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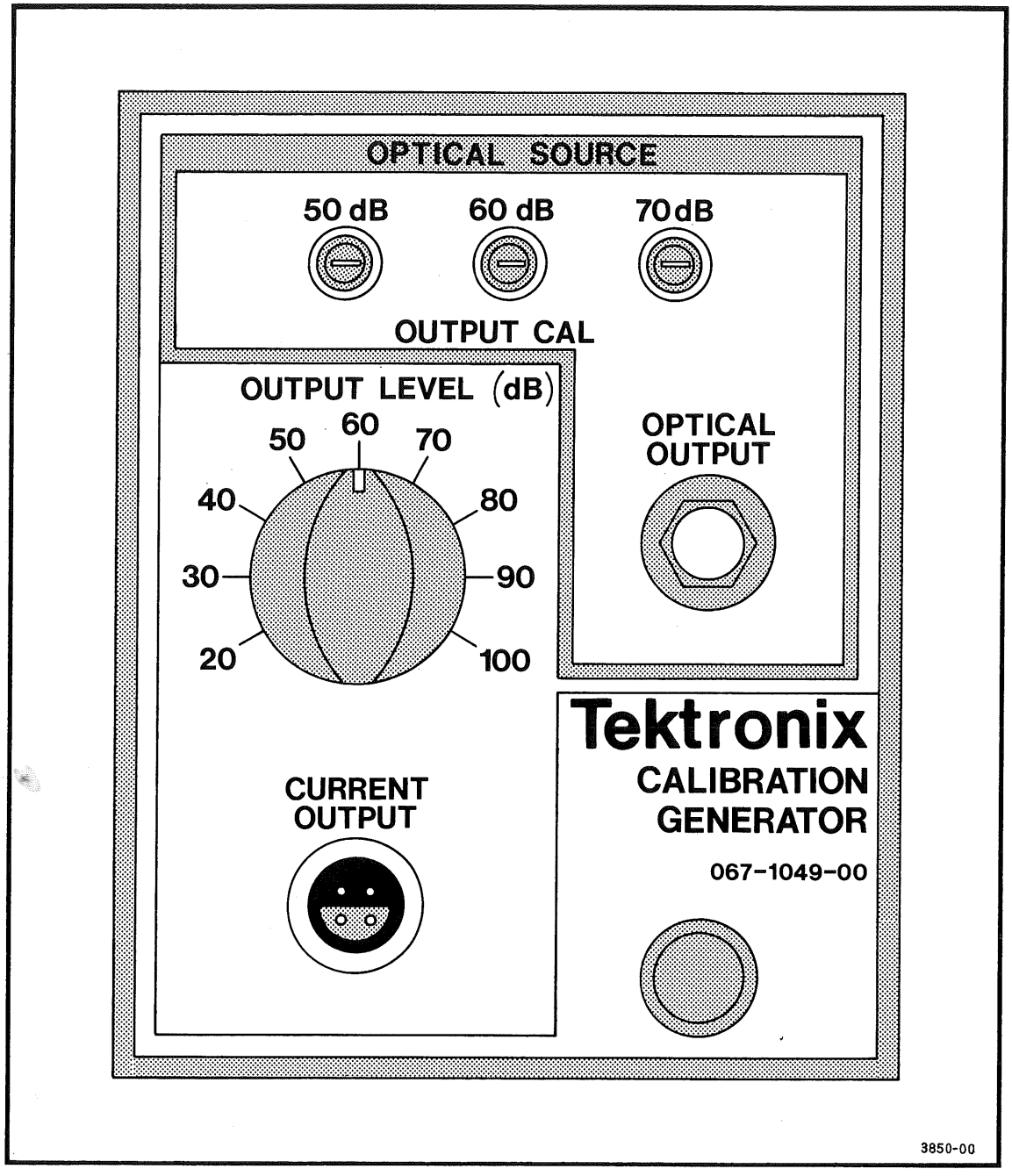
Instructions
OPTICAL CALIBRATION SIGNAL GENERATOR
067-1049-00



The 067-1049-00 Optical Calibration Signal Generator.

