

Instruction Manual

Tektronix

SA-42

Optical to Electrical Converter

070-7733-00

**Please check for change information at the rear
of this manual.**

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General Information

This manual is divided into six sections.

- Section 1 describes the SA-42 Optical Converter and its accessories.
- Section 2 explains how to use the SA-42 and the Power Supply and Charger Unit properly.
- Section 3 contains the specifications for the SA-42.
- Section 4 provides performance check procedures that you can perform on your instrument to verify its accuracy.
- Section 5 explains maintenance procedures and what to do if you suspect your instrument is not performing properly.
- Section 6 outlines the procedure for returning your Optical Converter for repair or replacement, and lists the standard and optional accessories.

If your instrument fails or does not perform as specified, please call your local Tektronix representative for repair or replacement.

Description

The Tektronix SA-42 is an analog optical-to-electrical converter which converts an optical input signal into an output voltage for display on either a high-speed oscilloscope, such as a Tektronix 11801A or a spectrum analyzer, such as a Tektronix 2782.

The conversion is calibrated for a gain of 25 $\mu\text{W}/\text{mV}$, when the input signal is in the 1300 nm band. The approximate response at other wavelengths in the 1000 nm to 1700 nm range can be determined from the graph shown in **Specifications**, Figure 3-2 on page 3-8.

For conversion from electrical power, measured on a spectrum analyzer, to optical power the following equation can be used:

$$\text{Optical Power, dBm} = \frac{\text{Electrical Power, dBm}}{2} + 8$$



The SA-42 is DC coupled to enhance the pulse response, so a high performance DC block, Tektronix 015- 0509-00, is recommended when used with any spectrum analyzer. Connecting the SA-42 to a spectrum analyzer without a DC block can cause damage to the spectrum analyzer.

The SA-42 has an electrical bandwidth from DC to 7 GHz. The approximate response at other frequencies up to 15 GHz maybe determined from a graph located on the converter body, which is duplicated in **Specification**, Section 3, Figure 3-1.

Optical input power is coupled into the SA-42 through a precision, FC-type fiber optic receptacle. For connecting the SA-42 to other connector types, a range of optical cables is available. Please refer to **Replaceable Parts**, Section 6. The output connector is an electrical SMA.

Power for the SA-42 can be provided from one of three sources:

- Internal batteries.
- From the host instrument via a probe power socket. This is available on Tektronix spectrum analyzers and some Tektronix laboratory oscilloscopes.
- The Power Supply and Charger Unit provided.

As the quiescent power required for the SA-42 is negligible, the batteries are permanently connected to the photodiode circuitry and are only disconnected when an external source is used. Please refer to **Maintenance**, Section 5, for battery life and charging information.

Accessories

The SA-42 is supplied with the following standard accessories:

- 1 Instruction Manual
- 1 Carrying Case
- 1 Power Supply and Charger Unit
- 1 DC Power Cable
- 1 AC Power Cable
- 1 Electrical Shorting Cap
- 1 SMA to SMA Adaptor

A spare fuse can be found in the fuse drawer of the IEC socket on the back panel of the Power Supply and Charger Unit. Part numbers, options, optional accessories and related products are listed in **Replaceable Parts**, Section 6.

NOTE

*Upon receipt, save the shipping and packaging materials for reuse should shipment become necessary. Refer to **Maintenance**, Section 5, for further information.*

Safety Summary

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

These two terms appear in manuals:

- **CAUTION** statements identify conditions or practices that could result in damage to the equipment or other property.
- **WARNING** statements identify conditions or practices that could result in personal injury or loss of life.

Do Not Operate In Explosive Atmospheres

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

Use Care When a Signal Source is Connected

To avoid personal injury, do not touch exposed connections and components while the converter is connected to power supplies or a signal source.



Operating Instructions

This section of the manual is intended to familiarize you with the use of your SA-42 Optical-to-Converter.

NOTE

*Upon receipt, save the shipping and packaging materials for reuse should shipment become necessary. Refer to **Maintenance**, Section 6, for further information.*

Connections

Optical Input Receptacle

The signal to be measured must be coupled via a fiber optic cable, terminated in a FC style connector. The FC style connector is attached to the SA-42 through the FC style receptacle, ensuring that correct alignment is made with the receptacle's keyway. The FC style connector needs only to be tightened finger tight, once properly aligned.

The device under test or signal source may be coupled directly to the SA-42 or through one of the optional cable accessories. Please refer to **Replaceable Parts**, Section 6. To achieve the calibrated response, any cable used must be single mode.

Damage may occur to the optical receptacle through excessive or improper cleaning. Reduce the need for cleaning by installing the protective dust cap over the receptacle when the SA-42 is not being used. Please refer to **Maintenance**, Section 5, for cleaning procedures.

Electrical Output Receptacle

The electrical output signal is coupled to the high-speed oscilloscope or spectrum analyzer via the electrical SMA receptacle. Damage can occur if a cable or adapter connector with a worn connector is attached to the receptacle. For best repeatability and prolonged life, a torque wrench should be used to tighten the connector to a setting of 7–10 lb. in (79–112 N-cm).

Whenever the SA-42 is not being used, the protective shorting cap should be attached to the receptacle. Various adaptors and accessories are available. Please refer to **Replaceable Parts**, Section 6.

3-Pole DC Power Receptacle

Whenever an external power source is used, power is connected to the SA-42 through the 3-pole receptacle. It is important to note that a keyway system is used for correct orientation of the connector pair. To ensure proper alignment, the red dot on the cable plug and the red dot above the receptacle on the side of the SA-42 should coincide.

