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User Manual



A6907 & A6909
High Voltage Isolators

070-9094-06

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.

CE

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Tektronix, Inc., P.O. Box 1000, Wilsonville, OR 97070–1000

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

Only qualified personnel should perform service procedures.

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

Injury Precautions

Use Proper Power Cord

To avoid fire hazard, use only the power cord specified for this product.

Avoid Electric Overload

To avoid electric shock or fire hazard, do not apply a voltage to a terminal that is outside the range specified for that terminal.

Ground the Product

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

Do Not Operate in Wet/Damp Conditions

To avoid electric shock, do not operate this product in wet or damp conditions.

Do Not Operate in Explosive Atmosphere

To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Product Damage Precautions

Use Proper Power Source

Do not operate this product from a power source that applies more than the voltage specified.

Do Not Operate With Suspected Failures

If you suspect there is damage to this product, have it inspected by qualified service personnel.

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Safety Terms and Symbols

Terms in This Manual

These terms may appear in this manual:

WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*

CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Terms on the Product

These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product

The following symbols may appear on the product:



DANGER
High Voltage



Protective Ground
(Earth) Terminal



ATTENTION
Refer to
Manual



Double
Insulated

Certifications and Compliances

CSA Certified Power Cords

CSA Certification includes the products and power cords appropriate for use in the North America power network. All other power cords supplied are approved for the country of use.

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Getting Started

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Product Description

The A6907 and A6909 High Voltage Isolators connect “floating” (not referenced to ground) signals to an oscilloscope or digitizer for measurement. Optical couplers, insulated transformers, and plastic barriers are used for extremely high isolation between channels and the chassis, and from channel to channel.

Signals measured between the tip and common connections of the special probes are fully isolated from ground and other channels. The maximum rated voltage between the probe tip and probe common (normal mode voltage) is 850 V (DC + peak AC). The maximum rated voltage between the probe common and chassis ground (common mode voltage) is also 850 V (DC + peak AC).

The electrical-to-optical (E/O) converter isolates the signal and converts it to an optical analogue. The optical-to-electrical (O/E) converter demodulates the optical signal to an electrical signal whose common mode elements have been rejected. The E/O converter uses a unique low-contact DC to DC converter as a power source to provide a high degree of isolation.

The A6907 and A6909 satisfy the UL1244, CSA 231, and IEC1010-1 safety standards for floating measurements. The A6907 and A6909 have the following special features:

- DC to 60 MHz bandwidth
- Self-calibration function for accurate measurements
- Portable configuration
- Excellent linearity and low interference
- External control through GPIB interface standard on the A6907 (option 10 on the A6909)
- 20 kV/µs slew rate

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Options And Accessories

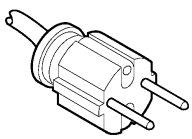
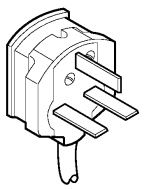
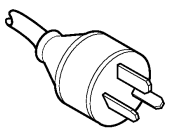
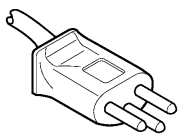
Several options and accessories are available for your isolator. Please review this listing to select the items that best suit your application.

Options

The following options are available for the A6907 and A6909:

- Option 10 includes the GPIB interface on the A6909.
- Options A1–A3, A5. Besides the standard North American, 110 V, 60 Hz power cord, Tektronix will ship any of four alternate power cords with the isolator when ordered by the customer.

Table 1–1: Optional Power Cords

Plug Configuration	Normal Usage	Option Number
	Europe 230 V	A1
	United Kingdom 230 V	A2
	Australia 230 V	A3
	Switzerland 230 V	A5

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Accessories

The following standard and optional accessories are available for the A6907 and A6909. Refer to the *Replaceable Parts* section for current part numbers.

Standard Accessories

The A6907 and A6909 come with the following standard accessories:

- Power cord
- Fuses (2.5 Amp, 250V, fast blow)
- 50Ω BNC cable set (4 cables with A6907, 2 cables with A6909)
- Special probes (4 with A6907, 2 with A6909)
- Instruction Manual

Optional Accessories

The following optional accessories are available for the A6907 and A6909:

- 50Ω BNC feedthrough termination
- GPIB cable
- A620 current probe

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Installation

The isolator must be connected to line power before you can configure it for measurements. Please read this portion carefully to avoid equipment damage or personal injury.

Power Source

The A6907 and A6909 can be used with AC power at frequencies from 50 Hz to 60 Hz and at voltages from 100 V to 240 V.

Line Fuse

Make sure that the proper line fuse has been installed before connecting the isolator to the power source.



CAUTION. *The isolator may be damaged if the wrong line fuse is installed.*

Check the fuse holder located beneath the input power connector:

1. Disconnect all power and signal connections to the isolator.
2. Use a small straight-slot screwdriver to pry the cap out of fuse holder.
3. Verify proper fuse value:

   Standard (115 V): 2.5 A, 250 V, fast-blow
   Options A1, A2, A3 & A5 (230 V): 2.5 A, 250 V, slow-blow

   For the correct part number of each fuse, refer to *Replaceable Parts* on page **¿¿¿¿**.
4. Install the proper fuse and reinstall the fuse holder cap.

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Power Cord



WARNING. *In order to prevent electrical shock, only plug the power cord into grounded three-wire outlets. Do not defeat the ground connection on the plug.*

The A6907 and A6909 power cords are three-wire grounded cords. The metal portions on the outside of the isolator are connected to the power-source ground by means of the ground wire in the power cord and plug.

Connecting the Probe



WARNING. *In order to prevent electrical shock, do not substitute any other style of probe for the special probes provided with the isolator. The provided probes are specially insulated for high voltage measurements.*

Do not make connections to a circuit before connecting the probe to the isolator. Firmly push the probe connector into the channel input on the front panel of the isolator. Refer to Figure 1–1.

For information on probe accessories and probing techniques, refer to the *Special Probe* section starting on page 2–5.

Connecting Output Cables

Use the 50 Ω BNC cables included with the instrument to connect the isolator to an oscilloscope or digitizer. Refer to Figure 1–1.

NOTE*. The input impedance of the connected oscilloscope must be 50Ω. If your oscilloscope does not provide a 50Ω termination, attach an optional 50Ω feedthrough termination between the BNC cable and the oscilloscope input connector. Unterminated channels will report the error code E06 during self-calibration.*

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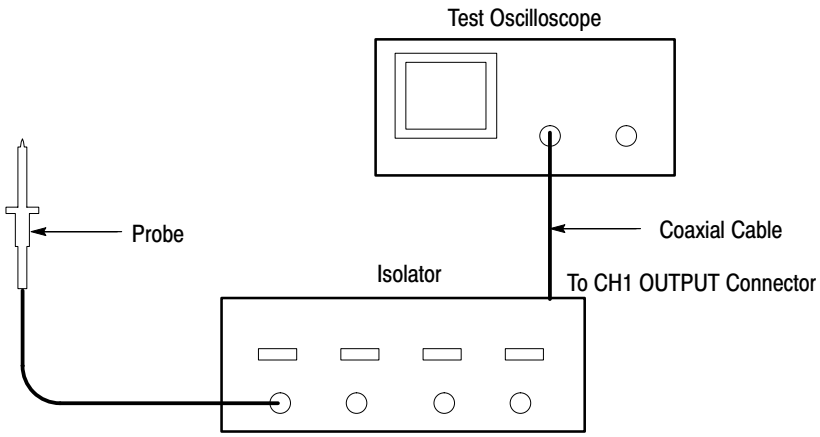


Figure 1–1: Isolator Setup

Set the oscilloscope input attenuators to 100 mV/division.

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Functional Check

After line power is connected to the isolator, perform a functional check to test normal system operation. To ensure proper operation of your isolator, follow these steps:

Turning On Power

Set the **POWER** switch on the rear panel to the ON position. This enables the STBY/ON control on the front panel.

Press the **STBY/ON** button on the front panel. The isolator will automatically begin the self-test procedure.

If the results of the self-test are normal, the channel display settings revert to the values that were effective when the power was last turned off. If there is a self-test error, an error code will appear on all of the channel indicators. See Table 1–2.

Table 1–2: Isolator Error Codes

Error Code	Description
E01	ROM checksum error
E02	RAM read/write error
E03	EEPROM checksum error
E04	EEPROM read/write error

If an error code is displayed, contact your local Tektronix Field Office for assistance.

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Self-Calibration

NOTE. *In order to ensure the accuracy of measurements, self-calibration should be performed just before taking measurements.*

The A6907 and A6909 are equipped with a self-calibration function that automatically calibrates the offset and gain for each channel for maximum accuracy. After the isolator has been warmed up for 20 minutes, use the following procedure to perform the self-calibration:

1. Make sure that each channel output is terminated into 50 Ω.
2. Set the oscilloscope input attenuators to 100 mV/division.
3. Press the **CAL** button on the front panel. Self-calibration will begin and the gain and offset values for each channel will be calibrated. If self-calibration completes without error, the values shown on the indicators will return to normal.

NOTE. *If error code EO6 appears after self-calibration, it may be because a 50 Ω load is not connected to the channel output. If a load is properly connected but the error code is still displayed, contact your local Tektronix Field Office.*

If you need to enter custom offset or gain values, refer to the *Manual Adjustments* section starting on page 3–3.

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Operating Basics

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Functional Overview

This section describes the controls, indicators and connectors on the A6907 and A6909. Figures 2–1 and 2–2 show the A6907; the A6909 does not have channels 3 and 4.

