Instruction Manual

Tektronix

A6905S
Optical Isolation System

070–8773–00

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

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

First Printing: April 1993

Instrument Serial Numbers

Each instrument manufactured by Tektronix has a serial number on a panel insert or tag, or stamped on the chassis. The first letter in the serial number designates the country of manufacture. The last five digits of the serial number are assigned sequentially and are unique to each instrument. Those manufactured in the United States have six unique digits. The country of manufacture is identified as follows:

B010000	Tektronix, Inc., Beaverton, Oregon, USA
E200000	Tektronix United Kingdom, Ltd., London
J300000	Sony/Tektronix, Japan
H700000	Tektronix Holland, NV, Heerenveen, The Netherlands

Instruments manufactured for Tektronix by external vendors outside the United States are assigned a two digit alpha code to identify the country of manufacture (e.g., JP for Japan, HK for Hong Kong, IL for Israel, etc.).

Tektronix, Inc., P.O. Box 500, Beaverton, OR 97077

Printed in U.S.A.

WARRANTY

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

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; or c) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

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Certificate of the Manufacturer/Importer

We hereby certify that the A6905S and all factory-installed options complies with the RF Interference Suppression requirements of Postal Regulation 1046/1984.

The German Postal Service was notified that the equipment is being marketed.

The German Postal Service has the right to re-test the series and to verify that it complies.

TEKTRONIX

Bescheinigung des Herstellers/Importeurs

Hiermit wird bescheingt, daß das A6905S and all factory-installed options in Übereinstimmung mit den Bestimmungen der Amtsblatt-Verfügung 1046/1984 funkentstört ist.

Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes angezeight und die Berechtigung zur Überprüfung der Serie auf Einhalten der Bestimmungen eingeräumt.

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NOTICE to the user/operator:

The German Postal Service requires that Systems assembled by the operator/user of this instrument must also comply with Postal Regulation, Vfg. 1046/1984. Par. 2, Sect. 1.

HINWEIS für den Benutzer/Betreiber:

Die vom Betreiber zusammengestellte Anlage, innerhalb derer dieses Gerät eingesetzt wird, muß ebenfalls den Voraussetzungen nach Par. 2, Ziff. 1 der Vfg. 1046/1984 genugen.

NOTICE to the user/operator:

The German Postal Service requires that this equipment, when used in a test setup, may only be operated if the requirements of Postal Regulation, Vfg. 1046/1984, Par. 2. Sect. 1.7.1 are complied with.

HINWEIS für den Benutzer/Betreiber:

Dieses Gerät darf in Meßaufbauten nur betrieben werden, wenn die Voraussetzungen des Par. 2, Ziff. 1. 7.1 der Vfg. 1046/1984 eingehalten werden.

Table of Contents

Table of Contents i

List of Figures iv

List of Tables v

User Safety Summary vii

Servicing Safety Summary ix

Introduction

Product Description 1-1
- **Accessories** 1-2
- **Options** 1-2
- **Power Cord Options** 1-3

Getting Started

Installation 2-1
- **Power Source Information** 2-1
  - Changing the Voltage Range 2-1
- **The Battery Pack** 2-2
  - Changing the Battery Pack 2-2
  - Recharging the Battery Pack 2-3
- **Connecting the Receiver to the Test Instrument** 2-4
- **Connecting the Fiber Optic Cables** 2-5
- **Power On** 2-5

Operation

A6905S Overview 3-1

A6905S Settings 3-3
- **Selecting Coupling** 3-3
- **Selecting the Attenuation Range** 3-3
  - Clipping 3-3
  - Noise Corruption 3-4
  - Example 3-5

Connecting the Probe 3-7

Industrial Lead Set 3-7
Making a Measurement 3-9
Operating Considerations 3-9
Common Mode Feedthrough 3-9
User Adjustments 3-13
Adjusting Gain and Offset 3-14
Checking Probe Compensation 3-16

Specification

Specification 4-1
Nominal Traits 4-1
Warranted Characteristics 4-3
Typical Characteristics 4-4

Performance Verification

Performance Verification 5-1
Adjusting Gain and Offset 5-2
Attenuator Accuracy Check 5-4
Probe Compensation Check 5-5
Bandwidth Check 5-6

Adjustment Procedures

Adjustment Procedures 6-1
Disassembly for Adjustment 6-2
Transmitter Disassembly 6-2
Receiver Disassembly 6-2
A6905S Calibration 6-3
Voltage Checks 6-5
Receiver Low-Frequency Circuit 6-6
Receiver High-Frequency Circuit 6-7
Receiver Output Circuit 6-7
Low- and HIgh-Frequency Detect 6-8
Gain Adjust 6-9
Compensation Adjust 6-9
Bandwidth 6-10
Probe Calibration 6-11

Servicing Information

Maintenance 7-1
Fiber Optic Cable Replacement 7-1
Probe Replacement 7-3

Replaceable Parts

Replaceable Parts 8-1

Index

Index I-1

List of Figures

Figure 1-1: Power-Cord Plug Identification 1-3
Figure 2-1: Location of the Line Voltage Selector on the Receiver Rear Panel 2-1
Figure 2-2: Opening the Line Voltage Selector 2-1
Figure 2-3: Positioning the Voltage Selector 2-2
Figure 2-4: Changing the Battery Pack 2-3
Figure 2-5: Charging the Battery Pack 2-4
Figure 3-1: The A6905S Optical Isolation System 3-1
Figure 3-2: Transmitter Controls 3-1
Figure 3-3: Receiver Controls 3-2
Figure 3-4: Clipping 3-3
Figure 3-5: Noise Corruption 3-4
Figure 3-6: Input Range for Attenuator Settings 3-4
Figure 3-7: The Industrial Lead Set 3-8
Figure 3-8: Lead Set Connected to Probe 3-8
Figure 3-9: A6905S Idealized Model 3-10
Figure 3-10: A6905S Realistic Model 3-11
Figure 3-11: Setup to Adjust Gain and Offset 3-14
Figure 3-12: Setup to Check Probe Compensation 3-16
Figure 5-1: Setup to Adjust Gain and Offset 5-2
Figure 5-2: Setup to Check Attenuator Accuracy 5-4
Figure 5-3: Setup to Check Probe Compensation 5-5
Figure 5-4: Setup to Check Bandwidth 5-6
Figure 6-1: The Transmitter Board 6-3
Figure 6-2: The Receiver Board 6-4
Figure 6-3: Setup for Probe Calibration 6-11
Figure 8-1: Transmitter Replaceable Parts 8-5
Figure 8-2: Receiver Replaceable Parts 8-7
Figure 8-3: Accessories 8-9

List of Tables

Table 3-1: Required Test Equipment 3-13
Table 4-1: Nominal Traits 4-1
Table 4-2: Warranted Characteristics 4-3
Table 4-3: Typical Characteristics 4-4
Table 5-1: Required Test Equipment 5-1
Table 6-1: Required Test Equipment 6-1

User Safety Summary

Please take a moment to review these safety precautions. They are provided for your protection and to prevent damage to the A6905S Optical Isolation System. This safety information applies to all users.

Symbols and Terms

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.

These two terms appear 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.

This symbol appears in manuals:

Static-Sensitive Devices

These symbols appear on equipment:

DANGER
High Voltage

Protective
ground (earth)
terminal

ATTENTION
Refer to
manual

Specific Precautions

Observe all of these precautions to ensure your personal safety and to prevent damage to either the A6905S or to equipment connected to it.

Do Not Connect Probe Common Reference to Live Equipment

To avoid possible shock hazard, do not connect the A6905S probe common reference to operating equipment. Make sure that equipment under test is turned off and any stored charge is safely discharged before attaching the probe common reference lead.

Do Not Remove Covers or Panels

The insulation system in the A6905S allows the user to safely perform floating measurements with common references elevated to the rated system voltage. The transmitter case is an important element in this insulation system. Several components within the transmitter are connected to the probe common reference. Never remove the transmitter case while the probe is connected to a circuit. The A6905S receiver contains line operated components. To avoid possible injury, do not remove the receiver cover.

Use Care When Exchanging Battery Packs

The rechargeable battery pack is equipped with an insulated handle to facilitate the safe exchange of the transmitter and receiver packs. Never insert other objects into the battery opening in the case. The safe operation of the transmitter requires the proper insulation of the battery pack. Do not attempt to operate the transmitter with any other batteries or power supplies.

Should battery replacement become necessary, obtain the exact replacement directly from Tektronix. Refer to the Replaceable Parts list for ordering information.

Electric Overload

Never apply a voltage to the A6905S probe common reference or signal pin that exceeds the system voltage rating.

Do Not Modify Probe

To avoid shock hazard, do not attempt to modify the probe common reference or signal connections and insulators. Do not use accessories other than those that were specifically designed for the probe.

Do Not Operate in Explosive Atmospheres

The A6905S Optical Isolation System provides no explosion protection from static discharges or arcing components. Do not operate the optical isolation system in an atmosphere of explosive gases.

Servicing Safety Summary

This safety information is for service personnel. Specific warnings and cautions may also be found throughout this manual where they apply.

Do Not Service Alone

Do not perform internal service or adjustments to 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 or components while power is on. Disconnect power before removing protective panels, soldering, or replacing components.

Specific Precautions

Observe all of these precautions to ensure your personal safety and to prevent damage to either the A6905S Optical Isolation System or equipment connected to it.

Use the Proper Fuse

To avoid fire hazard, use only the fuse specified in the parts list for your product, and which is identical in type, voltage rating, and current rating.

Shock Hazard When Covers are Removed

Internal components within the transmitter are connected to the probe common reference. To avoid the risk of serious electrical shock, disconnect both the probe tip and common reference connector from any device prior to opening the transmitter case.

Do not attach the probe tip or common reference to any hazardous voltage while the covers are removed. Hazard of electrical shock to the operator may result.

Introduction

Product Description

The A6905S Optical Isolation System provides a means of performing electrical measurements while separating the test equipment from the device under test. This allows electrical measurements to be safely made on circuits with common reference potentials elevated from Earth ground (often referred to as floating measurements). The A6905S can also be used to extend the distance of the measurement probe without the degrading effects of long cable lengths.

The A6905S consists of two physical units, a transmitter and a receiver, interconnected by a pair of flexible fiber optic cables.

Electrical signals placed on the conventional input probe are converted to optical signals in the A6905S transmitter. The transmitter employs a split path amplifier which separates the DC and low-frequency components from the higher-frequency input components. The use of pulse width modulation in the low-frequency path overcomes the temperature-induced gain and offset drifts common in electrical/optical converters. The optical signal from each amplifier path is transmitted through an independent fiber optic cable.

The A6905S receiver converts the pair of optical signals sent from the transmitter back into electrical form. The low-frequency signal is demodulated and recombined with the high-frequency information to form a replica of the transmitter input signal. The buffered output of the A6905S receiver drives 50 Ω, maintaining signal integrity at the measurement instrument input.

The A6905S Optical Isolation System provides the following key features:

- Three attenuator settings provide the user flexibility to preserve the dynamic range of the input signal.
- Configuration options support fiber optic cable lengths up to 100 meters.
- To facilitate floating measurements, the transmitter is powered from a removable, rechargeable battery pack. The A6905S receiver serves as a charging station for the rechargeable battery pack.

The A6905S Optical Isolation System can be used with a variety of test instruments. It is optimized for use with oscilloscopes.

Accessories

The following standard accessories are provided with the A6905S Optical Isolation System:

- Industrial lead set (used to connect the A6905S probe to banana plug test accessories)
- 50 Ω terminator (BNC)
- 50 Ω BNC cable
- Compact miniature probe hook tip

The standard A6905S has a three-meter fiber optic cable assembly. A 50 meter fiber optic cable assembly is available as an optional accessory. (See *Options*, below, for other available cable lengths.)

Part numbers and ordering information for accessories are listed in *Replaceable Parts.*

Options

In addition to power cord options (described below), the following instrument options are available:

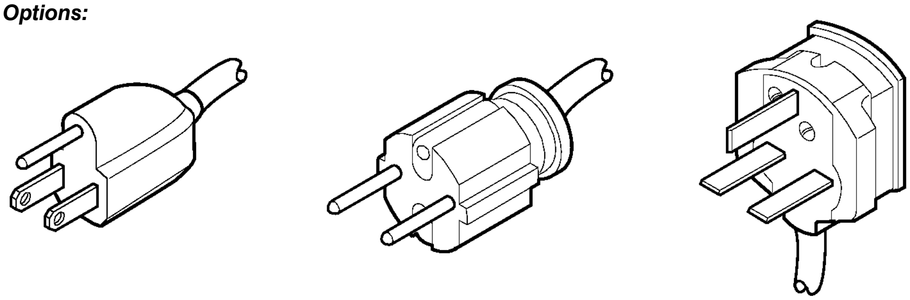
- Option 01, 15 meter fiber optic cable
- Option 02, 100 meter fiber optic cable

Part numbers and ordering information are listed in *Replaceable Parts.*

Power Cord Options

Instruments are shipped with the required power cords specified by the customer. Available power cord information is presented in Figure 1-1, and part numbers are listed in *Replaceable Parts*. Contact your local Tektronix Field Office or representative for additional power cord information.

Options:



Standard*	***Option A1***	***Option A2***
North American	***Universal Euro***	***UK***
115V	***230V***	***230V***

****** Canadian Standards Association certification includes these power plugs for use in the North American power network***

Figure 1-1: Power-Cord Plug Identification

Getting Started

Installation

Follow these instructions when installing the A6905S Optical Isolation System.

Power Source Information

The A6905S is designed to operate from a single phase AC power source in one of two ranges; 100–132 V or 200–242 V. The proper range for the included line cord was set at the factory.

Changing the Voltage Range

Should it become necessary to change voltage ranges, refer to the following procedure:

1. Remove the line cord from the connector on the rear of the receiver.
2. Carefully pry open the line voltage selector on the rear of the receiver (see Figure 2-1) using a small flat-blade screwdriver (see Figure 2-2).

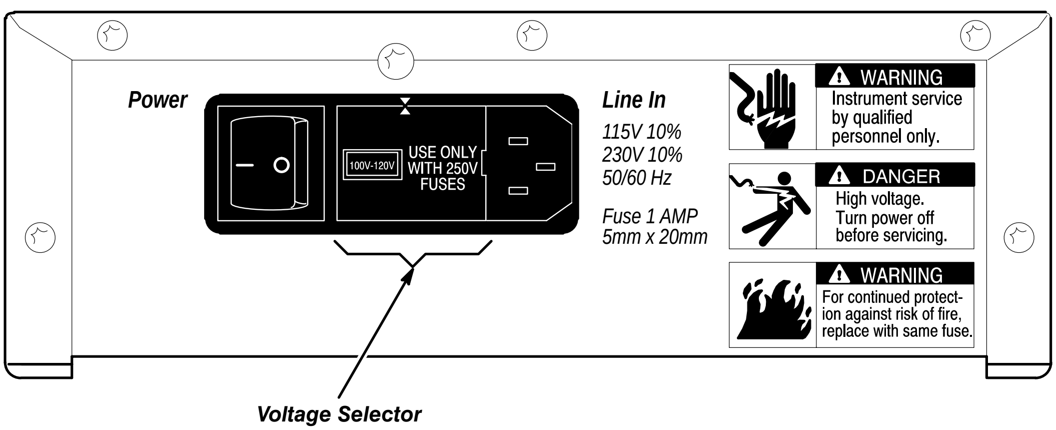


Figure 2-1: Location of the Line Voltage Selector on the Receiver Rear Panel

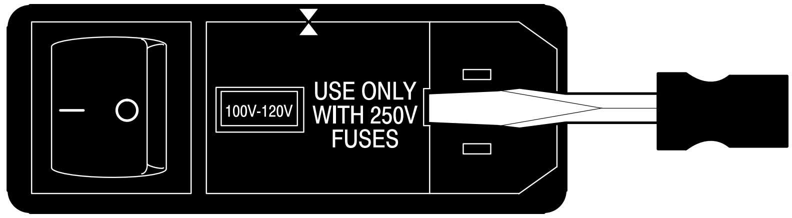


Figure 2-2: Opening the Line Voltage Selector

3. Replace the fuse with one of proper value for the selected range:

Voltage Range	Fuse Type
100–132 V	1.0 A Fast, 250 V, 5 mm x 20 mm
200–242 V	0.5 A Fast, 250 V, 5 mm x 20 mm

4. Slide out the voltage selector and reposition it as necessary. Verify that the intended selection is visible in the window. Refer to Figure 2-3.