When separating the SA-42 from the external power source, it is important to pull on the body of the cable plug, and not on the cable itself, because the plug latches into the receptacle.

4-pole DC Power Connector

If the external power source is the host instrument, the DC power cable provided has to be attached to the SA-42 via the 3-pin connector, and to the host instrument, via the 4-pin connector. Ensure that the plug is correctly aligned with the socket before inserting.

A latching mechanism is also used between this connector pair, so the cable must be removed from the host instrument by pulling on the body of the cable plug, and not the cable itself.

Operating Considerations

Optical Input

The SA-42 is only calibrated for use with single mode optical fiber, typically having a core diameter of 8 microns and 0.2 numerical aperture. A FC-style receptacle is used, to which the cable connector must be properly aligned on the keyway, before tightening finger tight.

The SA-42 is calibrated for use at 1300 nm, but may be used over the wavelength range from 1000 nm to 1700 nm. For determining the relative responsivity at a particular wavelength, refer to Figure 3-2, on page 3-8. The SA-42 is specified for use with optical powers up to 5 mW, mean and 25 mW, peak.

Electrical Output

The electrical output is a SMA receptacle. For adaptors and accessories, please refer to **Replaceable Parts**, Section 6. The electrical output must be terminated with 50 Ω to guarantee the specified conversion gain from the SA-42.

Battery Charge Indication

The state of the battery charge is indicated when the push button on the SA-42 is pressed and the associated LED lights. If the LED is bright, then the batteries have sufficient charge; if the LED is dim and/or appears to grow dimmer as the push button is held down, then the batteries require charging. For typical battery lifetimes, please refer to **Maintenance**, Section 5.

Power Supply and Charger Unit

The Power Supply and Charger Unit does not have an on-off switch and will provide power as soon as it is connected to an AC line. A green LED on the front panel indicates when the unit is powered.

When the SA-42 is powered from any external source, the internal batteries are disconnected. If the SA-42 is connected to the Power Supply and Charger Unit, and the AC supply is disrupted, the SA-42 immediately switches back to the internal batteries for power, without needing to disconnect the SA-42.



The internal batteries have no out-gassing facility, and are therefore sensitive to over-charging. No attempt must be made to recharge the batteries from a source other than the Power Supply and Charger Unit. The batteries must not be recharged at ambient temperatures above 45°C. If the batteries are over-charged or charged at temperatures above 45°C, the SA-42 can be damaged.

Recharging the batteries is initiated by pushing the START button on the front panel of the Power Supply and Charger Unit. To avoid over-charging, the unit first ensures that the batteries are fully discharged before recharging.

The total charge cycle takes 16 to 17 hours, and during this time the main AC supply, the Power Supply and Charger Unit and the SA-42 should not be interfered with. The yellow CHARGING LED on the front panel of the unit

indicates that charging is taking place. The LED is switched off at the end of the total charge cycle. While the batteries are being recharged, the Power Supply and Charger Unit continues to provide power to the SA-42. The timing circuitry within the unit derives a clock from the AC power line frequency. The unit has to be set for operation at either 50 or 60 Hz, and the specific frequency is indicated on the back panel of the unit. The Power Supply and Charger Unit will not work correctly from 440 Hz power lines. If there is a need to alter the frequency setting, please refer to **Maintenance**, Section 5.

If the Power Supply and Charger Unit should become temporarily disconnected from the SA-42 during the charge cycle, then this is likely to only result in a proportionate loss of charge for the batteries.

If disconnected for a significant length of time, then re-starting the charging process is recommended. This can be done by briefly interrupting the AC supply and then pushing the START button.

CAUTION

If the Power Supply and Charger Unit is disconnected from the SA-42 during the first hour of charging, and subsequently reconnected, the batteries may be damaged by overcharging. If the Power Supply and Charger Unit is disconnected within the first hour of charging, restart the charging process by pressing the START button on the front of the Power Supply and Charger Unit.

Restarting the charge process by briefly interrupting the AC line supply is safe because the batteries are fully discharged again before recharging.

If the AC line supply should be temporarily interrupted, then the charging process stops and will not continue when power is restored. The net result will be a proportionate loss of charge. If the AC line supply is temporarily interrupted, the charging process should be restarted.

Time Domain Measurements

The SA-42 conversion gain is specified as 25 $\mu\text{W}/\text{mV}$. It is specified in this manner to facilitate conversion of the measured signal to the equivalent optical input. For example, an oscilloscope trace of 20 mV/div . is equivalent to $20 \times 25 = 500 \mu\text{W}/\text{div}$

Frequency Domain Measurements

For frequency measurements the following equation relating electrical power, as measured on a spectrum analyzer, to optical power can be used:

$$\text{Optical Power, dBm} = \frac{\text{Electrical Power, dBm}}{2} + 8$$

This equation is derived from the 25 $\mu\text{W}/\text{mV}$ conversion gain of the SA-42. When taking relative measurements, in decibels, the "+ 8" should be dropped from the equation. The division by 2 is a result of the photodiode being a square law detector.

It is important to note that almost every optical signal has a mean level, which results in a DC signal after conversion. This is true even if an electrical signal is AC coupled to a laser or LED transmitter module.

An electrical source can often both sink and source current, producing negative as well as positive voltages. There is no direct equivalent to this in the optical domain. A negative going optical signal has to be a reduction from a mean level.



For the above reasons it is important consider the use of a DC block, Tektronix 015-0509-00, when using the with a spectrum analyzer. Spectrum analyzers do not, typically, quote a 'DC withstand voltage' for the input circuitry and, therefore, damage can occur if the SA-42 is used without a DC block.