Isolator Front Panel

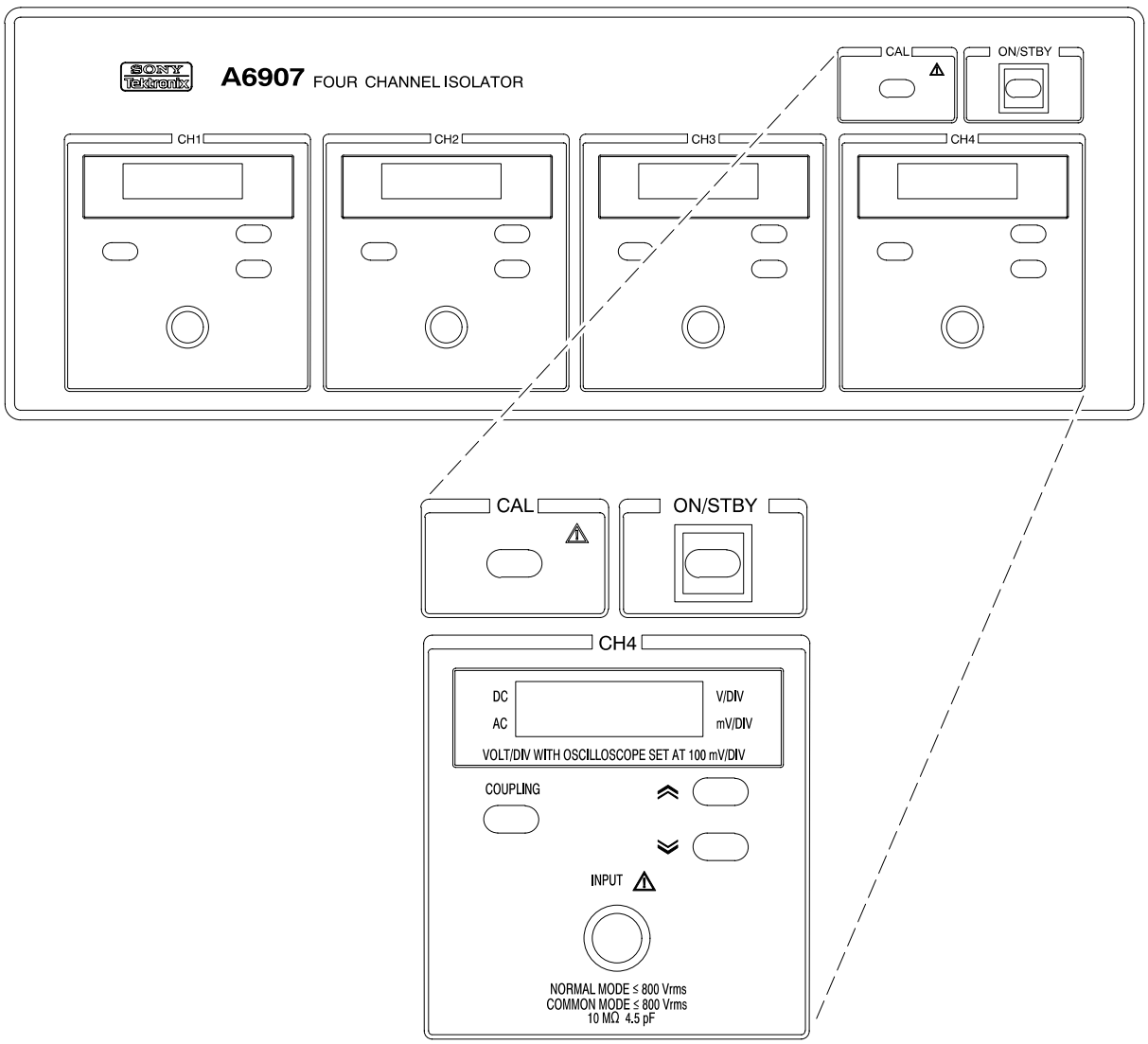
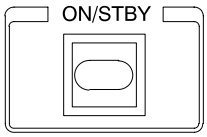


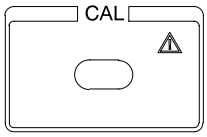
Figure 2–1: Isolator Front Panel

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Isolator Front Panel Controls and Connections



ON/STBY. Pressing the ON/STBY button toggles the isolator between the ON and STANDBY modes. The POWER switch on the rear panel must be in the ON position in order to enable the ON/STBY button. See page 2–3 for more details.



CAL. Pressing the CAL button starts a self-calibration process. The CAL process should be run before making any measurements. Also, the oscilloscope input should be set to 100 mV/division for the output scale factor to be accurate.

See page 1–10 for a description of the self-calibration process.

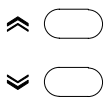


COUPLING. Pressing the COUPLING button toggles the isolator between DC and AC input coupling.

DC Coupling – All frequency components included in the input signal are passed to the attenuator.

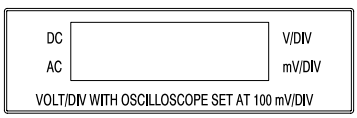
AC Coupling – DC signal components are blocked. The input signal first passes through a capacitor before being coupled to the attenuator.

The coupling status is shown on the left side of the channel display. This button also provides manual adjustment of the offset and gain values. See *Manual Adjustments* on page 3–3 for more details.



SCALE. Pressing the up and down SCALE buttons adjusts the attenuator scale for each channel on the isolator. The isolator attenuator scale can be set to any value between 100 mV and 200 V per division in 1–2–5 increments. The value shown on the channel indicator is the value when the oscilloscope connected to the isolator is set to 100 mV per division.

These buttons are also used during manual adjustment of the offset and gain. See *Manual Adjustments* on page 3–3 for more details.



CHANNEL DISPLAY. The channel display indicates channel coupling and scale factor. The display also shows error codes in the event of an error in the self-test or self-calibration processes.



INPUT. The INPUT connection is where the probe is connected to the isolator.

Do not attempt to substitute any other style probes for the ones that are provided with the isolator. The provided probes are specially insulated and using substitute probes may cause an electrical safety hazard.



WARNING. *To avoid the risk of electrical shock, do not connect any other probes than those shipped with the isolator.*

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Isolator Rear Panel

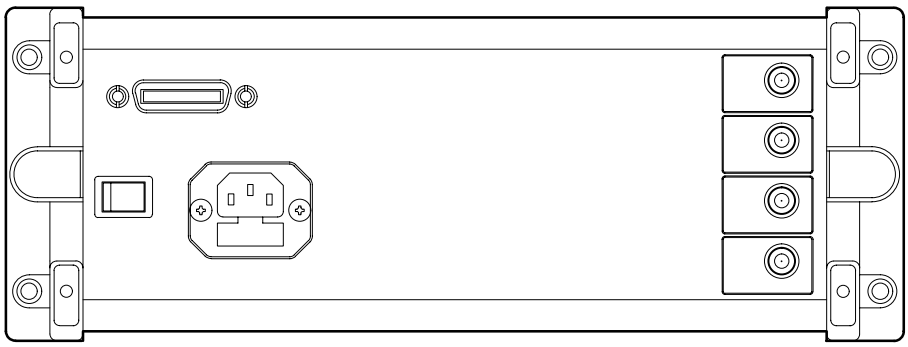
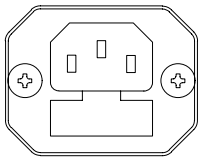
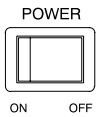
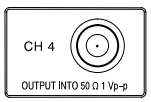
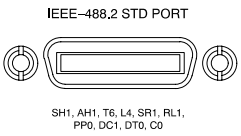


Figure 2–2: Isolator Rear Panel

Isolator Rear Panel Controls and Connections

	**INPUT POWER.** The input power connection provides a connection for the power cord and contains the input power fuse. For a list of the available power cords, refer to the *Options* section on page 1–3.
	**POWER ON/OFF.** This is the main power switch for the instrument. It must be set to the ON position to enable the STANDBY/ON key on the front panel.
	**OUTPUT.** Each channel in the isolator has a 50 Ω output BNC connection. In order for the isolator to successfully complete the self-calibration, all of the channels must each be terminated into a 50 Ω load. *If the error code EO6 appears after self-calibration, it may be because the channel is not terminated into a 50 Ω load.* If your oscilloscope does not provide a 50 Ω input termination, a 50Ω feedthrough termination may be ordered as an optional accessory. Also, the oscilloscope input should be set to 100 mV/division for the output scale factor to be accurate.
	**IEEE-488.2 STD PORT.** This is a General Purpose Interface Buss (GPIB) connector. The GPIB function is standard on the A6907 and may be ordered as option 10 with the A6909. For more information on GPIB operation, refer to the *GPIB Programming* section starting on page 3–7.

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Isolator Scale Factor

The voltage scale-factor displayed on the front-panel of the isolator is valid only when the oscilloscope is set to 100 mV/division. If you must set the oscilloscope at other than 100 mV/division, refer to Table 2–1 to calculate the new scale-factor.

***NOTE**. The performance characteristics of the isolator are not warranted if the oscilloscope is not set to 100 mV/division.*

Table 2–1: Isolator Scale Factors

Oscilloscope Setting	Isolator Scale Multiplier
100 mV	×1
200 mV	×2
500 mV	×5
1 V	×10
2 V	×20
5 V	×50
10 V	×100
20 V	×200
50 V	×500
100 V	×1000
200 V	×2000

For example, if the isolator is set at 20 Volts/division, and the oscilloscope is set at 1 Volt/division (scale multiplier = 10), the displayed waveform will be at 200 Volts/division (20 × 10 = 200).

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Special Probes

The isolator is supplied with special voltage probes for immediate use. An optional current probe may be ordered for current measurements.

WARNING. *Do not use a special probe if the probe head or leads are damaged. It may present an electrical safety hazard resulting in injury or death.*

Voltage Probe

The special voltage probe is provided with the following accessories: retractable hook tip, IC lead protection shroud, probe common leads, and cable-marker rings (see Figure 2–3).

