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Instruction Manual

Tektronix

P6701A, P6703A, P6711 & P6713 O/E Converters

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General Information

This manual is divided into six sections.

- Section 1 describes the P6700 Series Optical-to-Electrical Converters and includes specifications for each model.
- Section 2 explains how to operate the your optical-to-electrical converter.
- Section 3 discusses the theory of operation.
- Sections 4 and 5 provide performance check and adjustment procedures that you can perform on your instrument to verify its accuracy.
- Section 6 describes preventive maintenance, outlines the procedure for returning your Optical-to-Electrical 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 P6700 Series are analog optical-to-electrical (O/E) converters that convert an optical input signal into an electrical output signal for display on an oscilloscope equipped with the TEKPROBE® interface or any other oscilloscope when used in conjunction with the Tektronix 1103 TEKPROBE Interface Power supply.

Use of the TEKPROBE interface allows the oscilloscope to supply power to the probe, automatically determine and display the proper scale factor (in microwatts of optical power) and set the input termination to the required 50 Ω.

The P6700 Series consists of four products: P6701A, P6703A, P6711 and P6713. The P6700 Series converters have an added DC stable circuit from decreased offset drift (≤1 μW). This improves the performance for extinction ratio measurements and absolute optical power levels. The P6711 and P6713 have increased gain and lower noise, thus have improved the sensitivity of the converters and are excellent choices for LED measurements. Their optical characteristics are described in Table 1-1 and electrical characteristics are described in Table 1-2.

Input to the converters is through an SMA-style fiber optic connector (FC style available in Option 01, ST style available in Option 02, and DIN 47256 available in Option 03). Most manufacturers SMA-style connectors are compatible with this connector.

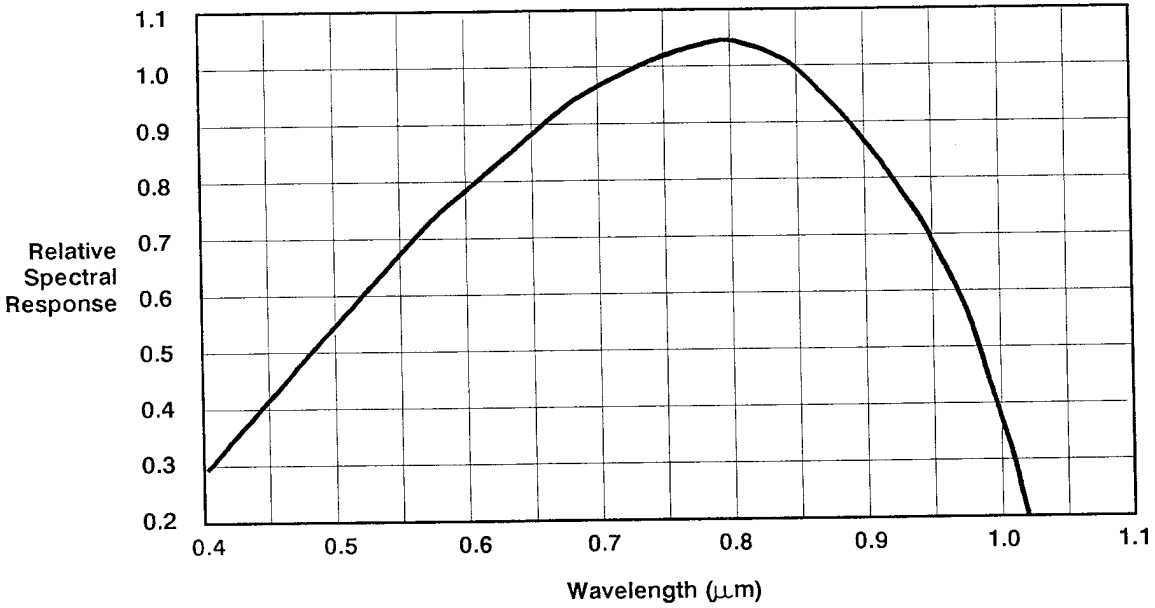


Figure 1-1: Normalized Spectral Response for the P6701A and P6711

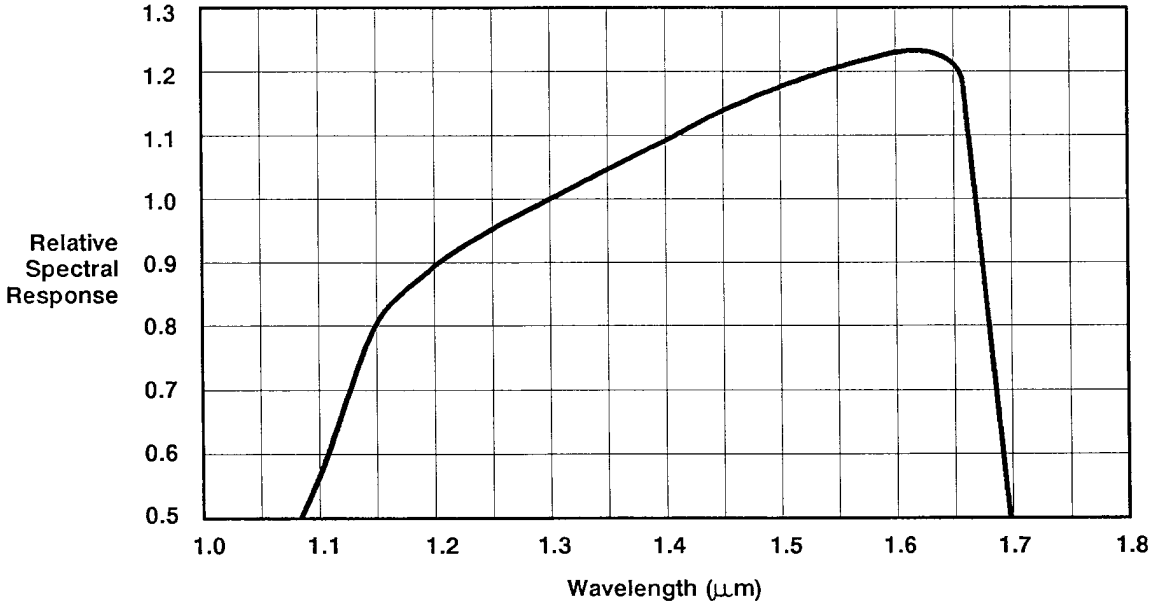


Figure 1-2: Normalized Spectral Response for the P6703A and P6713

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.