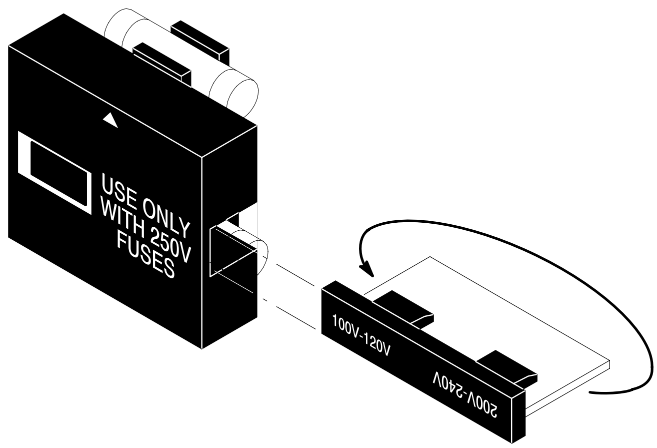


Figure 2-3: Positioning the Voltage Selector

5. Replace the line voltage selector/fuse holder in the rear of the receiver, aligning the arrow in the up direction.
6. Connect the proper line cord for the selected voltage range.

The Battery Pack

The battery pack provides power to the transmitter unit and is designed to provide at least 10 hours of continuous operation before recharging is required.

Changing the Battery Pack

WARNING

Disconnect the A6905S probe from all external power sources before changing the battery pack.

The battery pack is located in the left side of the transmitter unit (see Figure 2-4). To replace the battery pack with a freshly charged battery pack:

1. Disconnect the probe from all external power sources.
2. Turn off power to the transmitter (the POWER button should be in its outward position).
3. Slide the discharged battery pack out of the transmitter.
4. Insert the newly charged battery pack into the transmitter.

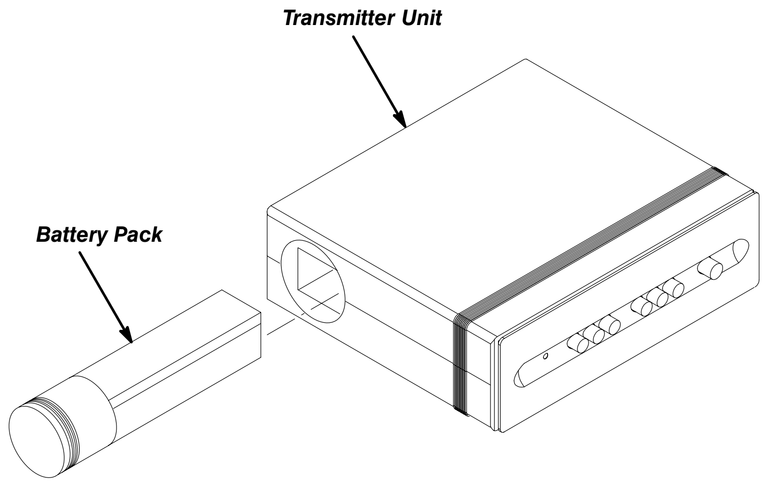


Figure 2-4: Changing the Battery Pack

Recharging the Battery Pack

The battery pack plugs into the front of the receiver unit for recharging. Recharge time for a fully discharged battery pack is 12 hours.

NOTE

To initialize the battery memory to its maximum charging capacity, it is important that the nickel cadmium batteries are fully discharged before recharging them during the first several cycles.

To recharge the battery pack (refer to Figure 2-5):

1. Insert the battery pack into the front of the receiver.
2. Plug the receiver in and turn the power on.

The CHARGING LED on the receiver will always be lighted when there is a battery in the battery charger.

WARNING

Use only battery packs that were specifically designed for the A6905S. The use of other batteries or power sources could result in severe personal injury as well as damage to the instrument. A6905S replacement battery packs can be ordered through your local Tektronix field office or distributor.

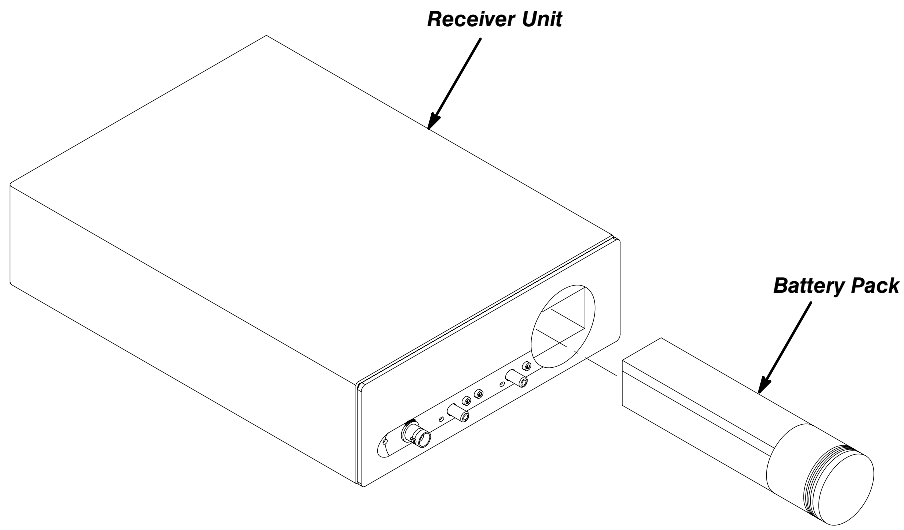


Figure 2-5: Charging the Battery Pack

Connecting the Receiver to the Test Instrument

The A6905S output can be connected to the test instrument through a standard 50 Ω BNC cable. A suitable cable is included with the A6905S unit. Use appropriate adapters when connecting to instruments with different input connectors.

The A6905S receiver is designed to drive 50 Ω loads. When driving high-impedance input loads, such as 1 MΩ oscilloscopes, use the 50 Ω terminator included with the A6905S. The terminator should be installed at the test instrument end of the BNC cable.

NOTE

The A6905S receiver output impedance is approximately 50 Ω. The system gain will be approximately twice the value indicated on the transmitter when driving a high-impedance load. To assure maximum gain accuracy, always operate the receiver into a 50 Ω load.

Connecting the Fiber Optic Cables

Position the transmitter physically close to the source of the test signal.

1. Carefully unwind enough fiber optic cable from the spool to reach the receiver. Any extra cable can remain on the spool, minimizing the chance of physically damaging it.
2. Remove the protective dust caps from the ends of the fiber optic cables and the optical input connectors on the receiver. (Retain the dust caps for future storage of the unit.)
3. Place the cable connector marked LOW into the optical input labeled LOW FREQUENCY FIBER IN. Tighten the connector fully finger tight. The connectors are spring loaded, assuring good optical connection when fully seated.
4. Connect the remaining cable marked HIGH to the HIGH FREQUENCY FIBER IN input in the same manner.
5. When removing the fiber optic cables for storage, always replace the protective dust caps on the cable ends and optical inputs.

CAUTION

Avoid sharp bends and kinks when handling fiber optic cables. The cables may be damaged if they are bent with a radius of less than 4 cm (1.5 inch).

Power On

The receiver power switch is located on the rear panel, next to the power cord connector and line voltage selector (see Figure 2-1).

To turn on the transmitter, press the power button on the front panel. The LOW BATTERY LED should flash momentarily when you press the POWER button.

NOTE

If the LOW BATTERY LED does not flash when you turn on the transmitter power, the battery pack is fully discharged and must be replaced. If the LOW BATTERY LED lights steadily, the battery charge is too low for proper operation (but not fully discharged) and the battery should also be replaced.

Operation

A6905S Overview

The following descriptions are intended to familiarize the operator with the location and function of the instrument's controls, connectors, and indicators.

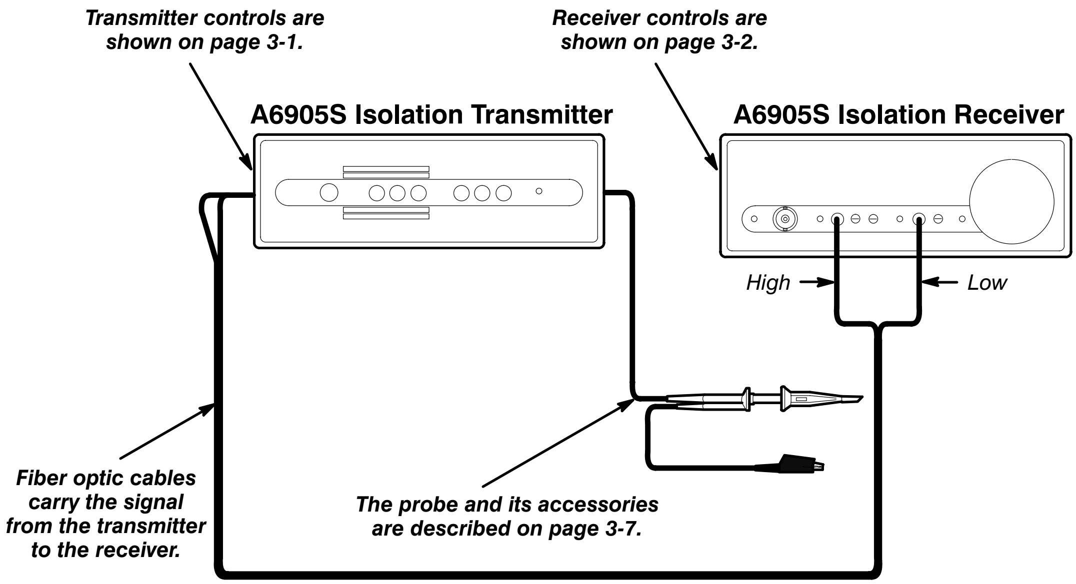


Figure 3-1: The A6905S Optical Isolation System

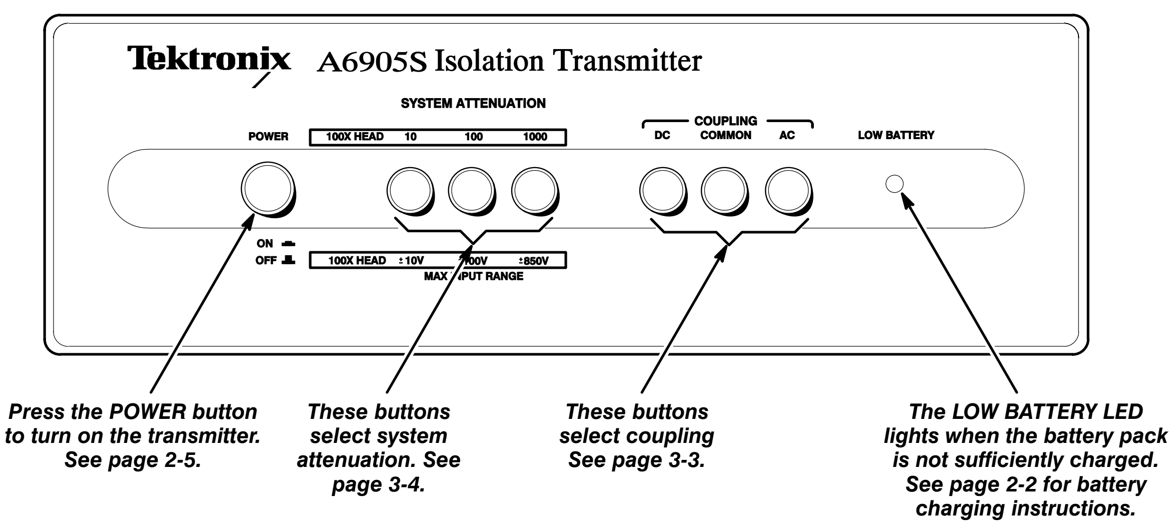


Figure 3-2: Transmitter Controls

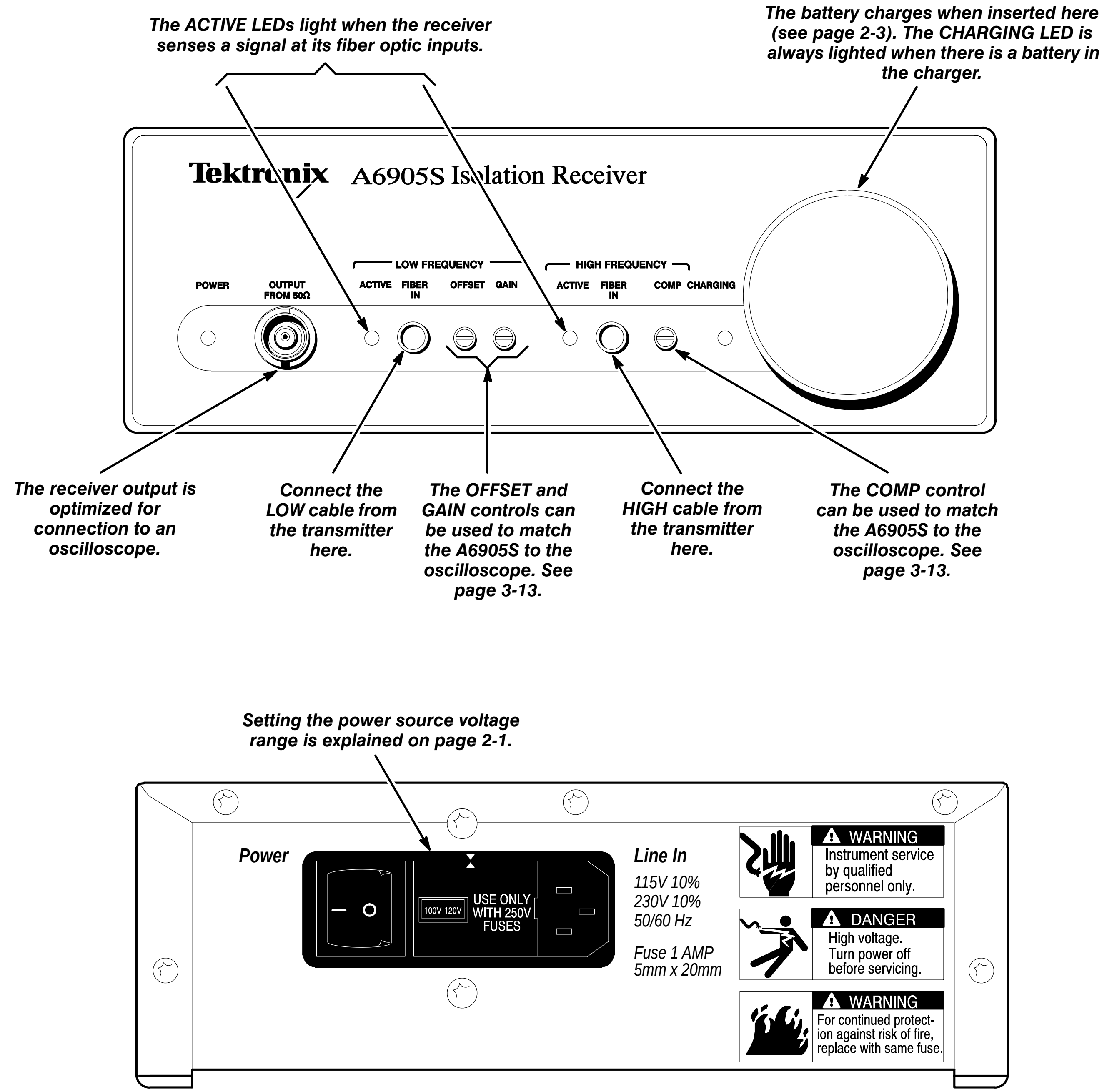


Figure 3-3: Receiver Controls

A6905S Settings

Input coupling and attenuation range can be selected at the A6905S transmitter front panel.