The SA-42 is DC-coupled instrument in order to faithfully reproduce a pulse response in the time domain.

Noise Measurements

Noise within an electro-optic system is typically produced by a combination of shot and thermal noise within the receiver and relative intensity noise within the transmitter. These are largely electrical sources and not optical.

Noise equivalent power is therefore, defined as the optical power level which would produce an electrical signal with an equivalent power to that of the measured noise signal. Noise equivalent power does not imply that a noise signal is produced in the optical domain.

Electrical noise is often expressed in terms of dBm/Hz. Because any photodiode has a square law response it is difficult to translate such units directly into the optical domain. It is, therefore, better to measure the absolute electrical noise power and convert this to an optical power using the above conversion equation. The resultant figure can then be quoted as the noise equivalent power, within the specific measurement bandwidth.



Specifications

This section details the performance of the SA-42. The **Performance Verification**, Section 4, then explains how to check this performance.

The Electro-Optic Characteristics listed in Table 3-2 and the Optical Characteristics listed in Table 3-3 apply when the SA-42 is calibrated with a single mode fibre input between 20°C and 30°C and is used with a calibrated instrument system operating within the environmental conditions stated in Table 3-4.

The converter's physical characteristics are listed in Table 3-1.

Items listed in the *Performance Requirements* column are verified in **Performance Verification**, Section 4. Items listed in the *Supplementary Information* column are not verified in the **Performance Verification**. They are either explanatory notes, calibration setup descriptions, performance characteristics for which no absolute limits are specified or characteristics that are impractical to check.

Performance Conditions

The electrical characteristics listed in Table 3-2 apply when the converter is calibrated between +20°C and +30°C, the converter has completed a warm-up period of at least 20 minutes, and is used with a calibrated instrument system operating within the environmental conditions stated in Table 3-4.

Items listed in the Performance Requirement column are verifiable qualitative or quantitative limits. Items listed in the Supplemental Information column are not verified in the **Performance Check Procedure**, Section 4; they are either explanatory notes, calibration setup descriptions, performance characteristics for which no absolute limits are specified, or characteristics that are impractical to check.

The converter's physical characteristics are listed in Table 3-1.

Table 3-1: Physical Characteristics

Characteristic	Information
Net Weight (includes accessories)	2.5 kg.

Table 3-2: Electro-Optic Characteristics

Characteristic	Performance Requirement	Supplemental Information
Conversion Range	25 $\mu\text{W}/\text{mV} \pm 20\%$	
Optical Pulse Response Speed ¹	50 ps, maximum	FWHM (Full Width Half Maximum)
Bandwidth (electrical)	DC to 7 GHz, -3 dB ²	See Figure 3-1.
	DC to 15 GHz, -25 dB ²	
	10 kHz to 15 GHz.	With DC block
Pulse Response Aberrations	15% peak-to-peak, maximum	0-400 ps after pulse
Linear Dynamic Range (optical)	Up to 5 mW, mean ²	Equivalent to +7 dBm
	Up to 25 mW, peak ²	Equivalent to +14 dBm

¹De-convoluted from measured response assuming gaussian approximation for FWHM

²Performance requirement not checked in manual.

Table 3-2: Electro-Optic Characteristics (Cont.)

Characteristic	Performance Requirement	Supplemental Information
Noise Equivalent Power (optical)	2.5 μ W, rms typical ¹	With SD-22 and smoothing With SD-24/26 and smoothing
	5 μ W, rms typical ¹	
	15 μ W, rms typical ¹	
	-70 dBm, typ. 0–7 GHz ¹ -58 dBm, typ. 0–7 GHz ¹	10 RBW 10 RBW, with 2782, 0 dB atten.
	-58 dBm, typ. 7–15 GHz ¹	10 RBW
	-55 dBm, typ. 7–15 GHz ¹	10 RBW, with 2782, 0 dB atten.
Maximum Nondestructive Optical Input	Up to 10 mW, mean ¹ Up to 75 mW, peak ¹	Equivalent to + 10 dBm Equivalent to + 18 dBm
Optical Load Requirements	50 Ω ¹	

¹Performance requirement not checked in manual.

Table 3-3: Optical Characteristics

Characteristic	Performance Requirement	Supplemental Information
Wavelength	1000 to 1700 nm ¹	Calibrations made at 1300 nm
Spectral Response		See Figure 3-2.
Input Return Loss	14 dB, Optical ¹	

¹Performance requirement not checked in manual.

Table 3-4: Environmental Characteristics

Characteristic	Information
Temperature Range (Operating)	0°C to +50°C (32°F to +131°F).
Temperature Range (Charging)	0°C to +45°C (32°F to +113°F).
Temperature Range (Nonoperating)	-55°C to +75°C (-67°F to +167°F).
Humidity (Operating)	90% to 95%, relative humidity between 30°C to 50°C.
Altitude (Operating)	15,000 feet
Altitude (Nonoperating)	50,000 feet
Vibration (Operating)	0.38 mm, 10 to 55 Hz, 75 minutes total
Shock (Operating)	30g, half-sine, 11 ms, 18 shocks
Bench Handling (Operating)	45° or 4" unit drop test
Transportation	Qualifies under National Safe Transit Association's Pre-shipment Test; 1A-B-1. Package Drop: 30 inches
Electrostatic Immunity	Qualifies under test limits specified in FCC Part 15J and VDE 0871 Class B.