NOTE*. The probe included with the isolator as a standard accessory is intended for use with the isolator only. The balun on the cable provides shielding from large* $^{dv}/_{dt}$ *fields. Do not use the special probe with other instruments.*

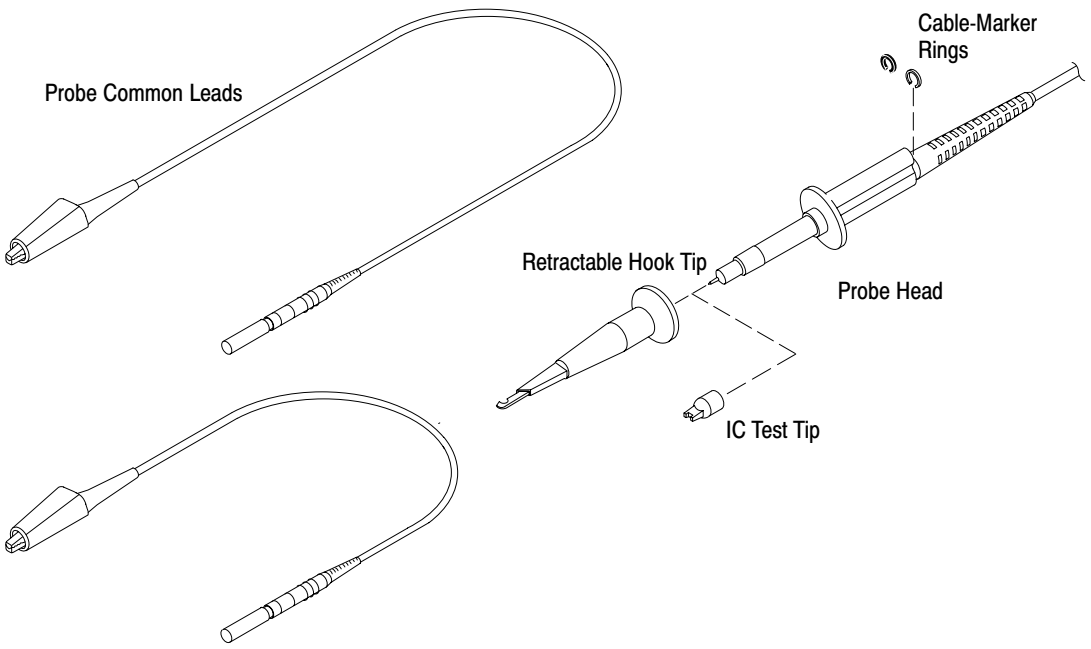


Figure 2–3: Special Voltage Probe and Accessories

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Use the sharp tip of the probe to make contact with terminals covered with solder resist or oxide. Handle the probe carefully to prevent damage to other objects or personal injury.

Use the retractable hook tip to connect the probe to the circuit (typically a component lead or test point connection) for “hands-free” measurements.

***NOTE**. When removing the hook tip from the probe, the probe may come loose from the probe cable. If this happens, the signals will not be passed from the probe to the isolator. When reconnecting the probe to the probe cable, make sure that the cable is securely inserted into the probe.*

When probing ICs, remove the retractable hook tip from the probe and attach the IC test tip to the tip of the probe. The tip of the probe will stick out from the IC test tip, but the probe tip will not come in contact with and short out an adjacent IC lead.

Connect the common lead to the reference point in the circuit. Because of the high capacitance of the common lead circuit, do not connect the common lead to high-impedance sections of the circuit. The additional capacitive loading may cause circuit damage. Connect the common lead to low-impedance sections of the circuit.



***WARNING.** In order to prevent electrical shock, do not attach the standard common lead to energized circuits above 42 V (60 VDC + peak AC). Use the optional industrial lead set for connecting to energized circuits above 42 V.*

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Common Lead Length

Always use as short a common lead as possible between the probe head and circuit common when you are probing a circuit.

The series inductance added by the probe tip and common lead can result in a resonant circuit; this circuit may cause parasitic "ringing" within the bandwidth of your oscilloscope. Refer to Figure 2–4.

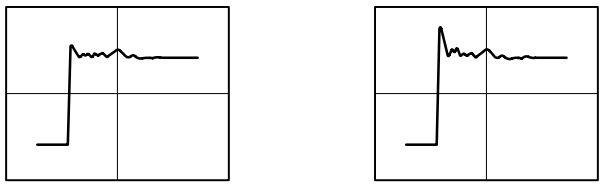


Figure 2–4: Waveform Distortion from Common Lead Length

When you touch your probe tip to a circuit element, you are introducing a new resistance, capacitance, and inductance into the circuit. Refer to Figure 2–5.

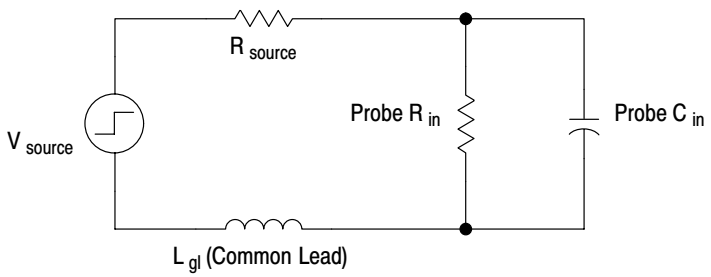


Figure 2–5: Common Lead Equivalent Circuit

Ringing and rise time degradation can be masked if the frequency content of the signal degradation is beyond the bandwidth of the oscilloscope.

You can determine if ground lead effects may be a problem in your application if you know the self-inductance (L) and capacitance (C) of your probe and common lead. Calculate the approximate resonant frequency (f_0) at which this parasitic circuit will resonate with the following formula:

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$$f_0 = \frac{1}{2\pi\sqrt{LC}}$$

The preceding equation shows that reducing the common lead inductance will raise the resonant frequency. If your measurements are affected by ringing, your goal is to lower the inductance of your common path until the resulting resonant frequency is well above the frequency of your measurements.

A620 Current Probe

The Tektronix A620 current probe enables the display of current waveforms up to 1000 amps when used with the isolator and an oscilloscope. The A620 is used where the display and measurement of distorted current waveforms and harmonics is required.



WARNING. *To avoid the risk of electrical shock, do not use the A620 in circuits operating at greater than 440 VAC (650 VDC + peak AC). Refer to the A620 Instructions for operating and safety information.*

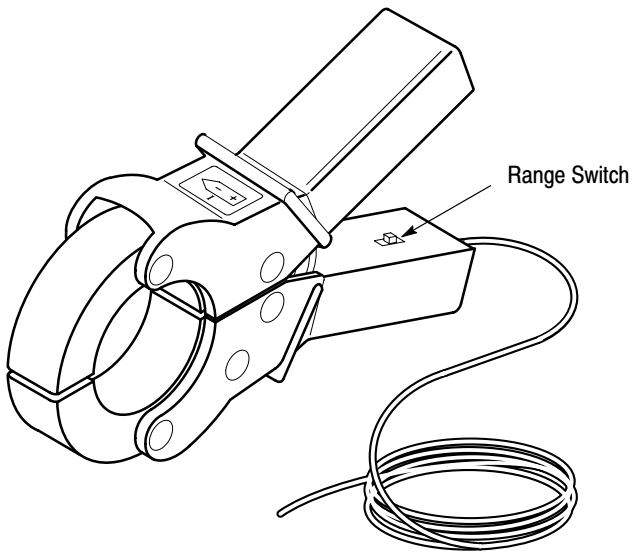


Figure 2–6: A620 Current Probe

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The A620 has three operating ranges, these ranges must be scaled to the operating characteristics of the isolator using the formula below:

$$Current\ /\ division = \frac{Isolator\ \ V/division}{A620\ \ Range\ \ Switch}$$

***NOTE**. The oscilloscope vertical input must be set to 100 mv/division when using the scale conversion formula.*

For example: If the isolator is set at 10 V/div. and the probe is set to 10 mV/A, then the displayed current per division will be 1000 A/division.

$$Current/division = \frac{10\ \ V/division}{10\ mV/Amp} = 1000\ A/division$$

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Reference

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Reference Introduction

The *Reference* section contains information on adjusting and operating the isolator. We have organized this section to provide basic information first, and information for experienced users at the end. This section contains the following information:

Manual Adjustments

After the calibration routine is completed, you may want to make adjustments to the offset and gain factors. This section provides detailed instructions for this process.

Floating Measurements

This section describes some of the terms and procedures used when making measurements that are not referenced to earth ground.

GPIB Programming

This section describes the set up and fundamental theory of controller operation of the isolator.

Syntax

This section describes the syntax or grammar of the commands that the controller will pass to the isolator.

Command Groups

This section lists the commands in groups according to the nature of their functions, and includes brief definitions and examples of the commands.

Commands

This section list the commands in alphabetical order and provides a detailed description of their definitions and operation.

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Status and Events

This section lists detailed information on the processor registers for the advanced user or programmer.

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Manual Adjustments

The self-calibration process ensures a high degree of accuracy for offset and gain values; however, the isolator also has a function for manual fine-adjustment of offset and gain values. This function may be used to eliminate an offset included in the input signal or to match the amplitude to that of a reference signal.

Adjusting Offset Values

Follow this procedure to change the channel offset value:

1. Press the **COUPLING** and down **SCALE** buttons simultaneously for the channel to which you wish to apply an offset value. The mode changes to the offset adjustment mode and an offset value (55 to 255) appears on the indicator.
2. Use the up and down **SCALE** buttons to set the offset value.
3. Once again, press the **COUPLING** and down **SCALE** buttons simultaneously. The channel reverts to the normal operating mode.

Adjusting Gain Values

Follow this procedure to change the channel gain value:

1. Press the **COUPLING** and up **SCALE** buttons simultaneously for the channel whose gain you wish to adjust. The mode will change to the gain adjustment mode and a gain value (55 to 255) appears on the indicator.
2. Use the up and down **SCALE** buttons to set the gain value.
3. Once again, press the **COUPLING** and up **SCALE** buttons simultaneously. The channel reverts to the normal operating mode.