070-3850-00

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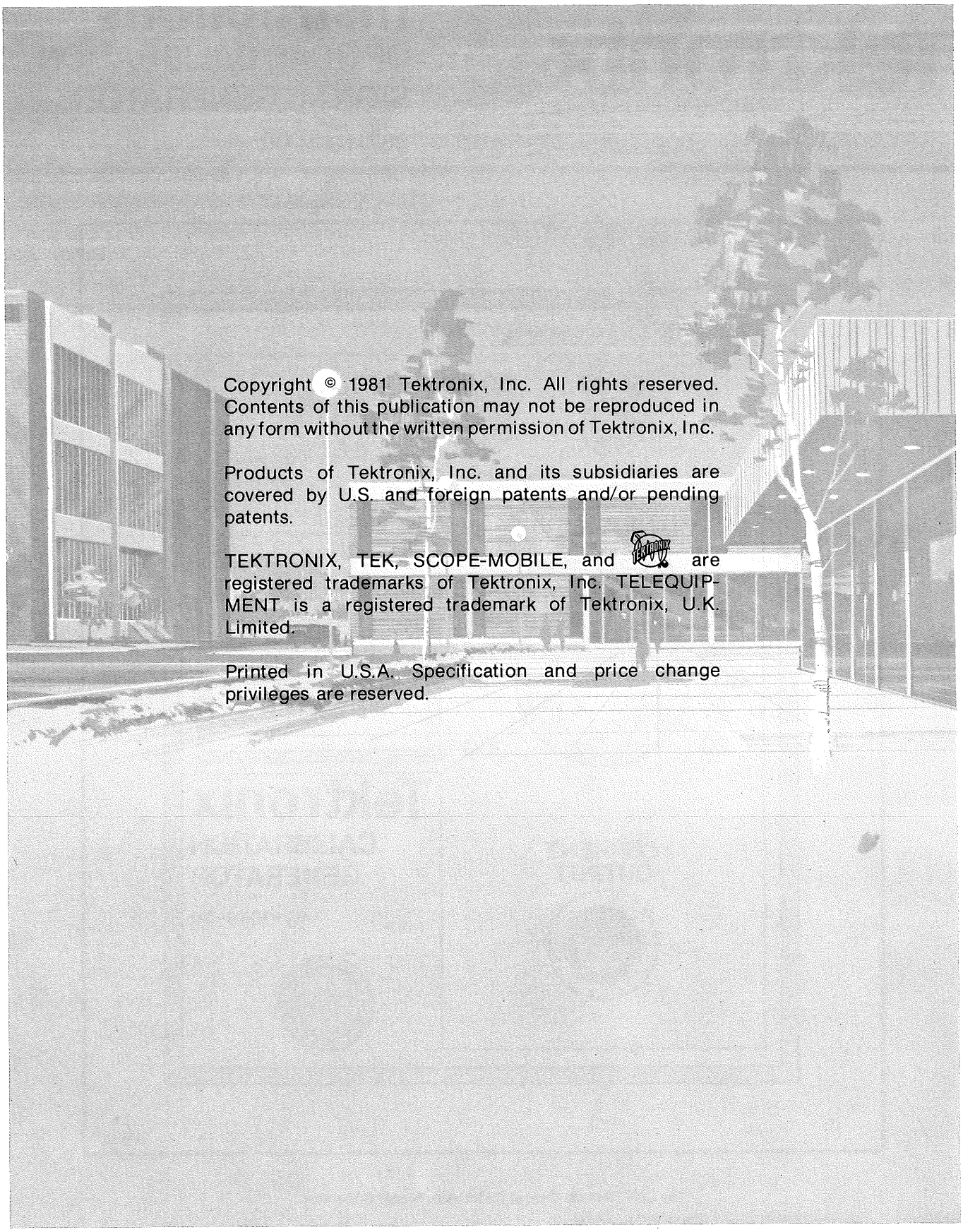

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SAFETY SUMMARY

TERMS

In This Manual

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.

As Marked on Equipment

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

SYMBOLS

In This Manual

This symbol indicates where applicable cautionary or other information is to be found.

As Marked on Equipment

DANGER—High voltage.

Protective ground (earth) terminal.

ATTENTION—refer to manual.

Do Not Service Alone

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

Use Care When Servicing With Power On

Dangerous voltages exist at several points in this product. To avoid personal injury, do not touch exposed connections and components while power is on.

Disconnect power before removing protective panels, soldering, or replacing components.