Selecting Coupling

Press one of the COUPLING buttons on the transmitter to select DC, common reference (COMMON) or AC coupling.

- DC coupling allows all signal frequencies to be measured.
- Common reference coupling disconnects the input signal from the transmitter, leaving the input at the common reference level (that is, at the level at the probe common reference lead). The signal source will see a 1 MΩ load to the common reference level.
- AC coupling blocks the DC component of the input signal from the transmitter's measurement circuitry.

Selecting the Attenuation Range

Three decades of attenuation are selectable at the transmitter.

The optimum selection of transmitter attenuator setting requires some knowledge about the signal to be measured. Like all real amplifier systems, the A6905S has finite dynamic range. Signals that are too large or too small for the selected range will be degraded by clipping or noise corruption, respectively.

Clipping

Input signals that are too large in amplitude for the selected range will cause the output of the amplifier to saturate, clipping the signal. The amplitude information that exceeds the amplifier's range will be lost, as shown in Figure 3-4.

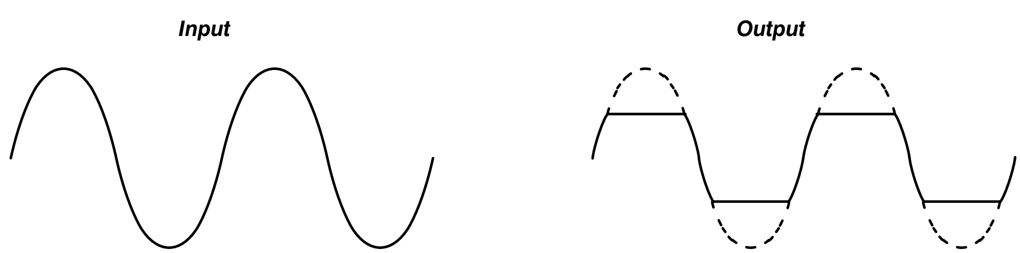


Figure 3-4: Clipping

Protection circuitry within the transmitter allows the maximum rated input voltage (850 V peak) to be applied to the probe head at any attenuator setting without damage.

Noise Corruption

Signals that are extremely low in amplitude in relation to the selected range will become corrupted with the baseline noise floor of the amplifier, as shown in Figure 3-5.

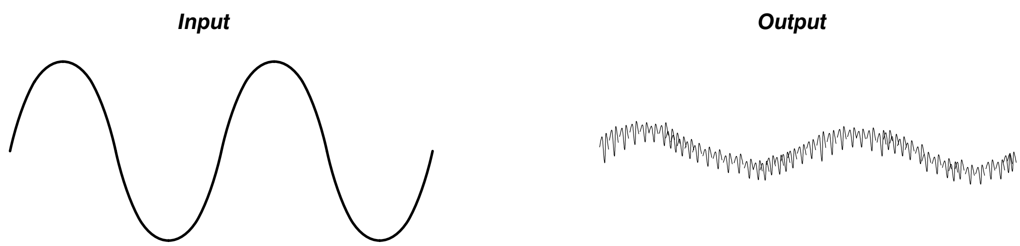


Figure 3-5: Noise Corruption

Generally, the attenuator setting should be selected to have just enough input range to measure the highest anticipated input amplitude. This utilizes the maximum dynamic range and signal-to-noise ratio.

The usable output amplifier range is ±1 V (2 V pk-pk) into a 50 Ω load. For convenience, the probe head attenuation has been factored with the transmitter gain for each attenuation setting. The maximum input range and resulting system attenuations are printed above the attenuator buttons on the transmitter. The table is color-coded black to match the probe head. This table is reproduced in Figure 3-6.

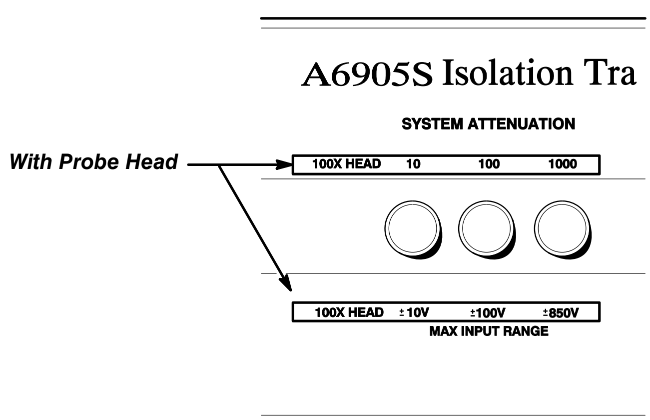


Figure 3-6: Input Range for Attenuator Settings

Example

Measure the gate drive signal on the line side of a switch mode power supply using the A6905S and an oscilloscope. The gate drive nominally swings 5 volts referenced to the source lead. The ±10 V range, selected by pressing the leftmost of the three buttons, is the lowest that will pass a 5 volt signal. By setting the oscilloscope scale factor to 100 mV/division, the waveform can be viewed at the equivalent 1 V/division.

Oscilloscope setting (100 mV/div) × A6905S attenuation (10X) = 1 V/div

Connecting the Probe

Connect the common reference lead to the point being tested that will be the reference voltage. Connect the probe tip to the signal being measured.

WARNING

The probe system shipped with the A6905S is specifically designed for performing measurements with common potentials elevated from earth ground. Do not modify the probe or probe accessories. Do not attempt to use the A6905S with probe accessories other than those included with this instrument. If the included accessories will not attach to the device under test, do not use the probe. (Safety test probe attachments rated for 1000 V are acceptable for connection to the industrial lead set.)

While the probe insulation system is rated for direct connections up to 850 V peak (above or below earth ground), the possibility of accidentally making bodily contact with high voltage potentials always exist. Whenever possible, deactivate power and safely discharge any stored energy in the device being tested before connecting or removing the probe.

Industrial Lead Set

The industrial lead set is provided as a standard accessory to the A6905S. This lead set consists of a 5-inch signal lead (red), a 14-inch common reference lead (black) and two right-angle safety jaw-grip connectors (one red, one black). These leads can be used to connect the probe directly to banana plug test ports, or to extend the distance between the probe tip and the common reference lead when probing large-geometry circuitry.

Figure 3-7 shows the industrial lead set.

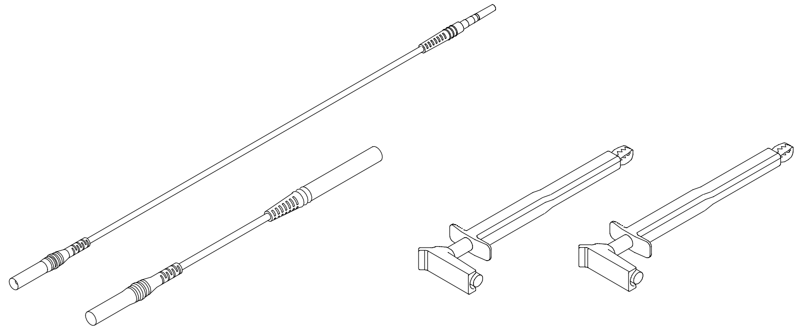


Figure 3-7: The Industrial Lead Set

The lead set should be connected to the A6905S probe as shown in Figure 3-8.

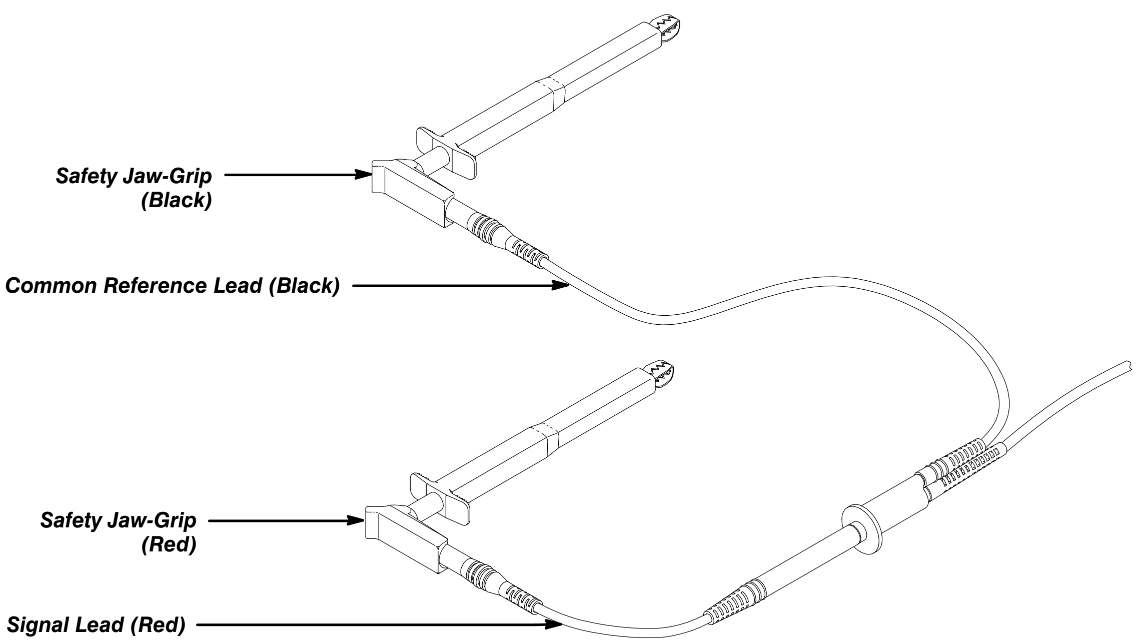


Figure 3-8: Lead Set Connected to Probe

In addition to the safety jaw-grip connectors, the lead set can also be used with any of the four-millimeter safety test probe attachments rated for connections up to 1000 V peak.

Making a Measurement

To make a measurement using the A6905S, follow this procedure:

1. Turn on the transmitter by pressing its POWER button.
2. Turn on the receiver by toggling the switch located on the rear cover.

   The system is properly operating when the three red indicators on the receiver front panel are lighted; POWER, LOW FREQUENCY ACTIVE, and HIGH FREQUENCY ACTIVE. (The CHARGING indicator also will be illuminated when a battery is inserted in the receiver.)

   If either the HIGH FREQUENCY ACTIVE or LOW FREQUENCY ACTIVE indicator fails to light, check the connection of the fiber optic cable. If neither is lighted, the battery may need recharging.
3. Press the transmitter COUPLING COMMON button.
4. Adjust the offset or position control on the measuring instrument to establish the common reference point.
5. Select either DC or AC coupling as appropriate for the intended measurement. The Isolation system is now operating and the measurement can proceed.

NOTE

If the low-battery indicator on the transmitter lights, turn off the transmitter power and swap the battery packs. Continued operation of the transmitter with the low-battery indicator lighted may result in distorted or inaccurate output signals.

When the measurement is completed, turn the transmitter off to conserve the battery charge.

Operating Considerations

For accurate measurements, you should be aware of these characteristics of the A6905S.

Common Mode Feedthrough

Because it is optically isolated, the A6905S allows measurements to be made with virtually total DC isolation. The only leakage path is the fiber optic cable, which has a resistance too high to measure by common methods. As the frequency of the Common Mode signal increases, the capacitive element of the isolation can affect the measurement.

To the outside world, the A6905S appears to be a differential measuring device. The output of the receiver is a ground-referenced signal that replicates the difference of the signals applied between the probe tip and the probe common. The idealized model is illustrated in Figure 3-9. The transmitter only sees the differential signal, V_{DIFF} . The optical signal that is sent through the fiber optic cable is proportional to V_{DIFF} . Any common mode signal, V_{CM}, is ignored. The receiver reconstructs the electrical signal from the optical information.

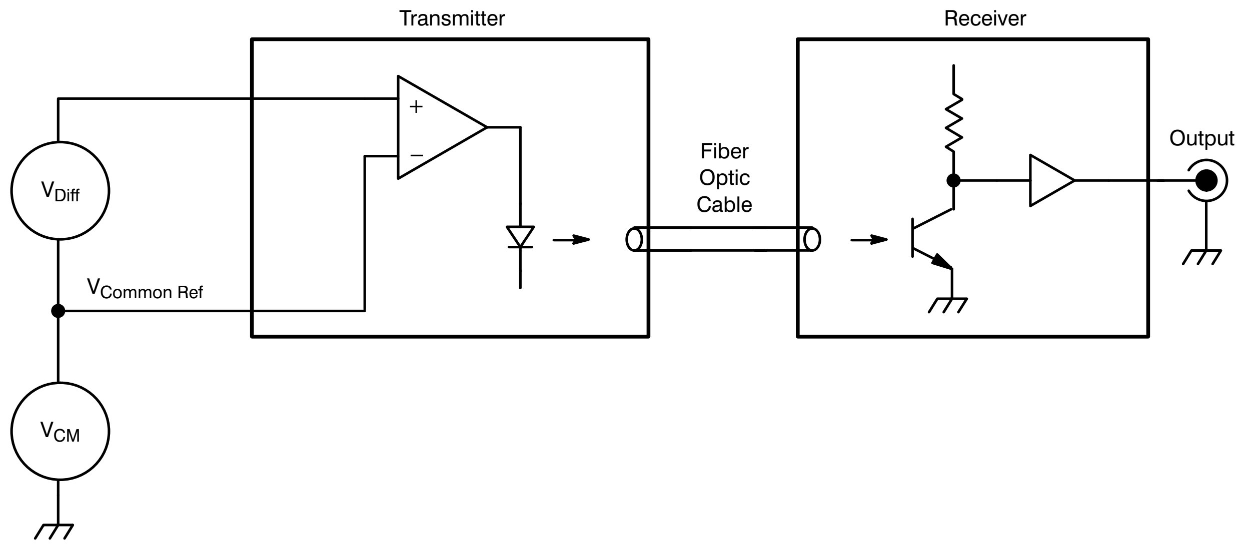


Figure 3-9: A6905S Idealized Model

Internally, the probe circuitry is actually single-ended. The probe common is the common reference for most of the transmitter circuitry. Figure 3-10 represents a more accurate model of the system. When the A6905S is used to make measurements with common references that are static or that change at relatively low frequencies with respect to Earth ground, the A6905S accurately reproduces the differential signal presented at its input (within its bandwidth and voltage range limitations). However, when the common reference is connected to a point in the circuit that rapidly changes potential with respect to earth ground, errors may be introduced in the output signal. In some circumstances, these errors can be significant.

