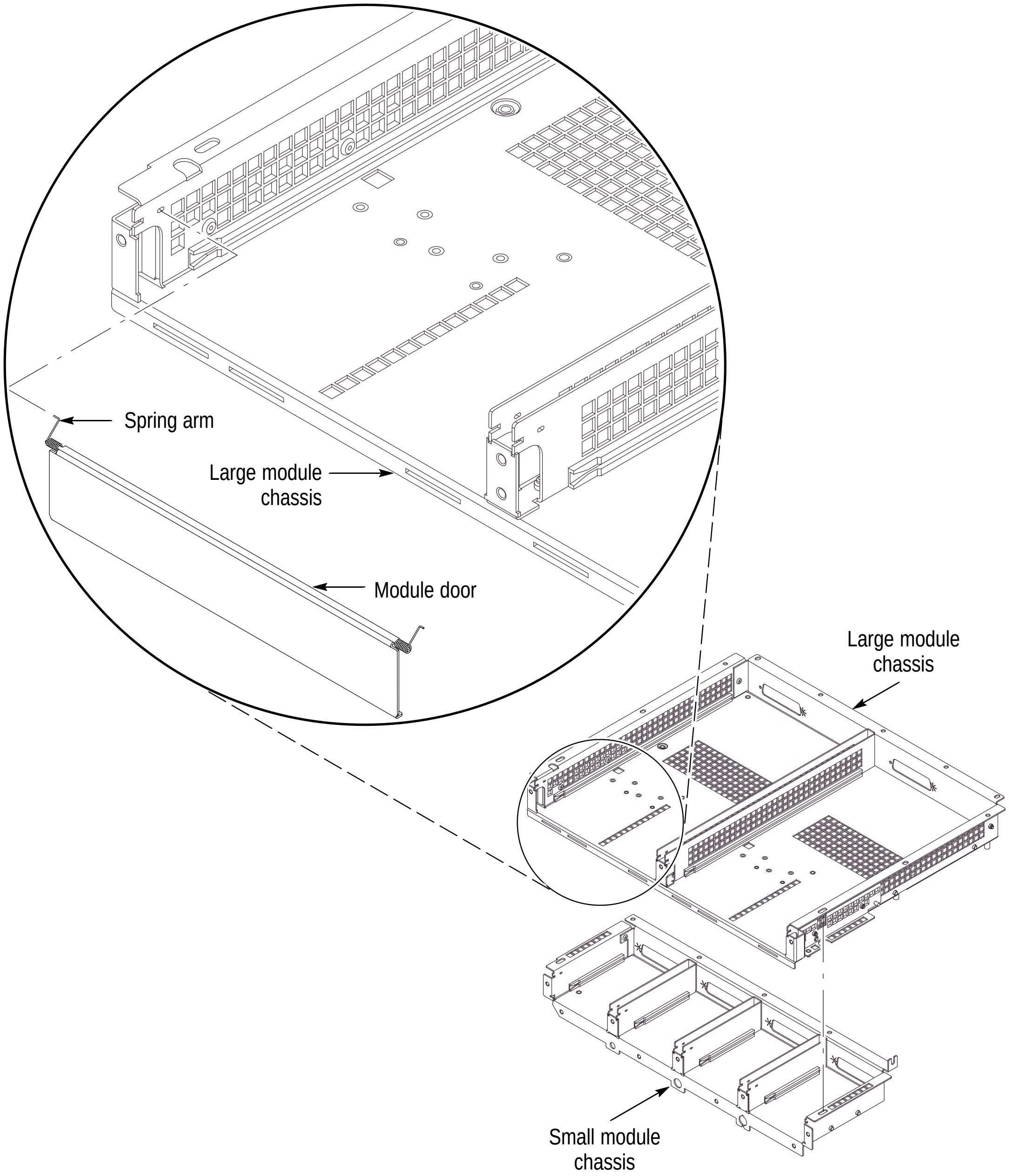


Figure 6–33: Module slot door removal

7. *Remove the module ejector levers:* See Figures 6–34 & 6–35, pages 6–59 6–60.

8. *Orient the small or large module chassis:* Set the optical chassis so the module ejector levers are facing you.

   a. Remove both T-10 Torxdrive screws that secure the ejector lever to the optical chassis.

   b. Remove both brass washers, ejector lever and ejector spring.

9. *Reinstallation:* Perform the following procedure to reinstall the ejector levers and module slot doors.

   a. Place the ejector spring over the pem nut standoffs (pivot and slider). One spring arm is positioned next to the ejector lever spring tab. The other spring arm is positioned to the left-side of the stud post.

   b. Place the ejector lever over the ejector spring and pem nut standoffs (pivot and slider).

NOTE. *Make sure the ejector lever is positioned correctly. The ejector lever has a dimple protruding to accommodate the snap-on handle. When installing the ejector lever this dimple must be facing up from the optical chassis. Refer to Figure 6–34 on page 6–59.*

   c. Place brass shoulder washers over both pivot and slider mounting positions.

   d. Install both T-10 and Torxdrive screws to secure the pivot and slider mounting positions.

   e. Move the left spring arm to the right-side of the stud post. The right spring arm must be on the left of the lever tab. Refer to Figure 6–35, page 6–60.

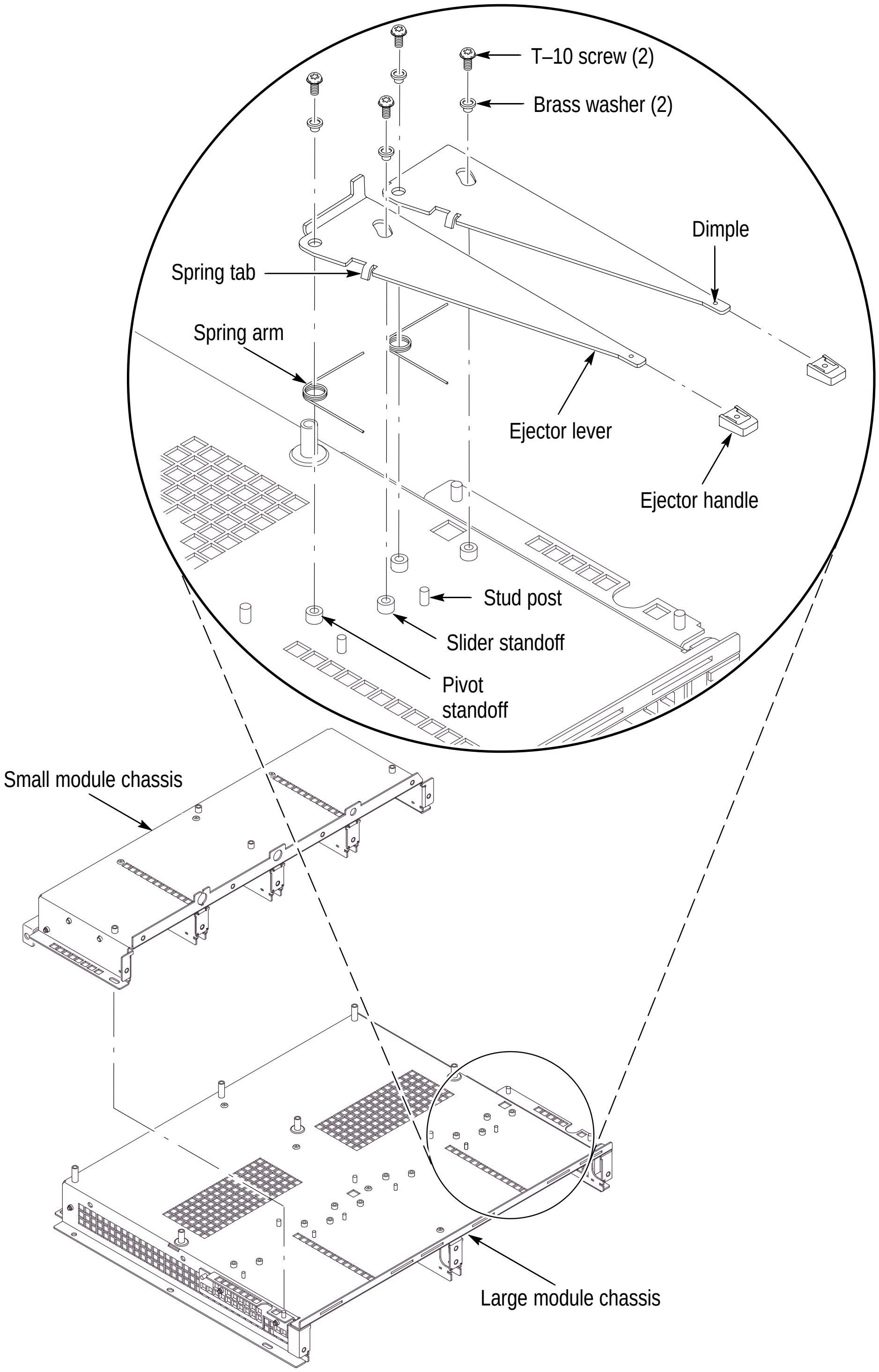


Figure 6–34: Module ejector handles removal

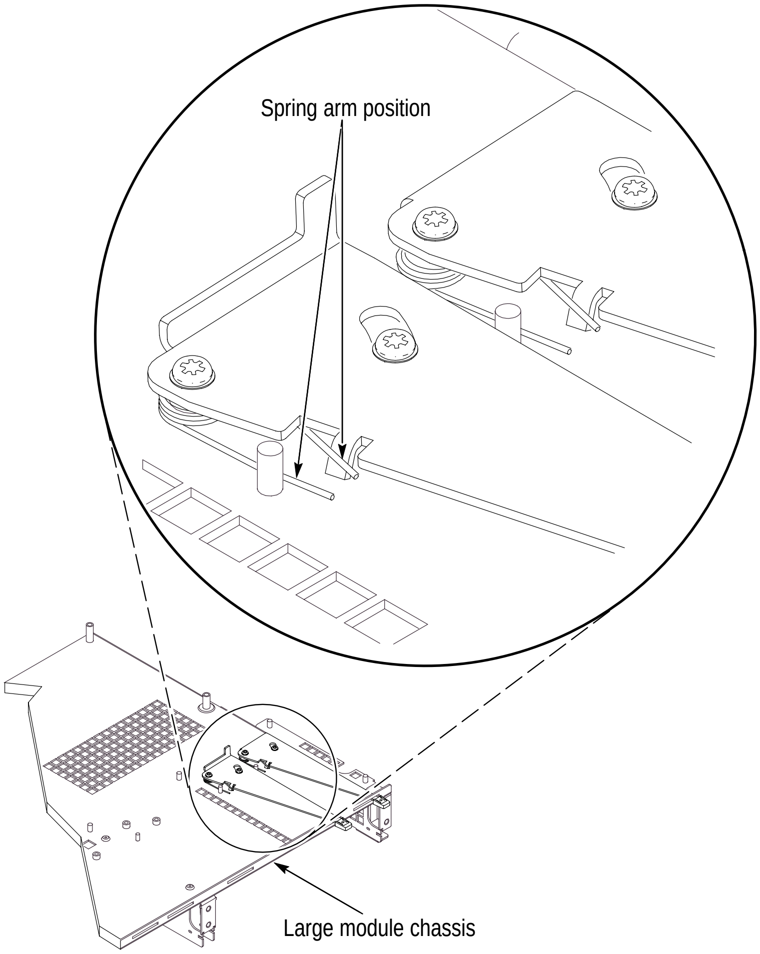


Figure 6–35: Spring arm position

Electrical Modules

1. *Orient the sampling module:* Set the sampling module so its left side is down on the work surface and its right side is facing you.

***CAUTION.** Static discharge can damage any semiconductor in the instrument or sampling module. To prevent damage from static discharge wear wrist and foot grounding straps while handling sampling module chassis. Service should be performed in a static-free work station by a qualified service technician. Minimize handling of static-sensitive components.*

---

2. *Remove the cover:* See Figure 6–36, page 6–61.
   - **a.** Remove two phillips screws that secure the front panel to the cover. Remove the front panel.
   - **b.** Remove the four phillips screws that secure the cover to the chassis.
   - **c.** Slide the chassis out toward the rear of the cover.

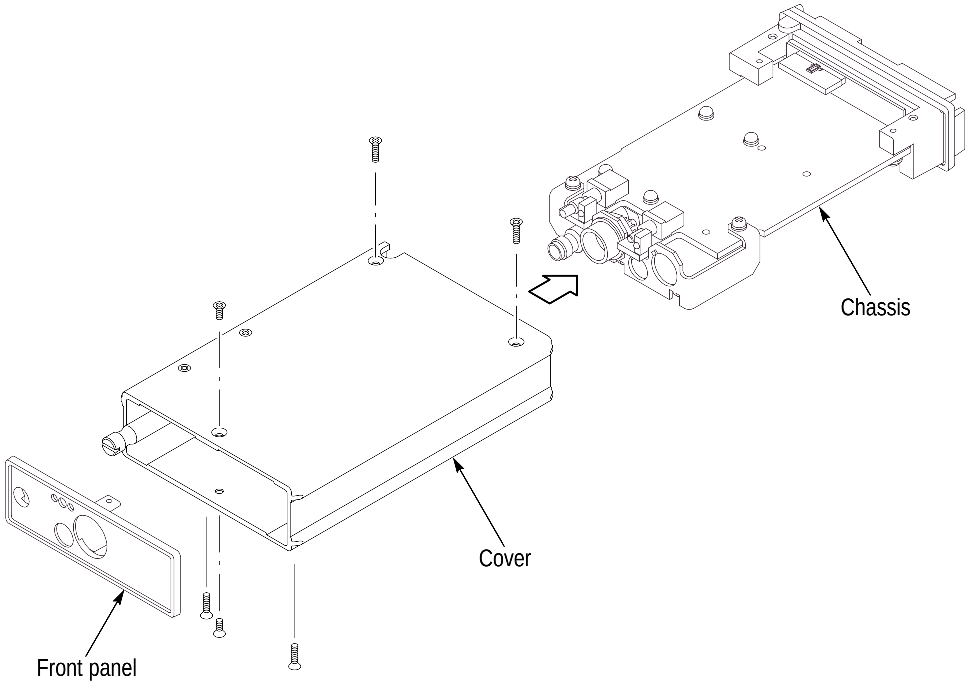


Figure 6–36: Electrical module hardware removal

Exchanging electrical sampling module

Replacing the sampling module chassis

If it is determined that a sampling module failure is caused by an internal part, you must exchange the complete sampling module chassis to Tektronix. The customer will keep the cover and attaching hardware. Sampling module exchange can be made with either your local Tektronix service center or central Tektronix exchange in Beaverton, Oregon.

1. Transport the chassis sampling modules with terminations on the inputs.
2. Transport the chassis sampling modules in their original containers and store the sampling modules on a metal or conductive surface.
3. When handling the exposed chassis sampling module only, do not touch any exposed component on the circuit board. Grasp the exposed module by the edges of the circuit board or the rear or front housings.

Reinstalling exchange module serial number

Program the serial number (printed on the sampling module cover) into the new replacement sampling module chassis.

1. Reinstall the chassis into the cover following the procedure on page 6–61.
2. Install the electrical sampling module into one of the instrument’s slots.
3. Connect a GPIB cable to the GPIB port of the instrument connect the remaining end to the GPIB port of a PC.

CAUTION. *Do not have any user interface dialogs active. Dialogs such as Compensation, System properties will prevent the instrument from responding to GPIB commands.*

---

4. Enter the following GPIB commands:
   - **a.** SYSTem:PROTect OFF
   - **b.** SYSTem:PROPerties:CH(1-8):SERialnum <serialNum_string>

Example: SYST:PROP:CH3:SER “B010123”

NOTE. *For a 2 channel sampling module either channel can be specified in step b. For an 80E01 sampling module use only the lower numbered channel number such as CH1 or CH3.*

- **c.** SYSTem:PROTect ON

5. Verify the serial number change, Pull down the **Utility** menu and then select **System Properties, Sampling Modules.** Click on the channel you want to verify, eg; **C3 or C4.** This display will confirm the sampling module serial number.

Optical Modules

1. *Orient the optical sampling module:* Set the optical sampling module so its left side is down on the work surface and its right side is facing you.

2. *Remove the cover:* See Figure 6–37.

   a. Remove the seven T-10 Torxdrive screws (80C02 has eleven T-10 Torxdrive screws, four T-10 Torxdrive screws on the top cover) that secure the cover to the module chassis.

   b. Lift the rear of the cover up and slide back about $^1/_2$ inch, then lift the non-optical connector side up toward the optical connector side.

   c. Remove the cover from the chassis.

3. *Reinstallation:* Do in reverse steps a through d to reinstall the front panel assembly.

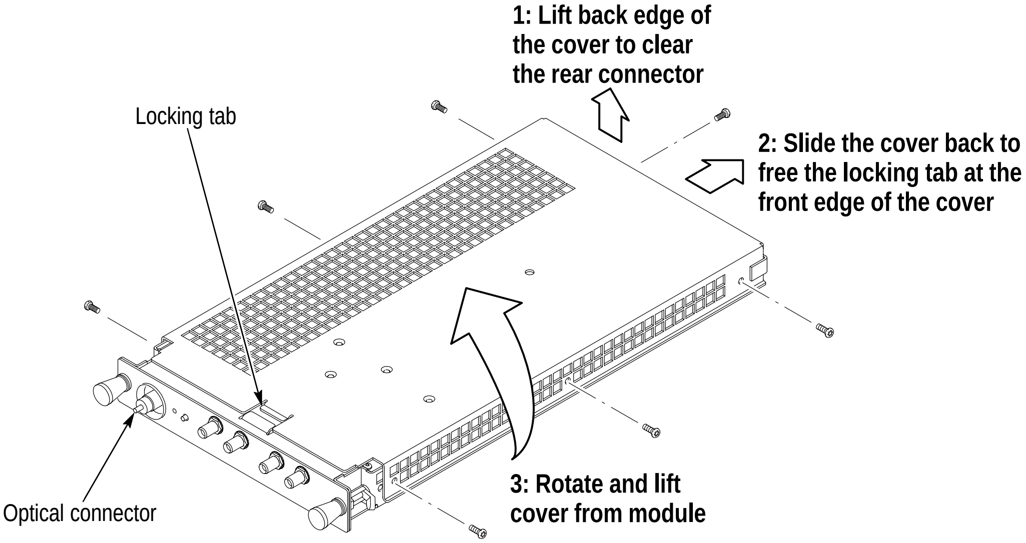


Figure 6–37: Optical module cover removal

80A01 module

1. *Orient the module:* Set the 80A01 module so that its left side is down on the work surface and its right side is facing you.

CAUTION. *Static discharge can damage any semiconductor in the instrument or sampling module. To prevent damage from static discharge wear wrist and foot grounding straps while handling the module chassis. Service should be performed in a static-free work station by a qualified service technician. Minimize handling of static-sensitive components.*

---

2. *Remove the front panel:* See Figure 6–38, page 6–64.
   - **a.** Remove two coaxial terminators on the front panel connectors.
   - **b.** Remove two phillips screws that secure the front panel to the cover. Remove the front panel.

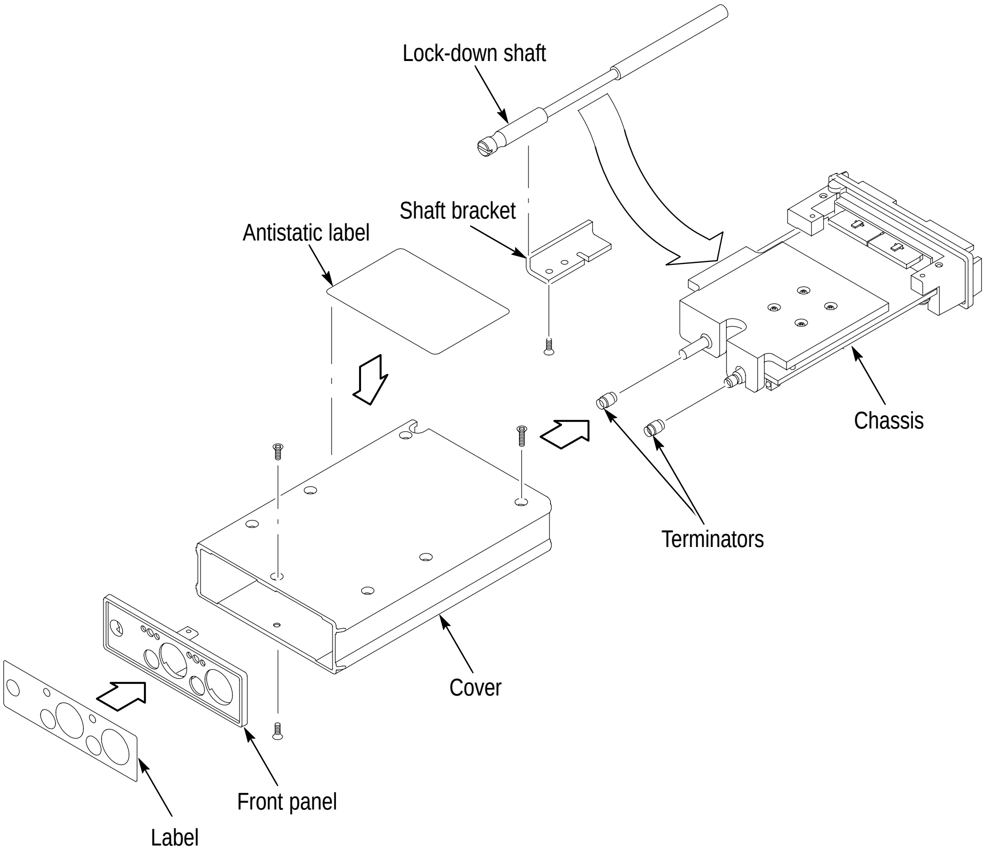


Figure 6–38: 80A01 parts removal

3. *Remove the cover:* See Figure 6–38, page 6–64.

   a. Remove the six phillips screws that secure the cover to the chassis.
   b. Slide the chassis out toward the rear of the cover.