Accessories

The P6700 Series O/E converters are shipped with the following standard accessories:

1 Instruction Manual

1 Carrying Case

Part numbers, options, optional accessories, and related products are listed in Replaceable Parts (Section 7).

Performance Conditions

The electrical characteristics listed in Table 1-1 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 1-3.

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 converters physical characteristics are listed in Table 1-4.

Table 1-1. Optical Characteristics

Characteristic	Performance Requirement	Supplemental Information
Wavelength Range		
P6701A, P6711	500 to 950 nm.[1]	Calibrations made at 850 nm.
P6703A, P6713	1100 to 1700 nm[1]	Calibrations made at 1300 nm.
Optical Input:		
P6701A, P6711	Accepts fiber up to 200 μm core diameter. NA[2] ≤0.29.[1]	
P6703A, P6713	Accepts fiber up to 100 μm core diameter. NA[2] ≤0.29.[1]	

[1]**Performance requirement not checked in manual.**
[2]**Numerical Aperture.**

Table 1-1. Optical Characteristics (Cont.)

Characteristic	Performance Requirement	Supplemental Information
Maximum Optical Input for Linear Output		
P6701A, P6703A	1 mW[1]	
P6711, P6713	200 μW[1]	
Absolute Maximum Nondestructive Optical Input	10 mW[1]	

[1]Performance requirement not checked in manual.

Table 1-2. Electrical Characteristics

Characteristic	Performance Requirement	Supplemental Information
Conversion Gain		
P6701A	1 V/mW ±8% at DC, 850 nm	
P6703A	1 V/mW ±8% at DC, 1300 nm	
P6711	5 V/mW ±8% at DC, 850 nm	
P6713	5 V/mW ±8% at DC, 1300 nm	
Bandwidth	(–3 dB optical, –6 dB electrical)	
P6701A	DC to 850 MHz	
P6703A	DC to 1 GHz	
P6711	DC to 250 MHz	
P6713	DC to 300 MHz	

Table 1-2. Electrical Characteristics (Cont.)

Characteristic	Performance Requirement	Supplemental Information
Noise Equivalent Power	Referenced to input	
P6701A	≤1 μW (rms)	
P6703A	≤1 μW (rms)	
P6711	≤250 nW (rms)	
P6713	≤200 nW (rms)	
Rise time		Converter only, excludes system rise time. Measured using integration of optical impulse response. Peak output during impulse ≤100 mV.
P6701A	≤600 ps	
P6703A	≤500 ps	
P6711	≤2 ns	
P6713	≤1.6 ns	

Table 1-2. Electrical Characteristics (Cont.)

Characteristic	Performance Requirement	Supplemental Information
Aberrations	$\leq \pm 10\%$, 15% p-p total	Measured using integration of optical impulse response. Peak output voltage during impulse $\leq$100 mV.
Output Zero	$\leq \pm 1$ mV, 20–25°C	
Output Zero Drift	$\leq \pm 1.5$ mV, 0–55°C	
Output Load Requirements	50 Ω $\pm 1\%$[1]	
Output Impedance	50 Ω $\pm 10\%$[1]	
Power Requirements	TEKPROBE Interface	+15 V DC $\pm 4\%$, 30 mA max.[1] +5 V DC $\pm 4\%$. 60 mA max.[1] -5 V DC $\pm 4\%$. 60 mA max.[1] -15 V DC $\pm 4\%$. 20 mA max.[1] <10 mV ripple (20 Hz to 500 kHz).

[1]**Performance requirement not checked in manual.**

Table 1-3. Environmental Characteristics

Characteristic	Information
Temperature Range (Operating)	0°C to +50°C (32°F to +131°F).
Temperature Range (Nonoperating)	−55°C to +75°C (−67°F to +167°F).
Humidity	Five cycles (120 hr.) 90% +5% −0%, relative humidity at 30°C to 60°C.
Transportation	Qualifies under National Safe Transit Association's Pre-shipment Test; 1A-B-1.
Electrostatic Immunity	Will withstand discharge of a 500 pF capacitor charged to 20 kV, through a 1 kΩ resistor (to TEKPROBE interface pins).

Table 1-4. Physical Characteristics

Characteristic	Information
Net Weight (includes accessories)	70 g (2.5 oz).



Operating Instructions

This section of the manual is intended to familiarize you with the use of your P6700 Series O/E Converter.

NOTE

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

Converter Handling

The P6700 Series O/E Converters and their accessories should be handled carefully at all times. Avoid dropping the converter assembly since damage and misalignment of the photodiode optical assembly can result. The dust cap should be installed over the end of the optical input assembly when a fiber optic connector is not attached. Avoid crushing, excessively bending or crimping the fiber optic cables.

Converter Cleaning

The converter needs very little cleaning. The optical input in particular can be damaged by excessive or improper cleaning. Reduce the need for cleaning by installing the protective cap over the input when it is not being used. Refer to ***Maintenance*** for cleaning procedures.