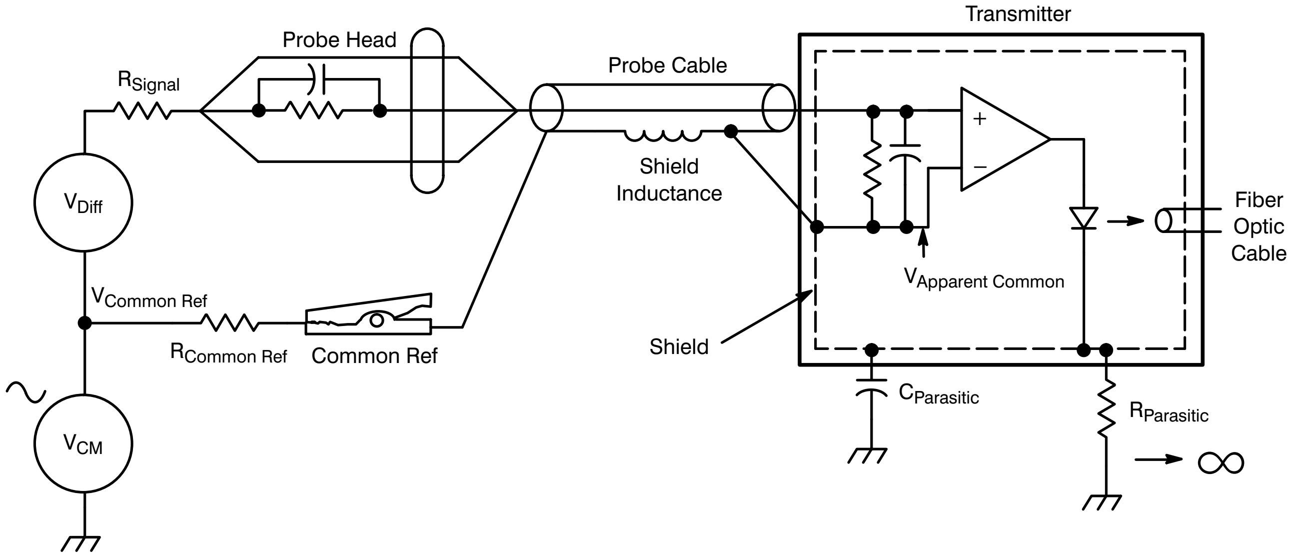


Figure 3-10: A6905S Realistic Model

Causes of Error in the Output Signal—With care, output signal errors can be eliminated or minimized. In order to do this, it is necessary to understand the cause. Refer to Figure 3-10.

Ideally, the common reference signal seen by the transmitter ($V_{Apparent\ Common}$) would always exactly equal the common reference potential ($V_{Common\ Ref}$) in the device under test. However, the probe shield inductance, added to source impedance $R_{Common\ Ref}$, is in the path between $V_{Common\ Ref}$ and the transmitter input. The sum of these impedances form a voltage divider with the stray parasitic impedances ($C_{Parasitic}$ and $R_{Parasitic}$) between the transmitter and earth ground.

$R_{Parasitic}$ is essentially infinite and can be ignored, leaving only $C_{Parasitic}$ in the divider shunt path. When the common mode signal (V_{CM}) is at DC or very low frequencies, the impedance through $C_{Parasitic}$ becomes infinite, resulting in $V_{Common\ Ref}$ being equal to $V_{Apparent\ Common}$.

As the frequency of the common mode signal increases, the impedance of $C_{Parasitic}$ decreases while the shield impedance increases. This results in $V_{Apparent\ Common} < V_{Common\ Ref}$. Therefore the output voltage is no longer an accurate representation of V_{Diff}.

Minimizing Error in the Output Signal—The error can be reduced by minimizing the effect of the voltage divider by minimizing the series impedance and maximizing the shunt element. Because both elements are reactive, the effects of the shield inductance and $C_{Parasitic}$ are reduced by lowering the frequency of V_{CM}. Specific strategies for minimizing error include:

- Whenever possible, choose a reference point in the circuit under test that is at a static potential with respect to earth ground.
- Connecting the probe common to the point of lowest impedance lowers the value of $R_{Common\ Ref}$.
- In some situations it is possible to interchange the probe tip and probe common connections to reduce the frequency of V_{CM} applied to the common reference or lower the value of $R_{Common\ Ref}$. By simply inverting the polarity of the measuring instrument, more accurate measurements can be made.
- Increasing the physical distance between the A6905S transmitter and any conductive surface will greatly reduce the parasitic capacitance. Because $C_{Parasitic}$ is the only shunt element of concern in the divider, minimizing the capacitance value can substantially reduce common-mode feedthrough errors. This is easily accomplished by supporting the transmitter with an insulating material such as wood.
- Similarly, if you are using more than one A6905S system, maintain physical distance between them. Do not stack the transmitter units.

User Adjustments

Minor adjustments can be made to the A6905S to optimize its performance. When the A6905S is used with an oscilloscope, these adjustments allow matching the A6905S to the test oscilloscope for maximum system accuracy.

If a transmitter and receiver from two different A6905S pairs are mated, a full calibration will be required.

Table 3-1: Required Test Equipment

Item Description	Minimum Requirements	Example
Generator, Calibration	Calibrated output 10 V–100 V, Rep Rate: 100 Hz–10 kHz, rise time ≤ 2 ns	Tektronix PG 506A[1]
Oscilloscope	Bandwidth ≥ 60 MHz, sensitivity = 10 mV/div	Tektronix TDS 400 or 500 Series Oscilloscope Tektronix 2400 Series Oscilloscope
BNC-to-BNC Cable	50 Ω, male to male BNC connectors	Tektronix part number 012-0057-01
Termination, 50 Ω	Impedance 50 Ω; connectors: female BNC input, male BNC output	Tektronix part number 011-0049-01
Adapter, Dual-Banana	Female BNC to dual banana	Tektronix part number 103-0090-00

[1]Requires a TM 500 or TM 5000 Series Power Module Mainframe.

Adjusting Gain and Offset

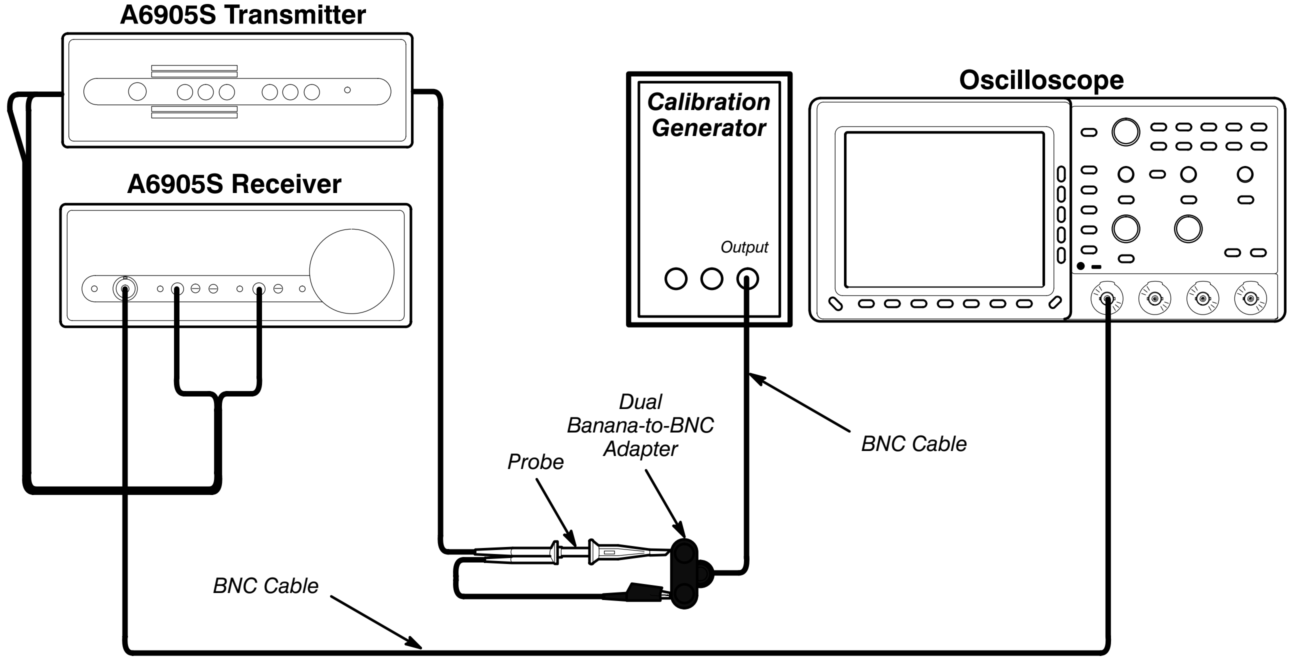


Figure 3-11: Setup to Adjust Gain and Offset

1. Press the POWER button on the front of the A6905S transmitter to turn it on.

   Check that the HIGH FREQUENCY ACTIVE and LOW FREQUENCY ACTIVE LEDs next to the fiber connections on the receiver are lighted, indicating that the receiver is properly receiving carrier from the transmitter. If these LEDs are not lighted, check that the high frequency and low frequency fiber cable connections to the receiver are hand tight and that they are not reversed. Check that the LOW BATTERY LED flashes when the transmitter power is cycled. If it does not, this indicates that the battery is completely discharged, and should be replaced with a fully charged one.

2. Attach the receiver to the oscilloscope using a BNC cable. Use the following settings:

   Vertical: 200 mV/div, DC Coupled, 50 Ω terminated
   20 MHz Bandwidth Limit
   Horizontal: 200 μs/division

3. Set the calibration generator to produce a 10 V Standard Output. Attach the BNC cable to the Standard Output BNC on the calibration generator. Attach the banana adapter to the other end.

4. Using a hook tip, attach the common reference lead to the grounded side of the banana adapter. Attach the probe tip to the signal side of the adapter.
5. Set the A6905S transmitter to the ±10 V range, DC coupled.
6. Insert a screwdriver into the trimpot access hole on the front of the receiver labeled GAIN and adjust the trimpot until the amplitude of the square wave displayed on the oscilloscope is 1 V peak-to-peak.
7. Press the COUPLING COMMON button on the transmitter. Insert a screwdriver into the trimpot access hole labeled OFFSET on the receiver, and adjust the trimpot for a 0 V output.
8. Set the calibration generator for a 100 Hz, Fast Rise output. Move the BNC cable to the positive-going (center) BNC output on the calibration generator. Insert a 50 Ω terminator between the end of the cable and the banana adapter. Set the oscilloscope horizontal to 2 milliseconds/division and the vertical to 20 mV/division.
9. Press the COUPLING DC button on the transmitter. Insert a screwdriver into the trimpot access hole labeled COMP on the front of the receiver and adjust the trimpot for the best square wave response.

NOTE

Due to interaction of the adjustments, you may have to repeat steps 1 through 9 to properly adjust the input circuitry.

Checking Probe Compensation

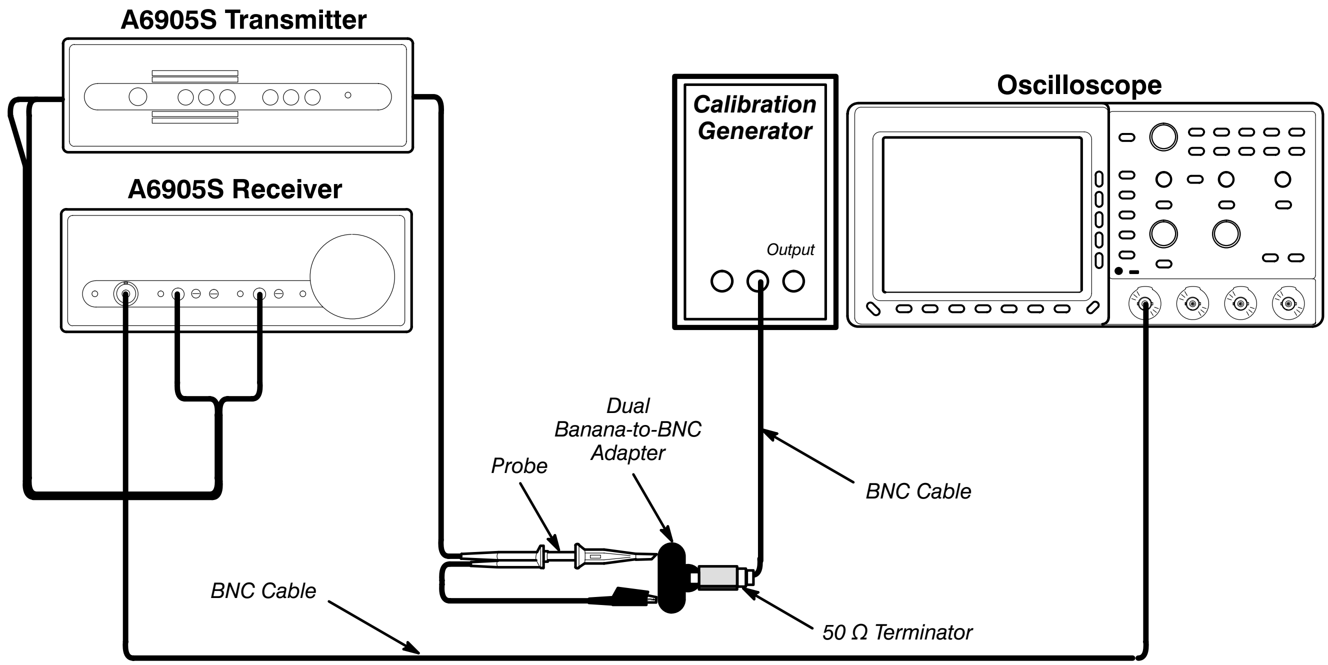


Figure 3-12: Setup to Check Probe Compensation

1. Set the calibration generator to produce a 10 kHz, Fast Rise step. Set the calibration generator Pulse Amplitude to maximum and attach the BNC cable to its center BNC (positive-going step). Insert a 50 Ω terminator between the end of the BNC cable and the banana adapter.
2. Set the transmitter range to ±10 V and set the oscilloscope to 20 mV/division and 10 µseconds/division.
3. Verify that the top of the waveform is flat to within 2%.

NOTE

If compensation is not within specifications, refer probe calibration to qualified service personnel. The probe calibration procedure is found in section 6.

Specification

Specification

The A6905S requires a 30-minute warmup period. The specifications in this section apply after the A6905S has been powered on for 30 minutes.

Nominal Traits

Nominal traits are described using simple statements of fact such as "SMA" for the trait "Connector Type," rather than in terms of limits that are performance requirements.

Table 4-1: Nominal Traits

Name	Description
Electrical Characteristics	
Voltage Ranges	
100X probe head	±10 V, ±100 V, ±850 V
Coupling	Common, AC, DC
Maximum Output Voltage	
50 Ω load	±1 V (best accuracy is achieved with a 50 Ω load)
1 MΩ load	±2 V
Output Impedance	50 Ω ±3%
Input Impedance	
100X probe head	10 MΩ, 2.9 pF
Probe Cable Length	2 m
Power Requirement	
Supply Voltage	100–132 V or 200–250 V (switchable at line input)
Supply Frequency	45 Hz to 65 Hz
Line Fuse Rating	1 A fast blow for 125 V supply 0.5 A fast blow for 250 V supply
Physical Characteristics — Fiber Optic Cable	
Cable Type	Duplex 200 µm glass, Kevlar reinforced
Bend Radius	1.5 inches minimum
Connector Type	SMA
Available Lengths	3 m, 15 m, 100 m (50 m cable available as an optional accessory)

Table 4-1: Nominal Traits (Cont.)

Name	Description
Transmitter	
Dimensions	21 cm W × 7 cm H × 19 cm D
Weight	1.42 kg ($3^1/_8$ lbs) with battery
Receiver	
Dimensions	20.5 cm W × 7.5 cm H × 29 cm D
Weight	2.32 kg ($5^1/_8$ lbs) with battery
Battery Pack	
Dimensions	5 cm W × 5 cm H × 18.5 cm L
Weight	425 g (15 oz.)
Packaged Unit	
Shipping Weight	6.6 kg ($14^1/_2$ lbs)

Warranted Characteristics

This subsection lists the various *warranted characteristics* that describe the A6905S Optical Isolation System. Warranted characteristics are described in terms of quantifiable performance limits which are warranted.