4. *Remove the lock-down shaft and bracket:* See Figure 6–38, page 6–64.
   a. Remove the two phillips screws that secure the bracket to its mount. Remove it.
   b. Lift out the lock-down shaft.
5. *Reinstallation: Perform steps 2 through 4 in reverse to reassemble the 80A01 module.*
   a. If installing a replacement the front panel, do the following steps before performing step 2:
      - Remove the backing from the front panel label.
      - Align the holes and attach to the front panel.
   b. If installing a replacement cover, do the following steps before performing step 3:
      - Remove the backing from the antistatic label.
      - Install the antistatic label to the replacement cover.

Troubleshooting

Service Level

This subsection contains information and procedures designed to help you isolate faulty modules in the instrument. If a module needs to be replaced, follow the *Removal and Installation Procedures* located in this section.

Check for Common Problems

Use Table 6–4 to quickly isolate possible failures. The table lists problems related to the instrument and possible causes. The list is not exhaustive, but it may help you eliminate a problem that is quick to fix, such as a blown fuse or loose cable.

Table 6–4: Failure symptoms and possible causes

Symptom	Possible cause(s)
Mainframe will not power on	■ Power cord not plugged in. ■ Failed fuse. ■ Faulty power supply. ■ Faulty modules. ■ Main power switch (rear panel) not on. ■ Front panel power switch not on. ■ Monitor not connected properly.
Front panel light comes on (mainframe powers on), but one or more fans will not operate	■ Faulty fan cable. ■ Defective fan assembly. ■ Faulty power supply.
Mainframe powers on but no signal displayed	■ Wrong channel is selected, Waveform Selector and Setup menus. ■ Module not fully installed into the slot. ■ Signal cable not connected properly. ■ Wrong trigger input, check signal cable and Setup menus are Direct or Prescale.
Controller appears “dead”; power light comes on, but monitor screen(s) is (are) blank	■ SO DIMMs incorrectly installed or missing. ■ Defective NLX board

Table 6–4: Failure symptoms and possible causes (Cont.)

Symptom	Possible cause(s)
Flat LCD panel display blank	■ External monitor plugged in but not powered on. ■ External monitor plugged in (look on external monitor for display). ■ Connect an external monitor cable to the SCOPE ONLY VGA OUT rear panel connector. If monitor has a display, replace the LCD panel assembly. ■ Connect an external monitor cable to the SVGA OUT rear panel connector, if monitor has a display the BIOS may need to be setup. ■ If the BIOS is OK then replace the Power PC circuit board assembly. ■ Connect an external monitor cable to the SVGA OUT rear panel connector. If the monitor has no display, replace the NLX circuit board assembly. ■ If the monitor has no display when connected to the SVGA OUT rear panel connector, replace the NLX circuit board assembly. ■ Defective cable from front panel board to riser board. ■ Defective cable from Power PC board to front panel board.
Front panel LEDs do not light.	■ Replace the front panel board.
Hard disk drive related symptoms	■ Defective hard disk drive. ■ Incorrect hard disk type selected in the BIOS setup. ■ Replaceable hard disk drive not installed. ■ Power supply failure. ■ Corrupted controller BIOS module firmware, reinstall firmware. ■ Controller BIOS setup problem. See BIOS Settings. ■ Replaceable hard disk drive or optionally field installed fixed hard disk drive not configured as bootable (slave) master hard disk drive. ■ Faulty benchtop controller.
CD-ROM related symptoms	■ Defective CD-ROM. ■ Defective CD-ROM drive cable. ■ Defective CD-ROM board. ■ Incorrect CD-ROM configuration in the BIOS setup.

Table 6–4: Failure symptoms and possible causes (Cont.)

Symptom	Possible cause(s)
Diagnostic errors	■ Remove all electrical and optical modules from the instrument, then diagnostics again. If the instrument passes diagnostics, check for the electrical and optical module that is causing the failures. The run diagnostics again. ■ If the instrument fails the diagnostics without the installed modules replace the Acquisition assembly. The run diagnostics again.
Compensation errors	■ Remove all electrical and optical modules from the instrument, then run compensation again. If the instrument passes compensation, check for the electrical and optical module that is causing the failure. ■ Verify that each module is completely installed into the slot. If the instrument still fails compensation, replace the Acquisition assembly.
Modules not recognized	■ Module firmware incompatible with mainframe software version. ■ Faulty module. Refer to appropriate module service manual for further troubleshooting information. ■ Module not fully installed into the slot.
80C0X modules have no signals displayed	■ Module not fully installed into the slot. ■ Wrong channel is selected, Waveform Selector and Setup menus. ■ Signal cable not connected properly. ■ Replace optical cables. ■ Replace Optical assembly or Acquisition assembly.
80C0X modules; poor noise performance	■ Male fiber-fiber connections need to be cleaned. Refer to Table 6–1 on page 6–3.
80C0X modules; frequency response exhibits a steep negative “droop” in its plot.	■ Bad internal O/E RF amplifier de-coupling. Check tightness of all rigid cable interconnect.
BIOS error messages	■ Refer to the BIOS error message table.
Instrument locks up	■ Power down the instrument, then restart. ■ Replace the NLX assembly. ■ Replace the Power PC circuit board assembly.

Equipment Required

You will need a digital voltmeter to check power supply voltages, as described on page 6–72.

Testing might also be required to correct some faults. Under those circumstances, you will need the test equipment listed in the *Performance Verification and Adjustment Procedures* in this manual.

Isolating Failures between the 80E0X/80C0X Modules or the Mainframe

To determine if the sampling module has failed or the mainframe failed, perform the following:

1. Perform the module compensation. Refer to *Perform the Compensation* on page 4–5.
2. Perform the measurement procedures you require to make your test.
3. If the the measurement fails, Remove the sampling module and install it into another slot.
4. Perform steps 1 and 2, then take the following action:
    - If the measurement successfully functions, there is a good chance the mainframe channel has failed. Perform other mainframe diagnostics in this section.
    - If the measurement fails, there is a good chance the sampling module has failed. Return to Tektronix, Inc. for repair.

Isolating to a Board if Power Will Not Come Up

If the mains power is on, a red light (see Figure 6–39 for its location) is visible through the right side of the instrument.

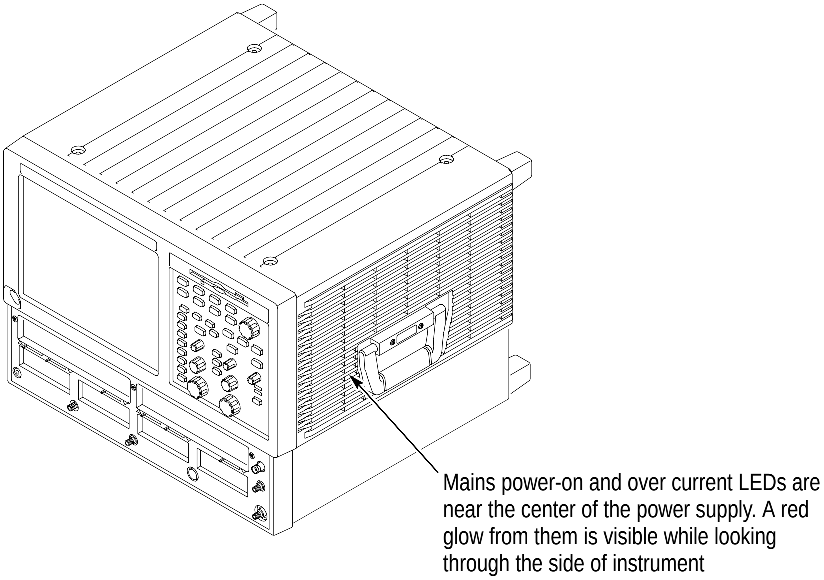


Figure 6–39: Location of power-on and over current LEDs

If the instrument thinks power is on, a red light (see Figure 6–39) means that there is an over current condition.

If the on/standby pin (pin C1 of P201 on the rear power distribution board or pin B162 on the riser board) is low, the instrument thinks power is on.

Remove boards one at a time to locate a fault (the display, floppy, acquisition board, front [analog supply to acquisition board] and rear power distribution boards, the NLX board, and the riser board). If you remove the NLX board, you must jumper the debug power-on pins (see Figure 6–40). The PPC board and the rear power distribution board are required for power to come up.

If removing the boards did not find the problem, replace the power supply.

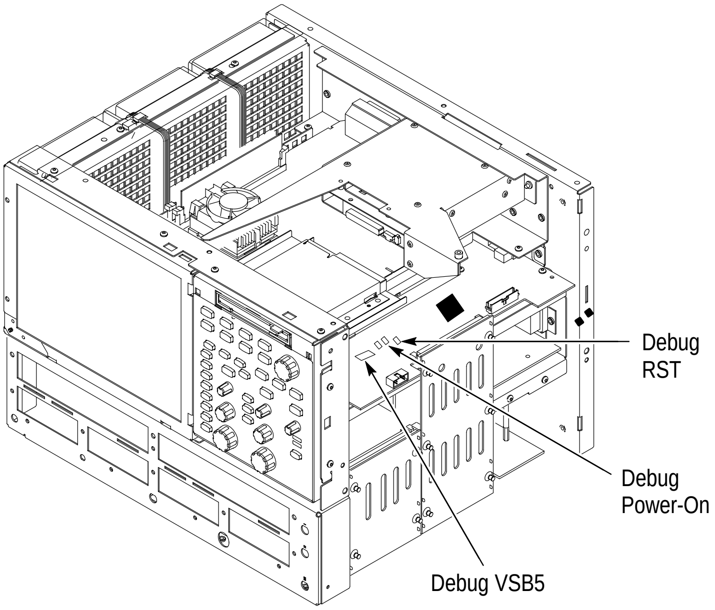


Figure 6–40: Location of debug pins

Checking the Power Supply Voltages

Power off the mainframe and remove any modules installed in it. Power on the instrument and connect the reference lead of a digital voltmeter to chassis ground, such as the top of the power supply.

Attach a 0.025 inch square pin to the probe tip of the other lead and insert it into a pin on one of the connectors. The pins that should be carrying voltages are listed in Table 6–5. The location of the P1 and P2 connectors is shown in Figure 6–41 on page 6–73.

Measure the power supply voltages with the voltmeter and compare each reading to the values listed in the tables. If the voltages are within about 5% of the nominal voltages, your power supply is functional.

Table 6–5: Power supply voltages

Front power distribution board (P2)	Voltage	Rear power distribution board (P1)	Voltage
Pins A1, B1, C1	+3.3 V	Pins A5, B5, C5	+12 V
Pins A13, B13, C13	–15 V	Pins A8, B8, C8	+5 V
Pins A15, B15, C15	+15 V	Pins A19, B19, C19	+3.3 V
Pins A17, B17, C17	–5 V		
Pins A24, B24, C24	+5 V		

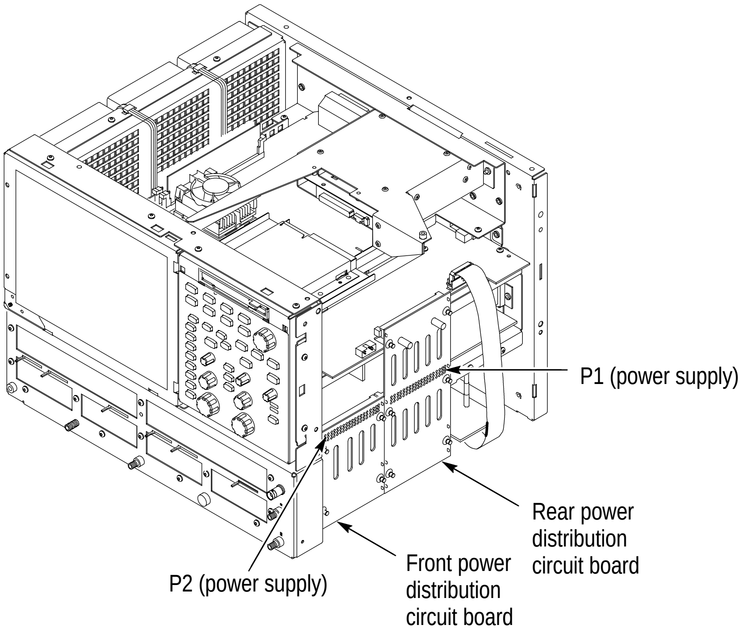


Figure 6–41: Connectors J1 and J2

If the instrument Will Not Boot

If there is a display on the VGA port, but not on the LCD, replace the display assembly (LCD, lamps, and cable).

If the display adapter is bad, the BIOS should report it using beep codes (see Table 6–8, on page 6–79).

If nothing is displayed, is the display turned on? At boot time and while using an external monitor connected to the NLX external video port, press F2 to enter the BIOS setup. The Advanced Video Configuration menu lets you select PCI (LCD) or AGP (the NLX port on the rear panel). The lower VGA port on the rear panel is the PCI video port (driven by the same video controller as the LCD).

Booting Into Windows

If the instrument will not boot, press F8 to enter the start up menu, and boot to the command prompt. If you can boot to the command prompt, use the MSDOS Edit program to edit the autoexec.bat file to run the CMOS restore utility (see *Update/Restore the NLX Board CMOS* on page 6–80).

If booting starts, finds the hard disk, but hangs displaying the Windows splash screen:

1. Select the AGP video port using the setup menu.
2. Disable the busses and disconnect the PPC board by installing J840 and J841.
3. If the system boots (it will only boot to Windows, the instrument application will not run) to the external NLX video port, replace the PPC board.

PPC and NLX PC Diagnostics

The primary diagnostics for the instrument are the power-on diagnostics, the QA+Win32 diagnostics, and the instrument diagnostics. Procedures for running these diagnostics are described below.

Power-On Diagnostics

The power-on diagnostics check the basic functionality of the instrument at every power on. If any failures occur at power on, the screen displays the calibration and diagnostics property page.

The power on tests ensure that hardware is installed and can be accessed by the software. The tests provide limited diagnostic information, but do not provide any performance information. The instrument diagnostics provide more extensive tests than the power-on diagnostics.

The power on tests check the generic hardware including the keyboard, mouse, memory, CPU, and associated peripherals. The interrupt lines and trigger lines are also checked.

QAPlus/Win

If the instrument passes all the BIOS tests and Windows boots, the primary tree calls for you to run QAPlus/Win diagnostics software.

QAPlus/Win is a comprehensive diagnostic software application to check and verify the operation of the PC hardware in the instrument.

To run QAPlus/Win, you must have a working keyboard (a working mouse or other pointing device is optional) and have the Windows operating system running. Repair or replace any failed component identified by QAPlus/Win.

***NOTE**. To run* QAPlus/Win *you must have either a working keyboard or a working mouse (or other pointing device) and Windows running.*

To run the QAPlus/Win diagnostic software, do the following steps:

1. Exit the instrument application.
    a. Display the Task Manager by pressing CTRL, ALT, and Delete.
    b. Select TDS7000 and then touch **End Task**.
    c. Display the Task Manager by pressing CTRL, ALT, and Delete.
    d. Select Windowsscopeservices and then touch **End TAsk**.
2. Exit all other applications and exit all windows.
3. Click Start → Programs → QAPlus_Win → QAPlus_Win.
4. Touch **OK** and select the tests you want to perform.
5. To restore the instrument to normal operating condition, reboot the instrument after QAPlus/Win diagnostic tests are complete.

instrument Diagnostics. If the instrument passes all the QAPlus/Win tests, the primary tree calls for you to run the instrument Diagnostics. The instrument Diagnostics are a comprehensive software test that checks the functionality of the instrument. If the instrument Diagnostics test fails, the instrument is defective.

To run the instrument Diagnostics, do the following steps:

1. Turn off all other applications.
2. From the menu bar, touch **Utilities** and then select **Instrument Diagnostics**.

Diagnostics

The instrument executes a set of internal diagnostics at every power-up. The results can be viewed from the Utilities > Diagnostics dialog. To execute diagnostics Refer to Perform Diagnostics on page to 4–3.

Firmware Updates

Firmware updates are easy to do. Simply install the firmware CD in your instrument and follow the displayed instructions or the instructions that accompany the CD.

If you want to order a firmware update, contact your Tektronix service center.

After Repair

After removal and replacement of a module due to electrical failure, you must perform the adjustment or software update as indicated in Table 6–6.

Table 6–6: Action required for module replaced

Module replaced	Adjustment required	Software update required
Front panel assembly	No	None
Acquisition board	Yes	Boot ROM and authorization code
PPC processor board	Yes	Boot ROM and authorization code
NLX processor assembly	No	Windows, instrument application
Display panel or display system	No	None
Power supply	Yes	None
Interconnect boards	No	None
Fans	No	None

BIOS Error Messages

Table 6–7 lists error messages displayed by the BIOS.

Table 6–7: BIOS error messages

Error message	Explanation
GA20 Error	An error occurred with Gate-A20 when switching to protected mode during the memory test.
Pri Master HDD Error Pri Slave HDD Error Sec Master HDD Error Sec Slave HDD Error	Could not read sector from corresponding drive.
A: Drive Error B: Drive Error	No response from diskette drive.
Cache Memory Error	An error occurred while testing L2 cache. Memory may be bad.
CMOS Battery Low	Replace the batter soon.
CMOS Display Type Wrong	The display type is different than what has been stored in CMOS. Check Setup to make sure type is correct.
CMOS Checksum Bad	The CMOS checksum is incorrect. CMOS memory may have been corrupted. Run Setup to reset values.
CMOS Settings Wrong	CMOS values are not the same as the last boot. These values have either been corrupted or the battery has failed.
CMOS Date/Time Not Set	The time and/or date values stored in CMOS are invalid. Run Setup to set correct values.
DMA Error	Error during read/write test of DMA controller.
FDC Failure	Error while trying to access diskette drive controller.
HDC Failure	Error while trying to access hard disk controller.
Update Failed	NVRAM was invalid but was unable to be updated.
Unlock Keyboard	The system keyboard lock is engaged. The system must be unlocked to continue to boot.
Keyboard Error	Error in the keyboard connection. Make sure keyboard is connected properly.
KB/Interface Error	Keyboard interface test failed.
Timer Error	Timer Test failed.
Memory Size Changed	Memory size has changed since the last boot. If no memory was added or removed, then memory may be bad.
Serial presence detect (SPD) device data missing or iinconclusive. Do you wish to boot at 100 MHz bus speed? [Y/N]	System memory does not appear to be SPD memory.
No Boot Device Available	System did not find a boot device.
Off Board Parity Error	A parity error occurred on an off-board card. This error is followed by an address.

Table 6–7: BIOS error messages (Cont.)

Error message	Explanation
On Board Parity Error	A parity error occurred in onboard memory. This error is followed by an address.
Parity Error	A parity error occurred in onboard memory at an unknown address.
NVRAM/CMOS/PASSWORD cleared by Jumper	NVRAM, CMOS, and passwords have been cleared. The system should be powered down and the jumper removed.
<CTRL_N> Pressed	CMOS is ignored and NVRAM is cleared. User must enter Setup.

BIOS Beep Codes

When an error occurs during the power on self test (POST), the BIOS displays an error message describing the problem. The BIOS also issues a beep code (one long tone followed by two short tones) during POST if the video configuration fails (a faulty video card or no card installed) or if an external ROM module does not properly checksum to zero.

An external ROM module (for example, a video BIOS) can also issue audible errors, usually consisting of one long tone followed by a series of short tones. For more information on the beep codes, check the documentation for the device.

There are several POST routines that issue a POST terminal error and shut down the system if they fail. Before shutting down the system, the terminal-error handler issues a beep code (see Table 6–8) signifying the test point error, writes the error to I/O port 80h, attempts to initialize the video, and writes the error in the upper left corner of the screen (using both monochrome and color adapters).

If the POST completes normally, the BIOS issues one short beep before passing control to the operating system.

Table 6–8: Beep codes

Beeps	Description
1	Refresh failure
2	Parity cannot be reset
3	First 64 K memory failure
4	Timer not operational
5	Processor failure (not used)
6	8042 Gate A20 cannot be toggled
7	Exception interrupt error
8	Display memory R/W error
9	ROM checksum error (not used)
10	CMOS shutdown register test error
11	Invalid BIOS (for example, POST module not found, etc.)

Installing the Instrument Model and Serial Number

To install a model or serial number into the instrument do the following steps:

1. Connect a PC with a GPIB interface to the GPIB interface of the instrument.

WARNING. *Make sure the unique identifier does not end in all zeros before generating or setting the key.*

---

2. Enter the following GPIB commands, if necessary install a new instrument’s model number:

   ```
   SYST:PROT OFF
   SYST:PROT:MAI:MODE “TDS8000” or SYST:PROP:MAI:MODE “CSA8000”
   SYST:PROT ON
   ```

3. Enter the following GPIB commands, if necessary install a new instrument’s serial number:

   ```
   SYST:PROT OFF
   SYST:PROP:MAI:SER <serial number string>, e.g. “B010100”
   SYST:PROT ON
   ```

4. These commands take effect immediately and can be verified by viewing the mainframe properties: Utilities>Sysem Properties.

Update/Restore the NLX Board CMOS

If the CMOS parameters become corrupted, restore the CMOS memory using the following procedures:

CAUTION. *Only install CMOS parameters from Tektronix. CMOS parameters from other manufactures may make your instrument inoperable.*

This procedure will allow the you to restore the CMOS settings with or without LAN (local area network). Resnonet command will restore the CMOS with the LAN disabled. Resnet command will restore restore the CMOS with the LAN enabled.

If the instrument is running normally or in safe mode:

1. Select Run from the Start menu.
2. From the Run dialog box type one of the following commands:

   C:resnet (to enable the network)

   C:resnonet (to disable the network)
3. Restart the computer, and hold down F2 while it reboots to get into the BIOS Setup Utility menu.
4. In the Bios Setup Utility menu:
   - **a.** select Advanced, using the right arrow.
   - **b.** select Peripheral Configuration, using the down arrow.
   - **c.** press Enter.
5. Confirm the LAN Device configurations:
   - Enabled if resnet was run.
   - Disable if resnonet was run.
6. Press CTRL-ALT-Delete to reboot the computer.

Repackaging Instructions

This section contains the information needed to repackage the portable mainframe for shipment or storage.