Connections

BNC Locking Ring

The BNC Locking Ring locks the converter onto the host instrument and houses the TEKPROBE interface connections (described below).

TEKPROBE Interface (Level 2)

Provides connections for power, signal, and data transfer, and allows the oscilloscope system to automatically set the scale factor (in mW) and input termination.

Optical Input Connector

Allows connection to a fiber optic cable with an SMA, FC, ST or DIN 47256 connector (depending on the converter option). Cleaning and replacement instructions are included in ***Maintenance*** (Section 6).

Operating Considerations

Optical Input

The P6701A and P6711 can be connected to optical fibers with a core diameter of up to 200 μm (Numerical Aperture (NA) < .29) through an SMA, FC, ST or DIN 47256 connector (depending on the converter option). The P6703A and P6713 can be connected to optical fibers with a core diameter of up to 100 μm (Numerical Aperture (NA) < .29) through an SMA, FC, ST or DIN 47256 connector (depending on the converter option). Most manufacturer's SMA-style optical connectors will connect to the converter. It is recommended that the straight-ferrule SMA connector that does not require use of a plastic alignment sleeve be used (Amphenol 905 or equivalent). If a stepped-style connector (Amphenol 906 or equivalent) is used, adapter cables are available as optional accessories.

NOTE

The stepped connection itself will connect with the converter, but the alignment will be poor without the use of a short, plastic sleeve. If a sleeve is used to improve alignment it may become lodged in the converter and be difficult to remove.

Adapter cables that aid in connecting many other popular optical connectors are also available (see ***Optional Accessories***).

The converter uses a rod lens to focus the light from the end of the fiber onto a large area (400 μm diameter in P6701A and P6711, 350 μm diameter in P6703A and P6713) photodiode. The use of this technique makes the unit readily adaptable to a large range of fiber sizes and numerical apertures while making it relatively insensitive to minor misalignment of the fibers in the connector. The P6701A and P6711 are calibrated for a wavelength of 850 nm. For any other wavelength in the range of 500 nm to 950 nm, the conversion gain can be determined from the responsivity curve shown on the converter cover and in ***Specifications*** (Section 1, Figure 1-1). The P6703A and P6713 are calibrated for a wavelength of 1300 nm. For any other wavelength in the range of 1100 nm to 1700 nm, the conversion gain can be determined from the responsivity curve shown on the converter cover and in ***Specifications*** (Section 1, Figure 1-2).

Output

The P6701A converts input optical power (0 to + 1 mW) into a corresponding output voltage ranging from 0.0 V to + 1.0 V (into a 50 Ω load, a conversion gain of 1 V/mW at 850 nm). The converter output is displayed as mW on the oscilloscope screen.

The P6703A converts input optical power (0 to +1 mW) into a corresponding output voltage ranging from 0.0 V to +1.0 V (into a 50 Ω load, a conversion gain of 1 V/mW at 1300 nm). The converter output is displayed as mW on the oscilloscope screen.

The P6711 converts input optical power (0 to +200 μW) into a corresponding output voltage ranging from 0.0 V to +1.0 V (into a 50 Ω load, a conversion gain of 5 V/mW at 850 nm). The converter output is displayed as mW on the oscilloscope screen.

The P6713 converts input optical power (0 to +200 μW) into a corresponding output voltage ranging from 0.0 V to +1.0 V (into a 50 Ω load, a conversion gain of 5 V/mW at 1300 nm). The converter output is displayed as mW on the oscilloscope screen.



Theory of Operation

This section is intended to provide a general description of how the P6700 Series O/E converters develop the output signal.

A P6700 Series O/E Converter can be divided into the following functional blocks:

- Optical Input
- High Frequency Amplifier
- Flexible Circuit Board and Interconnects

Optical Input

The optical input to the converter is supplied through the input fiber optic connector to a large area photodiode that is tolerant of minor misalignment. The optical signal is focused on the photodiode surface by means of a rod lens. Photons are absorbed at the photodiode, generating a current proportional to the optical input power. For the P6701A and P6711, the converter is calibrated so that this current is converted to 1 V/mW and 5 V/mW, respectively, with an optical-input wavelength of 850 nm. For the P6703A and P6713, the converter is calibrated so that this current is converted to 1 V/mW and 5 V/mW, respectively, with an optical-input wavelength of 1300 nm. (The responsivity of the photodiode depends on the wavelength of the input source. See Figure 1-1 and 1-2 for responsivity at other wavelengths.)

High-Frequency Amplifier

Input to the high-frequency amplifier is equal to the current generated in the photodiode. The amplifier consists of two transimpedance amplifier stages cascaded in series. A transimpedance amplifier converts an input current to an output voltage according to the relationship shown in Figure 3-1.

For lowest noise a large feedback resistor is desired, but this also decreases bandwidth. For example, in the P6703A a first stage feedback resistor of 825 Ω allows a bandwidth of 1 GHz to be achieved with an equivalent input noise level of <1 μW.

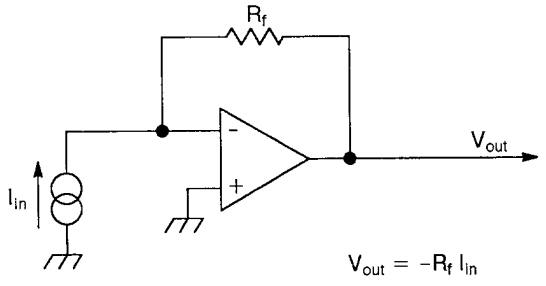


Figure 3-1: Transimpedance Amplifier

Flexible Circuit Board Interconnects

The flexible circuit board includes a factory-programmed ROM (U1010) that stores data (such as converter model, identification number, and coding information) for the oscilloscope system. It also provides the signal path.