GENERAL INFORMATION AND SPECIFICATION

PRODUCT DESCRIPTION

The Optical Calibration Signal Generator (OSCG) is a calibration fixture for the OF150 Fiber Optic Time Domain Reflectometer. The OCSG supplies three optical signal levels that may be used to verify the vertical scale of the OF150 display. These signal levels are 50 dB, 60 dB, and 70 dB, referenced to the bottom of the display. Nine electrical signal levels are provided for calibration of the OF150 Log Amplifier circuit. These signals are provided in 10 dB steps from 20 dB to 100 dB.

The OCSG has two operating modes. CAL, when selected, allows the OCSG optical output levels to be adjusted and their power content verified with an optical power meter. RUN, when selected, allows the OCSG to be used as a signal generator for calibration of the OF150. The OF150 is the power source for the OCSG.

NOTE

The OCSG will need to be recalibrated if the Fiber Optic Cable is removed.

SPECIFICATION

The following list of instrument characteristics and features apply to the Optical Calibration Signal Generator after a 10 minute warmup in 20°C ambient air.

The Performance Requirement column describes the limits of the characteristic and the Supplemental Information column describes features and typical values of information that may be useful to the user.

Table 1-1
OPTICAL AND ELECTRICAL CHARACTERISTICS

Characteristic	Performance Requirement	Supplemental Information
Optical Output Amplitude		
CAL mode		
at 70 dB	0.110 μW average power out of fiber, ±5%	After adjustment
at 60 dB	match 70 dB output, ±1%	After adjustment
at 50 dB	match 70 dB output, ±1%	After adjustment
RUN mode		
at 70 dB	0.550 μW average power out of fiber, ±10%	23.1 μW peak
Optical Pulse Width		After adjustment Measured in 4.900 ns/m on the OF150 DISTANCE CAL
CAL mode		
at 70 dB	100 meters, ±5%	1 μs pulse width
at 60 dB	10 X 70 dB pulse width, ±1%	10 μs pulse width
at 50 dB	100 X 70 dB pulse width, ±1%	100 μs pulse width
RUN mode	510 meters, ±5%	5 μs pulse width

Table 1-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
Optical Output Step Accuracy		±0.1 dB when calibrated to optical power meter, for ambient temperature variations of less than ±5°
Electrical Output Amplitude		Measured with an external dc supply set to 8 V, ±1%
at 100 dB		8.0 V, ±5% into 499 Ω
at 90 dB		4.05 V, ±2% into 499 Ω
at 80 dB		1.11 V, ±2% into 499 Ω
at 70 dB		3.95 V, ±2% into 24.9 kΩ
at 60 dB		0.73 V, ±2% into 24.9 kΩ
at 50 dB		0.079 V, ±2% into 24.9 kΩ
at 40 dB		7.50 V, ±2% open
at 30 dB		0.74 V, ±2% open
at 20 dB		0.0755 V, ±2% open
Electrical Pulse Width		50 μs, ±10%

Table 1-2
ENVIRONMENTAL CHARACTERISTICS

Characteristic	Description
Temperature	
Operating	+10°C to +40°C
Non-operating	−25°C to +75°C
Altitude	
Operating	3.050 meters
Non-operating	12,000 meters
Vibration	5 to 55 Hz, 2 g maximum
Shock, operating and non-operating	30 g
Bench handling	10 cm topple, 45°, or point of balance
Fungus inert	Materials used are fungus inert
Package transit vibration	Tektronix Standard 062-2858-00, paragraph 9.1
Package drop	Tektronix Standard 062-2858-00, paragraph 9.2
Electrostatic discharge	Tektronix Standard 062-2862-00

This instrument meets the specifications of MIL-T-28800B, Type III, Class 6, Style E, with the exception of the Non-operating Temperature specification, and the Humidity specification.

Table 1-3
PHYSICAL CHARACTERISTICS

Characteristic	Description
Weight (including standard accessories, except Instruction manual)	0.4 Kg (0.9 lbs)
Dimensions	7600 X 6400 X 1780 mm (3.04 X 2.56 X 7.12 inches)

Table 1-4
STANDARD ACCESSORIES

Description	Qty
Optical Interface Cable	1
Electrical Interface Cable	1

Refer to the Replaceable Mechanical Parts list for Tektronix Part Number.

OPERATION

CONTROLS AND CONNECTORS (see Figure 2-1)

1 OUTPUT LEVEL (dB).
Nine selections in 10 dB steps, from 20 to 100. All nine selections are active for the CURRENT OUTPUT (electrical signals). Only the 50 dB, 60 dB, and 70 dB selections are active for the OPTICAL OUTPUT signals. When an optical signal level is selected, the equivalent electrical signal level is selected.