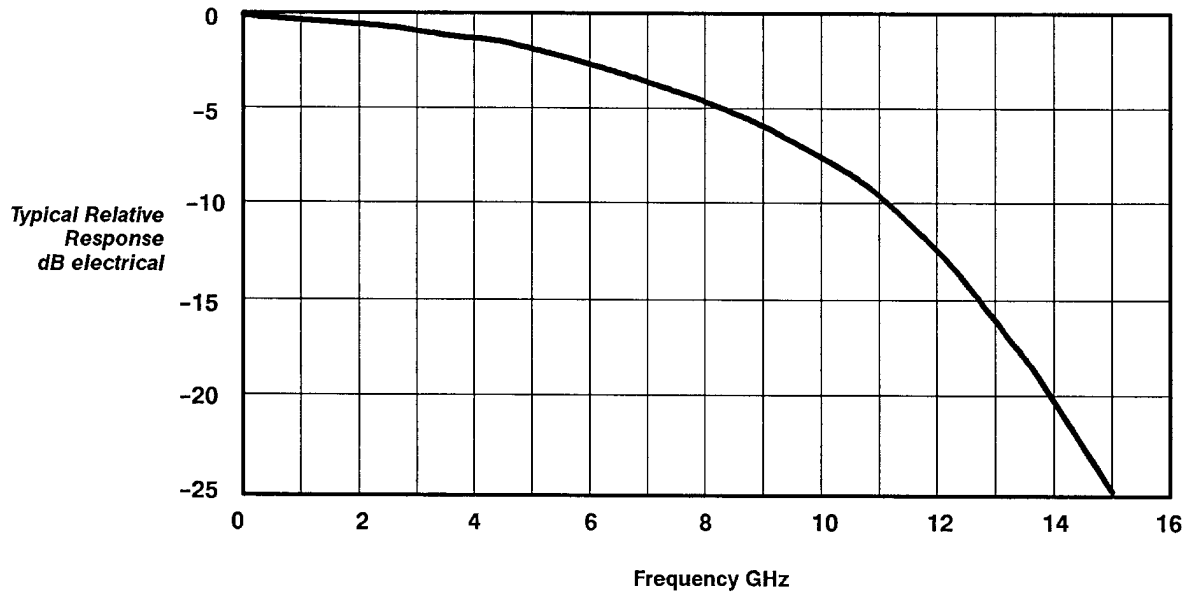


Figure 3-1: Relative Frequency Response

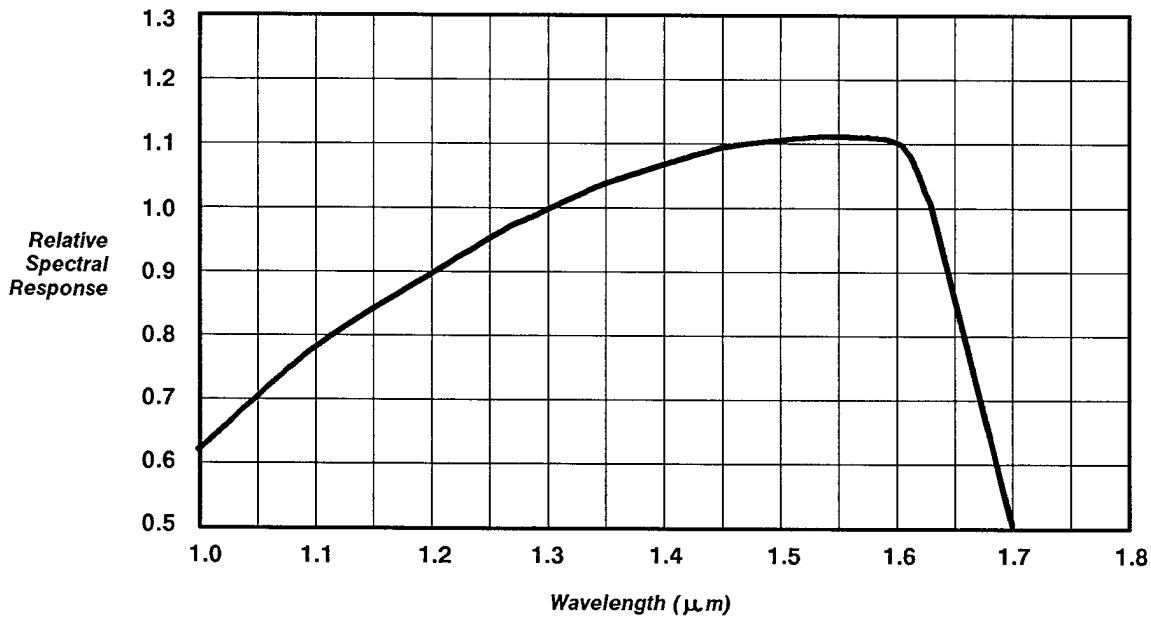


Figure 3-2: Normalized Spectral Response



Performance Check Procedure

The Performance Check Procedure is used to verify the converter's performance requirements as listed in **Specifications**, Section 3, and to determine the need for readjustment. This procedure may also be used as an acceptance check and a test of the SA-42 after repair.

Test Equipment Required

Test equipment described in Table 4-1 is a complete list of equipment required to conduct the **Test Procedure** in this section. Test equipment recommended is the minimum necessary to provide accurate results; therefore, substitute equipment must meet or exceed the specifications of the equipment listed. Detailed operating instructions for test equipment are not contained in this procedure. Should additional operating information be needed, refer to the appropriate test equipment instruction manual.

These procedures were written for use when the SA-42 being tested in conjunction with an 11800 Series Oscilloscope system. Procedures or portions of procedures may vary when SA-42 is used in other configurations or systems, or with 11800 Series systems with firmware updates not available at the time of publication.