Performance Check Procedure

The Performance Check Procedure is used to verify the converters performance requirements as listed in ***Specification*** (Section 1), and to determine the need for readjustment. This procedure may also be used as an acceptance check and a test of the converter after repair.

Test Equipment Required

Test equipment described in Table 4-1 is a complete list of equipment required to accomplish both the ***Performance Check Procedure*** in this section and the ***Adjustment Procedure*** in Section 5. 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 converter is used with an 11000 Series Oscilloscope system. Procedures or portions of procedures may vary when converters are used in other configurations or systems, or with 11000 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	1 GHz bandwidth, FFT capability	Tektronix 11403A with 11A72 and 11A32 vertical amplifiers. Any oscilloscope with FFT may be used in lieu of the 11403A.
Optical Impulse Generator	Rise Time, Aberrations, Bandwidth	<100 ps width and wavelength as listed below	
P6701A, P6711		850 nm	OIG 501
P6703A, P6713		1300 nm	OIG 502

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

Item Description	Procedure Where Used	Performance Requirement	Recommended Example
Optical Source	Conversion Gain, Low Frequency and High Frequency Compensation.	Wavelength as listed below	
P6701A, P6711		850 nm >1 mW output DC coupled >1 MHz BW	Tektronix 802-9249-06 Laser Diode Driver/Controller with 119-5020-00 laser[1]
P6703A, P6713		1300 nm >1 mW output DC coupled >1 MHz BW	Tektronix 802-9249-06 Laser Diode Driver/Controller with 802-1301-11 laser[1]
Optical Attenuator	Conversion Gain, Risetime & Aberrations, Bandwidth	>40 dB	JDS Model 5000L
Optical Power Meter	Conversion Gain	5% accuracy, 100 nW resolution	Hewlett Packard HP8152A

[1]Specify custom FC Modification when ordering.

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

Item Description	Procedure Where Used	Performance Requirement	Recommended Example
Electrical Pulse Generator	Low Frequency High Frequency Compensation	DC Coupled differential ECL output risetime <1 μs	Tektronix PG 503 or equivalent.[2]
Power Supply	For 802-9249-06	±5 V, 1 A	Tektronix PS 503A[2]
Low Capacitance Alignment Tool	All adjustments.		Tektronix part number 003-0675-00 or equivalent.

[2]Requires TM 500 or TM 5000-Series power-module mainframe.

Limits and Tolerances

The limits and tolerances given in these procedures are for the O/E converter 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). Each of the following checks can be independently performed.

Output Zero

Equipment Required (see Table 4-1):

Oscilloscope System

1. From the oscilloscope MEASURE major menu, select the MEAN measurement from the Measurements pop-up menu, and set VERT OFFSET to 0. Set the plug-in input impedance to 50 Ω.
2. Display a waveform, measure the mean value and verify that the vertical channel is properly nulled. If it is not, rezero the channel.
3. Connect the O/E converter and set vertical sensitivity to:

   P6701A and P6703A:1 μW/DIV

   P6711 and P6713: 200 nW/DIV
4. Display an output waveform and note its mean value and verify that the output zero is:

   P6701A and P6703A: < 1 μW

   P6711 and P6713: < 200 nW

Conversion Gain

NOTE

To ensure an accurate display, you should make certain that the converter is within the linear operating region (0 to 1.0 V) in all checks.

Please refer to Figure 4-1 for this check.

Equipment Required (see Table 4-1):

Oscilloscope with 11A32 plug-in

Optical Source

Optical Attenuator

Optical Power Meter

1. Attach the optical source to the power supply. Connect the optical source to the optical power meter using the appropriate optical cable.

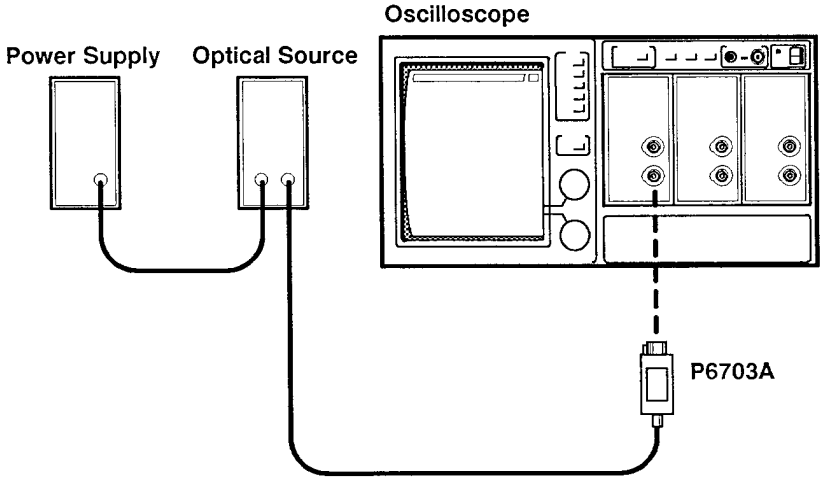


Figure 4-1: Conversion Gain and Offset Gain Check Setup

2. Following the instructions provided with the Laser Diode Driver/Controller, adjust the optical source to provide stable output by turning the I-bias and I-mod currents off and adjusting the I-mon current to provide the output power level required.