Packaging

When repacking the instrument or sampling modules for shipment, use the original packaging. If the packaging is unavailable or unfit for use, contact your local Tektronix representative to obtain new packaging.   Refer to *Contacting Tektronix* on page xvii for Tektronix's address, email address and phone number.

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

Shipping to the Service Center

Contact the Service Center to get an RMA (return material authorization) number, and any return or shipping information you may need.

If the instrument is being shipped to a Tektronix Service Center, enclose the following information:

- The RMA number.
- The owner's address.
- Name and phone number of a contact person.
- Type and serial number of the instrument.
- Reason for returning.
- A complete description of the service required.

Mark the address of the Tektronix Service Center and the return address on the shipping carton in two prominent locations.

Options and Accessories

This chapter lists available sampling modules, standard and optional accessories available for the instrument, as well as the product options.

Table 7–1: Available sampling modules

Module	Product	Description
Electrical	80E01	1 channel 50 GHz, 7 ps high performance sampling module
	80E02	2 channel 12.5 GHz, 28 ps high performance sampling module
	80E03	2 channel 20 GHz, 17.5 ps high performance sampling module
	80E04	2 channel 20 GHz, 17.5 ps with high performance TDR/sampling module
Optical	80C01	1100 nm to 1650 nm, >20 GHz optical bandwidth at connector
	80C01-CR	1100 nm to 1650 nm, >20 GHz optical bandwidth at connector, with clock recovery
	80C02	1100 nm to 1650 nm, >30 GHz optical bandwidth at connector
	80C02-CR	1100 nm to 1650 nm, >30 GHz optical bandwidth at connector, with clock recovery
	80C03	700 nm to 1650 nm, >2.3 GHz optical bandwidth at connector
	80C03-CR	700 nm to 1650 nm, >2.3 GHz optical bandwidth at connector, with clock recovery
	80C04	1100 nm to 1650 nm, >20 GHz optical bandwidth at connector
	80C04-CR1	1100 nm to 1650 nm, >20 GHz optical bandwidth at connector, with clock recovery
Other	80A01	1-channel, 8-14 GHz AC-coupled 50-Ω limiting, preamplifier module that increases the sensitivity of the oscilloscope prescale-trigger input to 200 mVpk-pk

Standard Accessories

Standard

Table 7–2 lists the standard accessories that ship with the instrument,

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NOTE. *Table 7–2 lists the standard accessories that ship with the instrument, not those shipped with any electrical or optical sampling modules ordered. Each sampling module ships individually in their own package. Consult the User manual found in the shipping package for any module you ordered:*

■ *80E01, 80E02, 80E03 & 80E04 Electrical Sampling Module User Manual*.	Part no. 071-0434-00
■ *80C00 Series Optical Sampling Modules User Manual.*	Part no. 071-0435-01
■ *80A01 Trigger Prescale Preamplifier Module User Manual.*	Part no. 071-0438-00.

Table 7–2: Standard accessories

Item	Part number
■ Certificate of Traceable Calibration for product at initial shipment	Not Orderable
■ Business reply card	Not Orderable
■ 1 Windows-98 compatible keyboard	119-6297-00
■ 1 Windows-98 compatible mouse	119-6298-00
■ 1 Instrument front cover	200-4519-00
■ 1 Accessory pouch	016-1441-00
■ 2 Touchscreen styluses	119-6107-00
■ 1 ESD wrist strap with 6 foot coiled cord	006-3415-04
■ *CSA8000 & TDS8000 Online Help* (part of application software)	Not Applicable
■ *CSA8000 & TDS8000 User Manual*	071-0433-00
■ *CSA8000 & TDS8000 Reference*	071-0437-00
■ *CSA8000 & TDS8000 Programmer Online Guide* (part of application software)	Not Applicable
■ CSA8000 & TDS8000 System Rebuild CD (includes a certificate of authenticity for software and a restore license)	063-3415-XX
■ Power cord	Order by Option Number

Optional Accessories

Optional The following accessories are orderable for use with the instrument at the time this manual originally published. Consult a current Tektronix catalog for additions, changes, and details:

Table 7–3: Optional accessories

Item	Part Number
■ DL-11 Dual Delay Line	DL-11
■ SIU-800 Static Isolation Unit	SIU-800
■ Sampling Module Extender (1 meter)	012-1568-00
■ Sampling Module Extender (2 meter)	012-1569-00
■ 3.5 Male to 3.5 Female SMA	015-0552-00
■ Slip-on SMA connector	015-0553-00
■ 2X Attenuator (SMA Male-to-Female)	015-1001-00
■ 5X Attenuator (Male-to-Female)	015-1002-00
■ Power Divider	015-0565-00
■ BNC Female 75 Ohm to 50 Ohm Type N Minimum Loss Attenuator	131-0112-00
■ P6209 4 GHz Active FET Probe	P6209
■ P6150 9 GHz Passive Probe	P6150
■ Replacement hard disk drive	119-6241-00
■ CSA8000 & TDS8000 Service Manual	071-0438-00

Options

The following options can be ordered for the instrument:

- Option 1K: Cart
- Option 1R: Rack Mount Kit (includes hardware and instructions for converting to rackmount configuration. Tektronix part number, 016-1791-XX.
- International Power Cords Options:
  - Option A1 – Universal Euro 220 V, 50 Hz
  - Option A2 – UK 240 V, 50 Hz
  - Option A3 – Australian 240 V, 50 Hz
  - Option A5 – Switzerland 220 V, 50 Hz
  - Option AC – China 220 V, 50 Hz
  - Option A99 – No power cord shipped
- Service offerings:
  - Option C3: Three years of calibration services
  - Option D3: Test Data for calibration services in Opt. C3
  - Option R3: Repair warranty extended to cover three years
  - Option D1: Calibration data report

Electrical Parts List

The modules that make up this instrument are often a combination of mechanical and electrical subparts. Therefore, all replaceable modules are listed in Section 10, *Mechanical Parts List.* Refer to that section for part numbers when using this manual.

Diagrams

This section describes the electrical operation of the CSA8000/TDS8000 instruments and modules using the major circuit blocks or modules. Figure 9–1 shows the instrument module interconnections.