Table 4-2: Warranted Characteristics

Name	Description
Electrical Characteristics	
Bandwidth	15 MHz (−3 dB)
DC Drift (system)	<2.5 mV per degree Celsius at receiver output
DC Gain Accuracy	±3% at 23° C ±5° C, all input ranges, with output terminated into 50 Ω Note: gain and offset may be adjusted by user to match system.
Maximum nondestructive input voltage at input terminal	±250 V
Maximum rated input voltage (at probe tip, with respect to common reference or earth ground)	600 V_{RMS}, 850 V DC + peak AC (over system frequency range)
Maximum rated input voltage (common lead, with respect to earth ground)	600 V_{RMS}, 850 V DC + peak AC
Underwriters Laboratories Inc. (UL) certification	Listed or Recognized Component, Electrical and Electronic Measuring and Testing Equipment UL 1244
Environmental Characteristics	
Operating Temperature	0° C to 45° C
Storage Temperature	−20° C to 70° C
Humidity	Up to 75% relative humidity at 25°C
Electromagnetic Compatibility	Conducted and radiated emissions per VDE 0871/6.78, Limit B, Vfg 1046/1984

Typical Characteristics

Typical characteristics are described in terms of typical or average performance. Typical characteristics are not warranted.

Table 4-3: Typical Characteristics

Name	Description
Electrical Characteristics	
Rise Time	<25 ns
Common Mode Rejection Ratio	
DC to 10 kHz	>100 dB
10 kHz to 100 kHz	>90 dB
100 kHz to 1 MHz	>70 dB
Noise	1.5 mV, tangentially measured (referred to output)
Propagation Delay	≈80 ns for 3 m fiber optic cable, measured from probe tip to end of 36 inch BNC output cable add ≈5 ns per meter for longer cables
Battery Pack	
Operating time per charge	10 hours
Recharge time	12 hours

WARNING

The following servicing instructions are for use only by qualified personnel. To avoid personal injury, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so. Refer to User Safety Summary and Servicing Safety Summary prior to performing any service.

Performance Verification

Performance Verification

The procedures in this section check that the A6905S performs as warranted. For accurate results, the first procedure, *Adjusting Gain and Offset*, must be performed before performing any of the other procedures.

Table 5-1: Required Test Equipment

Item Description	Minimum Requirements	Example
Generator, Calibration	Output level 10 V–100 V, Rep rate 100 Hz and 10 kHz, Rise time ≤ 2 ns	TEKTRONIX PG 506A Calibration Generator[1]
Generator, Sine Wave	Leveled output 5 mV–4 V pk–pk, flatness ≤ 3%, 50 kHz–20 MHz	TEKTRONIX SG 503 Leveled Sine Wave Generator[1]
Oscilloscope	Bandwidth ≥ 60 MHz, sensitivity 10 mV/division averaging desirable (digital scope)	TEKTRONIX TDS 400 or 500 Series Oscilloscope TEKTRONIX 2400 Series Oscilloscope
BNC-to-BNC Cable	50 Ω, male to male BNC connectors	Tektronix part number 012-0057-01
Termination, 50 Ω	Impedance 50 Ω; connectors: female BNC input, male BNC output	Tektronix part number 011-0049-01
Adapter, Dual-Banana	Female BNC to dual banana	Tektronix part number 103-0090-00

[1]Requires a TM 500 or TM 5000 Series Power Module Mainframe.

Adjusting Gain and Offset

Gain and offset must be adjusted before performing the other procedures in this section. This procedure is identical to the procedure “Adjusting Gain and Offset” in *User Adjustments*.

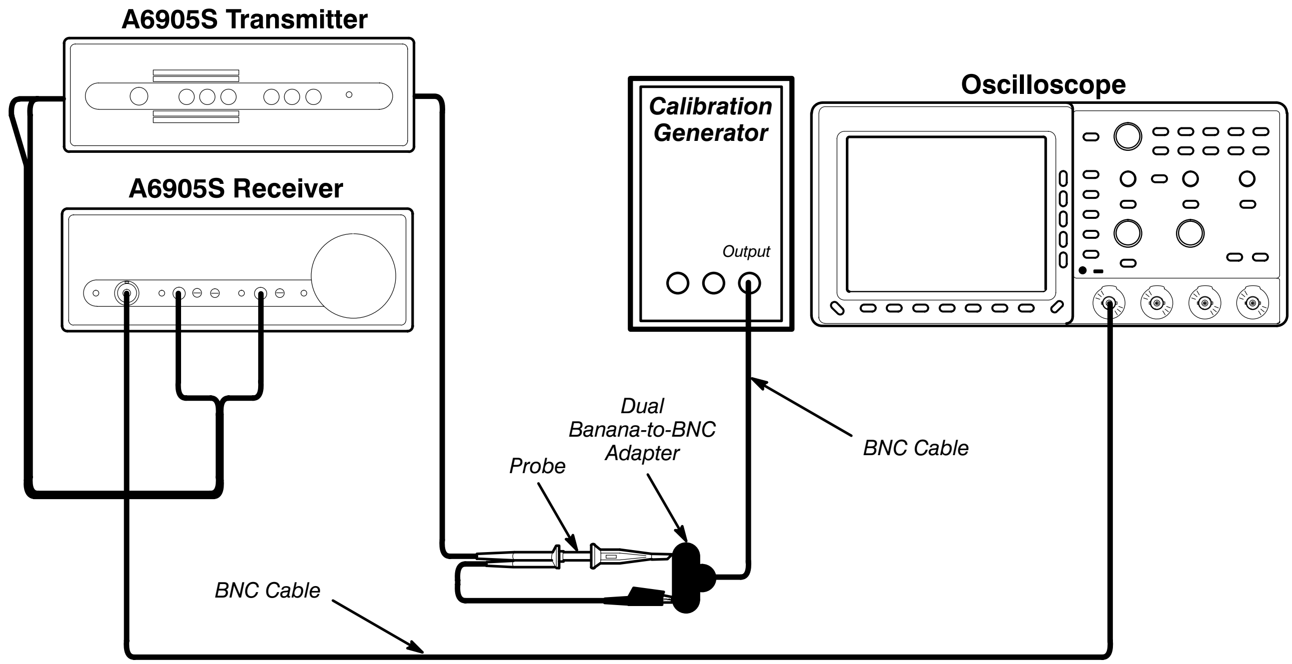


Figure 5-1: Setup to Adjust Gain and Offset

1. Press the POWER button on the front of the A6905S transmitter to turn it on.

   Check that the HIGH FREQUENCY ACTIVE and LOW FREQUENCY ACTIVE LEDs next to the fiber connections on the receiver are lighted, indicating that the receiver is properly receiving carrier from the transmitter. If these LEDs are not lighted, check that the high frequency and low frequency fiber cable connections to the receiver are hand tight and that they are not reversed. Check that the LOW BATTERY LED flashes when the transmitter power is cycled. If it does not, this indicates that the battery is completely discharged, and should be replaced with a fully charged one.

2. Attach the receiver to the oscilloscope using a BNC cable. Use the following settings:

   Vertical: 200 mV/div, DC Coupled, 50 Ω terminated
   20 MHz Bandwidth Limit
   Horizontal: 200 µs/division

3. Set the calibration generator to produce a 10 V Standard Output. Attach the BNC cable to the Standard Output BNC on the calibration generator. Attach the banana adapter to the other end.

4. Using a hook tip, attach the common reference lead to the grounded side of the banana adapter. Attach the probe tip to the signal side of the adapter.
5. Set the A6905S transmitter to the ±10 V Range, DC coupled.
6. Insert a screwdriver into the trimpot access hole on the front of the receiver labeled GAIN and adjust the trimpot until the amplitude of the square wave displayed on the oscilloscope is 1 V peak-to-peak.
7. Press the COUPLING COMMON button on the transmitter. Insert a screwdriver into the trimpot access hole labeled OFFSET on the receiver, and adjust the trimpot for a 0 V output.
8. Set the calibration generator for a 100 Hz, Fast Rise output. Move the BNC cable to the positive-going (center) BNC output on the calibration generator. Insert a 50 Ω terminator between the end of the cable and the banana adapter. Set the oscilloscope horizontal to 2 milliseconds/division and the vertical to 20 mV/division.
9. Press the COUPLING DC button on the transmitter. Insert a screwdriver into the trimpot access hole labeled COMP on the front of the receiver and adjust the trimpot for the best square wave response.

NOTE

Due to interaction of the adjustments, you may have to repeat steps 1 through 9 to properly adjust the input circuitry.

Attenuator Accuracy Check

Prerequisite: Gain and offset adjusted.

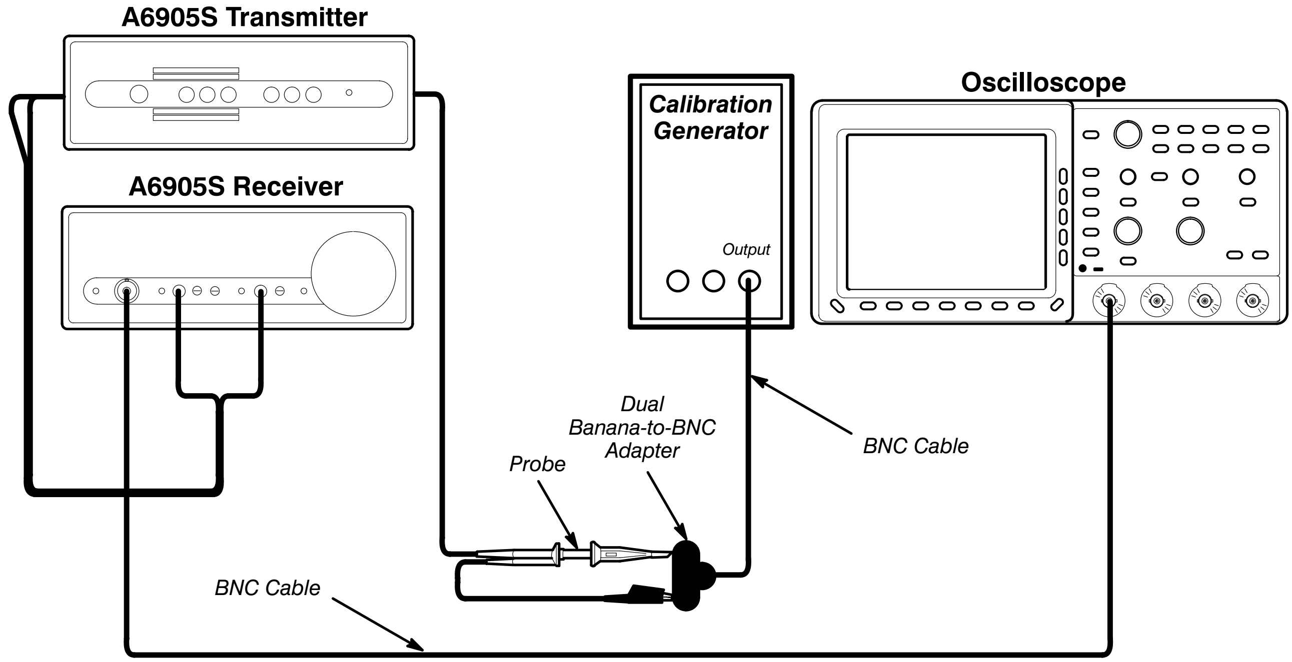


Figure 5-2: Setup to Check Attenuator Accuracy

1. Reset the calibration generator to produce a 10 V Standard Output. Return the BNC cable to the Standard Output BNC on the calibration generator. Remove the 50 Ω terminator. Set the oscilloscope horizontal to 200 μs/division.
2. Verify that with the calibration generator is set to 10 V Standard Amplitude and the A6905S transmitter set to ±10 V range, 1 volt is displayed on the oscilloscope.
3. Change the voltage range on the transmitter to ±100 V. Change the output of the calibration generator to 100 V Standard Amplitude. Verify that the displayed waveform is 1 V ±3%.
4. Change the voltage range on the transmitter to ±850 V. Verify that the displayed waveform is 100 mV ±3%.

Probe Compensation Check

Prerequisite: Gain and offset adjusted.

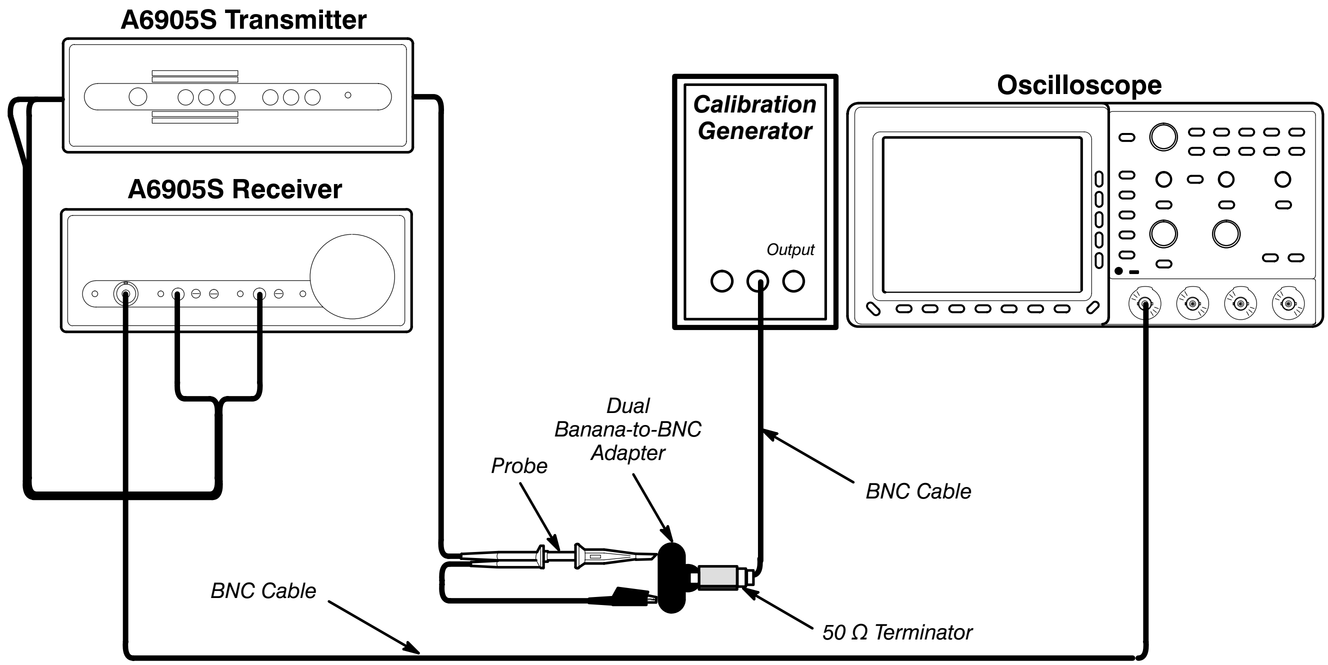


Figure 5-3: Setup to Check Probe Compensation

1. Set the calibration generator to produce a 10 kHz, Fast Rise step. Set the calibration generator Pulse Amplitude to maximum and attach the BNC cable to its center BNC (positive-going step). Insert a 50 Ω terminator between the end of the BNC cable and the banana adapter. Reattach the probe to the banana adapter.
2. Set the transmitter range to ±10 V and set the oscilloscope to 20 mV/division and 10 µseconds/division.
3. Verify that the top of the waveform is flat to within 2%.

   If noise causes difficulty in making this measurement, AVG (16) may be selected from the ACQUIRE menu on a TDS series oscilloscope.

Bandwidth Check

Prerequisite: Gain and offset adjusted.