2 CAL/RUN.
This switch is located on the circuit board and it is accessible through a hole in the top cover of the OCSG. When looking at the front of the OCSG, push the switch to the right to select CAL. This configures the OCSG for calibration of its optical output signals. The RUN selection (push to left) configures the OCSG for operation as a signal generator.

3 OPTICAL OUTPUT.
Source of calibrated optical signals at 50 dB, 60 dB, or 70 dB levels.

4 CURRENT SOURCE.
Source of electrical signals in 10 dB steps from 20 dB to 100 dB (typical) levels.

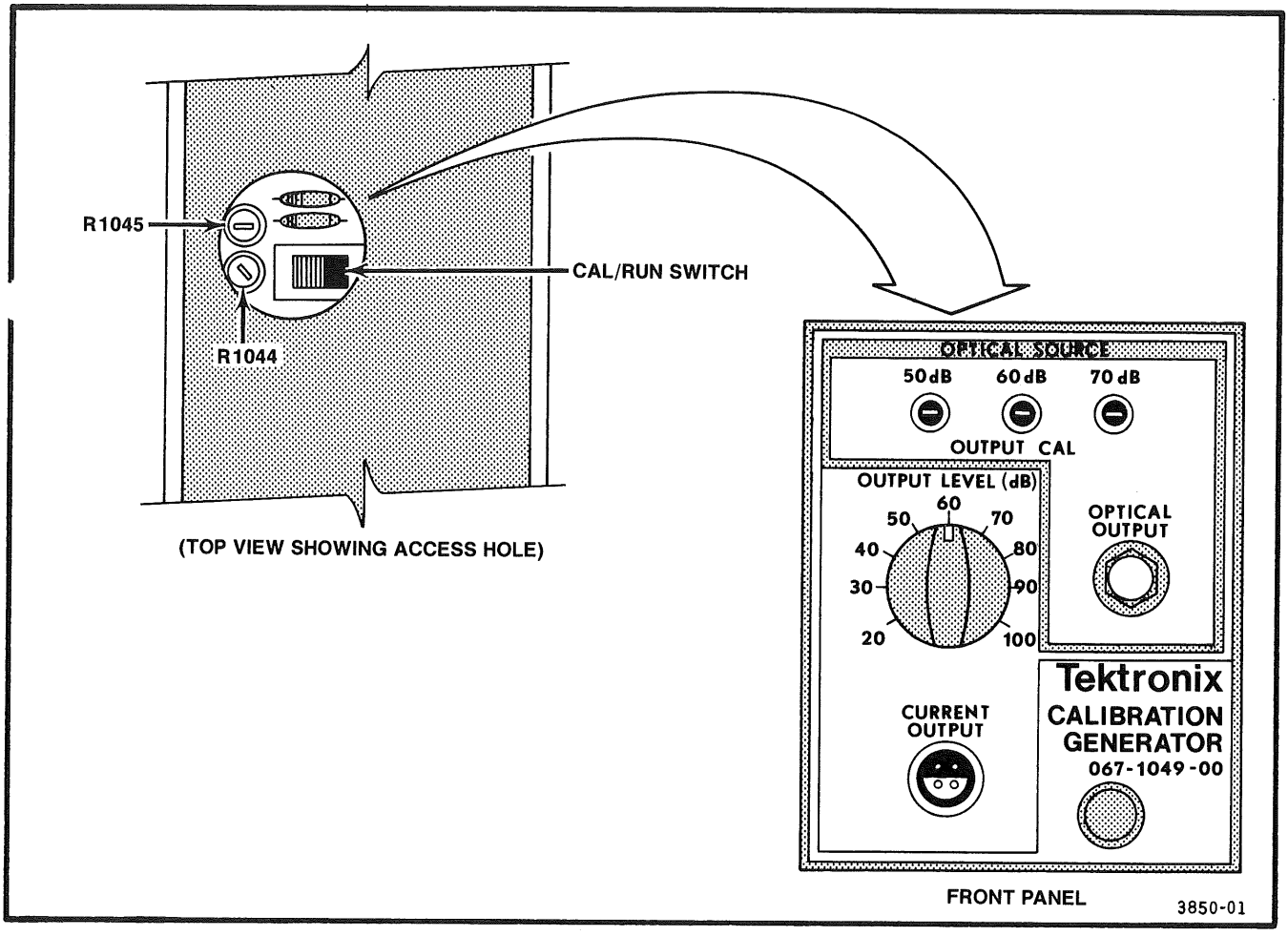

Fig. 2-1. OCSG Controls, Connectors, and Adjustments.