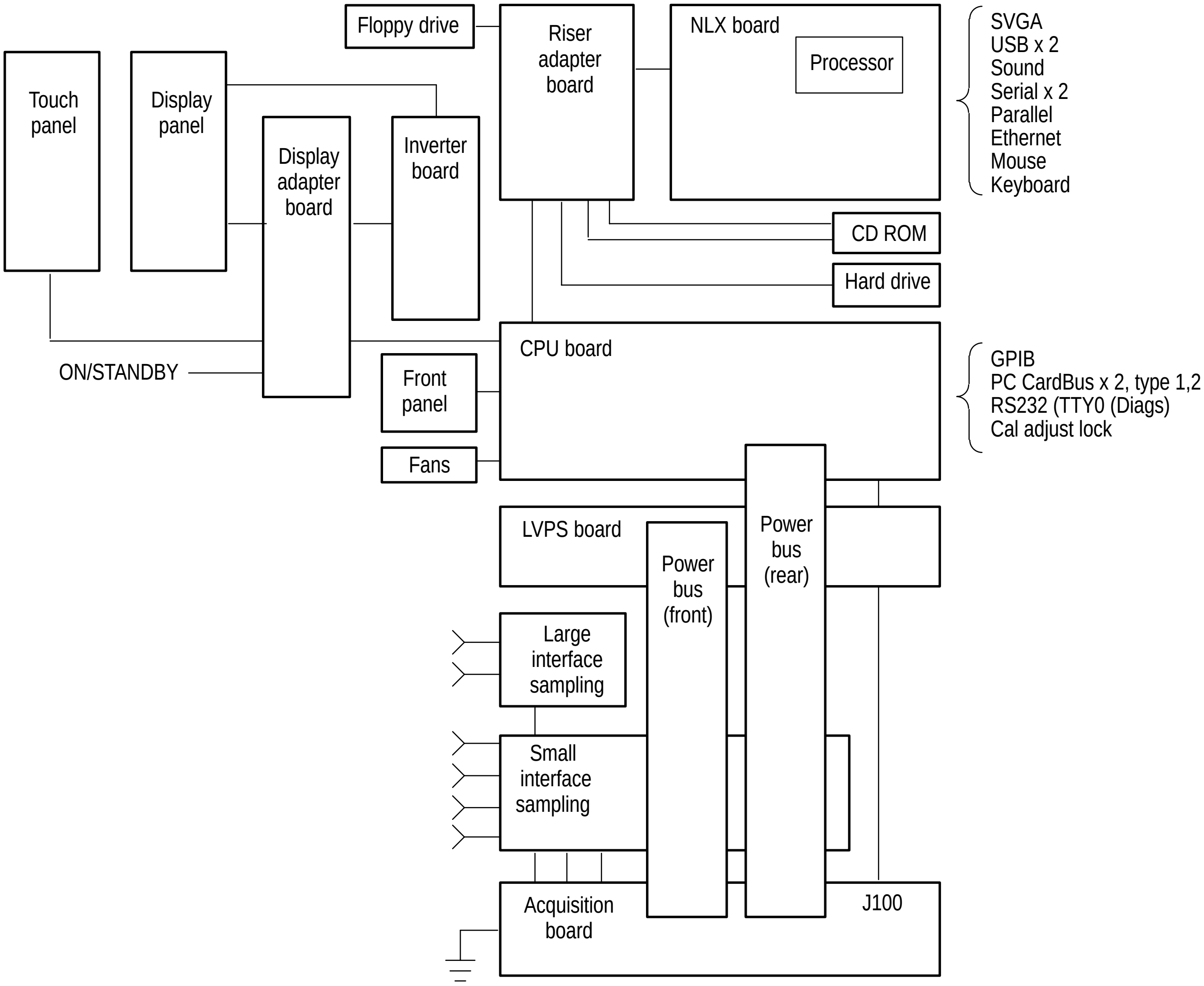

Figure 9–1: CSA8000/TDS8000 series block diagram

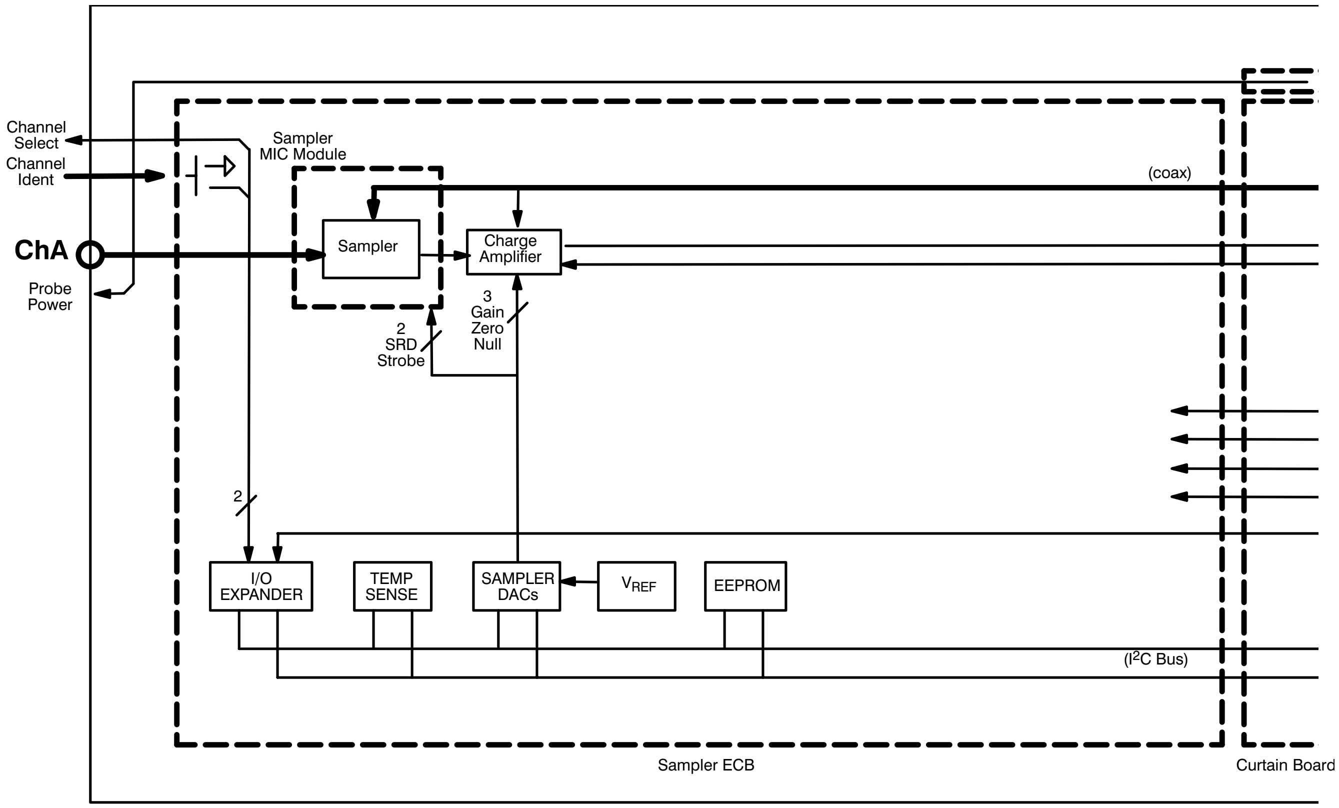

Figure 9–2: 80E01 Sampling module block diagram

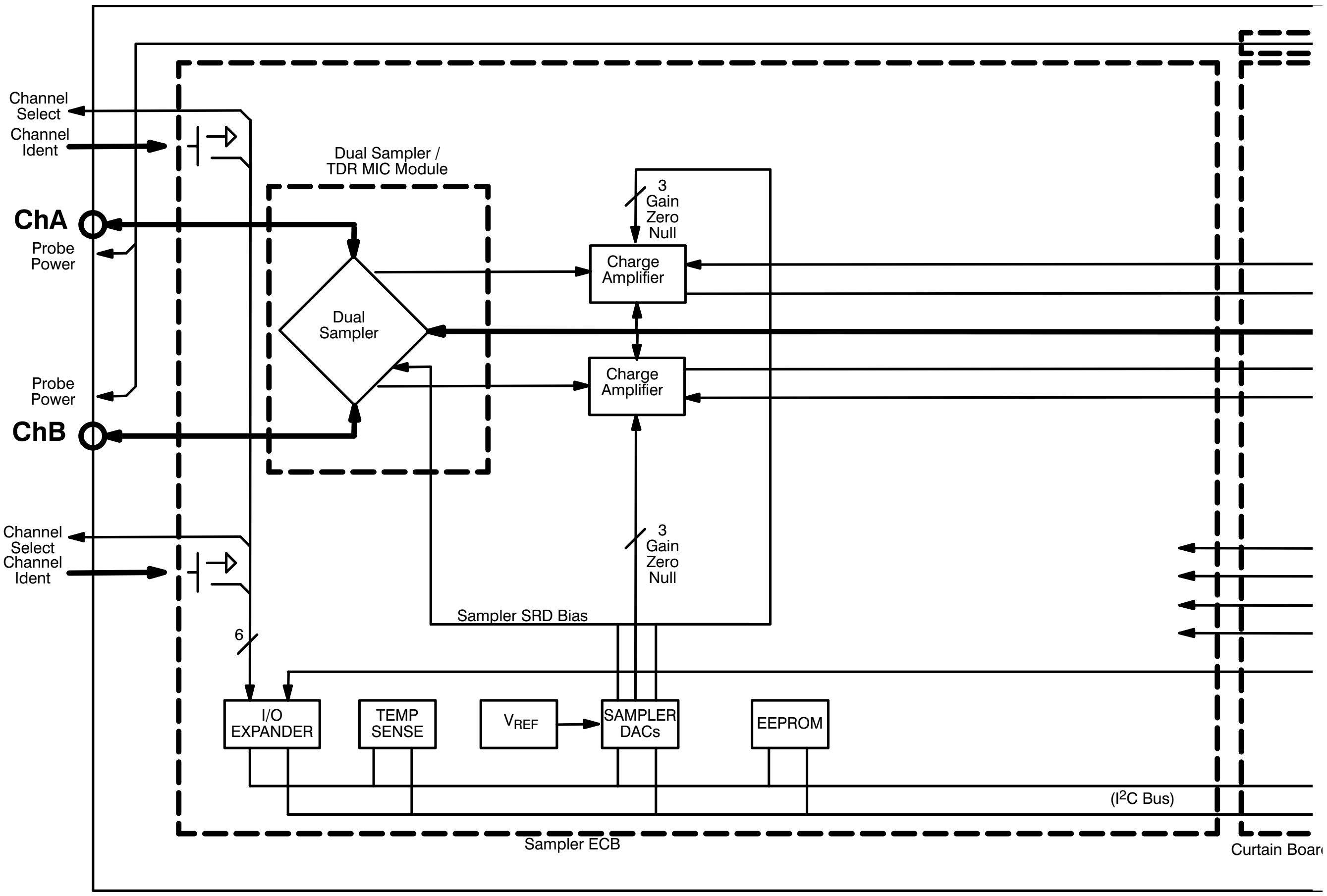

Figure 9–3: 80E02 and 80E03 Sampling module block diagram

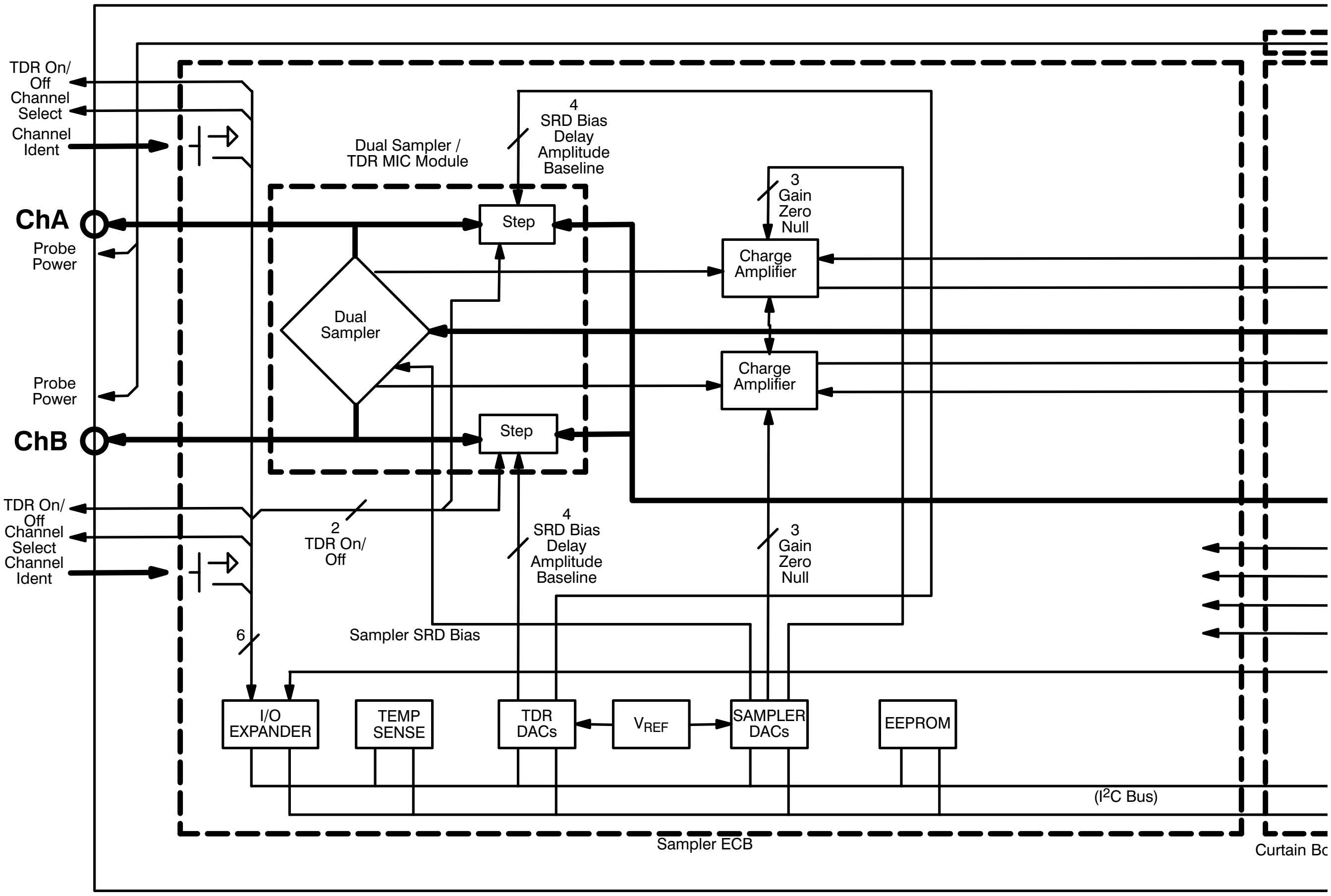

Figure 9–4: 80E04 TDR/Sampling module block diagram

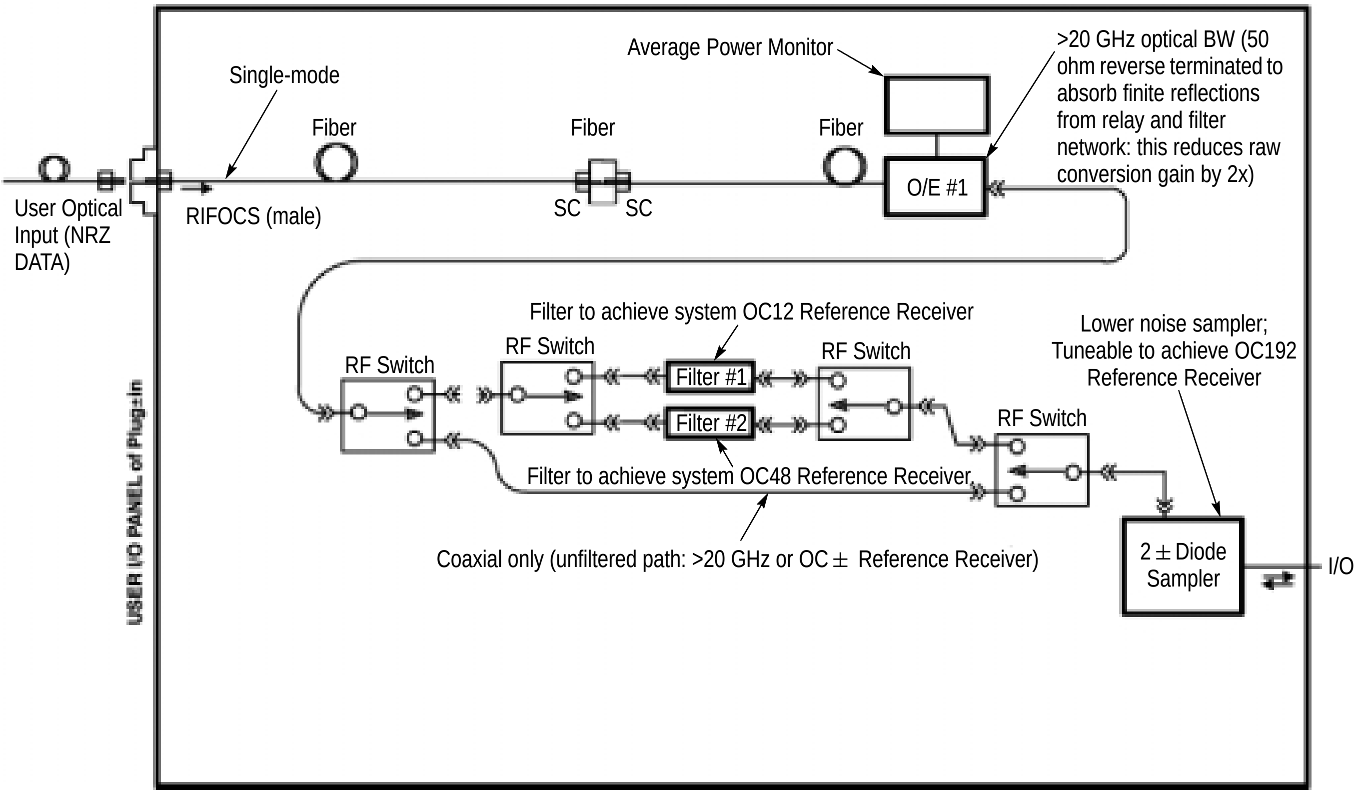

Figure 9–5: 80C01 Optical sampling block diagram

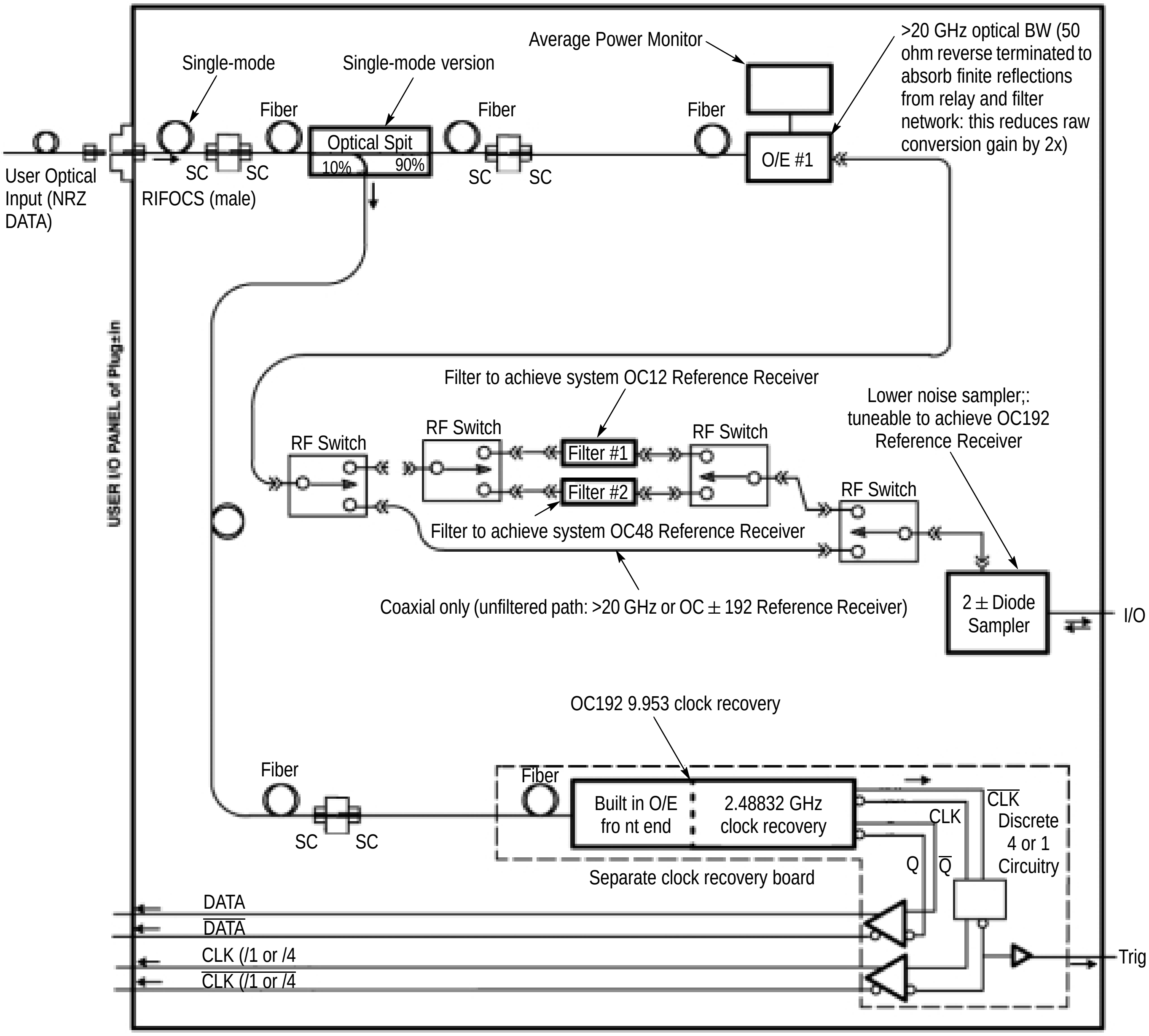

Figure 9–6: 80C01 Optical sampling with clock recovery block diagram

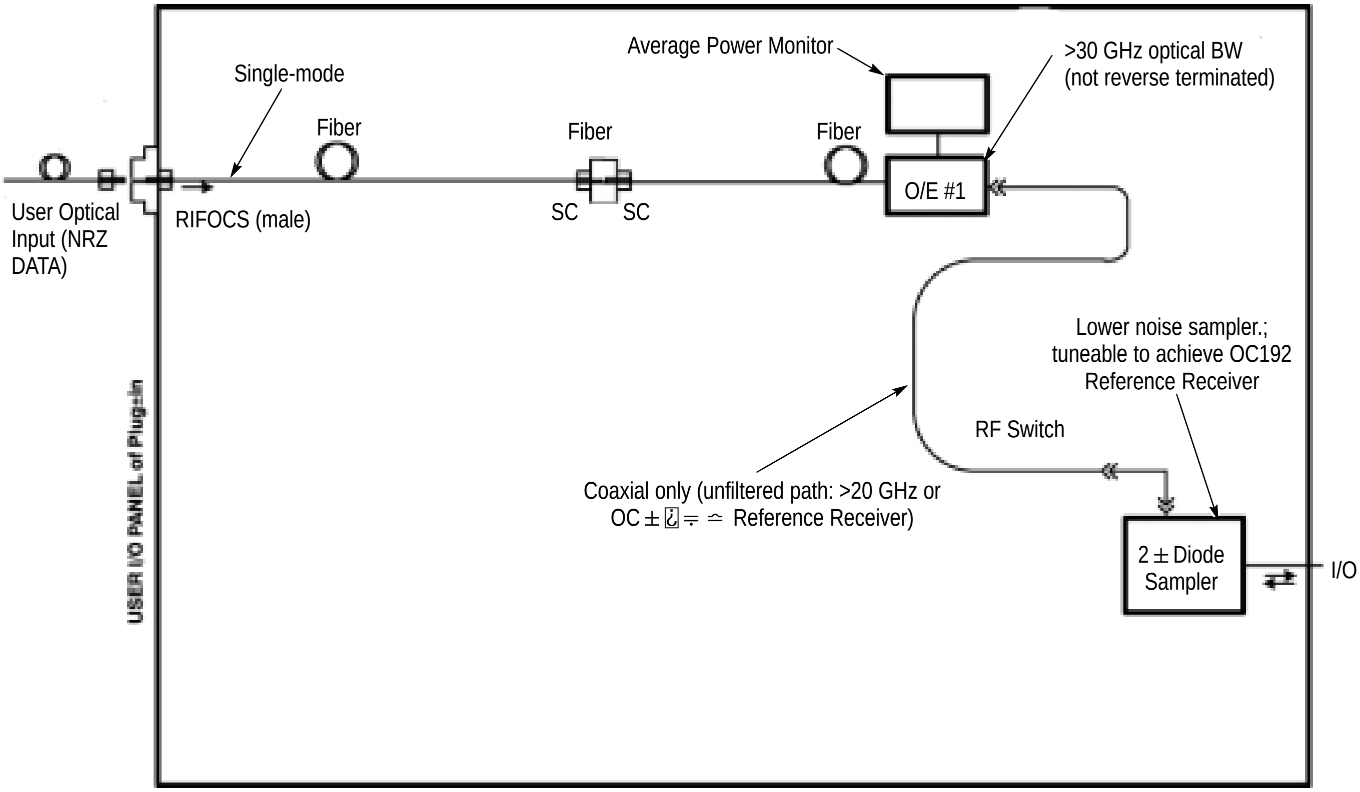

Figure 9–7: 80C02 Optical sampling block diagram

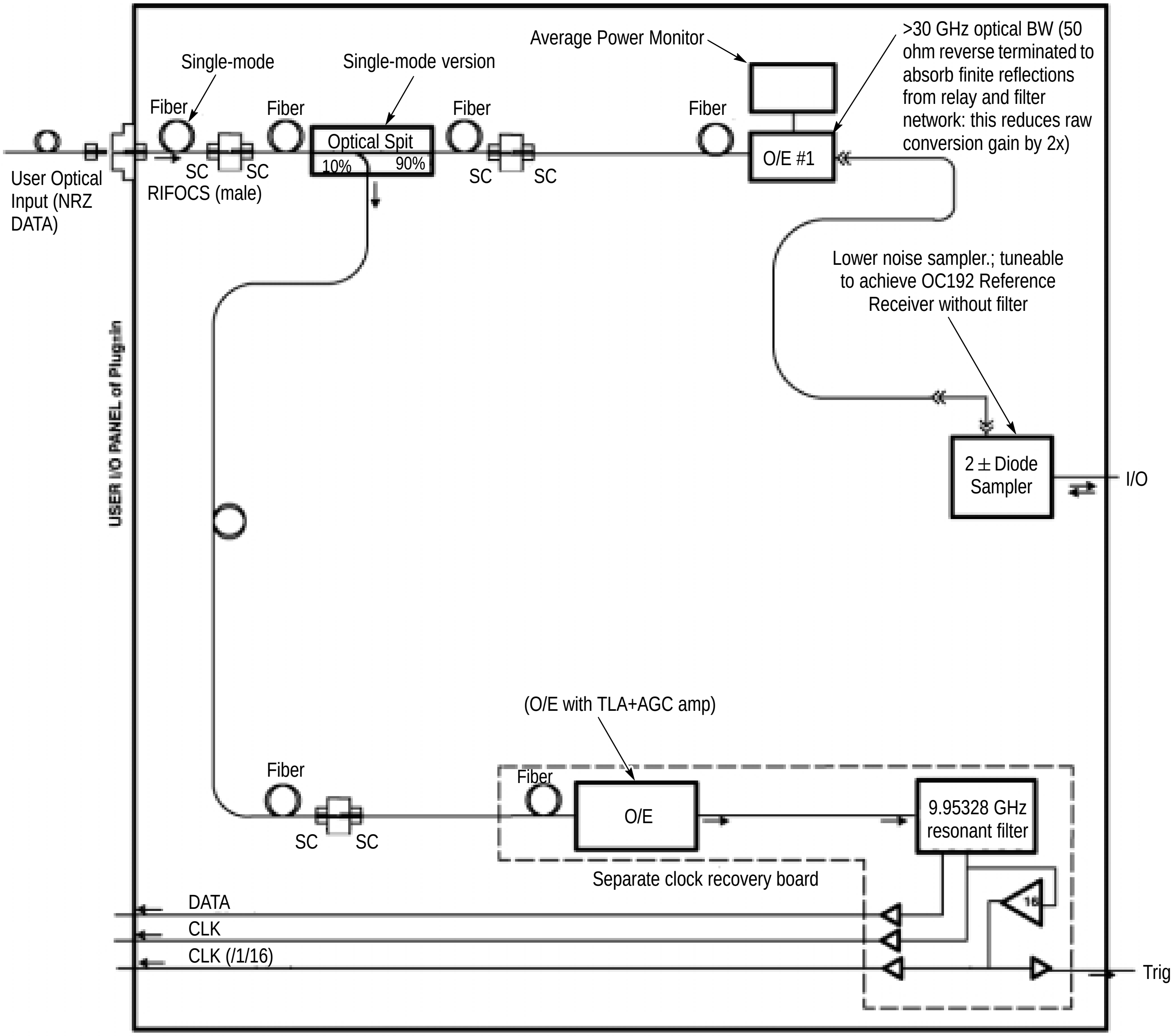

Figure 9–8: 80C02 Optical sampling with clock recovery block diagram

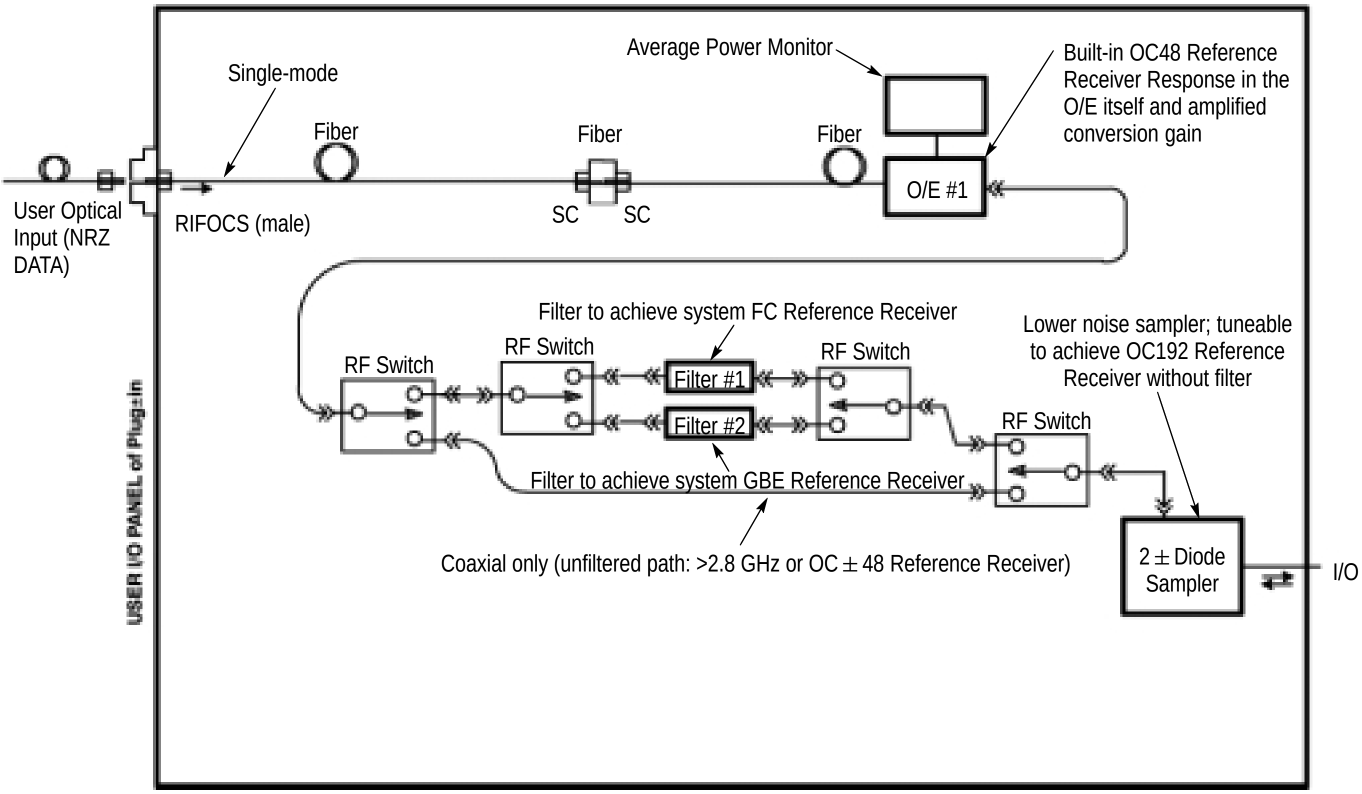

Figure 9–9: 80C03 Optical sampling block diagram

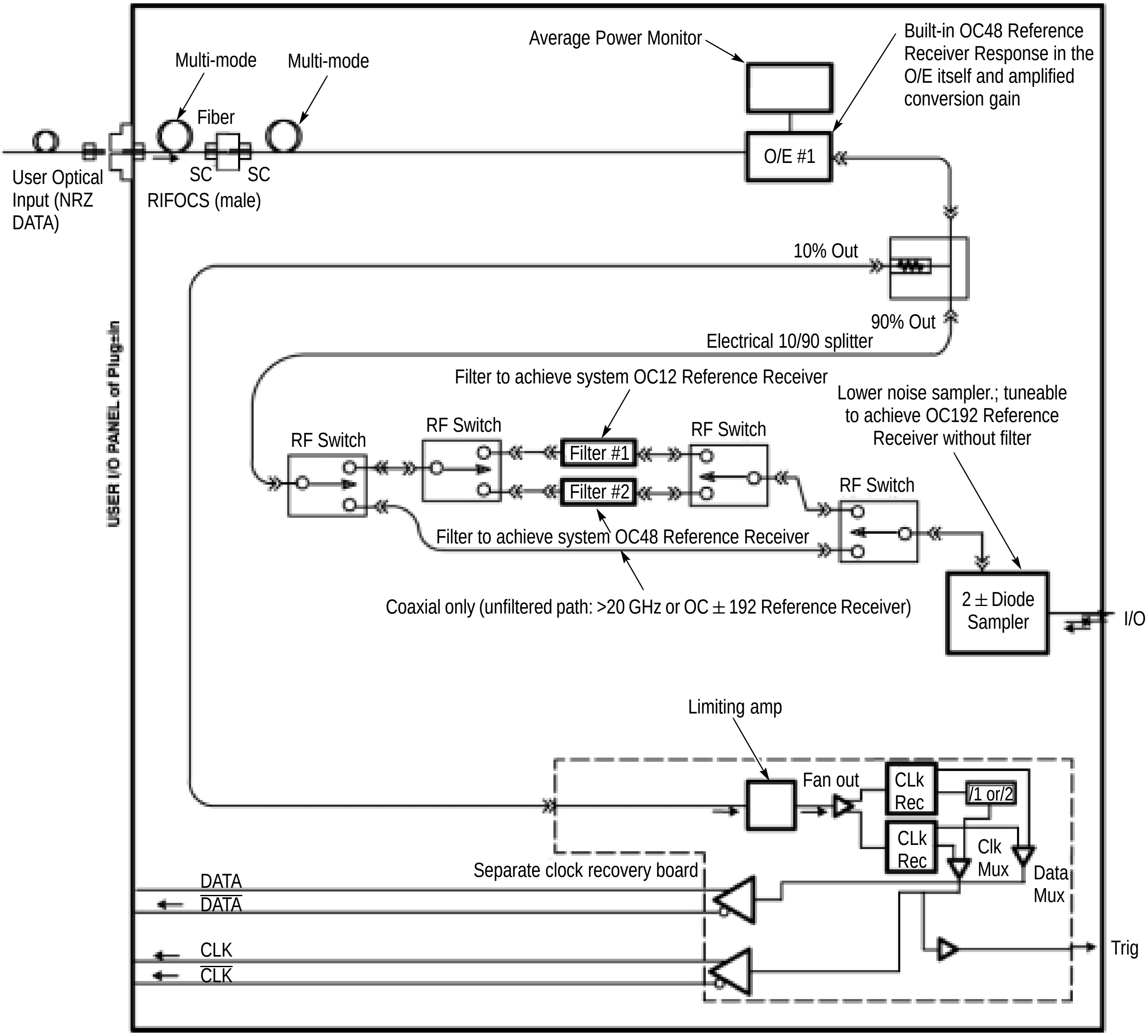

Figure 9–10: 80C03 Optical sampling with clock recovery block diagram

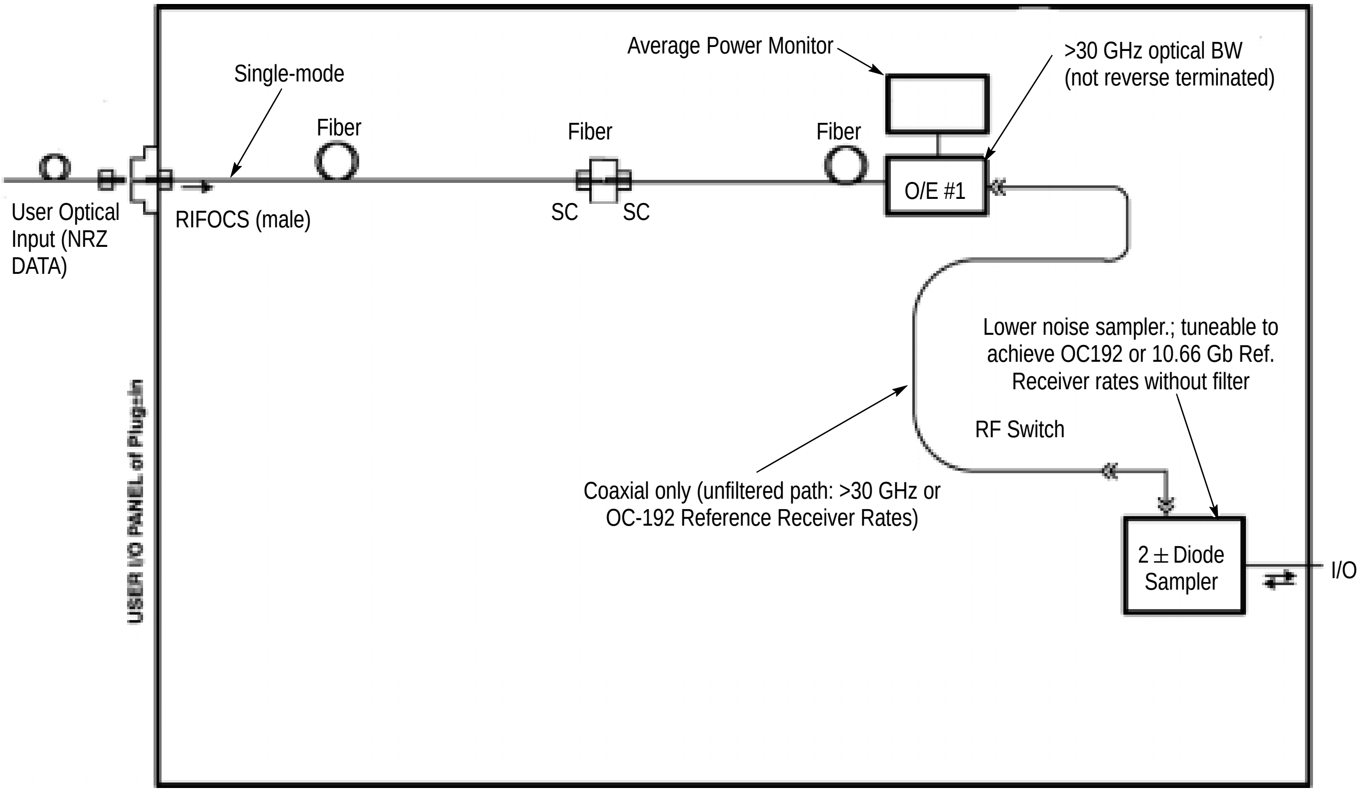

Figure 9–11: 80C04 Optical sampling block diagram

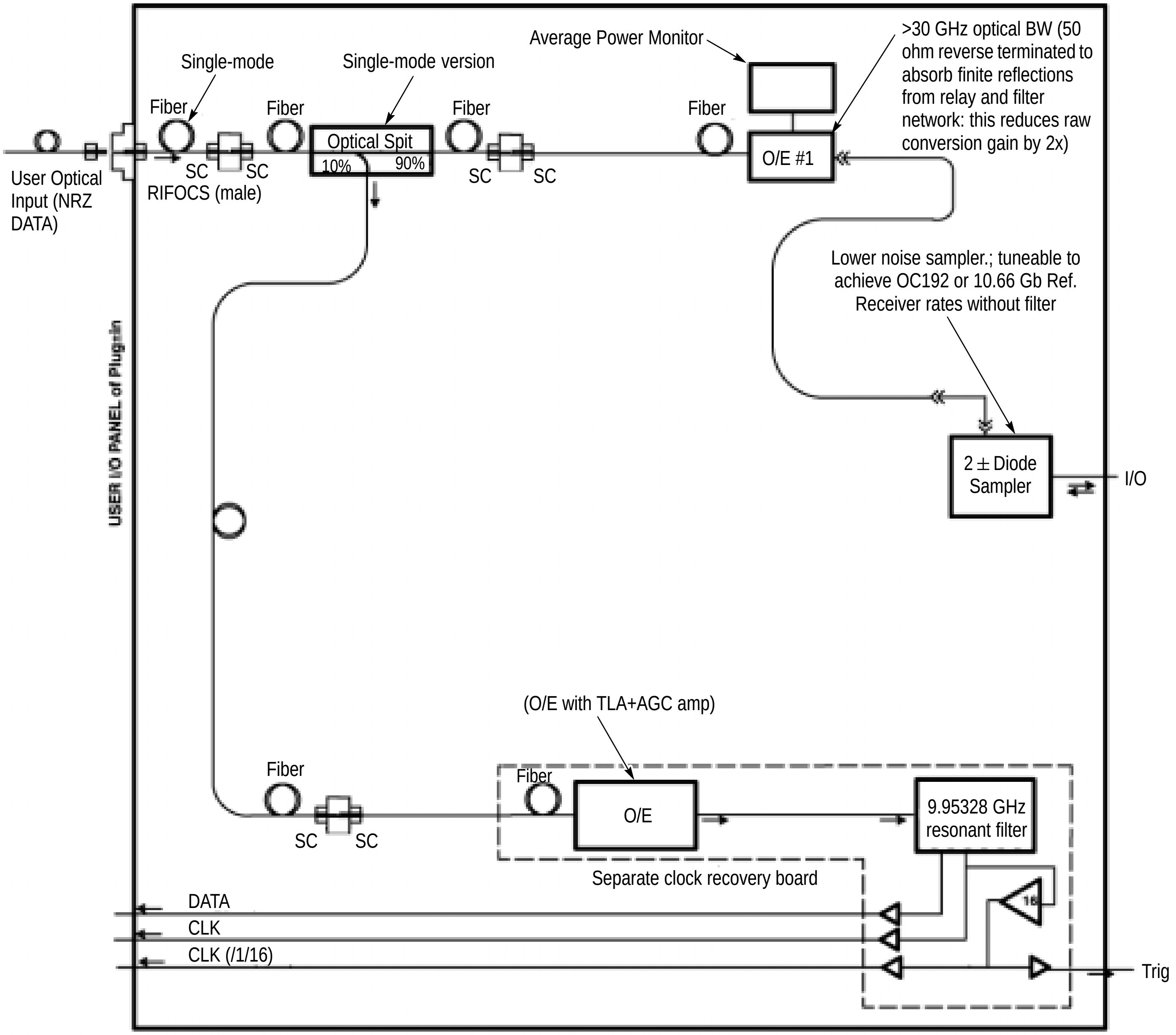

Figure 9–12: 80C04 Optical sampling with CR-1 clock recovery block diagram

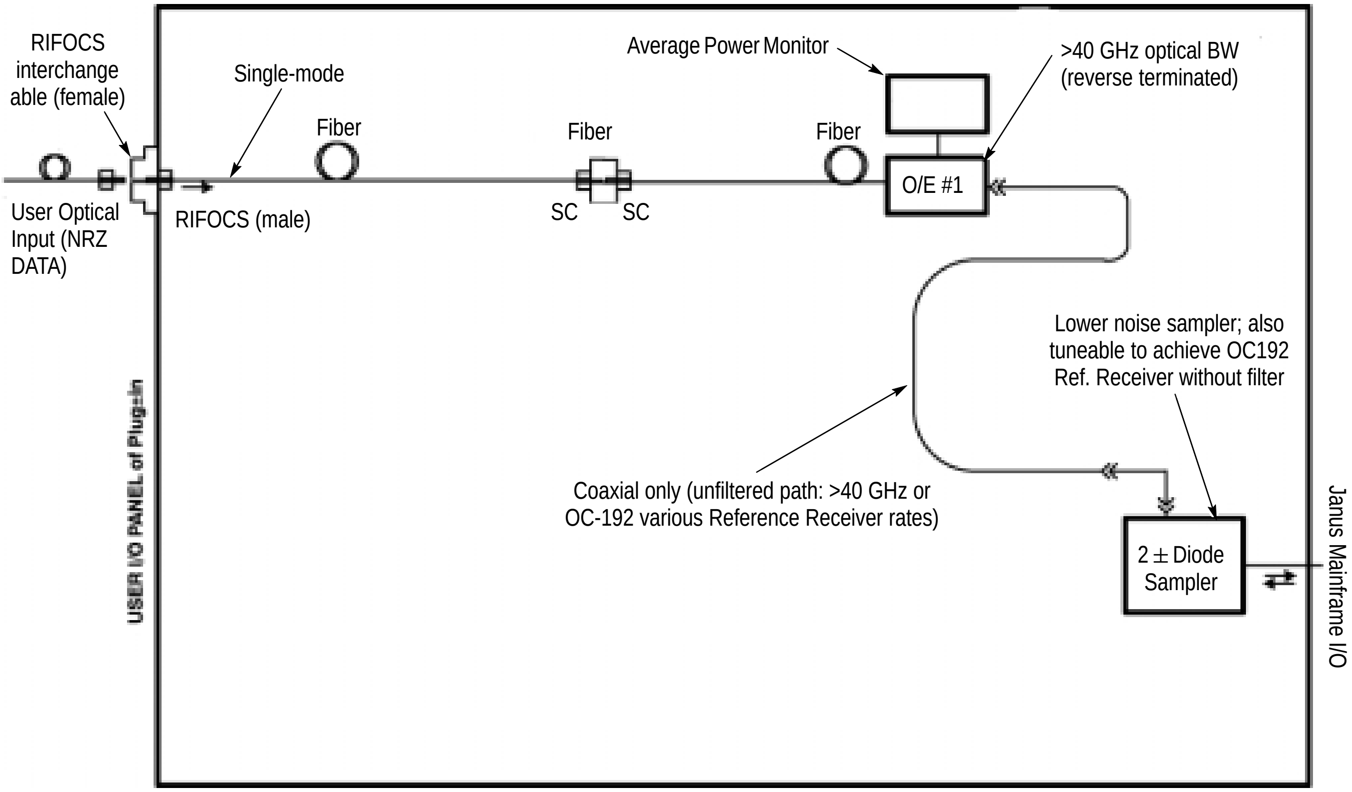

Figure 9–13: 80C05 Optical sampling block diagram

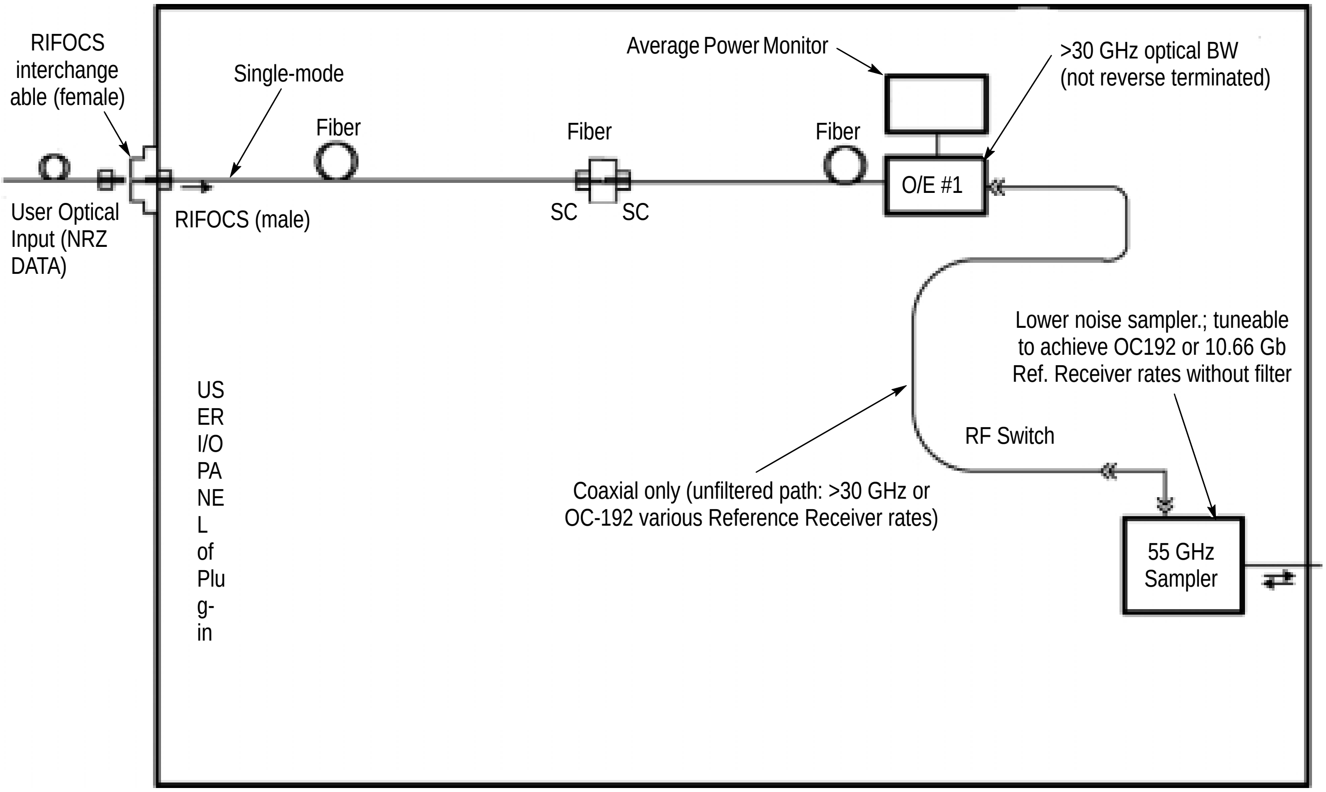

Figure 9–14: 80C06 Optical sampling block diagram

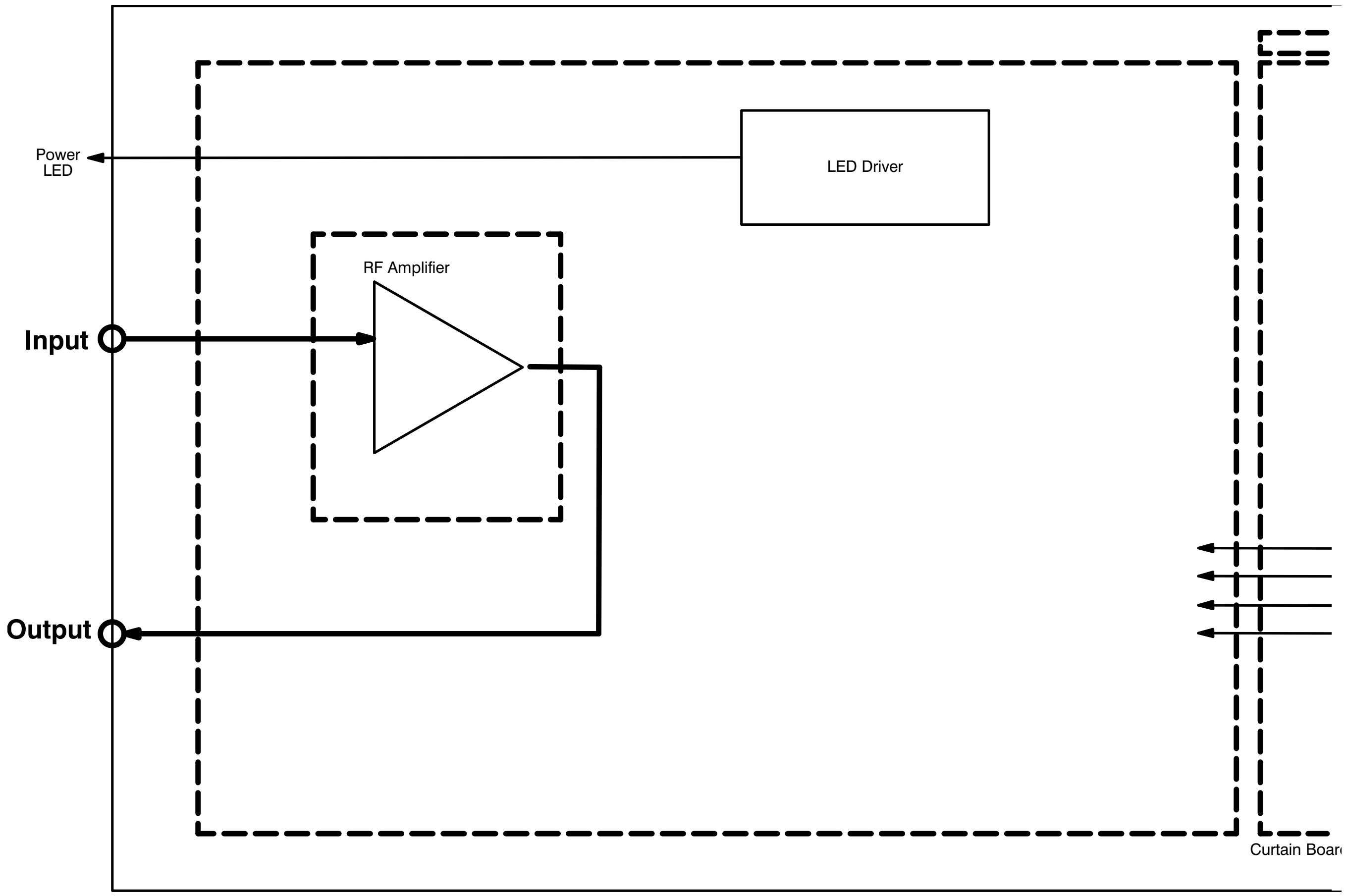

Figure 9–15: 80A01 block diagram

Symbols

Graphic symbols and class designation letters are based on ANSI Standard Y32.2–1975. Abbreviations are based on ANSI Y1.1–1972.

Logic symbology is based on ANSI/IEEE Std 91-1984 in terms of positive logic. Logic symbols depict the logic function performed and can differ from the manufacturer’s data.

The tilde (~) preceding a signal name indicates that the signal performs its intended function when in the low state.

Other standards used in the preparation of diagrams by Tektronix, Inc. are:

- Tektronix Standard 062–2476 Symbols and Practices for Schematic Drafting
- ANSI Y14.159–1971 Interconnection Diagrams
- ANSI Y32.16–1975 Reference Designations for Electronic Equipment
- MIL–HDBK–63038–1A Military Standard Technical Manual Writing Handbook

Mechanical Parts List

This section contains a list of the replaceable modules for the instrument. 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 instruments are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest circuit 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.

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.