   P6701A and P6703A: 0.5 mW

   P6711 and P6713: 100 μW

3. Connect the converter to the oscilloscope input. Set the vertical sensitivity to:

   P6701A and P6703A: 100 μW/DIV

   P6711 and P6713: 20 μW/DIV

4. Measure and note the converter output MEAN with no input signal applied.

5. Connect the optical source output to the input of the converter.

6. Verify that the change in the converter output is :

   P6701A and P6703A: 0.5 mW ±8%

   P6711 and P6713: 100 μW ±8%

Rise Time, Aberrations and Bandwidth

Equipment Required (see Table 4-1):

11403A Oscilloscope and 11A72 plug-in

OIG 501 or OIG 502 Optical Impulse Generator

TM 500 or 5000 mainframe

Optical Attenuator

50 Ω cable

1. Connect the converter to the oscilloscope system.
2. Connect the trigger out from the OIG to the trigger input of the oscilloscope.
3. Connect the OIG output to the optical attenuator and the attenuator to the converter input.
4. Set the OIG to 1 MHz rate and adjust for a triggered display. Set the Energy Mode to Low on the OIG.

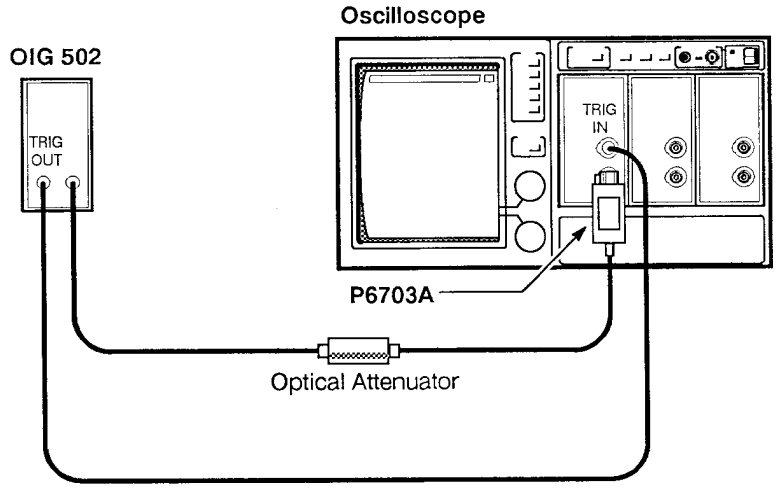


Figure 4-2: Bandwidth Check Setup

5. Adjust the attenuator to provide a peak converter output of approximately:

   P6701A and P6703A: 100 μW

   P6711 and P6713: 20 μW

6. Set the vertical scale to display approximately 5 divisions. Set the time base so that the pulse width is approximately 0.5 division wide and in the center of the time window.

7. Store the displayed waveform.

8. Recall the stored waveform and measure the mean value of the waveform in the period preceeding the pulse.

9. Define a new waveform to be the integral of the stored waveform minus the mean value determined in step 8. The resultant waveform should be the step response of the converter.

10. Measure the rise time and aberrations. Calculate the converter rise time using 350 ps as the oscilloscope system rise time.

$$t_{probe} = \sqrt{t^2_{measured} - t^2_{oscope}}$$

11. Verify that the rise time and aberrations are as follows:

    P6701A: rise time – $\leq$ 600 ps, aberrations: $\leq \pm 15\%$, 20% p-p

    P6703A: rise time – $\leq$500 ps, aberrations: $\leq \pm 15\%$, 20% p-p

    P6711: rise time – $\leq$2 ns, aberrations: $\leq \pm 10\%$, 15% p-p

    P6713: rise time – $\leq$1.6 ns, aberrations: $\leq \pm 10\%$, 15% p-p

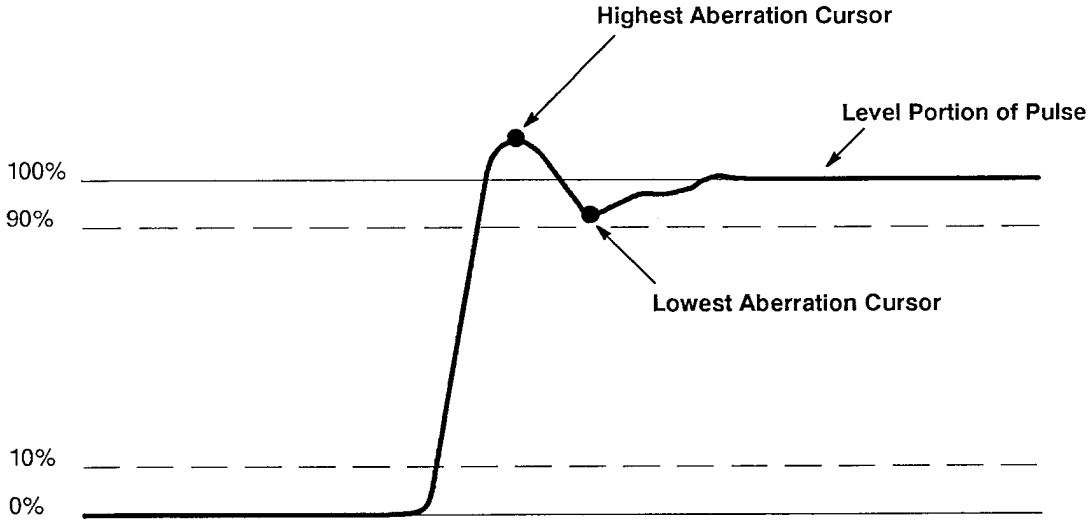


Figure 4-3: Typical Aberration Averaging Display

12. Take the FFT of the stored impulse response. Verify that:

P6701A: −8 dB point > 850 MHz
(−3 dB optical, −6 dB electrical converter bandwidth adjusted for system bandwidth)

P6703A: −9 dB point > 1 GHz

P6711: −6 dB point > 250 MHz

P6701A: −6 dB point > 300 MHz

Noise

Equipment Required (see Table 4-1):

11403A Oscilloscope and 11A72 plug-in for P6701A and P6703A

11A32 plug-in for P6711 and P6713

1. Connect the converter to the 11A72.
2. Set trigger level to maximum (for untriggered waveform), set the vertical scale to maximum sensitivity, and set the time base to 10 ns/DIV, trigger mode to Auto, and adjust for a stable, repetitive waveform.
3. Store the displayed waveform, recall the displayed waveform and measure the mean value.
4. Define a new waveform to be the stored waveform minus its mean value. The defined waveform should have a mean value of nearly zero.
5. Verify the defined waveform has an RMS value of:

   P6701A: $< 1\ \mu W$

   P6703A: $< 1\ \mu W$

   P6711: < 250 nW

   P6713: < 200 nW

This concludes the P6700 Series performance checks.