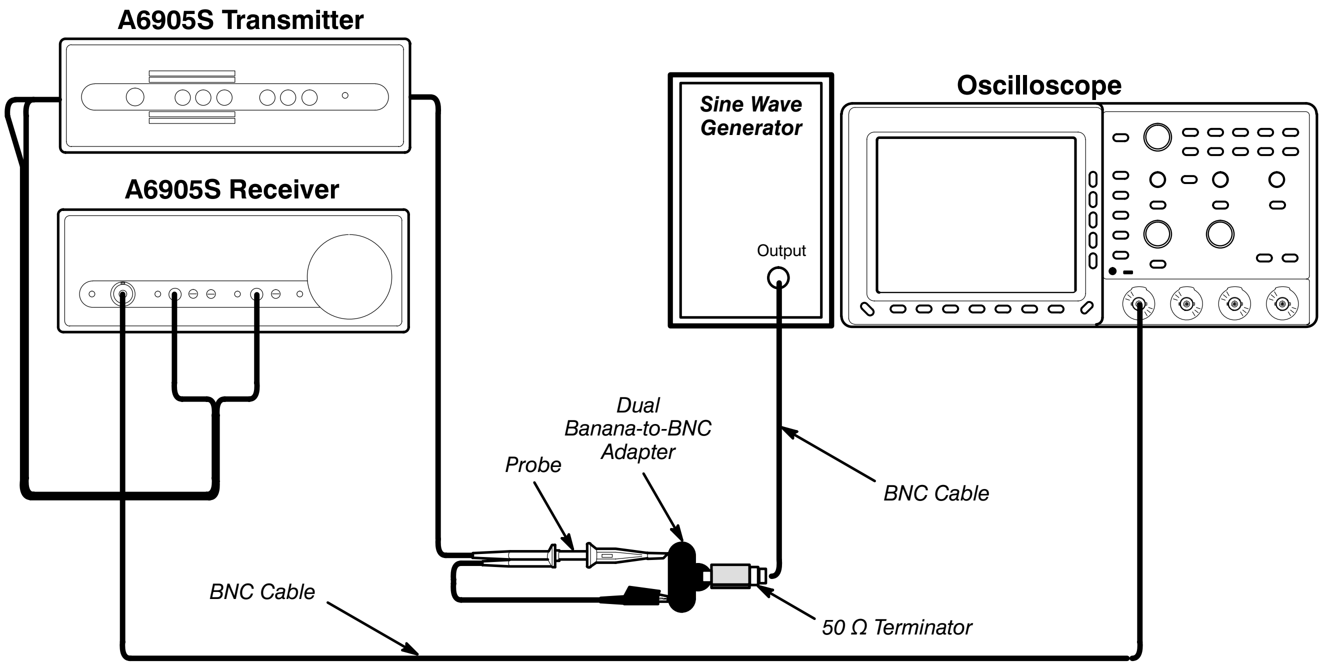


Figure 5-4: Setup to Check Bandwidth

1. Attach the BNC cable with a 50 Ω terminator and banana adapter to the signal output of the sine wave generator. Attach the probe head to the banana adapter. Set the sine wave generator to produce a 50 kHz, 1 V output. Set the transmitter to ±10 V. Set the oscilloscope to 20 mV/division and 10 μs/division, and set its bandwidth limit to >20 MHz (on a TDS oscilloscope, set the bandwidth limit to 100 MHz).
2. Adjust the sine wave generator Output Amplitude for a six-division display on the oscilloscope.
3. Set the oscilloscope to 20 nanoseconds/division. Set the sine wave generator to the 25 MHz range. Increase the frequency from 10 MHz until the displayed voltage drops to 4.2 divisions. Verify that the frequency is >15 MHz.

Adjustment Procedures

Adjustment Procedures

The procedures in this section describe calibration of the A6905S and the attached probe.

NOTE

With the exception of the 100 m cable, all lengths of fiber optic cable are interchangeable. When installing a 100 m cable into a system which previously used a shorter cable, or when installing a shorter cable into a system which previously used a 100 m cable, recalibration will be required.

Table 6-1: Required Test Equipment

Item Description	Minimum Requirements	Example
Oscilloscope	60 MHz bandwidth, sensitivity10 mV/division, averaging desirable	TEKTRONIX TDS 400 or 500 Series Oscilloscope TEKTRONIX 2400 Series Oscilloscope
Test Probe	>60 MHz bandwidth, 10X attenuation	TEKTRONIX P6137 or P6138
Generator, Calibration	10 V–100 V calibrated output, 100 Hz–10 kHz pulse frequency, rise time ≤2 ns	TEKTRONIX PG 506A[1]
Generator, Leveled Sine Wave, Medium-Frequency	50 kHz to 25 MHz; Variable amplitude from 5 mV to 4 V_{p-p} into 50 Ω; flatness ≤3%; harmonic content: 2nd harmonic down –30 dB from fundamental; all others down –40 dB	TEKTRONIX SG 503[1] Leveled Sine Wave Generator
Generator, Sine Wave, Low Frequency	1 kHz at 120 mV sine wave	TEKTRONIX SG 502[1]
Digital Multimeter	1 mV–20 V DC sensitivity	TEKTRONIX DM 511
BNC-to-BNC Cables (2)	50 Ω, male to male BNC connectors	Tektronix part number 012-0057-01
Terminators, 50 Ω (2)	Impedance 50 Ω; connectors: female BNC input, male BNC output	Tektronix part number 011-0049-01
Adapter, Dual-Banana	Female BNC to dual banana	Tektronix part number 103-0090-00
Adjustment Tool	Less than $^1/_8$ inch diameter	Tektronix part number 003-0675-01

[1]Requires a TM 500 or TM 5000 Series Power Module Mainframe.

Disassembly for Adjustment

The adjustment procedures in this section require removal of the instrument covers.

WARNING

Do not attach the probe tip or common reference to any hazardous voltage while the covers are removed. Hazard of electrical shock to the operator may result.

Transmitter Disassembly

1. Turn the transmitter off.
2. Turn the transmitter over and remove the two screws on the bottom. Set the unit upright again and remove the top cover.
3. Remove the Nylon screws securing the top shield and remove the top shield.

NOTE

When reassembling the transmitter, be careful not to pinch the probe cable and fiber optic cables between the shields.

Receiver Disassembly

1. Turn the receiver off.
2. Turn the receiver over and remove the four screws on the bottom. Slide the cover off the unit.

A6905S Calibration

The A6905S is calibrated by adjustments to the circuit boards of the transmitter and receiver. Refer to figures 6-1 and 6-2 for the locations of test points and adjustments on these boards.

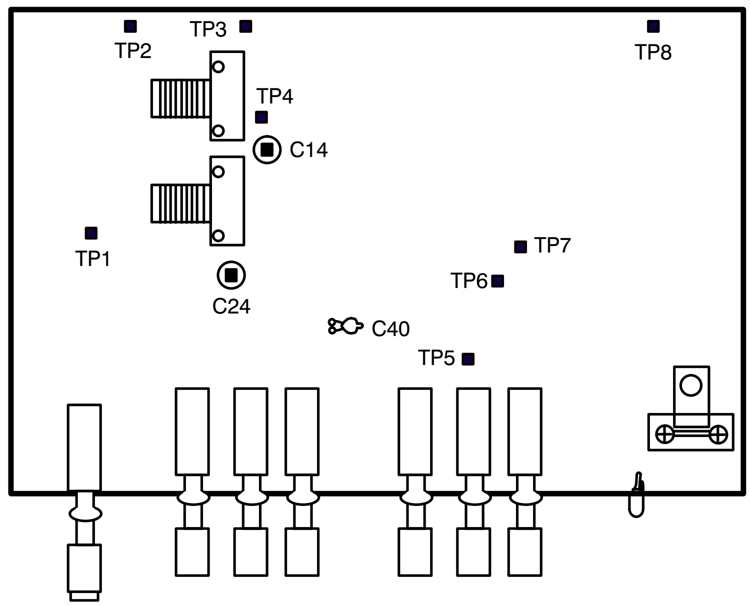


Figure 6-1: The Transmitter Board

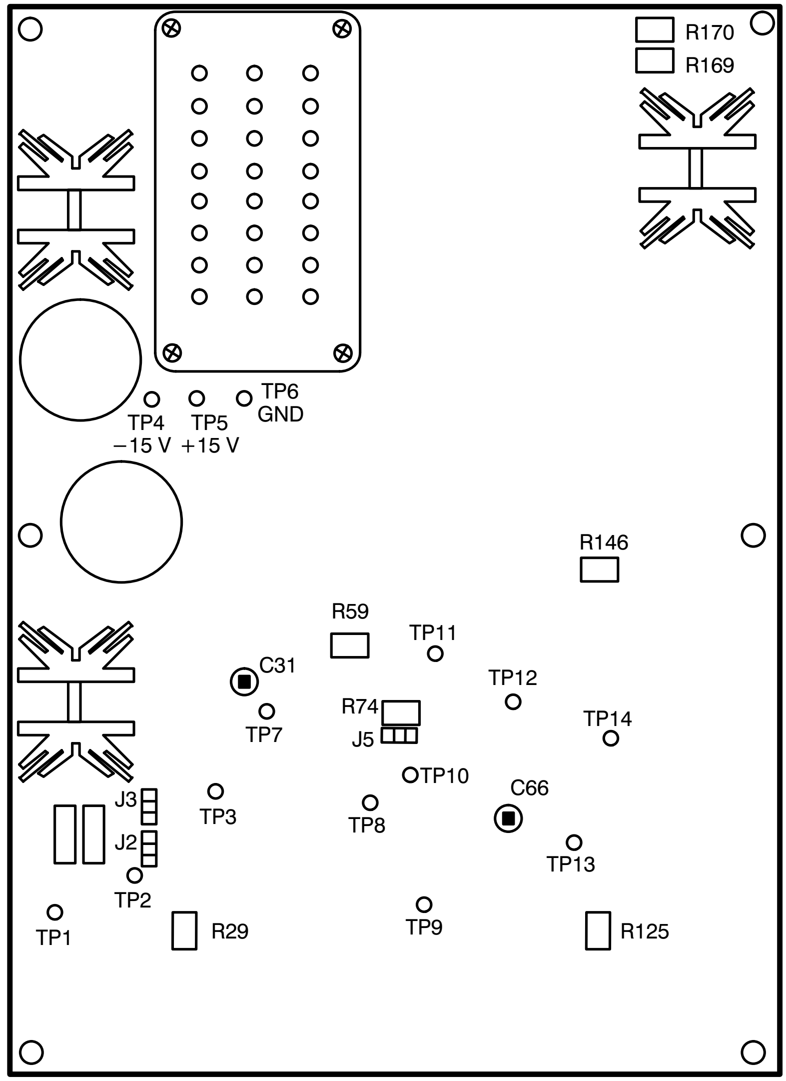


Figure 6-2: The Receiver Board

Voltage Checks

NOTE

Ferrite-core variable inductors are factory adjusted. Do not readjust these inductors.

1. Using the digital multimeter, verify the following voltages on the transmitter board (relative to TP7, which is at chassis ground):

   2.5 V ±37.5 mV at TP1

   5.0 V ±75.0 mV at TP2

   −4.0 V ±250 mV at TP6

2. On the receiver board, verify the following voltages (relative to battery ground):

   15 V ±1.5 V at TP5

   −15 V ±1.5 V at TP4

   5.0 V ±150 mV at TP3

NOTE

If the voltages at these test points are not as specified, do not proceed with calibration. Return the A6905S to a service center for repair.

Receiver Low-Frequency Circuit

1. Select common input coupling and the ±10 V range at the transmitter.
2. Disconnect the probe from the transmitter input.
3. Using a BNC cable and a 50 Ω terminator, connect the calibration generator's positive-going, Fast-Rise output to the transmitter input. Apply a 100 mV, 100 Hz square wave to the input of the transmitter.
4. Connect the low-frequency fiber optic cable from the transmitter to the receiver. Firmly tighten the threaded connector (hand tighten only).
5. Connect the test probe to the second oscilloscope input. Set the oscilloscope to 2 ms/division and 500 mV/division (includes the 10X probe attenuation).
6. Connect the probe tip to TP1 on the receiver board.
7. On the receiver board, turn R29 fully clockwise and verify that the pulse-width modulated signal at TP1 is at least 2.0 V peak-to-peak.
8. Set the oscilloscope to 200 mV/division. Adjust R29 until the signal at TP1 is 1 V peak-to-peak. Measure at the greatest amplitude of the waveform.

NOTE

The voltage at TP1 will vary depending on the cable length and the quality of the connection.

9. Move the probe to TP2 and verify that TP2 produces a square wave at 100 kHz ±10 kHz.
10. Move the probe to TP9 and verify that TP9 produces a triangle wave at 100 kHz ±10 kHz.
11. Select DC input coupling. Adjust the receiver front panel GAIN control for 1.0 V peak-to-peak at TP10. Verify that the signal is a 100 Hz square wave.
12. Select common input coupling. Adjust the receiver front panel OFFSET control for 0 V at TP10 as measured using the DMM (in its 200 mV range).

Receiver High-Frequency Circuit

1. At the transmitter, select common input coupling and the ±10 V input range. Apply the 100 mV, 100 Hz signal from the calibration generator to the input of the transmitter.
2. Disconnect the high-frequency fiber optic cable (if it is connected).
3. Adjust R125 for 0 V ±1 mV at TP13 as measured using the DMM (in its 200 mV range).
4. Reconnect the high-frequency fiber optic cable and firmly tighten the threaded connector (hand tighten only).
5. Set the oscilloscope to 2 ms/division and 100 mV/division.
6. Select DC input coupling. Using the oscilloscope probe, verify that TP13 and TP14 produce a 100 Hz square wave. Verify that the signal at TP13 is in the range of 150 mV to 400 mV peak-to-peak.

Receiver Output Circuit

1. At the transmitter, select DC input coupling, ±10 V range. Apply a 100 mV, 100 Hz signal from the calibration generator. Connect the receiver output to the oscilloscope channel 1 input using a coaxial cable and 50 Ω terminator at the oscilloscope input. Set the oscilloscope to 2 ms/division and 200 mV/division with DC input coupling.
2. On the receiver board, move the jumper at J5 to the right two pins. Adjust R74, R59, and R146 fully *clockwise*. Adjust the front-panel COMP control fully *counterclockwise*.
3. Observe the output signal on the oscilloscope display. Adjust R146 counterclockwise until the signal begins to decrease in amplitude.
4. Verify that by adjusting R74, the output signal may be adjusted from a minimum of 0 V to larger than 1 V peak-to-peak Adjust R74 for 1 V peak-to-peak.
5. Connect the test probe tip to TP10. Set the oscilloscope to display both channel 1 and channel 2. Adjust the channel 2 volts per division to produce a suitable display.
6. Triggering on the BNC output waveform, verify that the polarity of the signal at the output BNC is the opposite of that measured at TP10. If the polarity is not reversed, switch jumpers J2 and J3.
7. Select common input coupling. Adjust the receiver front-panel COMP control for 0 V at the output BNC as displayed on channel 1 of the oscilloscope.
8. Move the jumper at J5 to the left two pins.
9. Select DC coupling. Apply a 200 mV, 1 kHz sine wave to the transmitter input using the low-frequency sine wave generator.

10. Connect the oscilloscope probe to TP11 and set the oscilloscope input coupling to AC, and the time per division to 0.5 ms/division. Adjust R59 counterclockwise for a 2 kHz sine wave at TP11 with all peaks equal in amplitude.

NOTE

Use AC coupling on the oscilloscope; the signal at TP11 is at approximately 10 VDC.

11. Select common input coupling. Adjust R146 counterclockwise for 7.5 VDC at TP7 using the DMM.
12. Select DC input coupling, ±10 V range. Apply the 100 Hz, 100 mV peak-to-peak square wave from the calibration generator to the transmitter input.
13. Adjust the front-panel COMP control for the best flat-top square wave response from the output BNC. Ignore any tilt in the lower portion of the waveform.