Table 4-1: Test Equipment Required

Item Description	Procedure Where Used	Performance Requirement	Recommended Example
Digitizing Oscilloscope System	All checks	20 GHz bandwidth	Tektronix 11801A with SD-24/26 sampling heads.
C. W. Laser Source	Conversion Gain	1300 nm > 1 mW output	Tektronix 802-9249-06 Laser Diode Driver/Controller with 802-1301-11 laser
Pulsed Laser Source	Pulse Response	1300 nm	Tektronix OIG 502
Reference Optical Converter	All Checks		Tektronix SD-42/46 calibrated for t_{FWHM} ; must be less than 55 ps

¹ Requires TM 500 or TM 5000-Series power-module mainframe.

Table 4-1. Test Equipment Required (Cont.)

Item Description	Procedure Where Used	Performance Requirement	Recommended Example
Digital Multimeter	Conversion Gain		Tektronix DM501A ¹
Optical Fiber Cable, 2x	All Checks		Tektronix 174-1387-00
SMA cable	All Checks		Tektronix 174-1120-00 (11800 standard accessory)
DMM Leads	Conversion Gain		Tektronix 012-1286-00 & 012-1287-00 (standard SD-42/46 accessories)
BNC Cable			Tektronix 012-0482-00
BNC-SMA Adaptor			Tektronix 015-1018-00

¹Requires TM 500 or TM 5000-Series power-module mainframe.

Limits and Tolerances

The limits and tolerances given in these procedures are for the SA-42 under test only. Test equipment error is not included except as noted.

Preparation

Before proceeding with checks, allow sufficient warm-up time for test equipment to stabilize (typically 20 minutes). Ensure that all optical dust caps are in place. Each of the following checks can be independently performed.

WARNING

Do not enable the CW laser source at this stage.

Conversion Gain

Please refer to Figure 4-1 for the test setup.

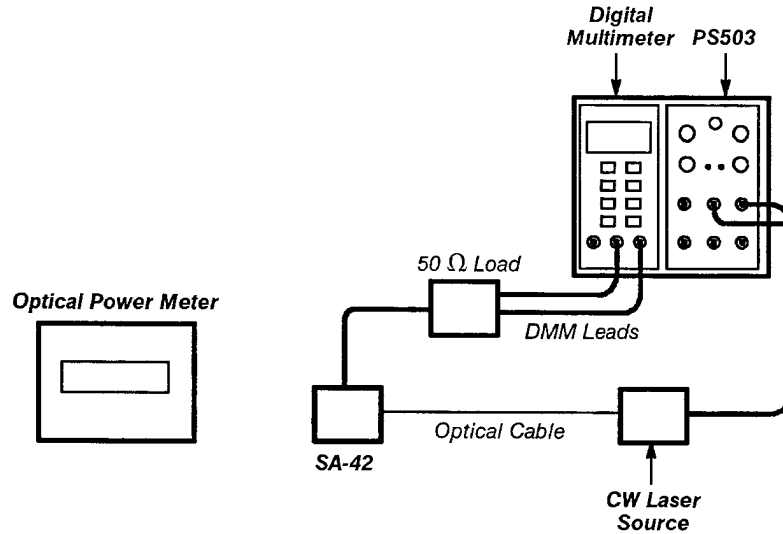


Figure 4-1: Conversion Gain and Offset Gain Check Setup

Equipment Required (see Table 4-1):

CW Laser Source

DVM

50 Ω Load

Optical power meter

Optical cables

1. Check that the battery in the SA-42 is fully charged.
2. Connect the SA-42 to the DVM through the 50 Ω load.
3. Connect the CW source to the optical power meter using the appropriate optical fiber cable.
4. Turn on the CW laser source and set it to 100 μ W.
5. Disconnect the cable from the power meter and connect it to the SA-42.

WARNING

Do not look directly into the fiber when the laser is enabled.

6. Calculate the Conversion Gain with this equation:

$$\text{Conversion Gain} = \frac{100}{\text{DVM reading in mV}}$$

The result should be $25 \mu\text{W} \pm 20\%$.

FWHM and Step Response

Please refer to Figure 4-2 for the test setup.

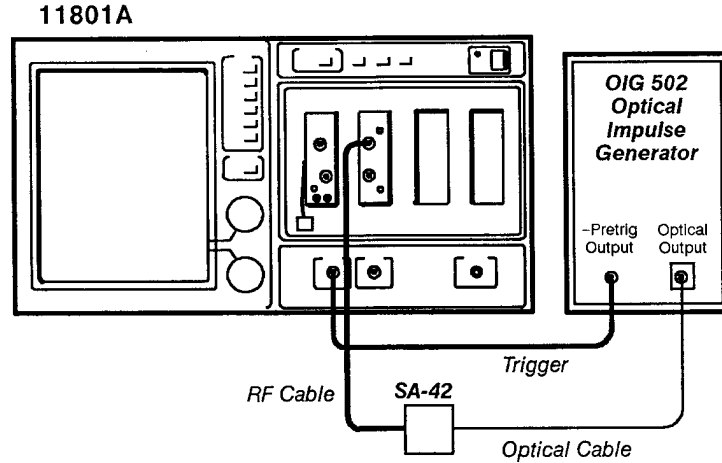


Figure 4-2: Setup to check FWHM and Step Response

Equipment Required (see Table 4-1):

- 11801A or CSA 803
- OIG 502 in TM500/TM5000 power module
- SD-24 or better
- Optical cables

Check the System Full Width Half Maximum – by performing steps 1 through 10.