Adjustment Procedure

This section contains the information necessary to perform the HF gain and LF gain adjustments for the P6700 Series O/E Converters. The adjustment procedures are not intended to be troubleshooting guides. However, any deficiency found during the performance of each adjustment step should be corrected before continuing. Tektronix Field Service Centers and the Factory Service Center provide instrument repair and adjustment service. Refer to Section 6 for further repair information.

The top cover of the converter must be removed to make the following adjustments. Instructions for removing the covers are given in Section 6 (***Maintenance***).

Test Equipment Required

Test equipment described in Table 4-1 is a complete list of equipment required to accomplish the Adjustment Procedure. (However, for these adjustments, the Oscilloscope System, may be any 11000 Series Oscilloscope and vertical plug-in.)

These procedures were written for use when the converter is used with an 11000 Series oscilloscope System. Procedures or portions of procedures may vary when converters are used in other configurations or systems, or with 11000 Series systems with firmware updates not available at the time of publication.

Preparation

Before proceeding with checks, allow sufficient warm-up time for test equipment to stabilize (typically 20 minutes).

Refer to Figure 5-1 for the location of adjustments used in the following checks.

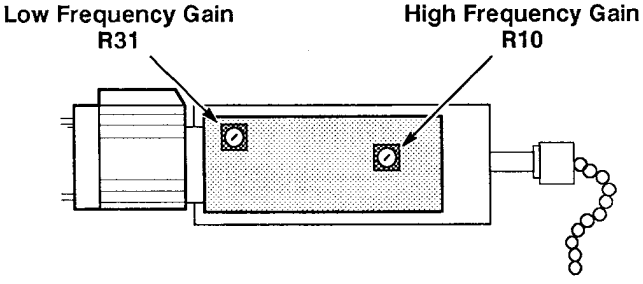


Figure 5-1: Adjustment Locations

Adjust LF Gain

Equipment Required (see Table 4-1):

Oscilloscope System

Optical Source

Optical Power Meter

TM 500 or 5000 mainframe

1. Ensure that the vertical amplifier is properly zeroed with the converter attached. If not, rezero the channel.

   P6701A and P6703A: 0.5 mW

   P6711 and P6713: 100 μW

2. Follow procedure for checking Conversion Gain.

3. Connect the optical source to the converter and adjust R31 until the converter output reads:

   P6701A and P6703A: 0.5 mW

   P6711 and P6713: 100 μW

Adjust HF Gain

Equipment Required (see Table 4-1):

Oscilloscope System
Optical Source
Optical Attenuator
Optical Power Meter
Adjustment Tool
ECL-to-Light Kit
LDC600
Pulse Generator (PG 503)
TM 500 or 5000 mainframe

1. Check output zero and LF Gain and adjust if necessary.
2. Adjust the output of the pulse generator to 1 kHz square wave and differential ECL output levels. Connect the pulse generator to the optical source.

3. Connect the optical source to the power meter. Set the pulse generator to Ext.trig. and use the complement button to switch the optical output. With the output set to low, check that the optical output is less than 250 nW. Switch the optical output to high and set the output level (using the I-mod potentiometer) to 500 μW for the P6701A and P6703A, or 100 μW for the P6711 and P6713.

4. Connect the optical output to the optical converter and set the modulation frequency to 1 kHz. Adjust the oscilloscope for a triggered display.

5. Adjust R10 so that the base line (low light level) is flat.

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

CAUTION

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

CAUTION

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 lbs. 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-velocity 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. 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 in the converter (refer to disassembly procedures provided later in this section to gain access to specific assemblies):

1. Ensure that all interconnections and mechanical components are functional.

2. Check the photodiode assembly by removing it and checking it on a curve tracer. The reverse-bias leakage current should be < 5 nA at 15 V. Diode response can be checked by directing a bright light (such as a flashlight) into the the optical-input connector. DO NOT disassemble the photodiode/lens assembly (see CAUTION under ***Assembly Replacement*** in this section).

3. Check the voltage levels at the junction of the flex circuit board and the main circuit board (refer to circuit diagrams in ***Replaceable Parts***). If there is a problem, separate the two boards.

4. Recheck the voltage levels where the flex board would connect to the main circuit board. If the voltage levels on the flex circuit board are incorrect, the problem is most likely in the flex board. If the voltage levels on the flex board are correct with the main board disconnected, the problem is most likely on the main circuit board.

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.