ADJUSTMENTS

1 OPTICAL SOURCE.
These three screwdriver adjustments are used to set the power output of the optical signal level selections.

2 PULSE WIDTH.
These two screwdriver adjustments are located on the circuit board and they are accessible through the hole in the top cover of the OCSG. The front potentiometer, R1044, is used to adjust the pulse width of the 50 dB optical signal. The rear potentiometer, R1045, is used to adjust the pulse width of the 60 dB optical signal.

NOTE

The voltage and current levels of the electrical signals from the CURRENT SOURCE are set by fixed resistors and are not adjustable.

PREPARATION FOR USE

The following procedure calibrates the pulse widths and power levels of the optical output signals. If this function is not required for a particular application, omit this procedure, set the CAL/RUN switch to RUN, insert the OCSG in the OF150 chart recorder compartment, and refer to the OF150 manual for setup and use instructions.

Equipment

The items required for calibration of the optical signals include:

Extender Module 068-1071-00

J6502 Irradiance Probe

J16 Photometer/Radiometer

Screwdriver, flat, 6 in. with 1/8 in. tip

Installation (for OCSG calibration)

1. Remove the chart recorder from the OF150.

2. Insert the Extender Module in the OF150 chart recorder compartment.

3. Attach the Extender Module cable to the circuit board connector at the rear of the OCSG (see Fig. 2-2).

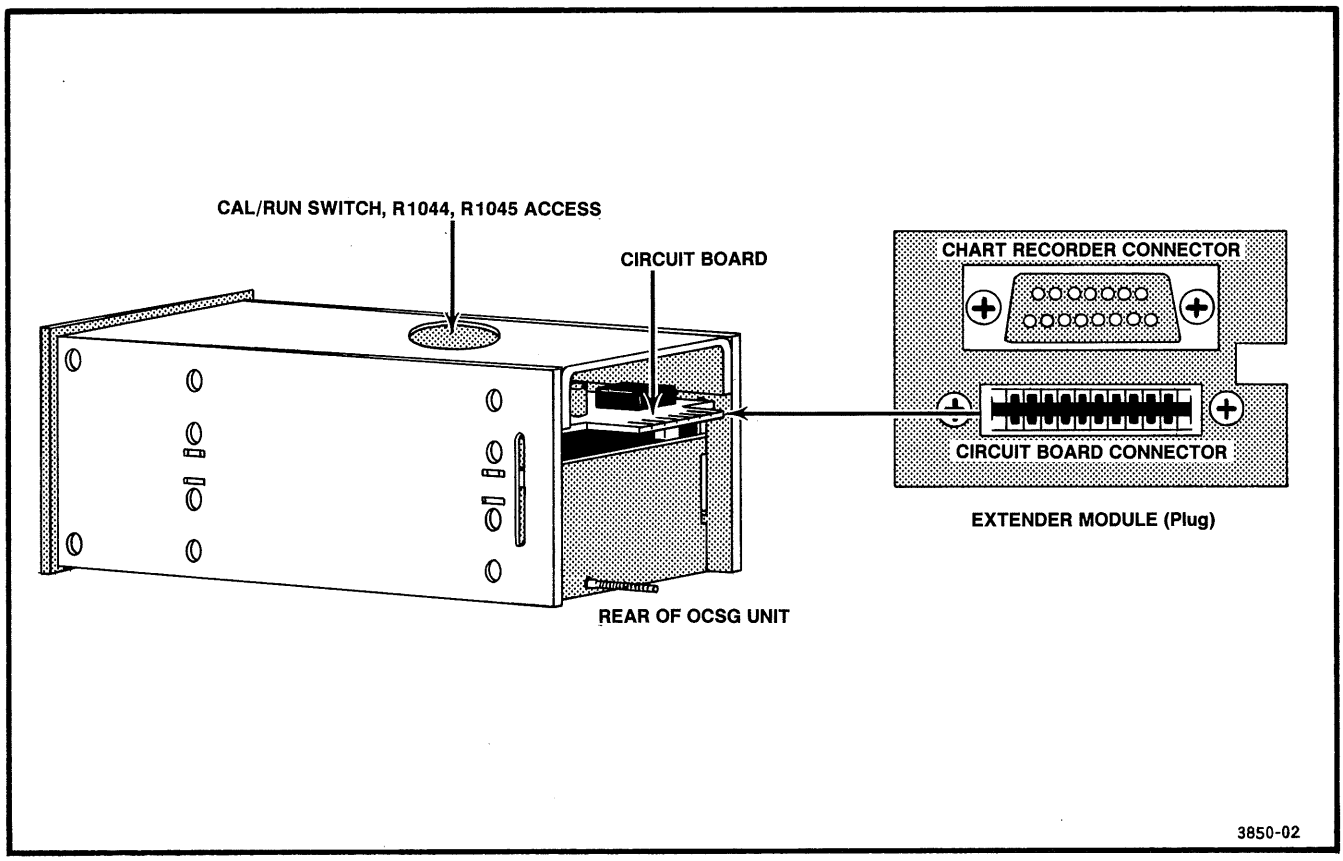

Fig. 2-2. OCSG to Extender Module cable connector.

CAUTION

The circuit board connector is not keyed. When correctly connected to the Extender Module cable, the connector that is used with the chart recorder is located above the OCSG connector as shown in Fig. 2-2.

4. Remove the protective dust caps and connect the Optical Interface cable to the Optical Output port of the OF150.

NOTE

A. Always keep these caps in place when the optical connectors are not in use, as the optic fiber connectors have an oil film and must be protected from foreign matter.

B. Do not sharply bend the Optical Interface cable.

CALIBRATION