***NOTE**. The V/DIV LED or mV/DIV LED on the indicator blinks to indicate that a channel is not calibrated when you have adjusted the offset or gain manually. To delete the values you have set manually, perform self-calibration again.*

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Floating Measurements

Floating measurements are measurements where a signal is measured between the probe tip and common, and not with respect to ground. To prevent electrical shock, the isolator probe tip and common lead for each channel are mutually isolated from one another as well as from the output. The E/O and O/E converters in the isolator convert the input signals into signals referenced to the chassis after common mode elements have been rejected. As a result, the potential between circuit elements can be measured directly regardless of the common lead reference.



WARNING. *In order to prevent electrical shock, do not attach the common lead to energized circuits above 42 V (60 V DC + peak AC). Use the optional industrial lead set for connecting to energized circuits above 42 V.*

The isolator chassis is grounded by means of a three-line grounded cord and three-prong plug. This ensures safety during the floating measurement process.



WARNING. *In order to prevent electrical shock, check to make sure that the power cord is firmly connected to a grounded outlet before connecting the probe of the isolator to the circuit to be measured.*

Maximum Common Mode Slew Rate

The maximum common mode slew rate indicates how fast a common mode input the instrument can withstand. This characteristic is sometimes called the "non-destructive $^{dv}/_{dt}$." On the A6907 and A6909, this value is 20 kV/µs. Therefore, the instrument can tolerate a common mode input signal with a slew rate less than this value.

Special Probe

The special standard probe features extra insulation to ensure safety when working with high voltages, and a balun to suppress the effects of large $^{dv}/_{dt}$ changes in the operating area.

Touching the probe when high-frequency high voltage is applied to the common lead will cause high-frequency current to flow by capacitive coupling to the person holding the probe. Although this capacitive current will not cause a

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physical shock, it is important to know the limits of the insulation. Please refer to figures 4–1 and 4–2 on page 4–3 for derating information.

Common Lead Connections

Although the isolator is insulated from ground, the common lead has 80 pF of capacitance to ground. Connect the common lead to low-impedance sections of a circuit to minimize the effects of capacitive loading

CAUTION. *To prevent damage to equipment, do not connect the common lead to high-impedance sections of a circuit. The additional capacitance may cause circuit damage. Connect the common lead to low-impedance sections only.*

Common Mode Rejection Ratio (CMRR)

The common mode rejection ratio (CMRR) indicates the quality of the floating measurement. This characteristic is typically expressed as a value in dB or as a ratio. The CMRR indicates the amplitude of the resulting error signal generated by a signal that has been applied in the common mode.

On the A6907 and A6909, a CMRR value at 1 MHz is 55 dB (560:1). For example, when a sine wave signal of 1 MHz at 100 Vp-p is applied as a common mode input, a differential error signal of 180 mV p-p or less will be generated (when the isolator range is set to 100 mV/div).

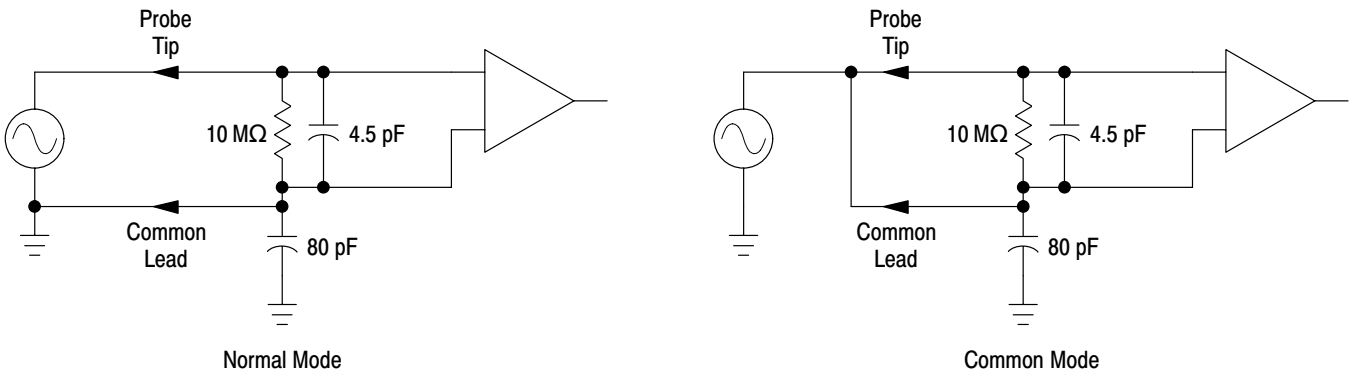


Figure 3–1: Normal and Common Mode Simplified Circuits

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GPIB Programming

You can use a computer to control the A6907 isolator and make measurements. (You can also control the A6909 with option 10 installed.) With an oscilloscope that also can be programmed, the computer and isolator can form a complete, automated measurement system.

Your computer, also known as the controller, must be capable of operating on a GPIB bus that conforms to IEEE Std 488.1–1987. GPIB cards are available to provide this capability for personal computers.

Attach an IEEE Std 488.1–1987 GPIB cable (see *Optional Accessories* in the *Replaceable Parts* section) between the GPIB connector and your controller. Figure 3–2 also shows how cables can be stacked together if you do not have a multiple connection cable. You can stack a second cable on either the isolator connector or the controller connector, to similarly connect your oscilloscope.

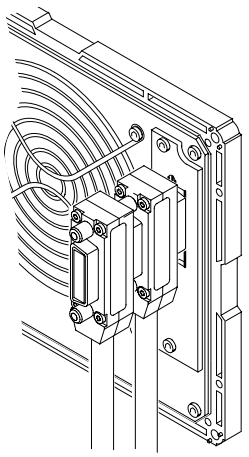


Figure 3–2: Typical Stacked GPIB Connectors

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GPIB Requirements

Observe these rules when you use your isolator with a GPIB network:

- Assign a unique device address to each device on the bus. No two devices can share the same device address.
- Do not connect more than 15 devices to the bus.
- Connect one device for every 2 meters (6 feet) of cable used.
- Do not use more than 20 meters (65 feet) of cable for the entire bus.
- Turn on at least two-thirds of the devices on the network while using the network.
- Connect the devices on the network in a star or linear configuration as shown in Figure 3–3. Do not use loop or parallel configurations.

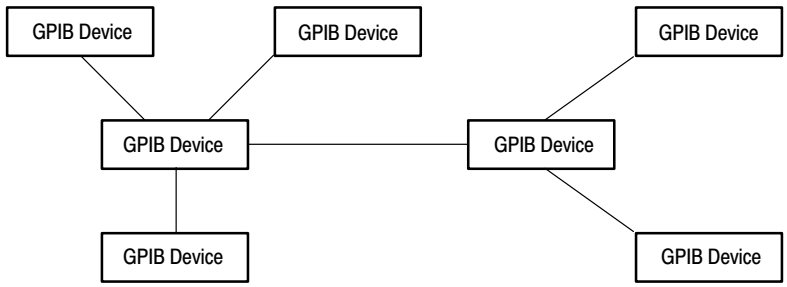


Figure 3–3: Typical GPIB Network Configurations

Setting the GPIB Parameters

You must set the GPIB parameters of the isolator to match the configuration of the bus and controller.

Setting the Bus Address

Use the following procedure to set the bus address on the isolator. The default value for bus address set at the factory is 1.

1. Simultaneously press the **CH1 COUPLING** key and the **CH2 down SCALE** key on the front panel. The current address setting will appear on the CH1 indicator.
2. Use the **CH1** up and down **SCALE** keys to set the value as desired.
3. Once again, press the **CH1 COUPLING** key and the **CH2 down SCALE** key simultaneously. The value you have set will be registered as the address and the isolator will revert to normal operation.

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The bus address can be set to any value between 0 and 31. Setting a value of 31 will cause the isolator to be logically separated from the GPIB interface. As a result, it will not respond to any GPIB address and will be unable to receive or transmit.

Message Terminators

The isolator accepts a line feed (LF) character simultaneous with the EOI as the end of a series of received bytes. It also transmits an LF with the EOI at the end of a series of transmitted bytes.

Other Documents You Will Need

To completely understand and implement a GPIB system, you will need the documentation that supports your controller. If you are using a personal computer with a GPIB card, you will need the documentation for both the PC and the GPIB card.

GPIB Interface Functions

The GPIB interface on this instrument satisfies the IEEE 488.2-1987 standard. Commands are compatible with Tektronix codes and format standards, making it possible to connect with other GPIB units through the bus. Table 3–1 shows the subsets for the GPIB interface on the isolator.

Table 3–1: GPIB Functions

Function Name	Subset	Note
Source Handshake	SH1	Complete capability
Acceptor Handshake	AH1	Complete capability
Talker	T6	Basic Talker, Serial Poll, Unaddress if MLA
Listener	L4	Basic Listener, Unaddress if MTA
Service Request	SR1	Complete capability
Remote/Local	RL1	Complete capability
Parallel Poll	PP0	No capability
Device Clear	DC1	Complete capability
Device Trigger	DT0	No capability
Controller	C0	No capability
Drivers	E2	Three-state

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Interface Messages

Interface messages are used by the controller to manage the talker/listener designation and other bus control operations. This section describes the function of the interface messages and how the isolator operates when it receives an interface message from the controller.

My Listen Address and My Talk Address (MLA and MTA)

The MLA and MTA messages are used to designate the instrument as a listener and a talker. When the ATN line is TRUE, the instrument will become a talker when it receives an MTA message. When the ATN line is no longer true, the instrument will begin source handshaking and data transmission. When the ATN line is true and the instrument receives an MLA message, it becomes a listener and is able to receive the data sent from the talker.

Go To Local (GTL)

When the isolator receives a GTL message, it changes to LOCAL status.

Device Clear (DCL)

This message initializes the communication status between the instrument and the controller. When it receives a DCL message, the instrument will clear all I/O messages and unexecuted control settings. This will also clear all errors and all Report Waiting events other than the Power On event. Also, when a DCL message is received, the SRQ will be cleared if an SRQ has been sent for any other reason than Power On.