Module Repair and Return. You may ship your module to us for repair, after which we will return it to you.

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 instrument. 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 component number.
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. (Code to name and address cross reference is located after this page.)
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 following table cross indexes codes, names, and addresses of manufacturers or vendors of components listed in the parts list.

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
00779	AMP INC.	CUSTOMER SERVICE DEPT PO BOX 3608	HARRISBURG, PA 17105–3608
01295	TEXAS INSTRUMENTS INC	SEMICONDUCTOR GROUP 13500 N CENTRAL EXPRESSWAY PO BOX 655303	DALLAS, TX 75272–5303
01963	CHERRY ELECTRICAL PRODUCTS CO	3600 SUNSET AVENUE	WAUKEGAN, IL 60087–3214
02660	AMPHENOL CORP	720 SHERMAN AVE	HAMDEN, CT 06514–6514
03ZT7	MOBILE PLANET	9175 DEERING AVE	CHATSWORTH, CA 91311
04713	MOTOROLA INC	SEMICONDUCTOR PRODUCTS SECTOR 5005 E MCDOWELL ROAD	PHOENIX, AZ 85008–4229
049S6	FUJITSU COMPUTER PRODUCTS OF AMERICA INC	2904 ORCHARD PARKWAY	SAN JOSE, CA 95134–2009
05791	LYN–TRON INC	SOUTH 6001 THOMAS MALLEN RD	SPOKANE, WA 99204
060D9	UNITREK CORPORATION	3000 COLUMBIA HOUSE BLVD, SUITE 1 20	VANCOUVER, WA 98661
06666	GENERAL DEVICES	PO BOX 39100	INDIANAPOLIS, IN 46239
06915	RICHCO	5825 N TRIPP AVE P.O. BOX 804238	CHICAGO, IL 60646
07416	NELSON NAME PLATE COMPANY	3191 CASITAS AVENUE	LOS ANGELES, CA 90039–2410
0ADN8	DELTA PRODUCTS CORP–DPZ	4405 CUSHING PARKWAY	FREMONT, CA 94538
0GZV8	HUBER & SUHNER INC	19 THOMPSON DRIVE	ESSEX JUNCTION, VT 05452–3408
0J9P9	GEROME MFG CO INC	PO BOX 737 403 NORTH MAIN	NEWBERG, OR 97132
0KB01	STAUFFER SUPPLY CO	810 SE SHERMAN	PORTLAND, OR 97214–4657
0KB05	NORTH STAR NAMEPLATE INC	5750 NE MOORE COURT	HILLSBORO, OR 97124–6474
0KBZ5	Q & D PLASTICS INC	1812 – 16TH AVENUE PO BOX 487	FOREST GROVE, OR 97116–0487
12136	PHC INDUSTRIES INC	1643 HADDON AVE PO BOX 1448	CAMDEN, NJ 08103
16179	M/A COM INC	1011 PAWTUCKER BLVD. PO BOX 3295	LOWELL, MA 01853–3295
1AW87	LEWIS SCREW CO.	4300 SOUTH RACINE AVENUE	CHICAGO, IL 60609
1DM20	PARLEX CORP	7 INDUSTRIAL WAY	SALEM, NH 03079
20944	ANRITSU COMPANY	685 JARVIS DRIVE	MORGAN HILLS, CA 95037
22526	FCI/BERG ELECTRONICS INC	825 OLD TRAIL ROAD	ETTERS, PA 17319–9769
22670	GM NAMEPLATE INCORPORATED	2040 15TH AVE WEST	SEATTLE, WA 98119–2783
24931	FCI/BERG ELECTRONICS INC	RF/COAXIAL DIV 2100 EARLYWOOD DR PO BOX 547	FRANKLIN, IN 46131
26003	MARTEK POWER MDI	4115 SPENCER STREET	TORRANCE, CA 90503–2489

Manufacturers cross index (cont.)