1. Check Optical Signal Pulse Widths:
70 dB = 100 meters, ±5%
60 dB = 10 X 70 dB width, ±1% (R1045)
50 dB = 100 X 70 dB width, ±1% (R1044)

a. Control Settings

OCSG

CAL/RUN	CAL
OUTPUT LEVEL (dB)	70

OF150

Dist/Div	1
Filter	Fast
Vertical Scale	10 dB/Div
Readout Mode	Dist (meters)
Power	On
Marker	Set to zero

b. Press the OF150 Sweep control. A waveform showing the leading edge and the beginning of the 70 dB OCSG output pulse should be displayed. Adjust the vertical Position control to align the top of the displayed waveform with a graticule line to facilitate finding the point of the waveform's leading edge that is −10 dB from the peak (steady state) value.

c. Read and note the distance in meters between the −10 dB point and the zero Marker. This distance is typically 3 meters.

d. Change the OF150 Dist/Div to 20 and move the Marker to the trailing edge of the 70 dB waveform.

e. Return the OF150 Dist/Div to 1 and move the Marker to the −10 dB point of the waveform. Read and note the distance in meters at which the −10 dB below peak value occurs.

f. Add the distance found in part c to the distance found in part d. This sum is the −10 dB pulse width of the 70 dB OCSG output. The pulse width should equal 100 meters, ±5%.

NOTE

The check and adjustment procedure for the 60 dB optical output pulse width, 10 X the 70 dB pulse width, begins with part g.

g. Set the OUTPUT LEVEL (dB) to 60.

h. Set the OF150 Dist/Div to 200 and move the Marker to the end of the pulse.

i. Change the OF150 Dist/Div to 10.

j. Adjust the OF150 Marker control to produce a readout that is 10X the pulse width of the 70 dB optical signal output.

k. Position the display vertically to facilitate finding the −10 dB point on the trailing edge of the displayed waveform.

l. Read and note the point on the trailing edge of the waveform that is −10 dB below the peak (steady state) value.

m. If the reading at the −10 dB point is outside the limits, 10 X 70 dB pulse width, ±1%, press and hold Sweep and adjust R1045 as necessary.

NOTE

At this Dist/Div setting, one graticule division equals 1% of the Readout.