Selected Device Clear (SDC)

This message is the same as the DCL message. However, only instruments addressed as listeners will respond to an SDC message.

Local Lockout (LLO)

When the instrument receives an LLO message in REMOTE status, it will become impossible to control the isolator using the keys on the front panel. If an LLO message is received in LOCAL status, control using the keys on the front panel will become ineffective when the instrument has been changed to REMOTE status.

Serial Poll Enable and Disable (SPE/SPD)

The instrument addressed as the talker transmits a serial poll status byte in response to the Serial Poll Enable (SPE) message. The Serial Poll Disable (SPD) message returns the instrument to normal status.

Unlisten and Untalk (UNL and UNT)

The UNL message releases all instruments on the bus from their addressed listener status. The UNT message releases all instruments on the bus from their addressed talker status.

Interface Clear (IFC)

When an IFC message is received, the instrument status becomes the same as if both UNL and UNT messages had been received.

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Remote, Local and Lockout

The instrument is normally set to one of the following three control conditions:

LOCAL When the power to the instrument is turned on, it is placed in LOCAL control. In LOCAL, the isolator is operated using the keys on the front panel. When an MLA message is received in LOCAL, the control changes to REMOTE.

REMOTE In REMOTE, the isolator can be controlled using programs from a controller. When a command is given using the front panel controls while in REMOTE, the instrument control will change to LOCAL.

LOCKOUT The isolator control changes to REMOTE LOCKOUT or LOCAL LOCKOUT status when the ATN line is true and an LLO message is received.

In LOCAL LOCKOUT control the instrument is operated using the controls on the front panel the same as in LOCAL control. At this time, if the REN and ATN lines are both true, the receipt of an MLA message will change control to REMOTE LOCKOUT instead of REMOTE.

Front panel control of the isolator is not possible in REMOTE LOCKOUT control. Also, it is not possible to use the front panel controls to change back to LOCAL status. REMOTE LOCKOUT control will be canceled when the REN line is no longer true.

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Syntax

The isolator is equipped with a set of commands for remote control from an external controller. This section describes how to use these commands to create programs for controlling the instrument.

In explaining these commands, this manual will use the following symbols:

Table 3–2: BNF Symbols and Meanings

Symbol	Meaning
< >	Indicates a defined element
::=	Indicates that the left member is defined as shown by the right member
|	Delimits Exclusive OR elements
{ }	Delimits a group of elements one of which must be selected
[ ]	Delimits an optional element (may be omitted)
. . .	Indicates that the previous element is repeated

Command Configuration

There are two types of commands: configuration commands and query commands. In this manual, we will refer to these as commands and queries. Commands are used to set and change values on the instrument and to execute specific operations. Queries are used to obtain information on instrument status.

Commands have the following configuration:

```
[:] <header> [<space><argument>]
```

In several cases, the same format is used for both commands and queries. This is done by putting a question mark (?) after the header of a command to turn it into a query.

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Header

Each command requires at least a header. Headers can be divided into six types according to their configuration:

Table 3–3: Header Configuration Types

Header Type	Configuration
Simple command header	A header made up of a single header mnemonic. Example: DESE HEADER
Simple query header	A header made up of a single header mnemonic plus a question mark (?) Example: ALLEV? EVENT?
Compound command header	A header made up of several header mnemonics separated by colons (:) Example: CH1:COUPLING CH1:GAIN
Compound query header	A header made up of several header mnemonics separated by colons (:) with a question mark at the end (?) Example: CH1:OFFSET?
Common command header	A header made up of a header mnemonic preceded by an asterisk (*) Example: *RST?
	NOTE: *Commands that include asterisks (*) are those defined by IEEE Std. 488.2. These commands can be used on all instruments with GPIB systems that support the IEEE Std 488.2.*
Common query header	A header made up of a header mnemonic preceded by an asterisk (*), with a question mark at the end (?) Example: *IDN?

Arguments

Arguments are placed at the end of the header to specify the command function. The isolator uses two types of arguments: decimal data and character string data.

Decimal Data

Three types of decimal data can be used: NR1, NR2 and NR3 as specified in ANSI/IEEE Std 488.2-1987 (see Table 3–4). When any one of these three can be used, it is noted as NRf.

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Table 3–4: Numeric Expressions

Type	Format	Example
NR1	Integer	1, +3, –2, +10, –20
NR2	Fixed Decimal Point	1.2, +23.5, –0.15
NR3	Floating Decimal Point	1E+2, +3.36E–2, –1.02E+3

Character String Data

Character string data is also called literal or string data. Character strings are enclosed in quotation marks.

```
"[<character string>]"
```

Example: “This is string constant.”

When the character string has quotation marks, add one more quotation mark to each quotation mark as shown below:

Example: To make the phrase Serial Number “J310000” into a character string, enter the following:

```
"Serial Number ""J310000"""
```

Delimiters

The grammatical elements making up program message units are delimited (differentiated) with colons, semicolons, white spaces and commas.

- Colon (:). Used to join the header mnemonics in a compound command header.
- White Space ( ). Used to delimit the header and argument. Normally the space character (ASCII code 32) is used as the white space, but ASCII code characters 0 to 9 and 11 to 31 can be used as well.
- Comma (,). Used to separate arguments when there is more than one argument in a single header.
- Semicolon (;). Used to link multiple commands. See the “Linking Commands” item.

Short Form

In order to make it easier to create programs and reduce the time required for bus communication, it is possible to omit some of the characters in the header and argument. In the description of commands in this manual, characters which

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absolutely must be present are shown in CAPITAL letters; characters which may be deleted are shown in small letters. For example, for the “VERBose?” command any of the three versions shown may be used:

VERBOSE?
VERBOS?
VERBO?

Linking Commands

The semicolon (;) can be used to link commands, making it possible to include several commands in a single program message. The isolator executes linked commands in the order in which they are received.

When linking commands, it is necessary to obey the following rules:

1. Except for the first one, headers that are completely different are separated using semicolons and the colon that comes before the command. For example, to link the SELFCAL command and the CH1:SCALE 100.0E-3 command, you would write the following:

   SELFCAL;:CH1:SCALE 100E-3

2. When linking commands that are identical except for the mnemonic at the end of the header, parts of the second command can be eliminated along with the colon at the beginning. For example, to link the CH1:SCALE 1.OE-0 command with the CH1: COUPLING AC command, you would write the following:

   CH1:SCALE 1.0E-0;COUPLING AC

   The same operation will be performed if the command is written out in its entirety.

   CH1:SCALE 1.0E-0;:CH1:COUPLING AC

3. Do not place a colon in front of a command that begins with an asterisk (*).

   CH1:COUPLING AC;*CAL?

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Command Groups

This section describes the commands in general categories. Commands to the A6907 and A6909 can be generally divided into five groups:

- Channel control
- Calibration and testing
- Status and events
- Synchronization
- System

Items followed by questions marks are queries; items without question marks are commands. Some items in this section have a question mark in parentheses (?) in the command header section; this indicates that the item can be both a command and a query.

Channel Control

These items control the range, input coupling, offset and gain values for each channel.

Table 3–5: Channel Control

Header		Description
CH<x>?		Range, input coupling or other query
CH<x>:CAL?		Query regarding calibration status
CH<x>:COUPling	(?)	Input coupling setting
CH<x>:GAIn	(?)	Gain setting
CH<x>:OFFSet	(?)	Offset setting
CH<x>:SCALe	(?)	Range setting

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Calibration and Testing

These items are used to execute the instrument's built-in self-calibration and self-test routines.

Table 3–6: Calibration and Testing

Header		Description
*CAL?		Executes self-calibration
SELFcal	(?)	Executes self-calibration
*TST?		Executes self-test

Status and Events

These items set and query the status and events reporting system in order to check the status of the instrument and control the occurrence of events. For details on the status and event reporting system, see the *Status and Events* section beginning on page 3–33.

Table 3–7: Status and Events

Header		Description
ALLEv?		Dequeues all events from event queue
*CLS		Clears Standard Event Status Register (SESR)
DESE	(?)	Sets and queries DESER
*ESE	(?)	Sets and queries ESER
*ESR?		Queries SESR setting
EVENT?		Dequeues event from event queue
EVMsg?		Dequeues event from event queue
EVQty?		Queries the number of events in the event queue
*SRE	(?)	Sets SRER
*STB?		Queries SBR setting

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Synchronization

These commands are used for synchronous control of command execution when it is necessary to wait for all actions to finish before executing the next command. For a detailed explanation of how these commands are used, see *Synchronizing Execution* on page 3–40.

Table 3–8: Synchronization

Header		Description
*OPC	(?)	Operation finished
*WAI		Waiting for command execution

System

These items are used to control the handling of the header in the response message, to query ID or setting data, or to initialize the instrument.

Table 3–9: System Commands

Header		Description
HEADer	(?)	Control header in response message
ID?		Queries instrument ID data
*IDN?		Queries instrument ID data
*LRN?		Queries setting data
*RST		Initializes instrument
SET?		Queries setting data
VERBose	(?)	Control header in response message

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Commands

This section defines and discusses each command in detail.

ALLEv?

This query retrieves the event messages corresponding to all of the event codes in the event queue. For more information on event codes and event messages, see *Messages* on page 3–39.

Syntax ALLEv?

Returns The following is a sample response to ALLEv?

```
:ALLEV 100,"Command Error",200,"Execution Error"
```

*CAL?

This query executes self-calibration and returns the result.

Syntax *CAL?

Returns <NR1>

Here <NR1> is one of the following:

0 – Self-calibration was completed without error.
100 – An error was detected in the channel 1 offset calibration.
110 – An error was detected in the channel 1 gain calibration.
200 – An error was detected in the channel 2 offset calibration.
210 – An error was detected in the channel 2 gain calibration.
300 – An error was detected in the channel 3 offset calibration.
310 – An error was detected in the channel 3 gain calibration.
400 – An error was detected in the channel 4 offset calibration.
410 – An error was detected in the channel 4 gain calibration.