Low- and HIgh-Frequency Detect

1. At the transmitter, select DC input coupling, ±10 V input range. Apply the 100 mV, 100 Hz square wave from the calibration generator to the transmitter input.
2. Adjust R169 (at the right rear corner of the receiver board) until the HIGH FREQUENCY ACTIVE LED on the receiver front panel just turns on.
3. Adjust R170 (next to R169 on the receiver board) until the LOW FREQUENCY ACTIVE LED on the receiver front panel just turns on.
4. Turn off the transmitter and verify that both LEDs turn off. If they remain lighted, readjust R169 or R170.
5. Turn on the transmitter. Both LEDs should turn on at the same time. If they do not, then readjust R169 or R170 until they do.
6. Remove both of the fiber optic cables from the receiver and verify that both LEDs turn off.
7. Set the calibration generator to provide a 10 Hz square wave (on a PG506A, rotate the Variable Frequency knob fully clockwise).
8. Check to see if either the HIGH FREQUENCY ACTIVE LED or the LOW FREQUENCY ACTIVE LED is blinking. If one or both are blinking adjust R169 or R170 until the blinking stops. Repeat steps 2 through 8.

Gain Adjust

1. Connect the output of the receiver to the test oscilloscope, being sure to terminate in 50 Ω. Set the calibration generator to deliver a 100 mV Standard Output waveform. Apply the Standard Output of the calibration generator to the input of the transmitter, being sure *not* to terminate in 50 Ω. Set the oscilloscope to 1 ms/division and 200 mV/division, DC coupled.
2. At the transmitter, select the ±10 V range, DC input coupling.
3. Adjust the receiver front-panel GAIN control for exactly 1.00 V displayed on the test oscilloscope.
4. Adjust the receiver front-panel COMP control if required to accurately adjust gain.
5. Set the transmitter input coupling to common. Adjust the front-panel OFFSET control for exactly 0 V output.
6. Repeat steps 3 through 6 until no improvement is possible. (The gain and offset adjustments interact.)
7. At the transmitter, select the ±100 V range. Set the calibration generator to deliver a 1 V Standard Output. Verify 1.00 V ± 30 mV at the output (typically 1.00 V ± 5 mV).
8. Select the ±850 V range. Set the calibration generator to deliver a 10 V Standard Output. Verify 1.00 V ± 30 mV at the output (typically 1.00 V ± 5 mV).

NOTE

The gains for the ±10 V and the ±100 V ranges are set by precision resistors, so there are no adjustments. This is a verification only. Accuracy is typically ± 5 mV.

Compensation Adjust

1. At the transmitter, select DC coupling, ±10 V input range.
2. Apply the 100 Hz, 100 mV peak-to-peak square wave from the calibration generator's positive-going Fast Rise output, 50 Ω terminated, to the transmitter input. Connect the receiver output to the oscilloscope input using a coaxial cable and 50 Ω terminator.
3. Adjust the front-panel COMP control for the best flat-top square wave response at the output, as displayed on the oscilloscope.
4. Select the ±100 V input range on the transmitter. Set the calibration generator to deliver 1 V peak-to-peak to the transmitter input. Recheck compensation, and readjust the COMP control for best balance between the ±10 V and ±100 V settings.

5. Select the ±100 V range. Set the calibration generator frequency to 1 kHz. Adjust the oscilloscope time per division as necessary.
6. Using the adjustment tool, adjust C24 on the transmitter board for the best square wave response on the output waveform
7. Select the ±850 V range. Increase the sensitivity of the test oscilloscope to show a five-division display.
8. Using the adjustment tool, adjust grasshopper C40 on the transmitter board for the best square wave response on the output waveform.

Bandwidth

1. At the transmitter, select DC coupling, ±10 V range. Set the medium-frequency sine wave generator amplitude to 120 mV peak-to-peak. Apply the 50 kHz reference voltage from the sine wave generator through a BNC cable and 50 Ω terminator to the transmitter input. Attach the receiver output to the test oscilloscope, being sure to terminate in 50 Ω.
2. Verify that the test oscilloscope shows a six-division display at 200 mV/division. Adjust the sine wave generator amplitude if necessary.
3. Set the sine wave generator frequency to 15 MHz. Using the adjustment tool, adjust C14 on the transmitter board and C66 on the receiver board for exactly a 4.2-division display. A midrange position of both capacitors is preferable.
4. Vary the sine wave generator frequency between 10 and 15 MHz to confirm that the displayed waveform does not drop below 4.2 divisions in this frequency range. Readjust C66 and C14 as required.

Probe Calibration

1. Set the calibration generator to produce a 10 kHz, Fast-Rise step. Set the calibration generator Pulse Amplitude to maximum and attach the BNC cable to its center BNC (positive-going step). Insert a 50 Ω terminator between the end of the BNC cable and the banana adapter. Attach the A6905S probe to the banana adapter by attaching the probe tip to the signal side of the banana adapter and attaching the reference common lead to the ground side of the adapter.

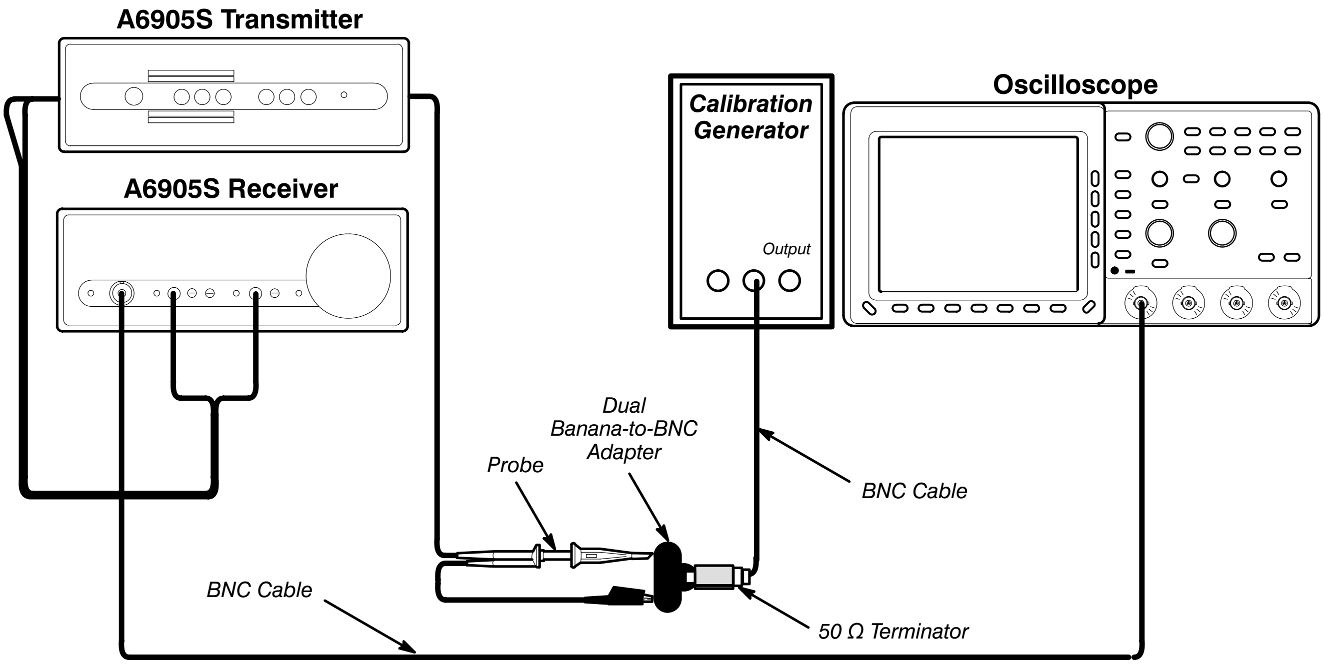


Figure 6-3: Setup for Probe Calibration

2. Set the transmitter range to ±10 V and set the oscilloscope to 20 mV/division and 10 µs/division.
3. The top of the waveform should be flat to within 2%. Insert a non-conductive screwdriver into the hole in the A6905S probe compensation box, and rotate the screwdriver until optimum flatness is obtained.

Servicing Information

Maintenance

WARNING

Internal components within the transmitter are connected to the probe common reference. To avoid the risk of serious electrical shock, disconnect both the probe tip and common reference connector from any device prior to opening the transmitter case.

Fiber Optic Cable Replacement

This procedure may be used to replace damaged cables or to install different length cables.

CAUTION

The fiber optic cable contains a glass fiber. Subjecting the cable to a bend with a radius less than 4 cm (1.5 inch) may damage the cable.

1. Remove both fiber optic cables from the receiver by loosening the front-panel connections. If the cable is to be reused, install the protective dust caps over the cable ends.
2. Remove the battery pack from the transmitter.
3. Using a Phillips screwdriver, remove the two recessed screws from the bottom case.

WARNING

Do not attach the probe tip or common reference to any hazardous voltage while the covers are removed. Hazard of electrical shock to the operator may result.

4. With the transmitter positioned upright, gently remove the top case. Note that the front panel is mounted in a groove in the case.
5. Using a flat-blade screwdriver, remove the four plastic screws from the inner shield.

6. Remove the shield by lifting straight up.
7. Remove the fiber optic cables by loosening the threaded connector. Replace the protective dust caps on the cable ends.
8. Remove the dust caps from one end of the replacement fiber optic cable pair. Carefully insert the cable connectors into the optical transmitters on the circuit board. Install the cable marked LOW in the optical transmitter closer to the rear of the instrument (closest to the shield).
9. Tighten the threaded connectors until the cables are fully seated into the transmitters. Tighten finger-tight only.

NOTE

With the exception of the 100 m cable, all lengths of fiber optic cable are interchangeable. When installing a 100 m cable into a system that previously used a shorter cable, or when installing a shorter cable into a system that previously used a 100 m cable, recalibration will be required. Perform the instrument calibration procedure prior to continuing. If neither of these conditions apply, proceed directly to Step 10.

10. If necessary, arrange the cables through the holes in the lower case. Align the upper shield with the lower shield and press it into place. The upper shield fits outside of the lower shield on all sides.
11. Install the four plastic screws that retain the shield. Use care to avoid over-tightening the screws.
12. Align top case cover with the front panel and press them together. Turn the instrument over and install the two case retaining screws.
13. Remove the dust covers from the other end of the cable and install the cable into the receiver.
14. Replace the battery pack into the transmitter.

Probe Replacement

1. Remove the battery pack from the transmitter.
2. Using a Phillips screwdriver, remove the two recessed screws from the bottom case.

WARNING

Do not attach the probe tip or common reference to any hazardous voltage while the covers are removed. Hazard of electrical shock to the operator may result.

3. With the transmitter positioned upright, gently remove the top case. Note that the front panel is mounted in a groove in the case.
4. Using a flat-blade screwdriver, remove the four plastic screws from the inner shield.
5. Remove the shield by lifting it straight up.
6. The probe is connected with a standard BNC connector. Remove the probe by rotating the connector shell one-quarter turn clockwise when facing the front of the transmitter. Pull back on the connector and remove the probe.
7. Carefully arrange the replacement probe cable through the holes in the outer case and the inner shield. Insert the probe connector into the BNC connector on the transmitter board. Align the compensation box with the LF adjustment hole facing up. (When properly aligned, the large end of the compensation box will be closest to the shield.) Tighten the BNC connecter by turning it counterclockwise when viewed from the front of the transmitter.
8. Reinstall the battery pack into the transmitter.

NOTE

It is necessary to adjust the probe low-frequency compensation following probe replacement. Perform the Probe Adjustment Procedure described on page 6-11 before reassembling the transmitter.

9. Align the upper shield with the lower shield and press it into place. The upper shield fits outside of the lower shield on all sides.
10. Install the four plastic screws that retain the shield. Use care to avoid over-tightening the screws.
11. Align the top case cover with the front panel and press them together. Turn the instrument over and install the two case retaining screws.

Replaceable Parts

Replaceable Parts

This section contains a list of the components that are replaceable for the A6905S Optical Isolation System. As described below, use this list to identify and order replacement parts. There is a separate Replaceable Parts list for each instrument.

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.

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 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

Leading dots in this parts list 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 (same number of leading dots) 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
S3109	FELLER	72 VERONICA AVE UNIT 4	SUMMERSET NJ 08873
0B445	ELECTRI–CORD MFG CO INC	312 EAST MAIN ST	WESTFIELD PA 16950
29870	VICTOR CORP	618 MAIN STREET	WEST WARWICK RI 02893
61935	SCHURTER INC	1016 CLEGG COURT	PETALUMA CA 94952–1152
64537	KDI ELECTRONICS INC SUBSIDIARY OF KDI CORP	31 FARINELLA DR	EAST HANOVER NJ 07936
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077–0001

Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
8-1–	118–9019–00			1	TRANSMITTER:W/3 METER CABLE (STANDARD ONLY)	80009	118901900
	118–9018–00			1	TRANSMITTER:W/15 METER CABLE (OPTION 01 ONLY)	80009	118901800
	118–9017–00			1	TRANSMITTER:W/100 METER CABLE (OPTION 02 ONLY)	80009	118901700
–1	118–9020–00			1	.BATTERY PACK:8 AA CELLS,TRANSMITTER	80009	118902000
–2	010–0565–00			1	.PROBE,PASSIVE:FLOATING,100X	80009	010056500
–3	206–0461–00			1	..PROBE HEAD:100X BLACK	80009	206046200
–4	013–0107–07			1	..TIP,PROBE:MINIATURE/COMPACT SIZE	80009	013010707
–5	174–3099–00			1	.CABLE ASSY:3 METER,FIBER OPTIC .(STANDARD ONLY)	80009	174309900
	174–3098–00			1	.CABLE ASSY:15 METER,FIBER OPTIC .(OPTION 01 ONLY)	80009	174309800
	174–3097–00			1	.CABLE ASSY:100 METER,FIBER OPTIC .(OPTION 02 ONLY)	80009	174309700
	––––––––			1	.CABLE ASSY:50 METER,FIBER OPTIC .(SEE OPTIONAL ACCESSORIES)		