NOTE

The check and adjustment procedures for the 50 dB optical output pulse width, 100 X the 70 dB pulse width, begins with part n.

n. Set the OUTPUT LEVEL to 50.

o. Set the OF150 Dist/Div to 1000.

p. Use the OF150 horizontal Position control to move the trailing edge of the waveform on screen and set the Marker to the trailing edge.

q. Set the OF150 Dist/Div to 100.

r. Adjust the OF150 Marker control to produce a readout that is 100 X the 70 dB pulse width.

s. Position the display vertically to facilitate finding the −10 dB point of the displayed waveform.

t. Read and note the point on the trailing edge of the waveform that is −10 dB below peak value.

u. If the reading is outside the limits of 100 X the 70 dB pulse width, ±1%, press and hold Sweep and adjust R1044 as necessary.

2. Check and Adjust Power of Optical Output Levels

70 dB = 0.110 μW, ±5%
60 dB = 70 dB Power, ±1%
50 dB = 70 dB Power, ±1%

a. Disconnect the Optical Interface cable from the OF150 (replace cap on port) and connect the cable to the input connector of the J6502 Irradiance Probe.

b. Set the OUTPUT LEVEL to 70 dB.

c. Set the OF150 Filter to Slow.

d. Note the photometer (J16) reading and, if necessary, use a screwdriver and adjust OPTICAL SOURCE, 70 dB, for a (J16) display of 0.110 μW, ±5%.

NOTE

1. *If the Optical Interface Cable connection is improperly aligned with the OCSG OPTICAL OUTPUT port, the Optical Power Out cannot be adjusted to 0.110 μW. To align, loosen the cable connector, then while viewing the photometer, rotate the cable for maximum power indication. Tighten the connector and repeat part d.*

2. *The OCSG OPTICAL OUTPUT pulse is active only during an OF150 sweep function. When adjusting the POWER SOURCE levels, press Sweep as necessary to maintain an optical output pulse.*

e. Set the OUTPUT LEVEL to 60 dB.

f. Note the J16 reading and, as necessary, adjust OPTICAL SOURCE, 60 dB, for a J16 reading equal to the 70 dB power ±1%.

g. Set the OUTPUT LEVEL to 50 dB.

h. Note the J16 reading and, as necessary, adjust OPTICAL SOURCE, 50 dB, for a J16 reading equal to the 70 dB power ±1%.

i. Disconnect the Optical Interface cable and replace the protective caps.

CONFIGURATION OF THE OCSG AS A CALIBRATION FIXTURE FOR USE WITH THE OF150

1. Set the CAL/RUN switch to RUN.

2. Set the OUTPUT LEVEL to 70 dB.

3. Remove the chart recorder from the OF150.

4. Insert the OCSG into the chart recorder compartment.

5. Remove the protective caps from the Optical Interface cable and the OF150 Optical Output port, and connect the cable to the port.

6. Refer to the OF150 Instruction manual for OF150 calibration procedures.

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CIRCUIT DESCRIPTION

The OCSG contains two pulse generators to produce calibration signals for the OF150. Both generators are triggered by the PULSTRIG signal from the OF150, allowing them to be synchronized with the OF150 sampling system.

CURRENT PULSE GENERATOR

The current output pulse is generated by the monostable multivibrator, UF150B. The 50 μsec wide output pulse is then level shifted by VR2030 to drive output switch Q2024. The collector of Q2024 is switched between ground and +8 volts (supplied by U2052). The output pulse is applied to the output cable through S1000A and resistor network R2010 through R2017. This resistor network, in conjunction with a network located on the OF150 Input Log Amplifier, generates a current pulse to be connected in place of the Avalanche Photo Diode for calibrating the OF150 vertical scale display.

OPTICAL PULSE GENERATOR

The optical pulse is generated by switching the drive current to an infrared LED, DS10. The width of the pulse is set by U1050A and is a function of S1040 (CAL/RUN) and S1000E. In the RUN position, the pulse width is approximately 5 μsec and independent of the S1000E position. In CAL mode, the pulse width is selected by S1000E (1 μsec, 10 μsec, and 100 μsec at 70 dB, 60 dB, and 50 dB, respectively).

The output of U1050A drives a current switch formed by Q2042 and Q2044. The current that is switched by the FETs is generated by the current source consisting of U2038, Q2032, and a current sense resistor selected by S1000D. Transistor Q2034 buffers the output of the current source from high speed switching transients.

The reference voltage for the current source is developed across a resistor (R10, R12, or R14) selected by S1000C. The reference current that develops this voltage is generated by a temperature-compensated current source formed by U1056, Q1056, U1058, and resistor network R1053-R1058. Temperature compensation is used to stabilize the optical output as a function of temperature.