Mfr. code	Manufacturer	Address	City, state, zip code
26805	M/A COM OMNI SPECTRA INC	MICROWAVE CONNECTOR DIV 140 4TH AVE	WALTHAM, MA 02254
2K262	BOYD CORPORATION	6136 NE 87TH AVENUE	PORTLAND, OR 97220
2W733	BELDEN WIRE & CABLE COMPANY	2200 US HWY 27 SOUTH PO BOX 1980	RICHMOND, IN 47374
32559	BIVAR INC	4 THOMAS ST	IRVINE, CA 92718
34649	INTEL CORPORATION	3065 BOWERS PO BOX 58130	SANTA CLARA, CA 95051–8130
3M099	PORTLAND SCREW COMPANY	6520 N BASIN AVE	PORTLAND, OR 97217
46628	LOGITECH INC	6505 KAISER DR	FREMONT, CA 94555
50356	TEAC AMERICA INC	7733 TELEGRAPH RD PO BOX 750	MONTEBELLO, CA 90640–6537
5Y400	TRIAX METAL PRODUCTS INC	1880 SW MERLO DRIVE	BEAVERTON, OR 97006
64537	KDI/TRIANGLE CORPORATION	60 S JEFFERSON RD	WHIPPANY, NJ 07981
6Y440	MICRON SEMICONDUCTOR PRODUCTS INC	8000 S FEDERAL WAY PO BOX 6	BOISE, ID 83707–0006
61058	MATSUSHITA ELECTRIC CORP OF AMERICA	PANASONIC INDUSTRIAL CO DIV TWO PANASONIC WAY	SECAUCUS, NJ 07094
64537	KDI/TRIANGLE CORPORATION	60 S JEFFERSON RD	WHIPPANY, NJ 07981
71400	BUSSMANN	DIVISION COOPER INDUSTRIES INC PO BOX 14460	ST LOUIS, MO 63178
74594	COMPONENT RESOURCES INC	BUSSMAN PARTS C/O CASEY LAKEY 14525 SW WALKER ROAD	BEAVERTON, OR 97006
76096	ELMA ELECTRONICS INC	41440 CHRISTY ST	FREMONT, CA 94538
78189	SHAKEPROOF	DIVISION OF ILLINOIS TOOL WORK ST. CHARLES ROAD	ELGIN, IL 60120
7X318	KASO PLASTICS INC	5720–C NE 121ST AVE, STE 110	VANCOUVER, WA 98682
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON, OR 97077–0001
86928	SEASTROM MFG CO INC	456 SEASTROM STREET	TWIN FALLS, ID 83301
8X345	NORTHWEST SPRING MFG CO	5858 WILLOW LANE	LAKE OSWEGO, OR 97035
93907	CAMCAR DIV OF TEXTRON INC	ATTN: ALICIA SANFORD 516 18TH AVE	ROCKFORD, IL 611045181
94222	SOUTHCO, INC.	210 N BRINTON LAKE RD	CONCORDVILLE, PA 19331
98291	ITT CANNON RF PRODUCTS	585 EAST MAIN STREET	NEW BRITAIN, CT 06051
S4091	SANYO DENKI	C/O TJBO LIAISON M/S 78–210	BEAVERTON, OR 97077–7077
S5769	NEC CORPORATION	NEC BUILDING 7–1, SHIBA 5 CHOME MINATO–KU	TOKYO, JP 108
TK0588	UNIVERSAL PRECISION PRODUCT	1775 NW CORNELIUS PASS RD	HILLSBORO, OR 97124
TK1163	POLYCAST INC	14140 SW 72ND AVE SUITE 100	TIGARD, OR 97224
TK1916	SKS DIE CASTING & MACHINING INC.	1849 OAK ST	ALAMEDA, CA 94501

Manufacturers cross index (cont.)

Mfr. code	Manufacturer	Address	City, state, zip code
TK1943	NEILSEN MANUFACTURING INC	3501 PORTLAND RD NE	SALEM, OR 97303
TK2172	WYLE ELECTRONICS INC	10300 SW NIMBUS AVE BLDG P, SUITE B	PORTLAND, OR 97223
TK2250	ARROW ELECTRONICS INC.	9500 SW NIMBUS AVE, BLDG E	BEAVERTON, OR 97008–7163
TK2338	ACC MATERIALS	ED SNYDER BLDG 38–302	BEAVERTON, OR 97077
TK2376	CONDUCTIVE RUBBER TECH	22125 17TH AVE SE, SUITE 117	BOTHELL, WA 98021
TK2491	RIFOCS CORPORATION	1340 FLYNN RD	CAMARILLO, CA 93012
TK2539	ROYAL CASE COMPANY INC	315 S MONTGOMERY PO BOX 2231	SHERMAN, TX 75070
TK2548	XEROX CORPORATION	14181 SW MILLIKAN WAY	BEAVERTON, OR 97005
TK2563	REVTEK INC	4288 SE INTERNATIONAL WAY	PORTLAND, OR 97222
TK2582	TUFF CAT USA LLC	814 N HAYDEN MEADOWS DRIVE	PORTLAND, OR 97217
TK2601	MAXTEK COMPONENTS CORPORATION	13335 SW TERMAN RD PO BOX 428	BEAVERTON, OR 97075–0428
TK2647	INSTRUMENT SPECIALTIES CO INC.	C/O TEMCO NW 1336 SE 51ST STREET	HILLSBORO, OR 97123
TK6173	MULTI–FINELINE ELECTRONIX INC (MFLEX)	DBA: MFLEX 1301 N DYNAMICS STREET	ANAHEIM, CA 92806
TK6181	IMC PLASTICS INC	19400 SW TETON AVE	TUALATIN, OR 97062
TK6253	VOLEX INTERCONNECT INC	646 CARRIBEAN DR	SUNNYVALE, CA 94089–1108

Replaceable Parts List

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
1–1	016–1441–00			1	POUCH, PLASTIC: PLASTIC POUCH	80009	016–1441–00
–2	211–1050–00			12	SCREW,MACHINE:6–32 X 0.312 L,PNH,STL CAD,T15	0KB01	OBD
–3	355–0298–00			4	STUD.SNAP:0.570 DIA,0.165 THK,STAINLESS STEEL	TK0588	355–0298–00
–4	348–1648–00			4	FOOT:REAR W/CORD WRAP,THERMOPLASTIC	TK6181	348164800
–5	211–0720–00			4	SCR,ASSEM WSHR:6–32 X 0.500,PNH,STL,CDPL,T–15	0KB01	ORDER BY DESCRIPTION
–6	161–0230–01			1	CABLE ASSY,PWR,:3,18 AWG,92 L,SVT, (STANDARD ACCESSORY)	TK2432	ORDER BY DESC
–7	159–0046–00			2	FUSE,CARTRIDGE:3AG,8A,250V,15SEC,CER	71400	ABC 8
	159–0381–00			2	FUSE,CARTRIDGE:5 X 20 MM,6.3A,250V,FAST BLOW,HIGH BREAKING CAPACITY,UL REC,SEMKO,	71400	GDA–6.3
–8	200–2264–00			2	CAP,FUSEHOLDER:3AG FUSES (AMERICAN)	61935	FEK 031 1666
	200–2265–00			2	CAP,FUSEHOLDER:5 X 20MM FUSES (EUROPEAN)	61935	FEK 031.1663
–9	200–4522–00			1	COVER,RIGHT:PCABS,13.645L X 8.250W, BLUE	TK6181	200–4522–00
–10	212–0232–00			2	SCREW,MACHINE:8–32 X 1.125L, PNH,STL,BLACK OXIDE,T–20	0KB01	OBD
–11	367–0477–00			1	HANDLE,CARRYING:POLYPROPYLENE VINYL GRIP	12136	PT 3170
–12	200–4556–00			1	COVER, BOTTOM RIGHT:0.050 ALUMINUM	0J9P9	200–4556–00
–13	200–4625–00			1	COVER,BOTTOM:0.060 AL,VINYL CLAD, INCLUDING FEET (ITEMS 13 & 14)	0J9P9	200–4625–00
–14	348–1515–00			1	FEET,CABINET:CABINET FEET,BLACK,GLASS–FIBRE REINFORCED PLASTIC,SET OF 4 FEET, W/SCREWS	76096	63–526
–15	101–0150–00			1	TRIM:ACQUSITION, PCABS	TK6181	101015000
–16	200–4519–00			1	COVER,FRONT:PCABS,17.420L X 8.670W X 2.000	TK6181	200–4519–00
–17	101–0151–00			1	TRIM,FRONT:PCABS,17.200W X 8.450H, SILVER GRAY	TK6181	101–0151–00
–18	260–2719–00			1	SWITCH,KEYPAD:ELASTOMERIC,FRONT PANEL,ON/OFF	TK2376	260–2719–00
–19	335–0103–00			1	MARKER,IDENT:LABEL,MAIN FRAME,0.500 X 8.510,LEXAN,W/ADHESIVE,CSA8000,	0KB05	335–0103–00
–19	335–0180–00			1	MARKER,IDENT:0.500 X 8.510,LEXAN W/ADHESIVE,MAIN FRAME,TDS8000,	0KB05	335–0103–00
–20	200–4555–00			1	COVER,TOP LEFT:0.050 ALUMINUM	0J9P9	200–4555–00
–21	200–4521–00			1	COVER,LEFT:PCABS,13.654L X 8.250W,BLUE	TK6181	200–4521–00
–22	200–4520–00			1	COVER,TOP:PCABS,17.200L X 13.550W,BLUE	TK6181	200–4520–00

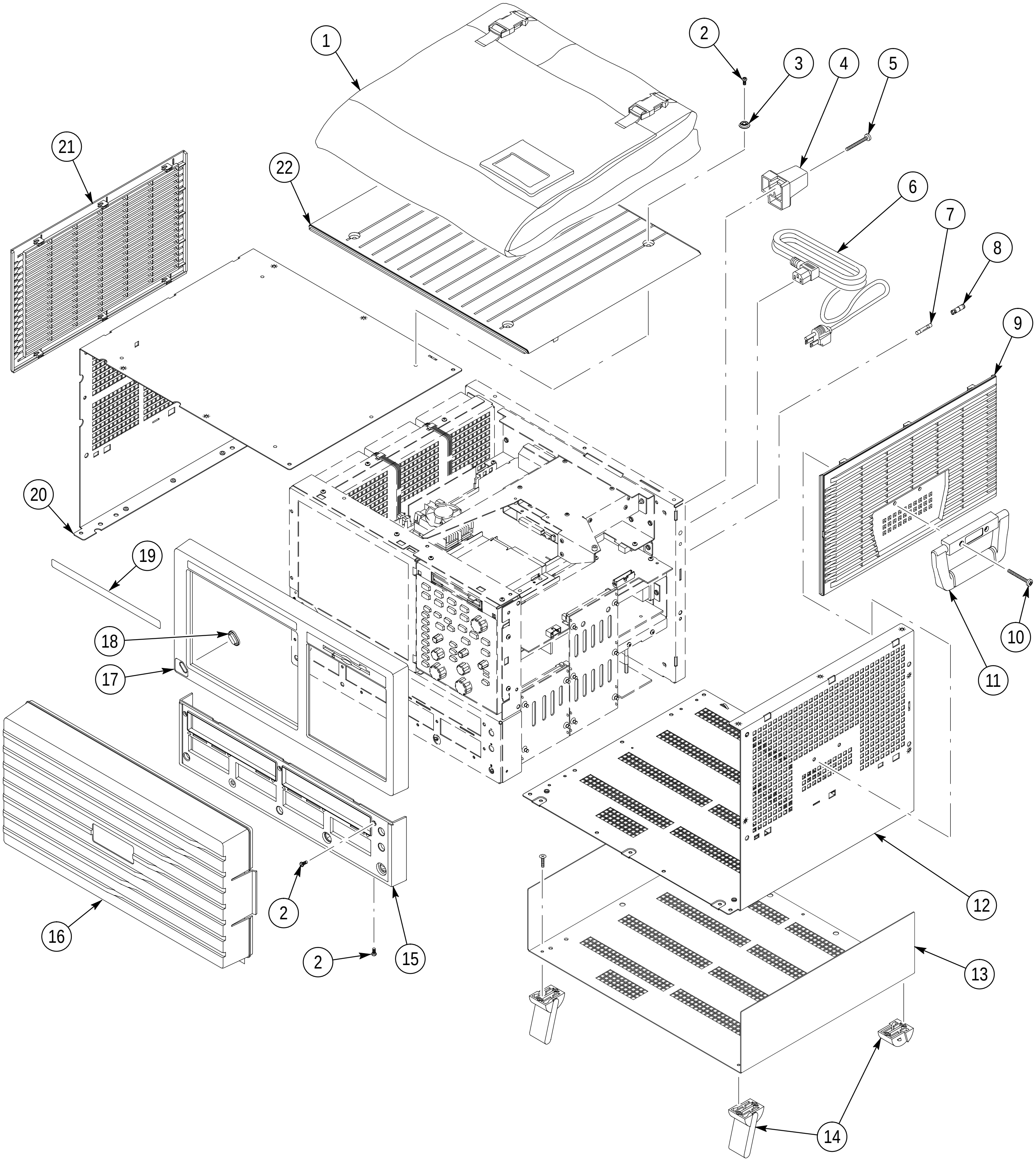

Figure 10–1: External parts

Replaceable Parts List

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
2–1	211–1050–00			8	SCREW,MACHINE:6–32 X 0.312 L,PNH,STL CAD,T15	0KB01	OBD
–2	650–4018–05			1	RHDD ASSEMBLY:W/O SW (ITEMS 3 THROUGH 7)	80009	650–4018–05
–3	119–6304–00			1	DISK DRIVE:WINCHESTER,2.5 IN, 6.0GB,SINGLE PLATTER	049S6	MHK2060AT
–4	437–0479–00			1	CABINET ASSY:REMOVEABLE HARD DISK DRIVE HOLDER	TK1943	437–0479–00
–5	211–1081–00			4	SCREW,MACHINE:M3 X 0.5 X 3.5MM	0KB01	211–1081–00
–6	174–3925–00			1	CA ASSY,SP:RIBBON,,28 AWG,1.0 L,2 X 22 (HARD DRIVE)	060D9	174–3925–00
–7	679–4378–00			1	CKT BD SUBASSY:HARD DISK DRIVE INTERFACE	80009	679–4378–00
–8	174–4320–00			2	CA ASSY:FLAT FLEX, 9.753L (FLOPPY DRIVE CABLE & FRONT PANEL)	060D9	174–4320–00
–9	671–4657–00			1	CIRCUIT BD ASSY:PROCESSOR	80009	671–4657–00
–10	407–4706–00			1	BRACKET:FLOPPY DRIVE,6.064 X 5.075,ALUMINUM	TK1943	407–4706–00
–11	211–1079–00			2	SCREW,MACHINE:2.6 X 0.45 MM,3.0L,PNH,STL,PHILLIPS	0KB01	10310188–0
–12	119–6106–00			1	DISK DRIVE:FLOPPY,3.5INCH,1.44 MB, 0.5 IN,DDDS	TK2250	FD–05HF5630
–13	174–4241–00			1	CA,ASSY:RIBBON,BUS,IDC,32 AWG,17.00L,60POS (PROCESSOR TO ACQ)	060D9	174–4241–00
–14	361–1762–00			1	SPACER,SUPPORT:0.250 X 0.171 X 0.375,CKT BD,NYLON	06915	CPST–4–01
–15	679–4761–00			1	CKT BD SUBASSY:POWER REAR	80009	679–4761–00
–16	679–4760–00			1	CKT BD SUBASSY:POWER FRONT	80009	679–4760–00
–17	614–0968–00			1	PANEL MODULE:FRONT,W/HARDWARE (ITEMS 18 THROUGH 23)	80009	614–0968–00
–18	679–4689–00			1	CKT BD SUBASSY:FRONT PANEL CONTROL BD	80009	679–4689–00
–19	260–2724–00			1	SWITCH,KEYPAD:ELASTOMERIC,FRONT PANEL	TK2376	260–2724–00
–20	366–0770–00			3	KNOB,CAP:0.925 DIA	TK1163	366077000
–21	366–0771–00			2	KNOB,CAP:SILVER GRAY,0.650 DIA X 0.520 H	TK1163	366–0771–00
–22	366–0772–00			3	KNOB,CAP:SIVER GRAY,0.425 DIA X 0.520 H	TK1163	366–0772–00
–23	333–4339–00			1	SUBPANEL,FRONT:6.380 X 7.700,ALUMINUM,LEXAN LABEL	TK1943	333–4339–00
–24	650–3938–00			1	COMPONENT KIT:DISPLAY MODULE (ITEMS 25 THROUGH 30)	80009	650–3938–00
–25	259–0155–00			1	FLEX CIRCUIT:POWER FLEX CIRCUIT SILVER INK	07416	259–0155–00
–26	650–4186–00			1	MODULE ASSY:TOUCH PANEL (ITEMS 25 & 26)	80009	650–4186–00
–27	174–4189–00			1	CABLE ASSEMBLY:FLAT FLEX (DISPLAY ADAPTER)	1DM20	174–4189–00
–28	650–4187–00			1	MODULE ASSY:LCD, DISPLAY (ITEMS 27 THROUGH 30)	80009	650–4187–00
–29	679–4479–00			1	CKT BD SUBASSY:DISPLAY ADAPTER, W/HARDWARE	80009	679–4479–00
–30	174–3618–00			1	CA,ASSY SP:RIBBON,CPR,28 AWG,9.5 L,1X5,0.049CTR	060D9	OBD
–31	437–0486–00			1	ASSY,FAN:SIX FANS ASSEMBLY	0J9P9	437–0486–00
–32	174–4188–00			1	CA ASSY:RIBBON, (DISPLAY)	060D9	174–4188–00
–33	679–4379–00			1	CKT BD SUBASSY:CONNECTOR CONVERSION	80009	679–4379–00
–34	174–4231–00			1	CABLE ASSY:IDE CABLE ASSEMBY (HARD DRIVE)	060D9	174–4231–00