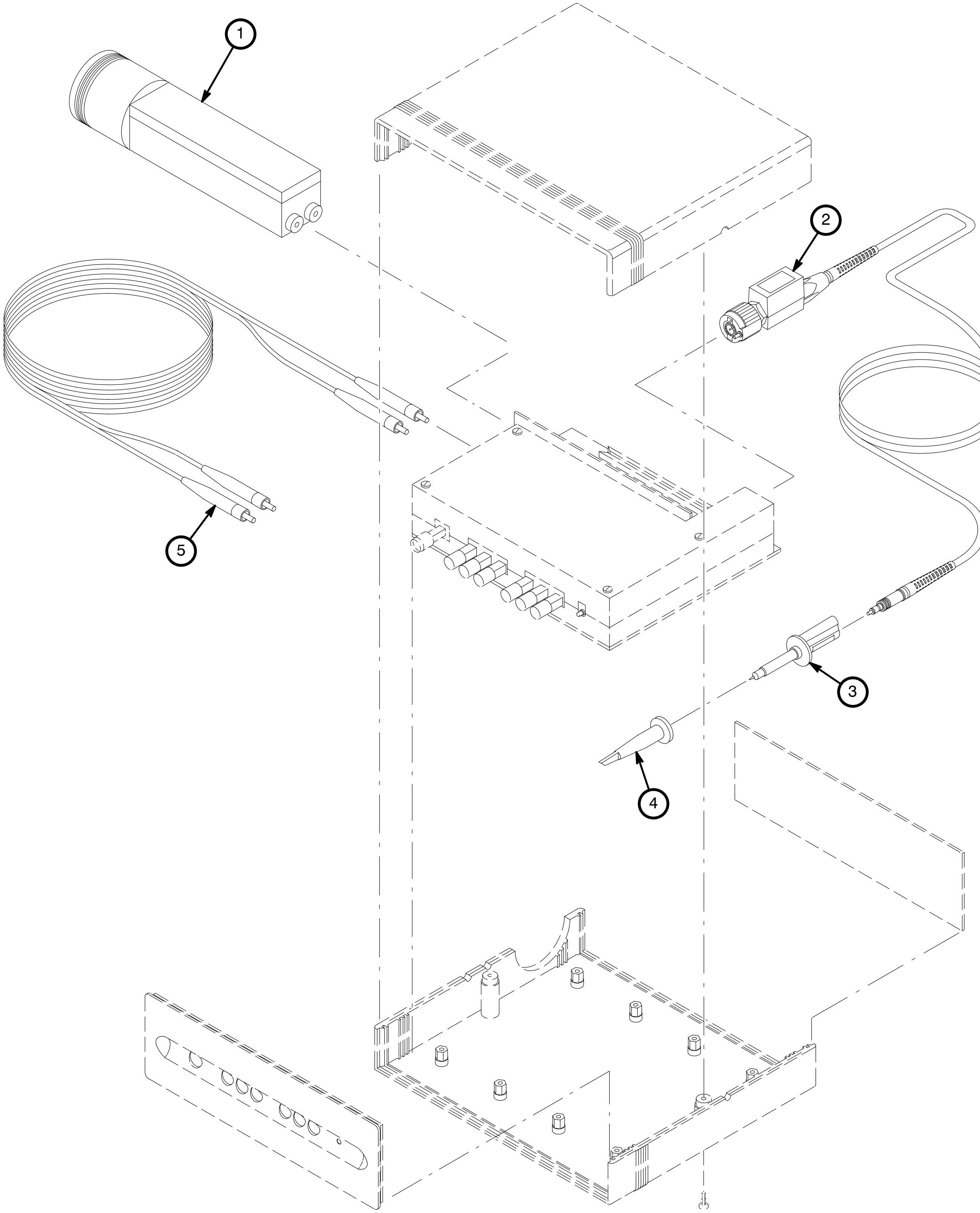


Figure 8-1: Transmitter Replaceable Parts

Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
8-2–	118–9016–00			1	RECEIVER:	80009	118901600
–1	159–0345–00			1	.FUSE,CARTRIDGE:DIN,1A,250V,FAST	80009	159034500
					.(STANDARD ONLY)	61935	001.1001
	159–0351–00			1	.FUSE,CARTRIDGE:5MM X 20MM,250V,0.5A,HIGH .BREAKING CAPACITY,CERAMIC .(OPTIONS A1 & A2 ONLY)		
–2	161–0066–00			1	.CABLE ASSY,PWR,:3,18AWG,98 L,SVT,GREY/BLK .6.0 DEG C,IEC BME X STR,IEC RCPT,10A/125V .(STANDARD ONLY)	0B445	ECM–161–0066–00
–3	118–9020–00			1	.BATTERY PACK:8 AA CELLS,TRANSMITTER	80009	118902000

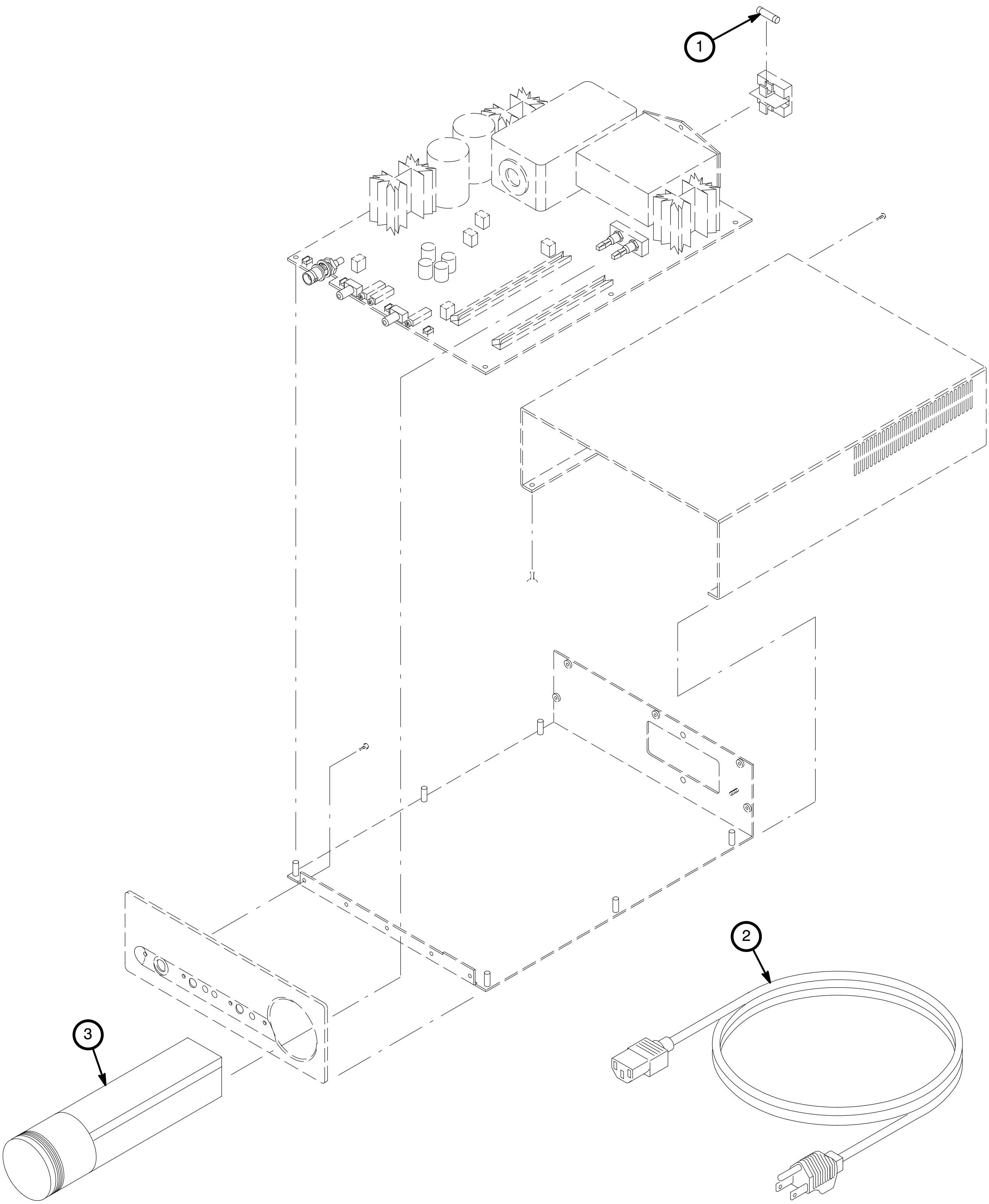


Figure 8-2: Receiver Replaceable Parts

Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
8–3–					**STANDARD ACCESSORIES**		
–1	161–0066–09			1	CABLE ASSY,PWR,:3,0.75MM SQ,220V,99.0 L EUROPEAN (OPTION A1 EUROPEAN)	S3109	86511000
–2	161–0066–10			1	CABLE ASSY,PWR,:3,0.1MM SQ,250VOLT,2.5 METERS LONG,UNITED KINGDOM,STR IEC–320 RCPT,13 AMP FUSED (OPTION A2 UNITED KINGDOM)	S3109	BS/13–H05VVF3G0
–3	011–0049–01			1	TERMN,COAXIAL:50 OHM,2W,BNC	64537	T132DS
–4	012–1392–00			1	LEAD,SET:(1) SIGNAL,(1) GROUND	80009	012139200
–5	012–0057–01			1	CA ASSY,RF:COAXIAL,;RFD,50 OHM,43 L, BNC,MALE, STR,BOTH ENDS,W/STRAIN RELIEF BOOT BOTH ENDS	80009	012005701
	070–8773–00			1	MANUAL,TECH:INSTRUCTION,A6905S	80009	070877300
					OPTIONAL ACCESSORIES		
	174–3096–00			1	CABLE ASSY:50 METER,FIBER OPTIC (SEE FIGURE 9–1, INDEX NUMBER 4)	80009	174309600

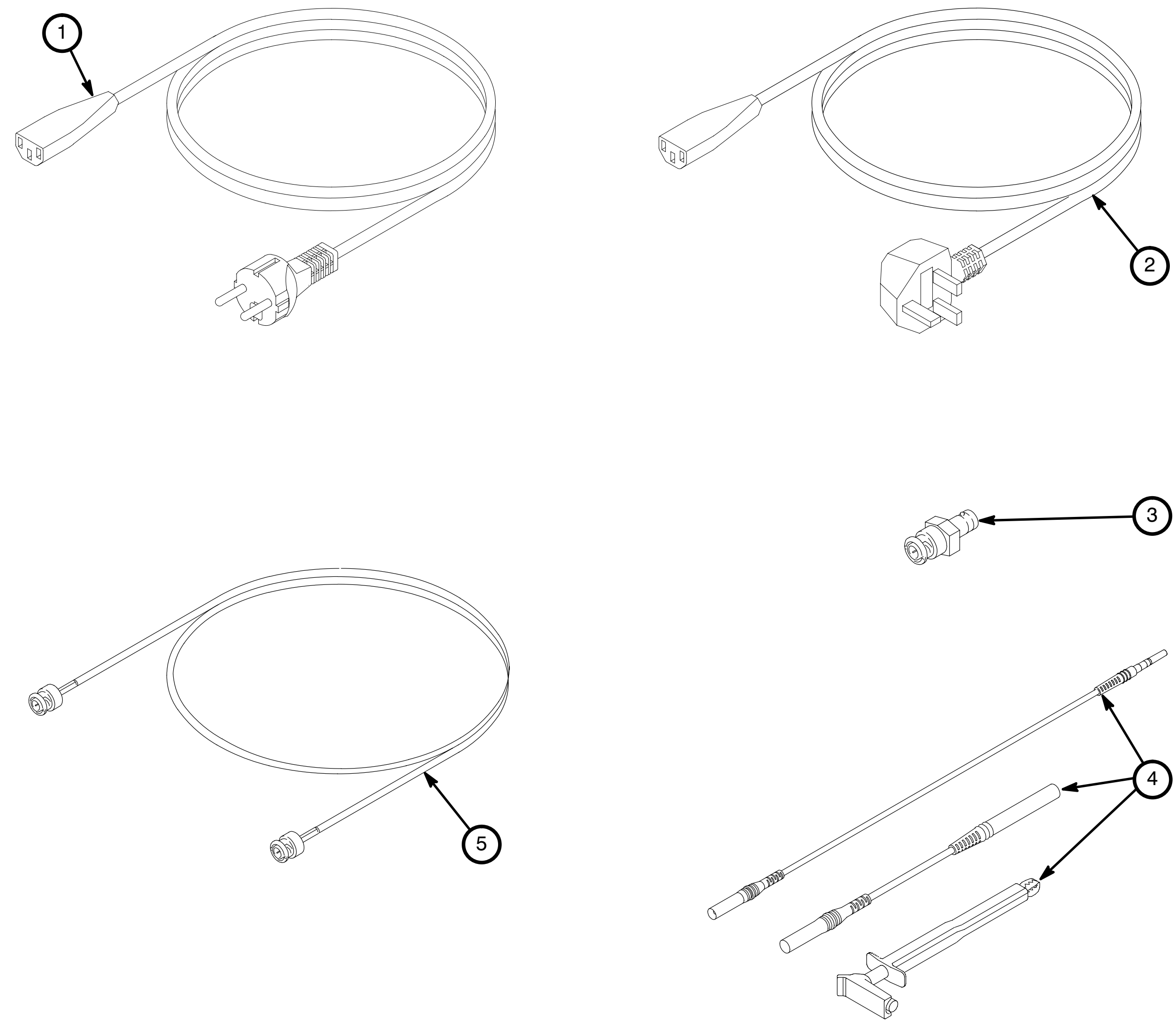


Figure 8-3: Accessories

Index

Index

A

Accessories, *1-2*
  industrial lead set, *3-7–3-8*

Adjustments
  by service personnel, *6-1–6-11*
    bandwidth, *6-10*
    compensation adjust, *6-9–6-10*
    gain adjust, *6-9*
    low- and high-frequency detect, *6-8*
    probe calibration, *6-11*
    receiver high-frequency circuit, *6-7*
    receiver low-frequency circuit, *6-6*
    receiver output circuit, *6-7–6-8*
    voltage checks, *6-5*
  by user, *3-13–3-16*
  gain and offset, *3-14–3-15*
  prior to performance verification, *5-2–5-3*

Attenuation range, selecting, *3-3–3-5*

Attenuator accuracy check, *5-4*

B

Bandwidth check, *5-6*

Battery pack, *2-2–2-4*
  changing, *2-2–2-4*
  recharging, *2-3–2-4*

C

Calibration, *6-3–6-11*
  bandwidth, *6-10*
  compensation adjust, *6-9–6-10*
  gain adjust, *6-9*
  low- and high-frequency detect, *6-8*
  probe, *6-11*
  receiver high-frequency circuit, *6-7*
  receiver low-frequency circuit, *6-6*
  receiver output circuit, *6-7–6-8*
  voltage checks, *6-5*

CAUTION
  statement in manual, *vii*
  statement on equipment, *vii*

Clipping, of input signal, *3-3–3-4*

Controls
  attenuation, *3-3–3-5*
  coupling, *3-3*
  power
    receiver, *2-5*
    transmitter, *2-5*
  receiver overview, *3-2*
  transmitter overview, *3-1*

Corruption, of input signal, *3-4*

Coupling, selecting, *3-3*

D

DANGER, statement on equipment, *vii*

Disassembly, *6-2*

F

Fiber optic cable
  connecting, *2-5*
  options, *1-2*
  replacing, *7-1–7-2*

Fuse, *2-2*

G

Gain adjustment
  by user, *3-14–3-15*
  prior to performance verification, *5-2–5-3*

Gain and offset adjustment, prior to performance verification, *5-2–5-3*

I

Industrial lead set, *3-7–3-8*

Installation, *2-1–2-5*

L

Lead set, *3-7–3-8*

LEDs
- active, *3-2*
- charging, *3-2*
- low battery, *2-5*

Line voltage selector, *2-1–2-2*
- location, *2-1–2-2*

Low battery LED, *2-5*

M

Maintenance, *7-1–7-3*
- replacing fiber optic cable, *7-1–7-2*
- replacing probe, *7-3*

Measurement
- conditions affecting accuracy, *3-9–3-12*
- procedure, *3-9*

Measurement accuracy, selecting proper attenuation, *3-3–3-5*

Measurements
- conditions affecting accuracy, common mode feed-through, 3-9–3-12
- error in output signal
  - causes of, *3-11*
  - minimizing, *3-12*

N

Noise corruption, of input signal, *3-4*

O

Offset adjustment
- by user, *3-14–3-15*
- prior to performance verification, *5-2–5-3*

Options, *1-2*
- power cord, *1-3*

Ordering information, *8-1–8-10*

P

Performance verification, *5-1–5-6*
- attenuator accuracy, *5-4*
- bandwidth check, *5-6*
- probe compensation check, *5-5*

Power button, transmitter, *2-5*

Power cords, *1-3*

Power source, selecting range, *2-1–2-2*

Power switch, receiver, *2-5*

Probe, *3-7–3-8*
- accessories, *3-7–3-8*
- compensation check, *3-16*, *5-5*
- replacing, *7-3*

Product description, *1-1–1-3*

R

Receiver board, *6-4*

Receiver controls
- overview, *3-2*
- power switch, *2-5*

Replaceable parts, *8-1–8-9*

S

Safety
- servicing summary, *ix*
- symbols and terms, *vii*
- user summary, *vii– viii*

Servicing safety summary, *ix*

Settings, *3-3–3-5*

Specifications, *4-1–4-4*
- nominal, *4-1–4-2*
- typical, *4-4*
- warranted, *4-3*

T

Test points
- receiver board, *6-4*
- transmitter board, *6-3*

Transmitter board, *6-3*

Transmitter controls
attenuation, *3-3–3-5*
coupling, *3-3*
overview, *3-1*
power button, *2-5*

U

User safety summary, *vii– viii*

V

Verification, performance, *5-1–5-6*

Voltage range, changing, *2-1–2-2*

W

WARNING, statement in manual, *vii*