1. Initialize the oscilloscope, connect the SA-42 to one of the inputs to the sampling head through an appropriate adapter (Tek part number 015-0551-01), and turn on the channel with the SA-42 attached.
2. Connect the OIG 502 output to the SA-42 input through the optical cable.
3. Connect the OIG 502 Pretrigger output to the trigger input of the 11800 through a 2X or 5X attenuator.
4. Set the oscilloscope trigger to external, negative slope, and trigger level to 100 mV.
5. Set the OIG 502 to 1 MHz, low impulse energy, and enable the laser.

6. Adjust the **Main Size** to 1 ns/div and position the impulse at the left-hand side of the screen. Adjust the **Main Size** to 100 ps/div. It may be necessary to readjust the **Main Pos.** to keep the pulse on the screen.
7. From the WAVEFORM major menu, touch **Acquire Dec.** and set **Average N** to **On**. Set the number of averages to 32.
8. Press the MEASURE button and then touch **Measurements**.
9. Touch **Width** in the **Measurements** pop-up menu.
10. Record the value for the **Width** and calculate the Input Full Width Half Maximum (t_{FWHM}) with the following formula:

$$\text{Input } t_{FWHM} = \sqrt{[(\text{Width : value})^2 - (\text{Calibrated SD-42/46 } t_{FWHM})^2]}$$

Check the step rise time and aberrations — by performing steps 11 to 24.

11. With the time/division set to 100 ps/div, center the impulse on the third graticule line from the left edge of the screen of the oscilloscope.

12. Store the waveform using the STORE/RECALL major menu.
13. Recall the stored waveform and measure the mean value in the first two divisions displayed on the screen. Note this value.
14. Define a trace as the integral of the stored waveform minus the mean from step 13.
15. Display the MEASURE menu and touch **Rise** in the **Measurements** pop-up menu
16. Check that the step rise time is < 60 ps.
17. Turn on the cursors and set the cursor type to horizontal bars.
18. Adjust the cursors to the 0% and 100% levels of the waveform.
19. Note the Δv value (dv1).
20. Adjust the cursors to the minimum and maximum points of the post-pulse aberrations (that is, the minimum and maximum reached above the 90% level of the waveform)
21. Note the Δv value (dv2).
22. Calculate the percent aberrations by dividing the peak-peak aberrations by the step size and multiplying by 100 ($dv1/dv2 \times 100$).

23. Check that aberrations are less than 15% peak-peak.
24. Set the OIG 502 laser enable switch to OFF.

Check the Pulse Aberrations – by performing Steps 25 through 33.

25. Touch the horizontal icon and adjust the **Main Pos.** so that the peak pulse is aligned approximately with the third graticule line.
26. Touch **Measurements** in the MEASURE major menu.
27. Touch **Max** and **Peak-Peak** and then **Exit Menu** in the **Measurements** pop-up menu.
28. Record the **Max** measurement.
29. Touch **Peak-Peak** and then touch **Left Limit** in the **Peak-Peak** pop-up menu to assign the knobs to position the left and right hand measurement limits.
30. Adjust the **Left Limit** to position the left cursor on the first minimum on the trace after the pulse peak.
31. Adjust the **Right Limit** to 40% further than the **Left Limit** % (e.g. if **Left Limit** is 37% then set **Right Limit** to 77%).

32. Record the **Peak-Peak** measurement and calculate the pulse aberration with the following formula:

$$\%Aberration = \frac{\text{Peak-Peak : value}}{\text{Max : value}} \times 100$$

33. Check the pulse aberration $\leq 15\%$.

This completes the Test Procedure for the SA-42. If any problems have been discovered, please turn to Troubleshooting in **Maintenance**, Section 5.



Maintenance

This section contains information for performing preventive and corrective maintenance and instrument repackaging instructions.

Preventive Maintenance

WARNING

To prevent electric shock or shorting of components, do not perform preventive maintenance while the converter is connected to the oscilloscope system.

Preventive maintenance consists primarily of cleaning and visual inspection. When performed on a regular basis, preventive maintenance can prevent instrument breakdown and may improve instrument reliability. Frequency of maintenance depends on the severity of the environment. A convenient time to perform maintenance is just before a performance check and calibration.

Cleaning

A rectangular box with a wavy, scalloped border containing the word "CAUTION" in bold, uppercase letters.

Avoid using chemical cleaning agents that can damage the plastics and circuit board used in the converter. In particular, avoid chemicals containing benzene, toluene, xylene, acetone, MEK, or similar solvents. For additional information on recommended cleaning agents, consult your Tektronix Service Center or representative.

Optical Input Lens

A rectangular box with a wavy, scalloped border containing the word "CAUTION" in bold, uppercase letters.

Use extreme caution when cleaning the converter optical input lens. Use of abrasive cleaners, solvents, excessive rubbing or high-pressure air will damage the lens.

Ordinarily, the lens should not need to be cleaned. To reduce the need for cleaning, keep the protective cover over the optical input to the converter at all times other than when in use. Use clean, dry, low-pressure air (5 lb/sq. in maximum) to remove dust from the lens.

Exterior

Loose dust accumulated on the outside of the converter can be removed with a soft cloth or a small brush. Dirt that remains can be removed with a soft cloth dampened in a mild detergent and water solution. Do not use abrasive cleaners. Avoid causing damage to the optical input lens during the cleaning procedure.