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CH<x>?

This query returns the settings for range and coupling and the offset and gain parameters for the designated channel.

Syntax CH<x>? Here <x> indicates the channel of the A6907 (1, 2, 3 or 4) or the channel of the A6909 (1 or 2).

Returns The following is a sample response to :CH1?

```
:CH1:SCLE 100.0E-3;COUPLING DC;OFFSET 123;GAIN 117
```

CH<x>:CAL?

This query returns whether or not the designated channel has been calibrated. If it has been calibrated, a value of “1” is returned. If it has not been calibrated, a value of “0” is returned.

Syntax CH<x>:CAL?

Here <X> indicates the channel (1, 2, 3 or 4).

Returns The following is a sample response to :CH1:CAL?

```
:CH1:CAL 1
```

In this case, channel 1 has been calibrated.

CH<x>:COUPling (?)

The CH<x>:COUPling command sets the coupling value for the designated channel. The CH<x>:COUPling? query returns the coupling status of the designated channel.

Syntax CH<x>:COUPling {AC|DC}
CH<x>:COUPling?

Here <x> indicates the channel (1, 2, 3 or 4).

Arguments O or AC: Coupling is set to AC.
1 or DC: Coupling is set to DC.

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Returns The following is a sample response to the query :CH1:COUPLING?

```
:CH1:COUPLING DC
```

CH<x>:GAIn (?)

The CH<x>:GAIn command sets the gain value for the designated channel. The CH<x>:GAIn? query returns the gain status of the designated channel.

Syntax

CH<x>:GAIn <NR1>
CH<x>:GAIn?

Here <x> indicates the channel (1, 2, 3 or 4).

Arguments <NR1> is an integer from 55 to 255.

CH<x>:OFFSet (?)

The CH<x>:OFFSet command sets the offset value for the designated channel. The CH<x>:OFFSet? query returns the offset status of the designated channel.

Syntax

CH<x>:OFFSet <NR1>
CH<x>:OFFSet?

Here <x> indicates the channel (1, 2, 3 or 4).

Arguments <NR1> is an integer from 55 to 255.

CH<x>:SCALe (?)

The CH<x>:SCALe command sets the range for the designated channel. The CH<x>:SCALe? query returns the range of the designated channel.

Syntax

CH<x>:SCALe <NR3>
CH<x>:SCALe?

Here <x> indicates the channel (1, 2, 3 or 4).

Arguments <NR3> indicates the range; the unit is Volt/div. On the isolator, the range can be set to any value between 200 V/div and 100 mV/div.

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Examples In the following example, the range for channel 1 will be set to 100 mV/div.

```
:CH1:SCALE 100.0E-3
```

The following is a sample response to the query :CH2:SCALE?.

```
CH2:SCALE 5.0E+0
```

*CLS

This command clears the Standard Event Status Register (SESR) used by the status/event reporting system. See page 3–34 for more information on the SESR.

Syntax *CLS

DESE(?)

The DESE command sets the bit of the Device Event Status Enable Register (DESER) used by the status/event reporting system. The DESE? query returns the contents of the DESER value. See page 3–35 for more information on the DESER.

Syntax DESE <NR1>
DESE?

Arguments <NR1> can be set to a decimal value between 0 and 255. The corresponding binary value is set for DESER. When the power to the instrument is turned on, all bits in DESER are set.

Examples In the following example, DESER will be set to 177 (10110001). In such cases, each of the bits PON, CME, EXE and OPC will be set.

```
:DESE 177
```

The following is a sample response to the query DESE?. In this example, DESER is set to 10110000.

```
:DESE 176
```


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*ESE (?)

The *ESE command sets the bit of the Event Status Enable Register (ESER) used by the status/event reporting system. The *ESE? query returns the contents of the ESER. For more information on the ESER, see page 3–36.

Syntax

*ESE <NR1>
*ESE?

Arguments

<NR1> can be set to a decimal value between 0 and 255. The corresponding binary value is set for ESER. When the power to the instrument is turned on, all bits in ESER are reset.

Examples

In the following example, ESER will be set to 209 (11010001). In such cases, each of the bits PON, URQ, EXE and OPC will be set.

```
*ESE 209
```

The following is a sample response to the query *ESE?. In this example, ESER is set to 11010000.

```
208
```

*ESR?

This query returns the contents of the Standard Event Status Register (SESR) used by the status/event reporting system. See page 3–34 for more information on the SESR.

Syntax

*ESR?

Examples

The following is a sample response to the query *ESR?. In this example, SESR is set to 10110101.

```
181
```

EVENT?

This query retrieves the code for the oldest event of the retrievable events in the event queue. For more information on event codes, see *Messages* on page 3–39.

Syntax

EVENT?

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Returns The following is a sample response to EVENT?

```
:EVENT 100
```

EVMsg?

This query retrieves the code for the oldest event of the retrievable events in the event queue, as well as the message corresponding to that code. For more information on event codes, see *Messages* on page 3–39.

Syntax EVMsg?

Returns The following is a sample response to EVMsg?

```
:EVMSG 100,"Command Error"
```

EVQty?

This query returns the number of events in the event queue.

Syntax EVQty?

Returns The following is a sample response to EVQty?

```
:EVQTY 4
```

HEADer (?)

The HEADer command specifies whether to include or omit the header from the response to all queries with the exception of IEEE Std 488.2 common commands. The HEADer? query returns whether or not the response message includes a header.

Syntax HEADer {0|1|OFF|ON}
HEADer?

Arguments O or OFF – Header is omitted from response
1 or ON – Header is included in response

Examples In this example, the header is included in the response:

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```
:HEADER ON
```

The following is a sample response to the HEADer? query:

```
:HEADER 1
```

In this example, the header is included in the response.

ID?

This query returns the instrument ID information.

Syntax ID?

Returns ID SONY_TEK/<Model>,CF:91.1 FV:<Firmware version no.>

Examples ID SONY_TEK/A6907,CF:91.1 FV:1.00

*IDN?

This query returns the instrument ID information.

Syntax *IDN?

Returns SONY/TEK,<Model>,<Serial no.>,CF:91.1CN FV:<Firmware version no.>

Examples SONY/TEK,A6907,0,CF:91.1CN FV:1.00

*LRN?

This query returns the setting data for the instrument.

Syntax *LRN?

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Returns The following is a sample response to *LRN?

```
:CH1:SCALE 100.0E-3;COUPLING DC;OFFSET 132;GAIN 115
:CH2:SCALE 200.0E-3;COUPLING DC;OFFSET 121;GAIN 104
:CH3:SCALE 500.0E-3;COUPLING AC;OFFSET 137;GAIN 134
:CH4:SCALE 100.0E-3;COUPLING DC;OFFSET 135;GAIN 129
:HEADER 1;:VERBOSE 1
```

***NOTE**. The *LRN? query always returns a string including the header, regardless of the HEADer setting. When a short form response has been set using the VERBose command, a shortened form of the header is returned.*

*OPC (?)

The *OPC command sets the Standard Event Status Register (SESR) bit 0 (OPC bit) as soon as all pending operations have been completed. The *OPC? query returns a value of ASCII character “1” as soon as all pending operations have been completed.

Syntax

```
*OPC
*OPC?
```

Examples The *OPC command can be used to synchronize instrument operation and application programs. For the method used to accomplish this, see *Synchronizing Execution* on page 3–40.

*RST

This command initializes the instrument.

Syntax

```
*RST
```

SELFcal (?)

The SELFcal command executes the self-calibration routine. The SELFcal? query returns the results of self-calibration.

Syntax

```
SELFcal
SELFcal?
```


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Returns <NR1>

Here <NR1> is one of the following:

0 – Self-calibration was completed without error.
100 – An error was detected in the channel 1 offset calibration.
110 – An error was detected in the channel 1 gain calibration.
200 – An error was detected in the channel 2 offset calibration.
210 – An error was detected in the channel 2 gain calibration.
300 – An error was detected in the channel 3 offset calibration.
310 – An error was detected in the channel 3 gain calibration.
400 – An error was detected in the channel 4 offset calibration.
410 – An error was detected in the channel 4 gain calibration.

SET?

This query returns data on instrument settings. This is the same as the operation performed by the *LRN? query.

Syntax SET?

Returns The following is a sample response to SET?

:CH1:SCALE 100.0E-3;COUPLING DC;OFFSET 132;GAIN 115
:CH2:SCALE 200.0E-3;COUPLING DC;OFFSET 121;GAIN 104
:CH3:SCALE 500.0E-3;COUPLING AC;OFFSET 137;GAIN 134
:CH4:SCALE 100.0E-3;COUPLING DC;OFFSET 135;GAIN 129
:HEADER 1;:VERBOSE 1

*SRE (?)

The *SRE command sets the bit of the Service Request Enable Register (SRER) used by the status/event reporting system. However, SRER bit 6 is always set to 0. The *SRE? query returns the contents of the SRER. For more information on the SRER, see page 3–36.

Syntax *SRE <NR1>
*SRE?

Arguments <NR1> can be set to a decimal value between 0 and 255. The corresponding binary value is set for SRER. When the power to the instrument is turned on, all bits in SRER are reset.

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Examples In the following example, SRER will be set to 48 (00110000). In this example, the ESB and MAV bits are set.

```
*SRE 48
```

The following is a sample response to the query *SRE?. In this example, ESER is set to 00100000.

```
32
```

*STB?

This query returns the contents of the Status Byte Register (SBR) used by the status/event reporting system. The SBR bit 6 is interpreted as the MSS (Master Status Summary) bit. For more information on the SBR, see page 3–33.

Syntax *STB?

Examples The following is a sample response to the query *STB?. In this example, SBR is set to 01100000.