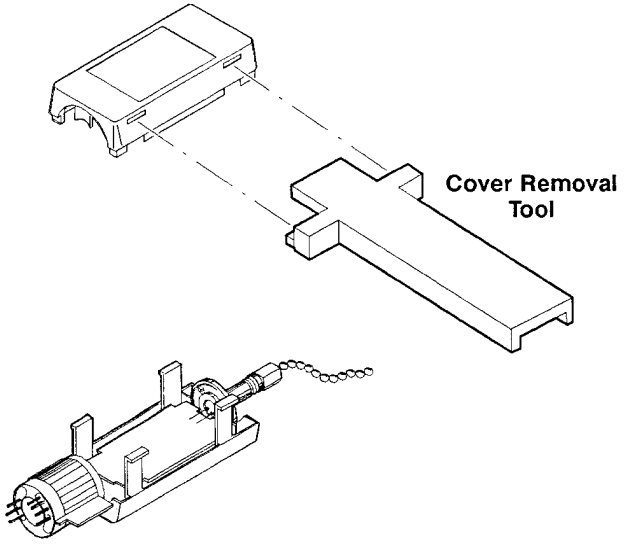


Figure 6-1: Top Cover Removal

Converter Top Cover Removal

Remove the top cover (the cover with slots), with the cover removal tool. (see Figure 6-1). The removal tool is available as an optional accessory, see ***Replaceable Parts***.

Photodiode Assembly Replacement

CAUTION

When replacing any electronic assembly in this instrument (including the photodiode assembly), use standard static-preventive procedures. All circuit assemblies in this converter are susceptible to static damage. Under no circumstances should the photodiode assembly be disassembled. The factory-set alignment between the photodiode and the lens will be lost and the converter response will be less than optimum.

To remove the diode assembly (refer to Figure 6-2):

1. Remove the top cover as described above.

2. The photodiode and carrier assembly are connected to the main circuit board through connecting pins. Carefully pry up the main circuit board (photodiode end) just enough so that the bottom of the diode assembly is free from the bottom cover.

3. Pull the diode assembly straight out from the main circuit board.

To install the new assembly:

1. Align the connector pins of the new assembly and connect it to the main board (the slot on the diode assembly faces the bottom of the bottom cover).

2. Carefully reseat the main circuit board and photo diode assembly into the bottom cover. Make certain that the BNC lead is in the socket on the board, that the connections between the circuit board and diode assembly remain intact, that the spring on the main board is on the same side of the dividing bulkhead (between the diode assembly and the circuit board) as is the circuit board, and that the first link of the protective-cap chain goes across the slot in the lower body half.

3. Replace the top cover.

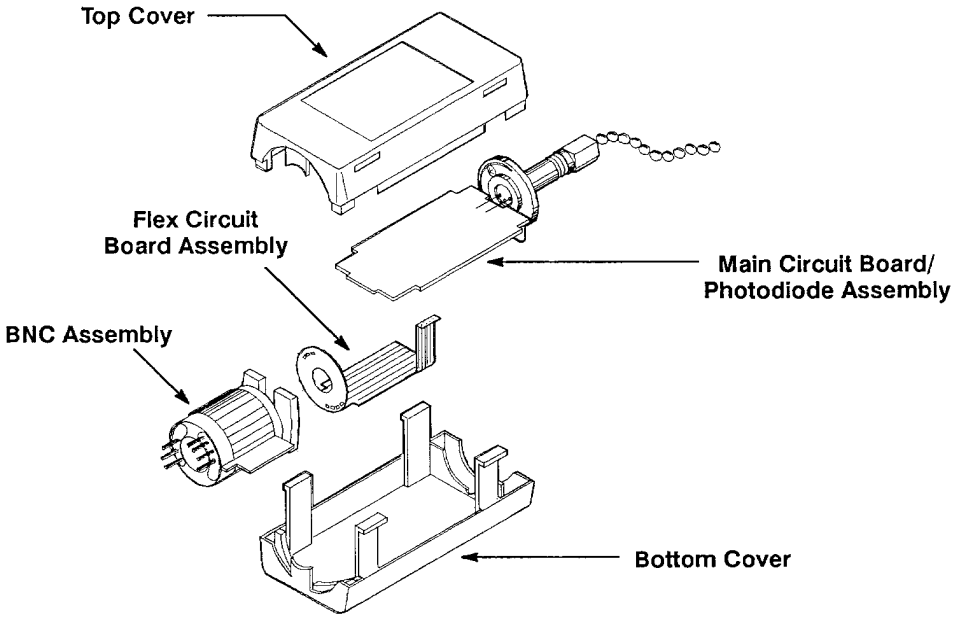


Figure 6-2: Assembly Replacement

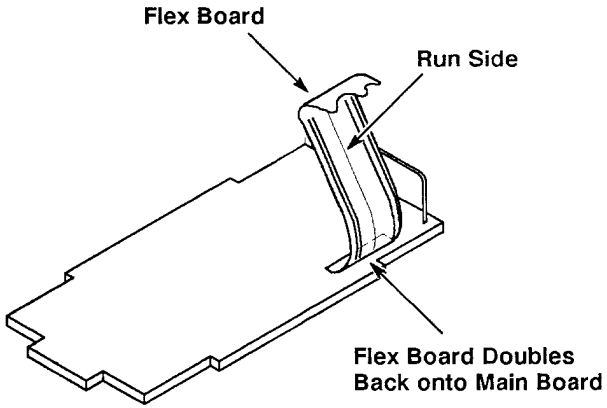


Figure 6-3: Flex Circuit Board Replacement

Flex Circuit Board Replacement

Please refer to Figures 6-2 and 6-3.

To replace the flex circuit board:

1. Remove the top cover.

2. Carefully pry up the main circuit board, photodiode, and BNC assemblies.

3. Disconnect the photodiode and BNC assemblies from the main circuit board.

CAUTION

The flex circuit board (as well as the main board) are easily damaged by excessive heat, and the connections from the flex circuit board to the main board are close together. To ensure proper operation of the converter:

1. Use only silver solder and a temperature-controlled soldering iron with a maximum tip temperature of 600°F.

2. Keep the soldering iron contact as brief as possible.

3. Observe and note the position of all connections. Check that there are no shorts or opens before reassembling the converter.