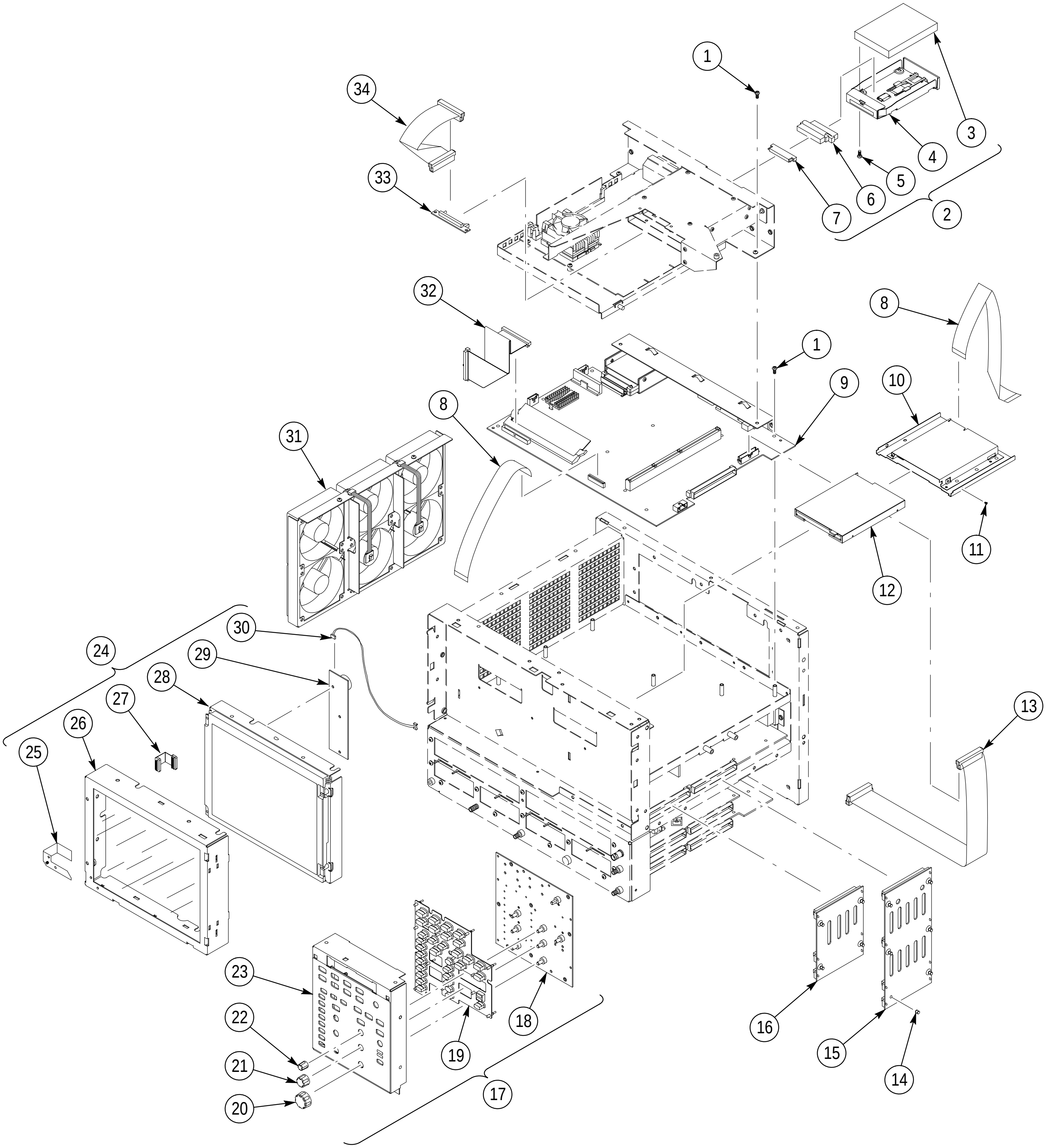

Figure 10–2: Front panel and drives

Replaceable Parts List

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
3–1	119–6490–00			1	IC,PROCESSOR:CMOS,MICROPROCESSOR,CELERON, 533 MHZ,66MHZ BUS,SOCKET 370 COMPATIB	34649	BX80524P500128
–1A	119–6459–00			1	FAN,CHIP COOLER:12VDC,80MA,4400RPM,30DBA,64MM X 51MM X 31MM,W/HEATSINK & CLIP FOR CELERON	80009	119–6459–00
–2	214–3903–00			8	SCREW,JACK:4–40 X 0.312 LONG,0.188 H HEX HEAD STAND OFF,4–40 INT THD, X 0.312 THD EXT 4–40	05791	LT4276
–3	039–0074–01			1	NLX BOARD:MODIFY MOTHER BOARD NLX PROCESSOR	80009	039–0074–01
–4	211–1050–00			8	SCREW,MACHINE:6–32 X 0.312 L,PNH,STL CAD PLT,T15	0KB01	OBD
–5	679–4667–00			1	CKT BD SUBASSY:RISER	80009	679–4667–00
–6	211–1050–00			4	SCREW,MACHINE:6–32 X 0.312 L,PNH,STL CAD PLT,T15	0KB01	OBD
–7	213–1061–00			2	JACKSCREW:6–32 X 0.320 EXT THD,M3.5 X 0.6–6 INT THD X 0.215L,GPIB	00779	554043–3
–8	386–7147–00			1	PANEL,I/O:ALUMINUM,POWER PC PROCESSOR	TK1943	386–7147–00
–9	131–6680–00			1	CONN HDR:CARDBUS HDR,SMD,MALE,RTANG,2 X 34	22526	61555–200CA
–10	211–0887–00			4	SCREW,METRIC:M2 X 0.4 X 16 MM L,PH,PHILLIPS DRIVE	0KB01	211–0887–00
–11	441–2172–00			1	CHASSIS ASSY:0.05 ALUM,13.65 X 16.50 X 3.55	0J9P9	441–2172–00
–12	119–5806–00			1	POWER SUPPLY:CUSTOM,AC–DC,375W,85–275VAC	26003	119–5806–00
–13	131–1315–01			1	CONN,RF JACK:BNC/PNL,50 OHM,FEMALE,STR,PELTOLA	24931	28JR306–1
–14	131–0269–00			3	CONN,RCPT,ELEC:BRASS	80009	131–0269–00
–15	131–0850–00			1	CONN,JACK,RF:SMA,FEEDTHRU,DUAL FEMALE,STR,50 OHM,0.25 MTG W/ 0.375HEX,0.59 X 0.24 MLG,GOLD/SS	26805	2084–0000–02
–16	210–0457–00			1	NUT,PL,ASSEM WA:6–32 X 0.312,STL CD PL,W/LOCKWASHER	0KB01	ORDER BY DESCRIPTION
–17	210–0465–00			1	NUT,PLAIN,HEX:0.25–32 X 0.375,BRS CD PL	0KB01	ORDER BY DESCRIPTION
–18	650–4086–00			1	CABLE ASSEMBLY:ELECT,ANTI STATIC CONNECTION	060D9	650–4086–00
–19	210–1443–00			1	WASHER,FLAT:0.25 ID X 0.375 OD X 0.265,NYLON	74594	5610–120–062
–20	136–0140–00			1	JACK,TIP:BANANA,CHARCOAL GRAY	0KBZ5	N/A
–21	156–4827–00			1	IC,MEMORY:CMOS,SDRAM,8MEG X 64,MC–458CB646–A10,DIMM168	6Y440	MT8LSDT864AG–10 EC7
–22	441–2183–00			1	CHASSIS:REAR DRIVE BAY (HDD & CD–ROM) AL & STEEL	TK1943	441–2183–00
–23	407–4709–00			1	BRACKET,CD–ROM:STEEL	TK1943	407–4709–00
–24	174–4231–00			1	CABLE ASSY:CABLE ASSEMBY (CD–ROM)	060D9	174–4231–00
–25	671–4377–00			1	CIRCUIT BD ASSY:CD ROM INTERFACE	80009	671–4377–00
–26	119–5728–00			1	DISK DRIVE:OPTICAL,644MB,CD–ROM,16.7 MB/SEC	50356	CD–224E–903
–27	211–1070–00			4	SCREW:M2 X 2MM,PNH,PHL, STL NI PLT	0KB01	211–1070–00
–28	441–2184–00			1	CHASSIS,NLX:ALUMINUM,W/HARDWARE	TK1943	441–2184–00
–29	211–0720–00			5	SCR,ASSEM WSHR:6–32,0.500,PNH,STL,CDPL,T–15	0KB01	ORDER BY DESCRIPTION
–30	156–4828–00			1	IC,MEMORY:CMOS,SDRAM,16MEG X 64, SYNC, UNBUFFERED,3.3V,MC–4516CD646–A10,DIMM168	S5769	MC–4516CD646–A10

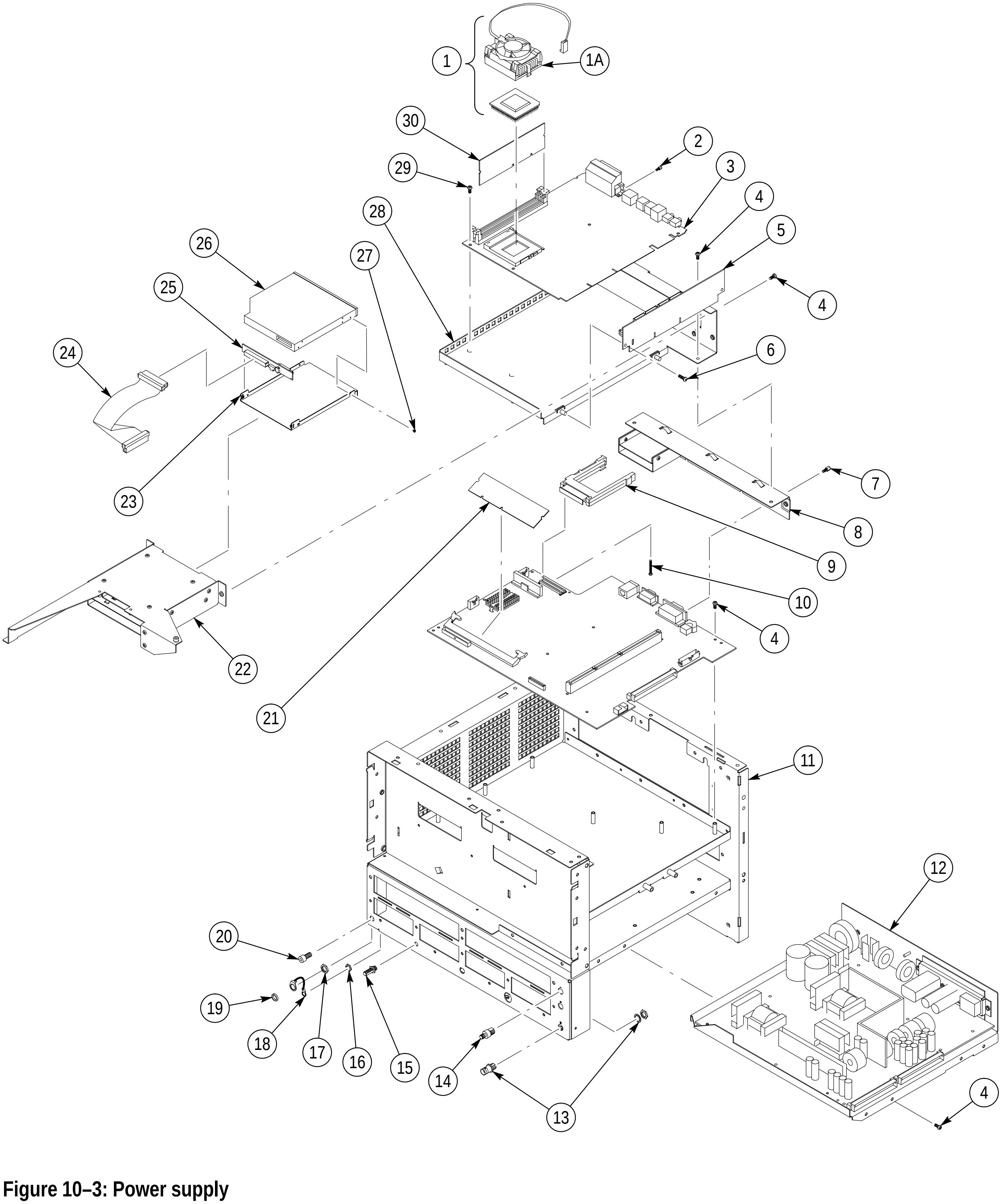

Figure 10–3: Power supply

Replaceable Parts List

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
4–1	441–2176–00			1	CHASSIS ASSY:LARGE MODULE,0.050 AL	0J9P9	441–2176–00
–2	211–1050–00			21	SCREW,MACHINE:6–32 X 0.312 L,PNH,STL CAD PLT,T15	0KB01	OBD
–3	671–4483–00			1	CIRCUIT BD ASSY:OPTICAL FRONT END	80009	671–4483–00
–4	174–4046–00			1	CA ASSY,SP:RIBBON,BUS PROCESSOR,IDC,32 AWG	060D9	174–4046–00
–5	351–1068–00			4	GUIDE:CARD GUIDE	32559	E–1000
–6	129–1516–00			3	SPACER, POST:ECB–1.077,0.250 HEX 12L 14 STEEL	TK0588	129–1516–00
–7	210–0457–00			20	NUT,PL,ASSEM WA:6–32 X 0.312,STL CD PL,W/LOCKWASHER	0KB01	ORDER BY DESCRIPTION
–8	174–4045–00			2	CA ASSY,SP:RIBBON,BUS ACQUISITION,IDC,32 AWG	060D9	174–4045–00
–9	671–4482–00			1	CIRCUIT BD ASSY:SMALL MODULE INTERFACE	80009	671–4482–00
–10	679–4481–00			1	CKT BD SUBASSY:ACQ BOARD	80009	679–4481–00
–11	650–4153–00			1	COMBO ASSEMBLY:ACQP/EFE,JANUS	80009	650–4153–00
–12	351–1067–00			8	GUIDE:CARD GUIDE,E–300	32559	E–300
–13	174–4043–00			1	CA ASSY,SP,ELEC:DISCRETE,TRIGGER PROBE POWER	060D9	174–4043–00
–14	211–0815–00			3	SCREW,MACHINE:6–32 X 1.750,PNH,STL,ZINC,T–15	3M099	211–0815–00
–15	174–4322–00			1	CA ASSY,RF:RFS,0.141OD,50 OHM,SMA,JACK, X SMA,JACK	060D9	174–4322–00
–16	441–2175–00			1	CHASSIS ASSY:SMALL MODULE,0.050 AL	0J9P9	441–2175–00
–17	211–0373–00			18	SCREW,MACHINE:4–40 X 0.250,PNH,STL CD PLT,T10	93907	ORDER BY DESCRIPTION
–18	355–0259–00			4	STUD,LOCKING:0.850 X 0.188 HEX,SST	TK0588	ORDER BY DESCRIPTION
–19	214–4893–00			6	SPRING,TORSION:0.126OD X 0.094ID,DOOR,RIGHT,0.018DIA	8X345	R07SPRG4
–20	200–4560–00			4	COVER:SMALL MODULES,0.036 SST	TK1943	200–4560–00
–21	214–4892–00			6	SPRING,TORSION:0.126OD,0.094ID.DOOR,LEFT,0.018DIA	8X345	R07SPRG3
–22	105–1132–00			4	LEVER,EJECT:0.048 THK SSTL,SMALL MODULE	TK1943	105–1132–00
–23	210–0185–00			12	WASHER,SHLDR:0.375 OD X 0.115 ID X 0.093 THK	TK0588	210–0185–00
–24	366–0815–00			6	KNOB:EJECTOR LEVER,PC/ABS,SILVER GRAY	TK6181	366–0815–00
–25	105–1131–00			2	LEVER,EJECT:0.048 THK SSTL,LARGE MODULE	TK1943	105–1131–00
–26	214–4891–00			6	SPRING,TORSION:0.304 X 0.256 X 1.152	8X345	R07SPRG1
–27	355–0297–00			2	STUD,SHOULDERED:4–40 X 1.050L,SST	TK0588	355–0297–00
–28	200–4561–00			2	COVER:0.036 SST,LARGE MODULES	TK1943	200–4561–00

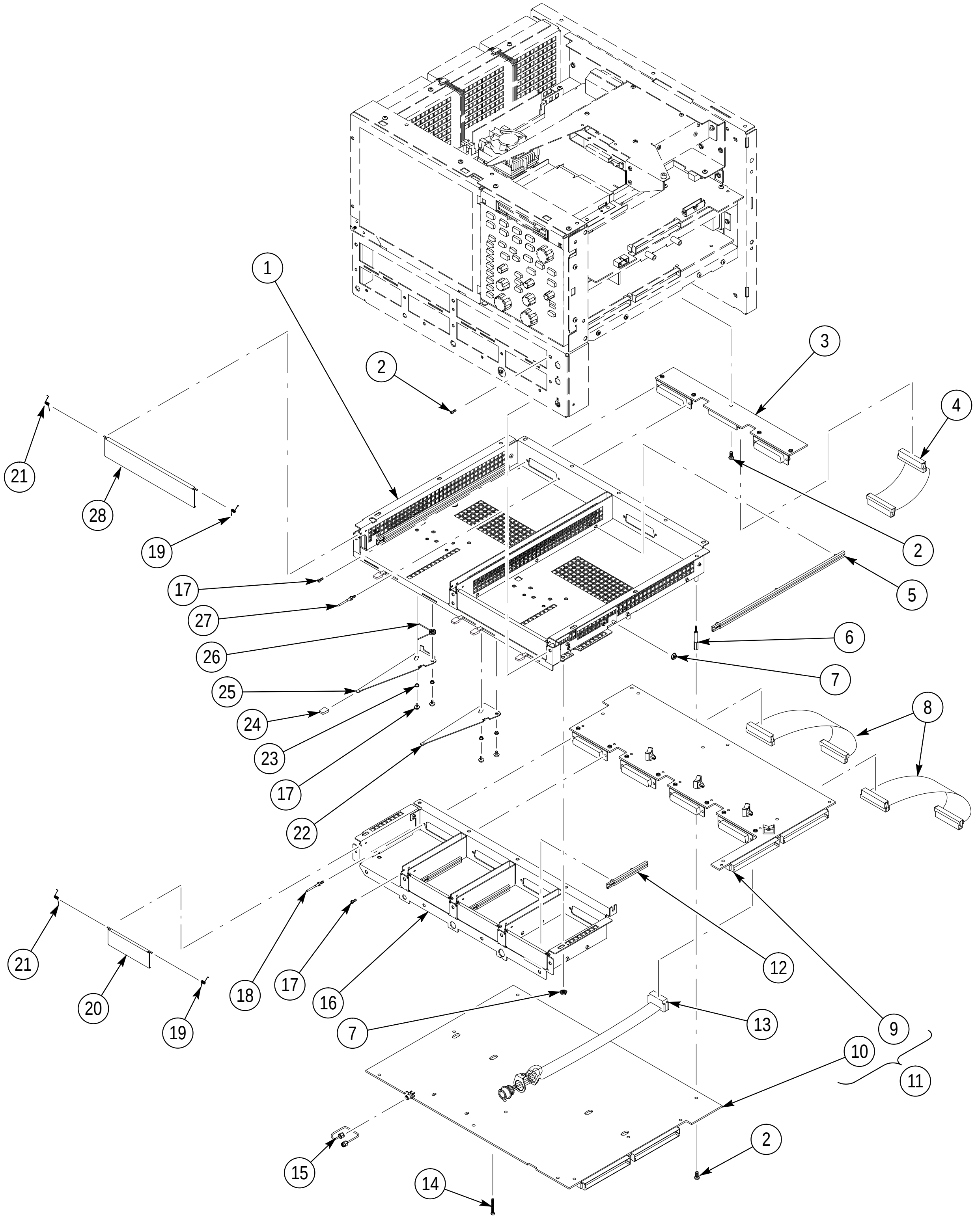

Figure 10–4: Acquisition

Replaceable Parts List

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
5–1	174–4348–00			2	CA ASSY, RF:COAXIAL,50 OHM,RG–316,12.00L,MCX RTANG PLUG 50 OHM TO MCX RTANG PLUG	060D9	174–4348–00
–2	174–4233–00			4	CA ASSY,RF:COAXIAL,50 OHM, DSUB TO MCX–B,R07CABL1	060D9	174–4233–00
–3	174–4347–00			10	CA ASSY,RF:COAXIAL,50 OHM,RG–316,7.500L,X D–SUB	060D9	174–4347–00
–4	174–4138–00			3	CABLE ASSY,RF:COAXIAL,50 OHM,OPTICAL BD TO ACQ BD	060D9	174–4138–00
–5	174–4132–00			1	CABLE ASSY,RF:COAXIAL,50 OHM,7.5 L,SMB TO PELTOLA	060D9	174–4132–00
–6	174–4133–00			3	CABLE ASSY,RF:COAXIAL,50 OHM,14.0 L,MCX TO PELTOLA	060D9	174–4133–00
–7	174–4137–00			2	CABLE ASSY,RF:COAXIAL,50 OHM,D–SUB TO ACQ BD	060D9	174–4137–00
–8	174–4234–00			1	CA ASSY,RF:COAXIAL,50 OHM, SMB TO MCX,R07CABL2	060D9	174–4234–00

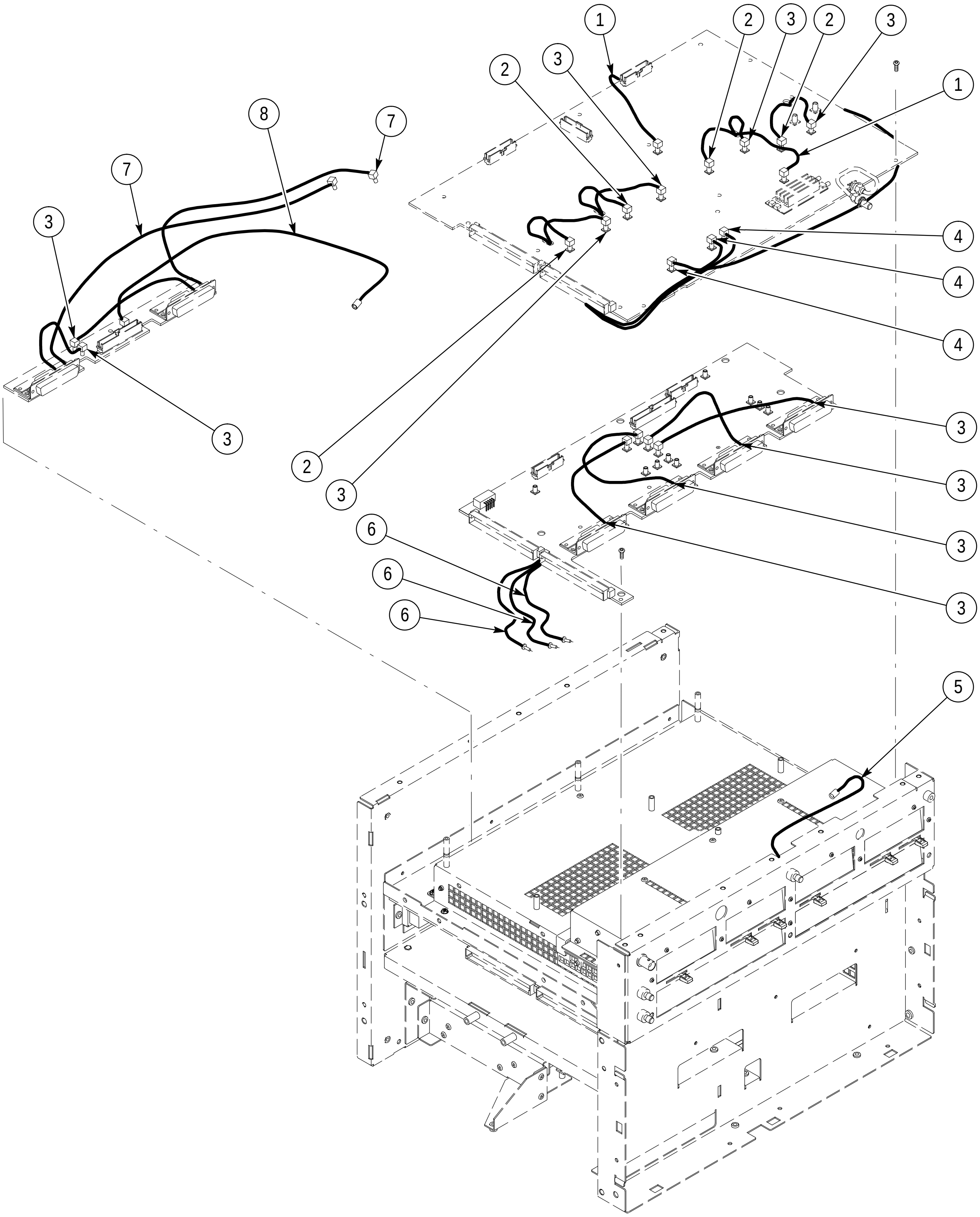

Figure 10–5: Coaxial cables

Replaceable Parts List

Fig. & Index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
6–1	211–0088–00			3	SCREW,MACHINE:2–56 X 0.281,FLH,82 DEG,STL BK OXD,POZ	0KB01	ORDER BY DESCRIPTION
–2	386–7293–00			1	PLATE,FRICTION	TK2601	386–7293–00
–3	384–1138–00			1	EXTENSION SHAFT:5.215 L X 0.124 OD,EPOXY GL	TK2563	ORDER BY DESCRIPTION
–4	391–0239–00			1	LOCK SCREW:MOUNTING BLOCK	TK2601	391–0239–00
–5	211–0088–00			4	SCREW,MACHINE:2–56 X 0.281,FLH,82 DEG,STL BK OXD,POZ	0KB01	ORDER BY DESCRIPTION
–6	366–0804–00			1	KNOB:PUSH BUTTON, 0.11 OD, 0.33L, DELRIN, GRAY, 80E01	TK1163	366–0804–00 (R05PBKNB)
	366–0804–00			2	KNOB:PUSH BUTTON, 0.11 OD, 0.33L, DELRIN, GRAY, 80E02, 80E03, 80E04	TK1163	366–0804–00 (R05PBKNB)
–7	211–0087–00			2	SCREW,MACHINE:2–56 X 0.188,FLH,82 DEG SST,POZ	1AW87	ORDER BY DESCRIPTION
–8	214–4081–00			1	MTG,SCR LOCKDWN:ALUMINUM	5Y400	ORDER BY DESCRIPTION
–9	380–1132–00			1	HOUSING:SAMPLING HEAD,AL, 80E02	5Y400	380–1132–00
–10	333–4340–00			1	PANEL,FRONT:ALUMINUM,CHROMATE,W/TEK SILVERGRAY	5Y400	333–4340–00
–11	335–0151–00			1	MARKER,IDENT:LABEL,0.010 POLY,W/ADHESIVE,80E02	0KB05	335–0151–00
	335–0152–00			1	MARKER,IDENT:LABEL,,0.010 POLY,W/ADHESIVE,80E03	0KB05	335–0152–00
	335–0153–00			1	MARKER,IDENT:LABEL,0.010 POLY,W/ADHESIVE,80E04	0KB05	335–0153–00
–12	380–1138–00			1	HOUSING:ALUMINUM,SAMPLING HEAD 80E01	5Y400	380–1138–00
–13	333–4371–00			1	PANEL,FRONT:ALUMINUM,CHROMATE,W/TEK SILVERGRAY	5Y400	333–4371–00
–14	335–0339–00			1	MARKER,IDENT:LABEL,0.010 POLY,W/ADHESIVE, 80E01	0KB05	335–0339–00