Interior

Normally, the main circuit board will not require cleaning unless a cover has been removed for an extended period of time. The best way to clean the interior is to blow off the accumulated dust with dry, low-pressure air (about 9 lb/sq. in). Remove any dirt that remains with a soft brush or a cloth dampened with a nonresidue-type cleaner, preferably isopropyl alcohol. A cotton-tipped applicator is useful for cleaning in narrow spaces or for cleaning more delicate circuit components.

Troubleshooting

Individual components are not replaceable by the customer. Either obtain a new assembly to replace a defective one or send the converter to a Tektronix Repair Center for repair (see **Assembly Replacement** and **Instrument Repackaging** procedures in this section). The following basic procedure may be useful in locating and isolating a malfunction:

1. Ensure that all interconnections and mechanical components are functional.
2. Check the mean level of the optical input signal. Ensure that it is neither too high, nor too low. Please refer to **Specification**, Section 3.
3. If the battery indicator LED fails to light, or remains dim even after charging then the battery/circuit board assembly needs replacing. Ensure, however, that the SA-42 works correctly when attached to the Power Supply and Charger Unit.
4. The Power Supply and Charger Unit can only be replaced as a single unit. Failure of this unit may be determined by one of the following symptoms:
 - Failure of the green POWER LED to illuminate when the unit is attached to the AC power line.
 - Failure of the yellow CHARGING LED to illuminate after pressing the START button.

- Failure of the yellow CHARGING LED to extinguish after 17 hours from pressing the START button. This fault could result in overcharging the batteries.

If the battery charger does not seem to be operating properly, check to ensure that the external 120V/240V switch is set correctly and that the appropriate fuse is installed. Also check that the internal line frequency switch is set correctly. (See ***Changing the AC Line Frequency*** on page 5-8.)

Obtaining Replacement Parts

When ordering parts, to ensure receiving the proper parts or assemblies, include all of the following information with your order:

1. Instrument type (including modification or option numbers).
2. Description of the part (if electrical, include the circuit number).
3. The Tektronix part number.

Converter Top Cover Removal

1. Carefully lift up an edge or corner of the top-cover label, and then remove the label to gain access to 5 cap head screws. The top and bottom cover labels are replaceable parts.
2. Remove the 5 cap-head screws in order to separate the two halves of the converter. Ensure that the photodiode and output adaptor do not remain attached to the top cover. The output adaptor is likely to be a tight fit in the top cover.
3. Put the top cover and 5 screws carefully to one side. Be careful not to scratch the serial number information.

Reassemble the SA-42 following the reverse procedure. When replacing the top cover, install the final link of the dust cap chain between the top and bottom covers.

Battery Charge Life

Battery charge life is heavily dependant on the amount and type of use that the SA-42 receives, and also on ambient temperature. The maximum lifetime is between 3 and 6 months if the SA-42 is powered solely from an external source and used only at 25°C approx. If used at 50°C, the self-discharge time of the batteries is approximately 2 weeks, even if powered from an external source. If powered from the batteries, and used to continuously monitor a mean optical signal of 1 mW, then the batteries will last between 24 and 36 hours.



It is possible to discharge the batteries to a point at which they are no longer able to hold a useful amount of charge. At this point, battery replacement becomes necessary, although the SA-42 can still be powered from an external source.

For the above reason, carefully monitor the amount of use that the SA-42, powered internally, receives.

The switch and LED on the side of the SA-42 provide a means for checking the charge level, but if in any doubt, do not hesitate to use the Power Supply and Charger Unit provided. Please refer to ***Operating Instructions***, Section 2.

Even if the SA-42 is always powered externally and always used at room temperature, the batteries should be recharged at least every 6 months. This will ensure that the batteries remain in good condition for the lifetime of the instrument.

Changing the AC Line Frequency Setting

As explained in ***Operating Instructions***, Section 2, the Power Supply and Charger Unit depend upon the AC line frequency for correct operation. The unit is factory set to operate at the correct operating frequency, as defined by the option requested when the SA-42 was ordered. The specific frequency is shown on the back panel of the unit. Should it become necessary to change this, then the following procedure should be performed.

1. Ensure that the unit is not connected to the AC line supply.
2. Turn the unit over and remove the 2 recessed screws.

3. Turn the unit right-side up and remove the top cover. A 'pin' and 'jumper' arrangement is used to set the operating frequency, with the central pin common to both settings. The jumper should be attached to the appropriate 2 pins, as shown by the marking on the circuit board.

Instrument Repackaging

If the converter is to be shipped to a Tektronix Service Center for service, attach a tag that contains the following information:

1. Owner's name and address and the name of an individual that can be contacted.
2. Description of the service required.

To repackage the converter, use the original packaging in which your converter was shipped. If the original packing is unfit for use or is not available, repackage the converter as follows:

1. Obtain a corrugated cardboard carton having inside dimensions that allow for at least 6 inches of cushioning around the converter. Use a carton having a test strength of at least 175 pounds.
2. Surround the converter with protective polyethylene sheeting.

3. Cushion the converter on all sides by tightly packing dunnage or urethane foam between carton and converter, allowing 6 inches on all sides.
4. Seal the carton with shipping tape or an industrial stapler.
5. Send the instrument to the nearest Tektronix Repair Center (check your Tektronix Product Catalog for the correct address).



Replaceable Parts

This section contains a list of the components that are replaceable for the SA-42 Optical-to-Electrical Converter. As described below, use this list to identify and order replacement parts.

Parts Ordering Information

Replacement parts are available from or through your local Tektronix, Inc. service center 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 a part you order has been replaced with a different or improved part, your local Tektronix service center or representative will contact you concerning any change in the part number.