4. Carefully unsolder the flex board from the BNC assembly and the main circuit board.

5. Carefully solder the new flex circuit board to the main circuit board and the BNC assembly.

6. Reassemble (by reversing the disassembly procedure) the BNC and photodiode assemblies and the converter body.

Main Circuit Board Replacement

1. Remove the top cover.

2. Carefully pry up the main circuit board, photodiode, and BNC assemblies.

3. Remove the photodiode and BNC assemblies from the main circuit board.

4. Carefully unsolder the flex board from the main circuit board.

5. Carefully solder the flex circuit board to the new main circuit board.

6. Reassemble (by reversing the disassembly procedure) the BNC and photodiode assemblies and the converter body.

BNC Assembly Replacement

1. Remove the top cover.
2. Carefully pry up the main circuit board, photodiode, and BNC assemblies.
3. Remove the BNC assembly from the main circuit board and unsolder the flex circuit board connections.
4. Carefully solder the new flex board to the BNC assembly and install the new BNC assembly on the main circuit board.
5. Reassemble (by reversing the disassembly procedure) the BNC and photodiode assemblies and the converter body.

Readjustment After Repair

After any electrical or optical component has been repaired or replaced, complete the ***Performance Check Procedure*** (Section 4), to verify that the converter is within specifications. If adjustment is necessary, perform the appropriate ***Adjustment Procedure*** (Section 5).

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. Owners 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 2 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 2 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 P6701A/P6703A/P6711/P6713 Optical-to-Electrical Converters. 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
Assembly and/or Component
Attaching parts for Assembly and/or Component
(END ATTACHING PARTS)
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
(END ATTACHING PARTS)
Parts of Detail Part
Attaching parts for Parts of Detail Part
(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
TK1690	EAGLE INDUSTRIES	115 E SHERMAN ST	NEWBERG OR 97132
TK1857	HIROSE ELECTRIC /U S A/ INC	9254 DEERING AVE	CHATTSWORTH CA 91311
65148	INTEROPTICS DIV OF WILLIAM J PURDY CO	770 AIRPORT BLVD	BURLINGAME CA 94010-1927
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
98291	SEALECTRO CORP BICC ELECTRONICS	40 LINDEMAN DR	TURNBULL CT 06611-4739

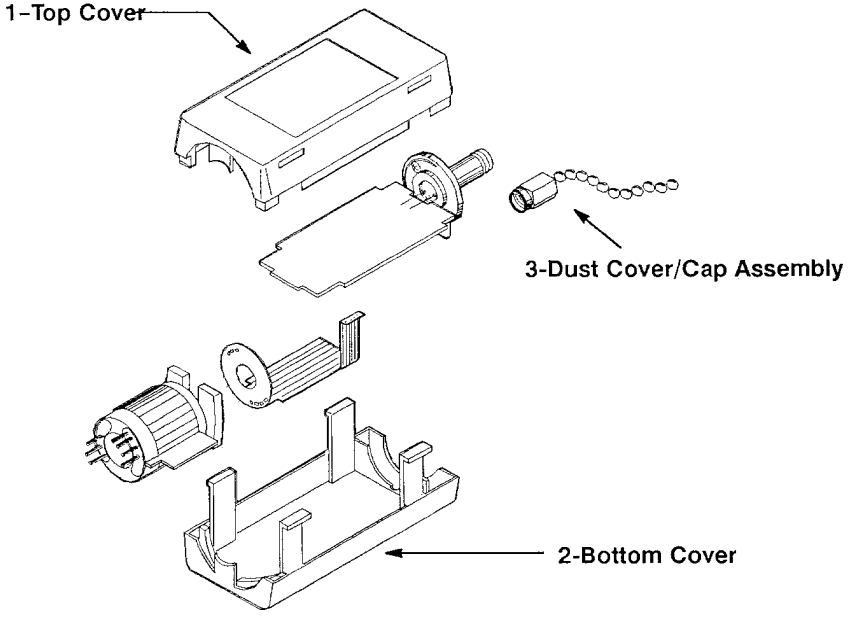

1-Top Cover
3-Dust Cover/Cap Assembly
2-Bottom Cover

Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Serial No. Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1	206-0429-03				COMP BOX TOP:W/LABEL,P6711	80009	206042903
	206-0429-04			1	COMP BOX TOP:W/LABEL,P6713	80009	206042904
	206-0429-01			1	COMP BOX TOP:W/LABEL,P6701A	80009	206042901
	206-0429-02			6	COMP BOX TOP:W/LABEL,P6703A	80009	206042902
2	206-0430-03			1	COMP BOX:COVER,BOTTOM,W/LABEL,P6711	80009	206043003
	206-0430-04			1	COMP BOX:COVER,BOTTOM,W/LABEL,P6713	80009	206043004
	206-0430-01			1	COMP BOX:COVER,BOTTOM,W/LABEL,P6701A	80009	206043001
	206-0430-02			1	COMP BOX:COVER,BOTTOM,W/LABEL,P6703A	80009	206043002
3	200-3455-00			1	COVER,CONNECTOR:DUST CAP,NON SHORTING	98291	50-601-4110-890
	200-3091-00			1	COVER,DUST:W/BEAD CHAIN,FC STYLE	TK1857	HRFC-C1
	200-3659-01			1	COVER,DUST:W/BEAD CHAIN,ST STYLE	TK1690	200-3659-01
	200-3120-00			1	CAP,DUST:W/BEAD CHAIN,DIN STYLE	65148	78C-1700-49
	070-8237-00			1	MANUAL,TECH:USER,P6701A/6703A/6711/6713	80009	070823700

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