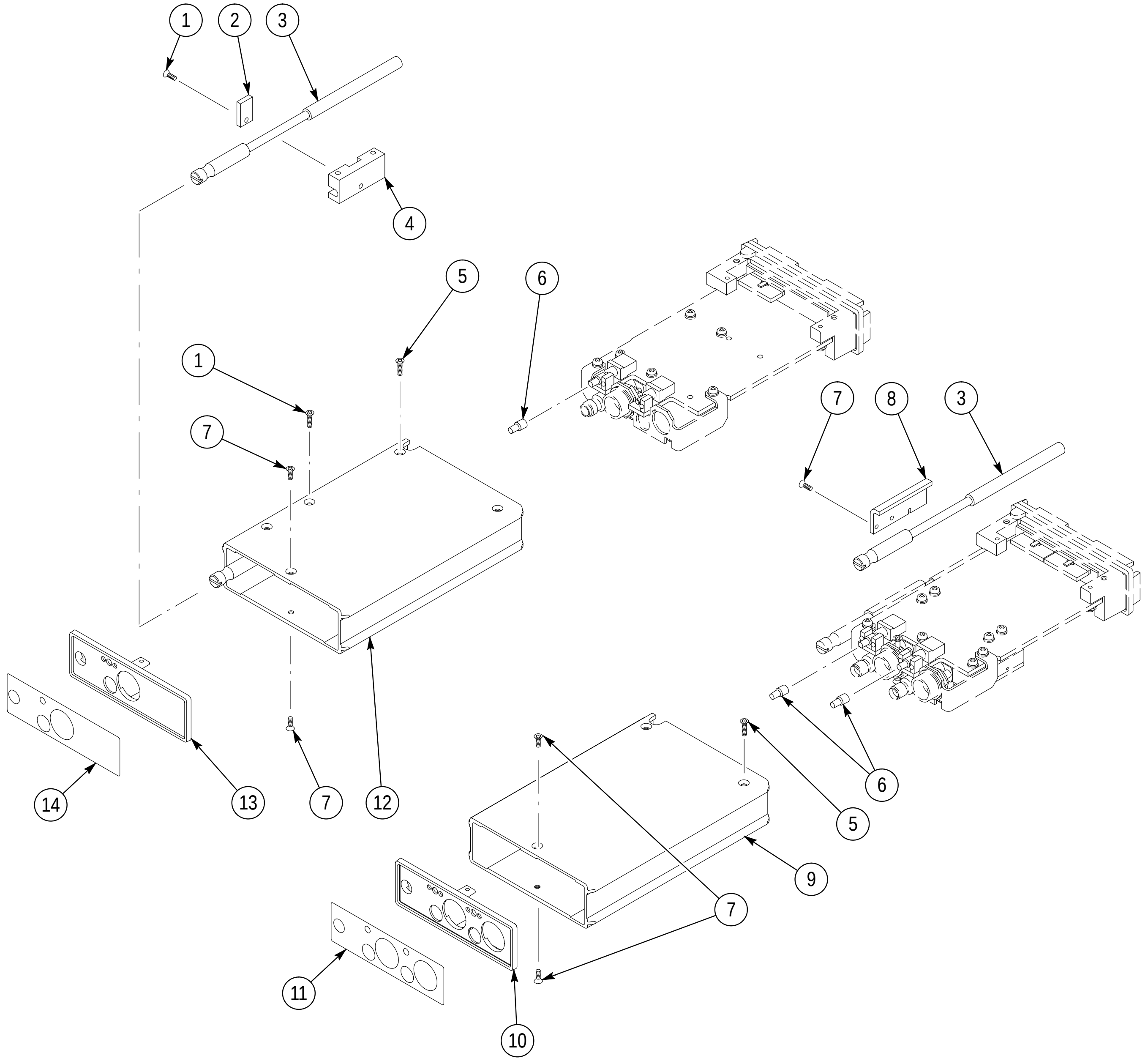

Figure 10–6: Electrical modules

Replaceable Parts List

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
7–1	200–4568–00			1	COVER:OPTICAL MODULE,0.050 AL	TK1943	200–4568–00
–2	335–0370–00			1	MARKER,IDENT:ANTI–STATIC LABEL,0.005 POLY	0KB05	335–0102–00
–3	211–0373–00			7	SCREW,MACHINE:4–40 X 0.250,PNH,STL CD PLT,T10	93907	ORDER BY DESCRIPTION
–4	105–1115–00			2	LATCH:ADJUSTABLE GRIP,16–10–511–16	94222	16–10–511–16
–5	200–4104–00			1	CAP,DUST:ELAY M75–M80 SHORE,BLACK MATT TEXTURED	TK2491	UT11–01

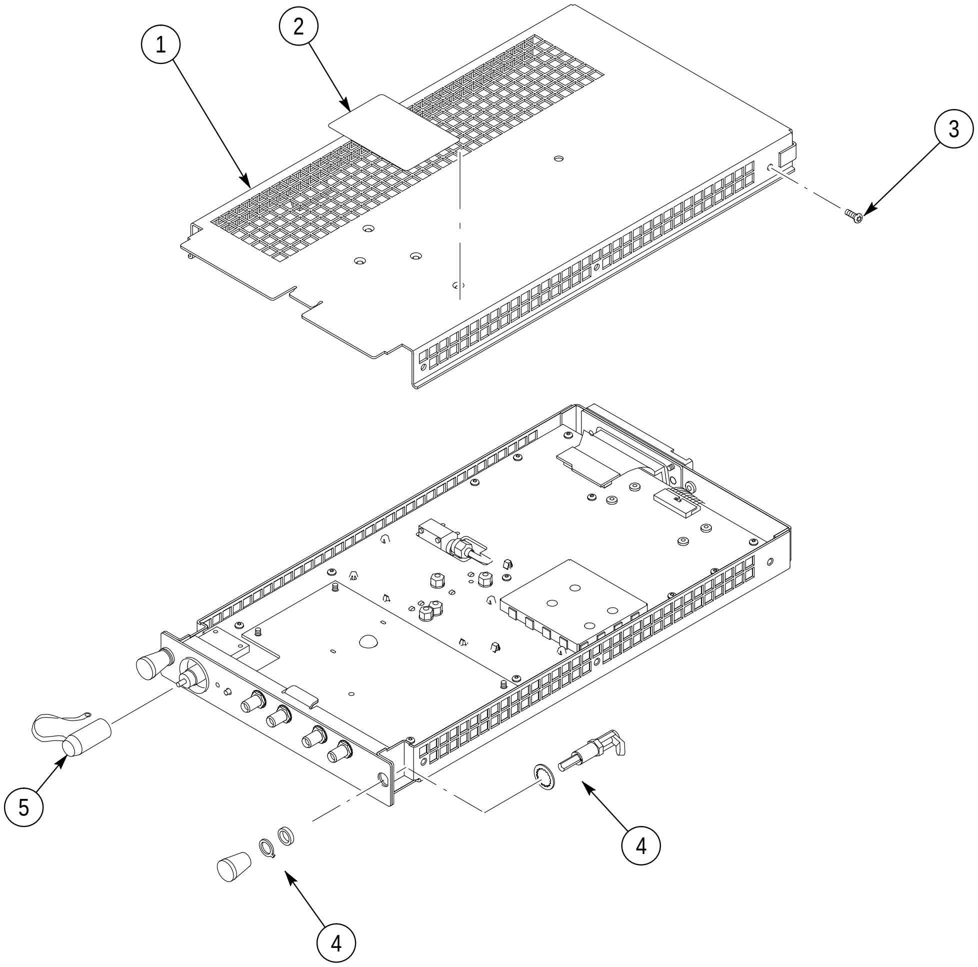

Figure 10–7: Optical modules

Replaceable Parts List

Fig. & Index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
–1	384–1838–00			1	SHAFT:SCREW LOCKDOWN,303 SST,R05HDSCR	TK0588	384–1838–00
–2	214–4081–00			1	LOCKDOWN:SCREW MOUNT,0.080 AL	5Y400	214–4081–00
–3	211–3008–00			2	SCREW,MACHINE:2–56 X 0.281,PNH,SST,PASS,POZI DR	0KB01	211–3008–00
8–4	015–1022–01			1	TERMINATOR:COAXIAL, 50 OHM, 0.5W, SMA	61162	50T–320 SMA M
–5	335–0370–00			1	MARKER,IDENT:ANTI–STATIC LABEL,0.005 POLY	0KB05	335–0102–00
–6	211–0088–00			8	SCREW,MACHINE:2–56 X 0.281,FLH,82 DEG,STL BK OXD,POZ	0KB01	ORDER BY DESCRIPTION
–7	380–1151–00			1	HOUSING:SAMPLING MODULE,TRIGGER PRESCALE LIMITING PREAMP	5Y400	380–1151–00
–8	211–0087–00			2	SCREW,MACHINE:2–56 X 0.188,FLH,82 DEG SST,POZ	1AW87	ORDER BY DESCRIPTION
–9	333–4392–00			1	PANEL,FRONT:TRIGGER PRESCALE LIMITING PREAMP,AL ALLOY	5Y400	333–4392–00
–10	335–0485–00			1	MARKER,IDENT:LABEL,MKD 80A01 PRESCALE MODULE,2.760 X .810,LEXAN,	0KB05	335–0485–00

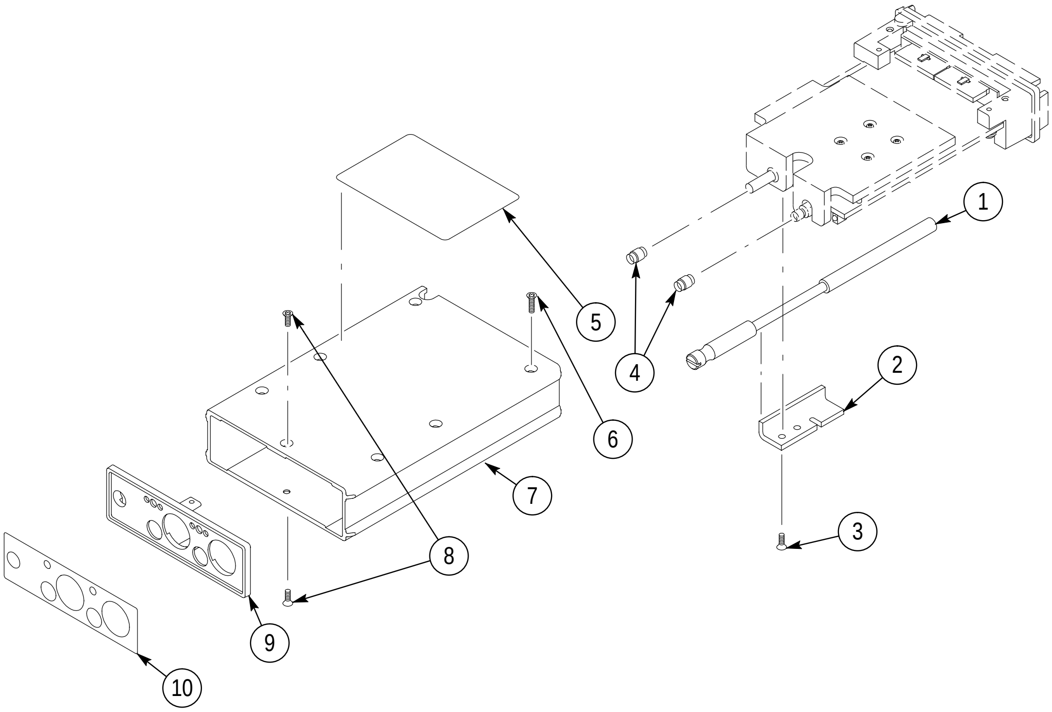

Figure 10–8: 80A01 module

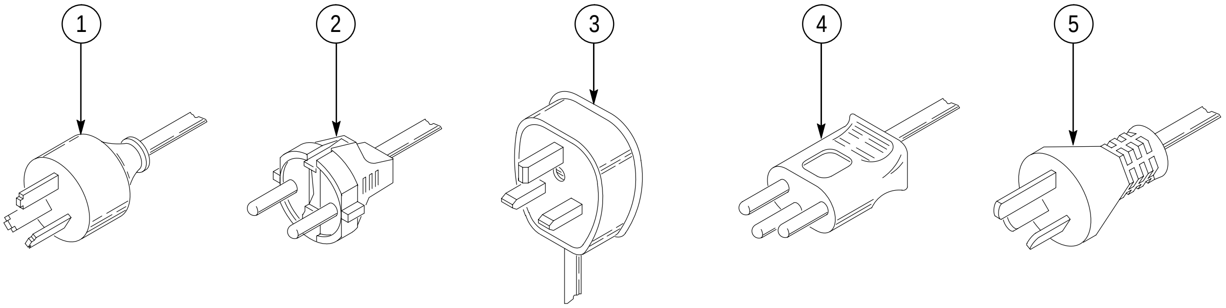

Figure 10–9: Accessories

Replaceable Parts List

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
					MAINFRAME STANDARD ACCESSORIES		
8–1	161–0104–05			1	CA ASSY,PWR:3,1.0MM SQ,250V/10A,2.5 M (OPTION A3 – AUSTRALIAN)	S3109	198–010
–2	161–0104–06			1	CA ASSY,PWR:3,1.0MM SQ,250V/10A,2.5 M (OPTION A1 – EUROPEAN)	S3109	198–010
–3	161–0104–07			1	CA ASSY,PWR:3,1.0MM SQ,240V/10A,2.5 M (OPTION A2 – UNITED KINGDOM)	S3109	209010
–4	161–0167–00			1	CA ASSY,PWR:3,0.75MM SQ,250V/10A,2.5 M (OPTION A5 – SWITZERLAND)	S3109	ORDER BY DESC
–5	161–0306–00			1	CA ASSY,PWR:3,1.0MM SQ,250V/10A,2.5 M (OPTION AC – CHINA)	TK6253	92–2637–250BKH
	————			1	CABLE ASSY,PWER:3,18 AWG,92 L (STANDARD CABLE – SEE FIG 10–1–6)		
	016–1268–00			1	POUCH, PLASTIC:POUCH (STANDARD CABLE – SEE FIG 10–1–1)	TK2539	2122
	020–2350–00			1	SOFTWARE KIT:CONTAINS LICENSE CERTIFICATE EASY RESTORE,CERTIFICATE AUTHENTICITY WIN 98 AND WI	80009	020–2350–00
	071–0433–00			1	MANUAL,TECH:USER, CSA8000, TDS8000	TK2548	071–0433–00
	071–0434–00			1	MANUAL,TECH:SAMPLING MODULE USER (SHIPPED WITH EACH ELECTRICAL SAMPLING MODULE ORDERED WITH THE MAINFRAME)	TK2548	071–0434–00
	071–0435–00			1	MANUAL,TECH:OPTICAL MODULE USER (SHIPPED WITH EACH OPTICAL SAMPLING MODULE ORDERED WITH THE MAINFRAME)	TK2548	071–0435–00
	071–0436–00			1	MANUAL,TECH:PROGRAMMER, CSA8000, TDS8000	TK2548	071–0436–00
	071–0437–00			1	MANUAL,TECH:REFERENCE, CSA8000, TDS8000	TK2548	071–0437–00
	119–6297–00			1	KEYBOARD:USB KEYBOARD	01963	G81–3505–LAAUS
	119–6298–00			1	MOUSE:LOGITECCH WHEEL MOUSE	46628	830306–001
	119–6107–00			1	STYLUS:STYLUS FOR TOUCH SCREEN	03ZT7	T1100

Replaceable Parts List (Cont.)

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
	011–0157–00			1	ADPTR,RF,PRCN:2.4MM OR 1.85MM MALE TO 2.92MM FEMALE, 80E01 ONLY	20944	34VKF50
					MAINFRAME OPTIONAL ACCESSORIES		
	012–1568–00			1	CA ASSY:SSP,ELEC,1 METER LONG, EXTENDER	060D9	012–1568–00
	012–1569–00			1	CA ASSY:SSP,ELEC,2 METER LONG, EXTENDER	060D9	012–1569–00
	015–0552–00			1	ADPTR,APC,ELEC:3.5MM,MALE TO FEMALE	02660	131–7053
	015–0553–00			1	ADPTR,SMA,ELEC:MALE TO FEMALE,SLIDE ON MALE	98291	50–674–6324–990
	015–1001–00			1	ATTENUATOR, FIX:2:1 ATTENUATION, 50 OHM, SMA SERIES CONNECTORS	16179	2082–4573–06
	015–1002–00			1	ATTENUATOR, FIX:5:1 ATTENUATION, 50 OHM, SERIES SMA CONNECTORS	16179	2082–4573–14
	015–0565–00			1	POWER DIVIDER:50 OHM, 3 SMA FEMALE CONNECTORS	64537	D293S
	016–1791–00			1	RACKMOUNT KIT: OPTION 1R, CSA/TDS8000 SERIES	80009	016–1791–00
	067–1338–00			1	FIXTURE,CAL:,SAMPLING HEAD CAL UNIT	TK2601	067–1338–00
	071–0438–00			1	MANUAL,TECH:SERVICE, CSA8000, TDS8000	TK2548	071–0438–00
	119–6241–00			1	DISK DRIVE:WINCHESTER,2.5 IN,6.4GB SINGLE PLATTER,9.5 MM,IDE,MHH2064AT,	049S6	MHH2064AT
	—————			1	DUAL DELAY LINE: DL–11	80009	DL–11
	—————			1	PROBE: P6209, 4.0 GHz ACTIVE FET PROBE	80009	P6202
	—————			1	STATIC ISOLATOR: SIU-800, STATIC ISOLATION UNIT	80009	SIU-800
					80E0X STANDARD ACCESSORIES		
	071–0434–00			1	MANUAL,TECH:SAMPLING MODULE USER	TK2548	071–0434–00
	015–1020–01			1	TERMINATOR, COA:SHORT CIRCUIT, SMA MALE (80E01)	0GZV8	64SMA–50–0–1
	015–1020–01			2	TERMINATOR, COA:SHORT CIRCUIT, SMA MALE (80E02, 80E03 AND 80E04)	0GZV8	64SMA–50–0–1
	011–0157–00			1	ADPTR,RF,PRCN:2.4MM OR 1.85MM MALE TO 2.92MM FEMALE	20944	34VKF50
					80E0X OPTIONAL ACCESSORIES		
	012–1568–00			1	CA ASSY:SSP,ELEC,1 METER LONG, EXTENDER	060D9	012–1568–00
	012–1569–00			1	CA ASSY:SSP,ELEC,2 METER LONG, EXTENDER	060D9	012–1569–00
	015–1001–00			1	ATTENUATOR, FIX:2:1 ATTENUATION, 50 OHM, SERIES SMA CONNECTORS	16179	2082–4573–06
	015–1002–00			1	ATTENUATOR, FIX:5:1 ATTENUATION, 50 OHM, SERIES SMA CONNECTORS	16179	2082–4573–14
					80C0X STANDARD ACCESSORIES		
	071–0435–00			1	MANUAL,TECH:OPTICAL MODULE USER	TK2548	071–0435–00
					80C0X OPTIONAL ACCESSORIES		
	119–4514–00			1	ADAPTER,D4:TFS3030,AD4–20	TK2491	AD4–20
	119–4515–00			1	ADAPTER,BICONIC:TFS3030,AB1–25	TK2491	ABI–25

Replaceable Parts List (Cont.)

Fig. & index number	Tektronix part number	Serial no. effective	Serial no. discont'd	Qty	Name & description	Mfr. code	Mfr. part number
	119–4516–00			1	CONNECTOR, OPTO:ADAPTER, FC–PC, ATTEN 0.6DB, RTN LOSS 35DB, RPTB+/–0.2DB, RIFOCS, APC–10	TK2491	APC–10
	119–4517–00			1	ADAPTER,SMA:TFS3030,2.5MM,AMT–10	TK2491	AMT–10
	119–4518–00			1	ADAPTER,SC:TFS3030,ASC–10	TK2491	ASC–10
	119–4546–00			1	ADAPTER,DIN:47256,AD–234	TK2491	AD–234
	119–4556–00			1	ADAPTER,HP–PC:OPTICAL CONNECTOR, UNIVERSAL CONNECTOR INTERFACE, AHP–10	TK2491	PROPRIETARY INFORMATION (AHP–10)
	119–4557–00			1	ADAPTER,UNIV:SMA 905/906,ASM–90	TK2491	PROPRIETARY INFORMATION (ASM–90)
	119–4558–00			1	ADAPTER,UNIV:DIAMOND 3.5MM,AMS–00	TK2491	PROPRIETARY INFORMATION (AMS–00)
	119–4513–00			1	CONNECTOR, OPTO:ADAPTER, ST, ATTEN 0.6DB, RTN LOSS 35DB, RPTB +/–0.2DBRIFOCS, ATS–16	TK2491	ATS–16