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

Using the Replaceable Parts List

The tabular information in the Replaceable Parts List is arranged for quick retrieval. Understanding the structure and features of the list will help you find the all the information you need for ordering replacement parts.

Item Names

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

Indentation System

This parts list is indented to show the relationship between items. The following example is of the indentation system used in the Description column:

1	2	3	4	5	Name & Description
					<i>Assembly and/or Component</i>
					<i>Attaching parts for Assembly and/or Component</i> (END ATTACHING PARTS)
					<i>Detail Part of Assembly and/or Component</i>
					<i>Attaching parts for Detail Part</i> (END ATTACHING PARTS)
					<i>Parts of Detail Part</i>
					<i>Attaching parts for Parts of Detail Part</i> (END ATTACHING PARTS)

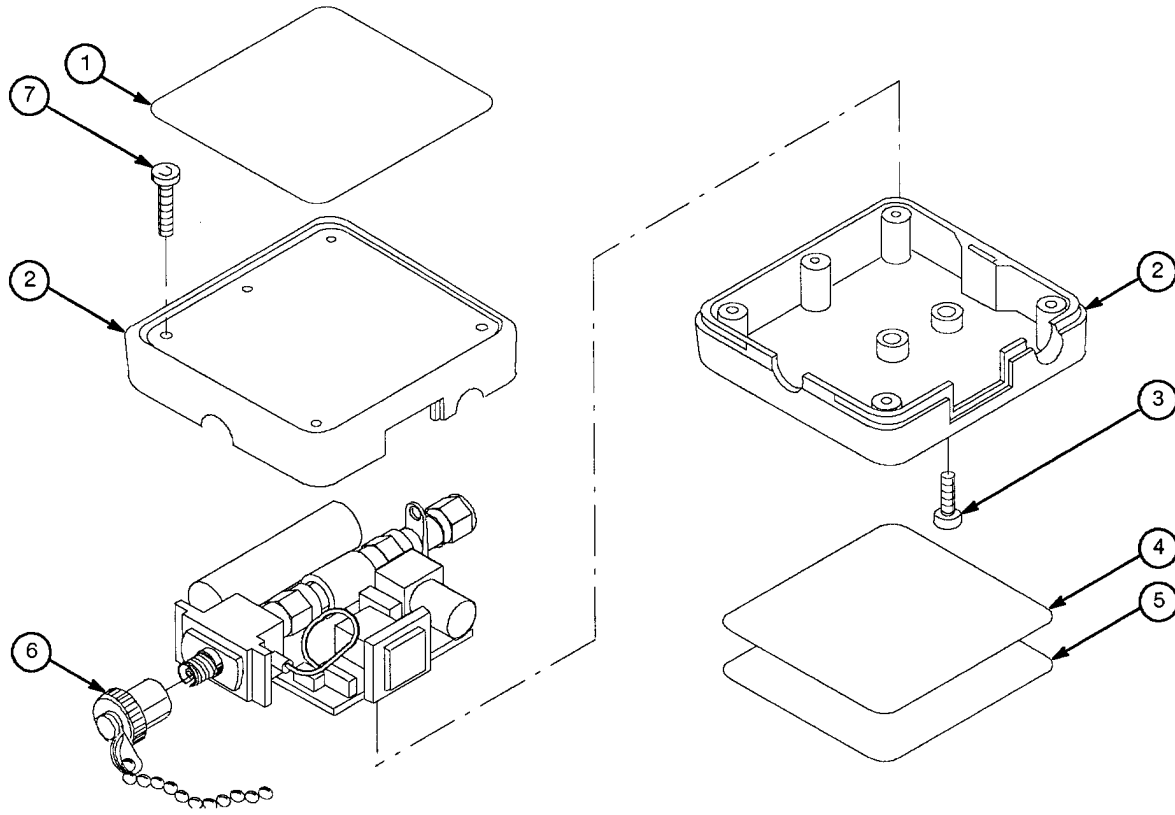
Attaching parts always appear at the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. Attaching parts must be purchased separately, unless otherwise specified.

Abbreviations

Abbreviations conform to American National Standards Institute (ANSI) standard Y1.1

CROSS INDEX – MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001



Index No.	Tektronix Part No.	Serial No.		Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont				
1	334-7714-00			1	MARKER, IDENT: SA-42	80009	334-7714-00
2	380-0800-00			1	HOUSING, OUTER: SA-42	80009	380-0800-00
3	211-0668-00			2	SCREW, CAP: 2-56 X 0.188	80009	211-0668-00
4	334-7781-00			1	LABEL, CALIBRATION: SA-42	80009	334-7781-00
5	334-7782-00			1	LABEL, IDENT, MARKED: SA-42	80009	334-7782-00
6	200-3658-00			1	COVR, CAP/CHAIN	80009	200-3658-00
7	211-0278-00			5	SCREW, MACHINE: 2-56 X 0.5 CAP	80009	211-0278-00
STANDARD ACCESSORIES							
	070-7733-00			1	MANUAL, TECH: INSTR, SA-42	80009	070-7733-00
	016-1066-00			1	CASE, CARRYING: SA-42	80009	016-1066-00
	119-3716-00			1	POWER SUPPLY, CHARGER	80009	119-3716-00
	174-1966-00			1	CABLE, ASSY, SP, ELEC: LEMO-LEMO	80009	174-1966-00
	015-1020-00			1	CONN, PLUG, ELEC, SMA, SHORT	80009	015-1020-00
	015-1011-00			1	ADAPTOR SMA TO SMA, PLUG-PLUG	80009	015-1011-00
	161-0104-00			1	STANDARD POWER CORD	80009	161-0104-00