```
96
```

*TST?

This query executes self-test and returns the result.

Syntax *TST?

Returns <NR1>

Here <NR1> is one of the following:

0 – Self-calibration was completed without error.
100 – A ROM checksum error has been detected.
200 – A RAM read/write error has been detected.
300 – A EPROM read/write error has been detected.

VERBose (?)

The VERBose command determines whether or not the shortened form of the header is included in the response to a query.

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Syntax

VERBose {0|1|OFF|ON}
VERBose?

Arguments

0 or OFF – Shortened form of the header is used
1 or ON – Complete form of the header is used

Examples

In the following example, the complete (unshortened) form of the header is designated for the response to a query.

```
:VERBOSE ON
```

The following is a sample response to the :VERBOSE? query.

```
:VERBOSE 1
```

In this example, the complete (unshortened) form of the header is used in the response to a query.

*WAI

This command stops the execution of other commands and queries until all pending operations have been completed.

Syntax

*WAI

Examples

The *WAI command can be used to synchronize instrument operation and application programs. For the method used to accomplish this, see *Synchronizing Execution* on page 3–40.

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Status and Events

The GPIB interface on the isolator includes a status and event reporting system which informs the user of crucial events that occur on the instrument. The isolator is equipped with four registers and one queue that conform to IEEE Std 488.2-1987, as well as one register and one queue that conform to Tektronix specifications. This section will discuss these registers and queues along with status and event processing.

Registers

There are two main types of registers:

- Status Registers: stores data relating to instrument status. This register is set by the isolator.
- Enable Registers: determines whether to set events that occur on the instrument to the appropriate bit in the status registers and event queues. This type of register can be set by the user.

Status Registers

There are two types of status registers: the Status Byte Register (SBR) and the Standard Event Status Register (SESR). Each of the bits in these status registers is used to record specific types of events, such as execution errors and service requests. When an event occurs, the corresponding bit is set to 1. Therefore, by reading the contents of these registers, it is possible to find out what type of event has occurred.

Status Byte Register (SBR)

The SBR is made up of 8 bits. Bits 4, 5 and 6 are defined in accordance with IEEE Std 488.2-1987 (see Table 3–10). These bits are used to monitor the output queue, SESR and service requests, respectively. Bits 0 – 3 and 7 are user-definable bits. On the isolator, however, these bits are not used, so they are permanently set to 0.

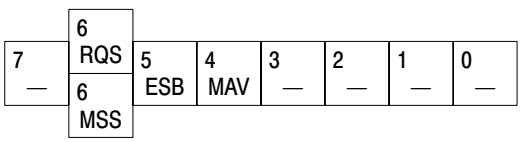


Figure 3–4: The Status Byte Register (SBR)

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Table 3–10: SRB Bit Functions

Bit	Function
7	Not used.
6	RQS (Request Service)/MSS (Master Status Summary). When the instrument is accessed using the GPIB serial poll command, this bit is called the Request Service (RQS) bit and indicates to the controller that a service request has occurred (in other words, that the GPIB bus SRQ line is LOW). The RQS bit is cleared when serial poll ends. When the instrument is accessed using the *STB? query, this bit is called the Master Status Summary (MSS) bit and indicates that the instrument has issued a service request for one or more reasons. The MSS bit is never cleared to 0 by the *STB? query.
5	Event Status Bit (ESB). This bit indicates whether or not a new event has occurred after the previous Standard Event Status Register (SESR) has been cleared or after an event readout has been performed.
4	Message Available Bit (MAV). This bit indicates that a message has been placed in the output queue and can be retrieved.
3 – 0	Not used.

Standard Event Status Register (SESR)

The SESR is made up of 8 bits. Each bit records the occurrence of a different type of event, as shown in Figure 3–5 and Table 3–11.

7	6	5	4	3	2	1	0
PON	URQ	CME	EXE	DDE	QYE	RQC	OPC

Figure 3–5: The Standard Event Status Register (SESR)

Table 3–11: SESR Bit Functions

Bit	Function
7	Power On (PON). Indicates that the power to the instrument is on.
6	User Request (URQ). Indicates that the instrument has generated an event requesting something from the user, or that a cautionary event has occurred. This bit is not used on the isolator.
5	Command Error (CME). Indicates that a command error has occurred while parsing by the command parser was in progress.

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Table 3–11: SESR Bit Functions (Cont.)

Bit	Function
4	Execution Error (EXE). Indicates that an error occurred during the execution of a command. Execution errors occur for one of the following reasons: ■ When a value designated in the argument is outside the allowable range of the instrument, or is in conflict with the capabilities of the instrument ■ When the command could not be executed properly because the conditions for execution differed from those essentially required
3	Device-Specific Error (DDE). An instrument error has been detected.
2	Query Error (QYE). Indicates that a query error has been detected by the output queue controller. Query errors occur for one of the following reasons: ■ An attempt was made to retrieve messages from the output queue, despite the fact that the output queue is empty or in pending status. ■ The output queue messages have been cleared despite the fact that they have not been retrieved.
1	Request Control (RQC). Indicates that the instrument has asked the controller to give up control over the bus. Not used on the isolator.
0	Operation Complete (OPC). This bit is set with the results of the execution of the *OPC command. It indicates that all pending operations have been completed.

Enable Registers

There are three types of enable registers: the Device Event Status Enable Register (DESER), the Event Status Enable Register (ESER) and the Service Request Enable Register (SRER).

Each bit in these enable registers corresponds to a bit on the controlling status register. By setting and resetting the bits in the enable register, the user can determine whether or not events that occur will be registered to the status register and queue.

Device Event Status Enable Register (DESER)

The DESER is made up of bits defined exactly the same as bits 0 through 7 in the SESR. This register designates which events are registered to the SESR and event queue and which are ignored.

In order to set events to the SESR and the event queue, the DESER bits corresponding to those events are set. When events are to be ignored, the SESR bits corresponding to those events are reset.

Use the DESE command to set the bits of the DESER. Use the DESE? query to read the contents of the DESER.

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7	6	5	4	3	2	1	0
PON	URQ	CME	EXE	DDE	QYE	RQC	OPC

Figure 3–6: The Device Event Status Enable Register (DESER)

Event Status Enable Register (ESER)

The ESER is made up of bits defined exactly the same as bits 0 through 7 in the SESR. This register is used by the user to designate whether the SBR ESB bit should be set when an event has occurred and whether the corresponding SESR bit has been set.

To set the SBR ESB bit (when the SESR bit has been set), set the ESER bit corresponding to that event. To prevent the ESB bit from being set, reset the ESER bit corresponding to that event.

Use the *ESE command to set the bits of the ESER. Use the *ESE? query to read the contents of the ESER.

7	6	5	4	3	2	1	0
PON	URQ	CME	EXE	DDE	QYE	RQC	OPC

Figure 3–7: The Event Status Enable Register (ESER)

Service Request Enable Register (SRER)

The SRER controls bit 6 of the SBR. Setting this register causes the SBR RQS bit to be set when the corresponding SBR bit is set, generating a service request (SRQ).

The generation of a service request involves changing the SRQ line to LOW and making a service request to the controller. The result is that a status byte for which an RQS has been set is returned in response to serial polling by the controller.

Use the *SRE command to set the bits of the SRER. Use the *SRE? query to read the contents of the SRER. Bit 6 must normally be set to 0.

7	6	5	4	3	2	1	0
—	—	ESB	MAV	—	—	—	—

Figure 3–8: The Service Request Enable Register (SRER)

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Queues

There are two types of queues in the status reporting system used on the isolator: output queues and event queues.

Output Queue

The output queue is a FIFO queue and holds response messages to queries, where they await retrieval. When there are messages in the queue, the SBR MAV bit is set.

The output queue will be emptied each time a command or query is received, so the controller must read the output queue before the next command or query is issued. If this is not done, an error will occur and the output queue will be emptied; however, the operation will proceed even if an error occurs.

Event Queue

The event queue is a FIFO queue and stores up to 10 events that have occurred on the instrument. If more than 10 events occur, event 10 will be replaced with event code 350 (“Queue Overflow”).

To retrieve events, set the *ESR? query to synchronize operations and then use the ALLEv?, EVENT?, or EVMsg? queries to retrieve the events. A detailed explanation of this process follows.

First, issue an *ESR? query to read the contents of the SESR. Reading the SESR contents will clear the SESR, and simultaneously it will become possible to retrieve events from the event queue. Then use one of the following queries to retrieve events:

- ALLEv? Retrieves all retrievable events and returns their event codes and message texts.
- EVENT? Retrieves the event code for only the oldest event.
- EVMsg? Retrieves the event code and message text for only the oldest event.

When a new event occurs before events have been retrieved, the SESR bit corresponding to that event is set and the event is placed in the event queue. However, only the events that have been made retrievable by the *ESR? query can be retrieved. When yet another *ESR? query is issued before the retrievable events have been retrieved, all of these retrievable events will be deleted. In their place, the next group of events (those that were received after the first *ESR? query was issued) will become retrievable.

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Status and Event Processing Sequence

Figure 3–9 shows an outline of the sequence for status and event processing.

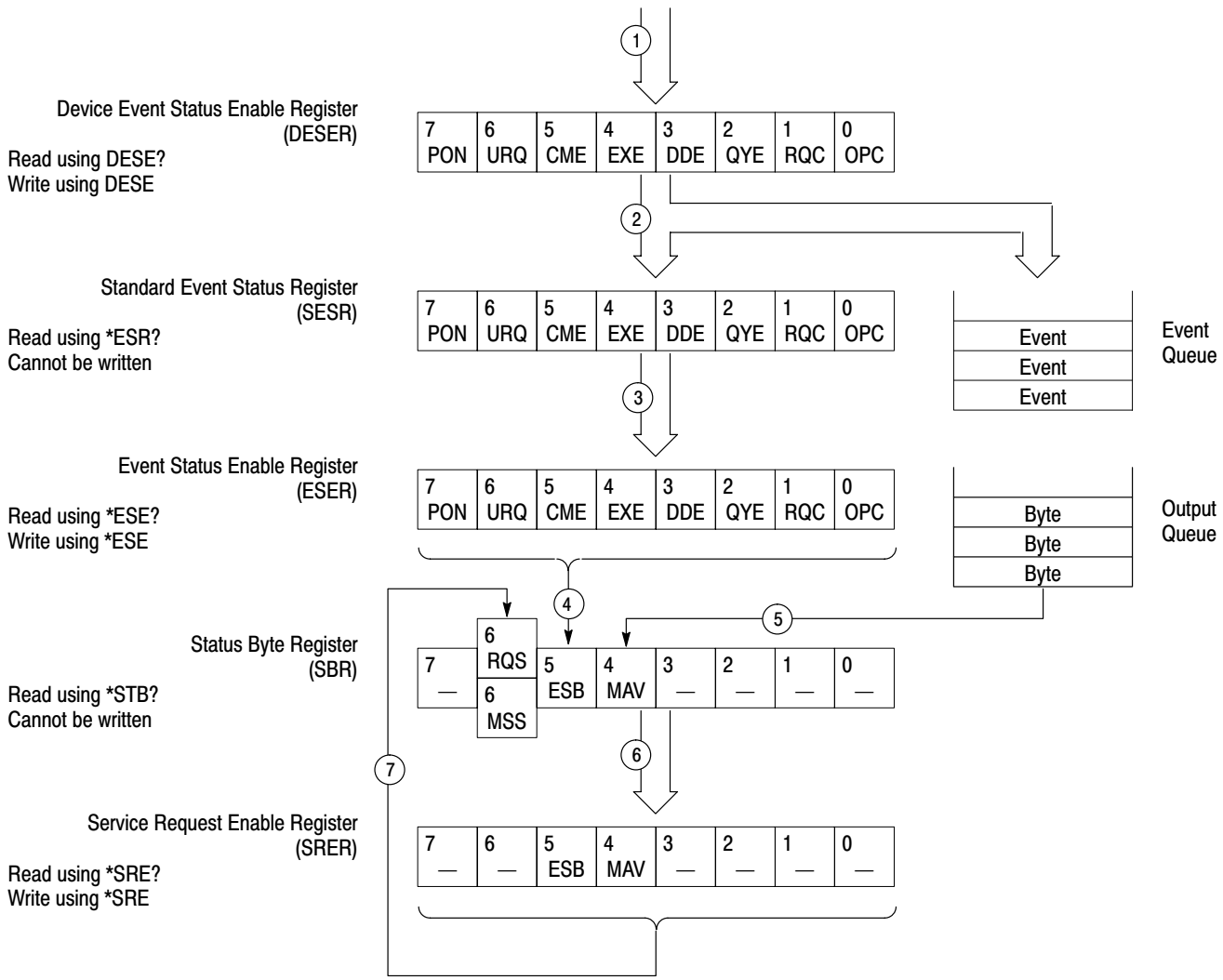


Figure 3–9: Status and Event Processing Sequence

When an event occurs, first of all the contents of the DESER are investigated. If a DESER bit corresponding to an event has been set, the SESR bit corresponding to that event is set as well, and the event is placed in the event queue. Likewise, if a bit corresponding to that event in the ESER has been set, the SBR ESB bit is set as well.

When a message has been sent to the output queue, the SBR MAV bit is set.

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When one of the bits in the SBR and the corresponding SRER bit has been set, the SBR MSS bit is set and a service request is generated.

Messages

Tables 3–12 through 3–16 show the codes and messages used in the status and event reporting system on the isolator.

Event codes and messages can be obtained by using the queries EVMsg? and ALLEv?. These are returned in the following format:

```
<event code>,"<event message>"
```

The EVENT? query returns only the event code. When using these commands, you will need to synchronize their operation with the *ESR? query.

Table 3–12 shows the messages for normal status (when there are no events). There are no corresponding SESR bits in this case.

Table 3–12: Normal Status

Code	Message
0	No events to report – queue empty
1	No events to report – new events pending *ESR?

Table 3–13 shows the messages generated when there is a syntax error in the command.

Table 3–13: Command Errors

Code	Message
100	Command error
102	Syntax error
104	Data type error
108	Parameter not allowed

Table 3–14 shows the messages generated when an error is detected while a command is being executed.

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Table 3–14: Execution Errors

Code	Message
200	Execution error
222	Data out of range

Table 3–15 shows the messages generated when an internal instrument error is detected. When this type of error occurs, it may be due to a hardware problem.

Table 3–15: Internal Errors

Code	Message
300	Device-specific error
330	Self-test failed
350	Queue overflow (DDE bit is not set)

Table 3–16 shows the messages for system events. This type of message is generated when the instrument changes to a certain status.

Table 3–16: System Events

Code	Message
401	Power on
402	Operation complete
410	Query INTERRUPTED
420	Query UNTERMINATED
440	Query UNTERMINATED after indefinite response

Synchronizing Execution

Almost all GPIB commands are executed in the order in which they are sent from the controller, and the execution of each command is completed in a short period of time. However, some commands require a longer period of time to complete execution. These commands are designed so that the next command to be sent is executed without waiting for the previous command to be completed. In some cases, a process executed by another command must first be completed before these commands can be executed; in other cases, these commands must be completed before the next command is executed.

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The execution of the commands shown below must be synchronized with the execution of other commands. When these commands are executed at the same time as other commands, the results of all commands executed in the same time will be irregular.

```
*CAL?
*RST
*TST?
SELFcal
```

To synchronize execution, use the following commands:

```
*OPC
*OPC?
*WAI
```

Using the *WAI Command

The *WAI command can be used to easily synchronize execution. Simply send the *WAI command and then send the next command. In the following example, self-calibration will be executed and then the range will be changed.

```
SELFcal;*WAI;:CH1:SCALE10.0E+0
```

Or

```
SELFcal
*WAI
:CH1:SCALE 10.0E+0
```

Using the *OPC Command

The *OPC command sets the SESR OPC bit when all pending operations have been completed. It is possible to synchronize execution by using this command together with the serial poll or service request functions.

Enable the corresponding status register

```
:DESE 1
*ESE 1
*SRE 0 (when using serial poll)
```

Or

```
*SRE 32 (when using service request)
```

Start self-calibration.

```
SELFcal
```

Wait until self-calibration has finished.

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*OPC
(Wait while serial poll is 0, or wait for a service request to be generated)

Change the range.

:CH1:SCALE 10.0E+0

Using the *OPC? Query

The *OPC? query writes an ASCII code “1” to the output queue when all pending operations have been completed. Synchronization can be performed using the following procedure:

Start self-calibration.

SELFcal

Wait until self-calibration has finished.

*OPC?
(Waits for a “1” to be written to the output queue. In the event that the system is waiting for data to be retrieved from the output queue, a “time out” may occur before the data is written to the output queue.)

Change the range.

:CH1:SCALE 10.0E+0

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Specifications

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Specifications

The following electrical characteristics are valid when the instrument has been adjusted at an ambient temperature between +20° C and +30° C, has had a warm-up period of at least 20 minutes, and is operating at an ambient temperature between 0° C to +50° C.

Warranted Electrical Characteristics

Table 4–1 lists the guaranteed isolator characteristics:

Table 4–1: Warranted Electrical Characteristics

Sensitivity	100 mV/div to 200 V/div in a 1-2-5 sequence with oscilloscope set to 100mV/div
Input Impedance	10 MΩ, 4.5 pF ± 0.5 pF
Maximum Input Voltage, Probe Tip to Probe Common	850 V (DC + peak AC) or 600 V (AC_{RMS}); derate at 20 dB/decade from 3 MHz to 60 MHz
Maximum Common Mode Input Voltage, Probe Common to Chassis	850 V (DC + peak AC) or 600 V (AC_{RMS}); derate at 20 dB/decade from 500 kHz to 60 MHz
Maximum Input Voltage, Between Channels	1700 V (DC + peak AC) or 1200 V (AC_{RMS})
Maximum Common Mode Slew Rate	20 kV/µs
Bandwidth (–3 dB)	
100 mV/div and 200 mV/div	DC to 50 MHz
500 mV/div to 200 V/div	DC to 60 MHz
Pulse Waveform Flatness	±3%, 1 kHz and 10 kHz
Rise Time	
100 mV/div and 200 mV/div	≤7.0 ns
500 mV/div to 200 V/div	≤5.8 ns
Aberrations	8%p-p within first 40 ns
Output Impedance	50 Ω
Offset Accuracy	±20 mV (when changes in ambient temperature are no greater than 3° C and self-calibration has been performed)

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Table 4–1: Warranted Electrical Characteristics (Cont.)

DC Gain Accuracy	±3% of full scale (when changes in ambient temperature are no greater than 3° C and self-calibration has been performed)
Isolation Between Channels	
Normal Mode	90 dB (DC to 10 MHz)
Common Mode	70 dB (DC to 10 MHz)
Overdrive Recovery Time	<200ns to 3% of full scale (when input voltage of 5 V has been applied at 500 mV/DIV)
Power Requirements	100 to 240 VAC, 50 to 60 Hz
Power Consumption, Maximum	
A6907	48 W
A6909	28 W
Fuse Rating	2.5 A, 250 V fast blow

Typical Electrical Characteristics

Table 4–2 lists typical electrical characteristics that are provided for the user's convenience. These characteristics have no tolerances and are not guaranteed.

Table 4–2: Typical Electrical Characteristics

DC Linearity	±2%, typical at 25° C
Common Mode Rejection Ratio	
1 MHz	55 dB (100 mV/div) 40 dB (1 V/div)
10 MHz	55 dB (100 mV/div) 40 dB (1 V/div)
Output Noise Level, DC to 100 MHz	
100 mV/div	2.5 mV_{RMS}
200 mV/div	1.5 mV_{RMS}
500 mV/div to 200 V/div	1.1 mV_{RMS}
Total Harmonic Distortion, 1 kHz Sine Wave	2% at 1 Vp-p output
Maximum Output Voltage	±500 mV with 50 Ω load
Skew Between Channels	2 ns
Common to Chassis Capacitance	80 pF, typical

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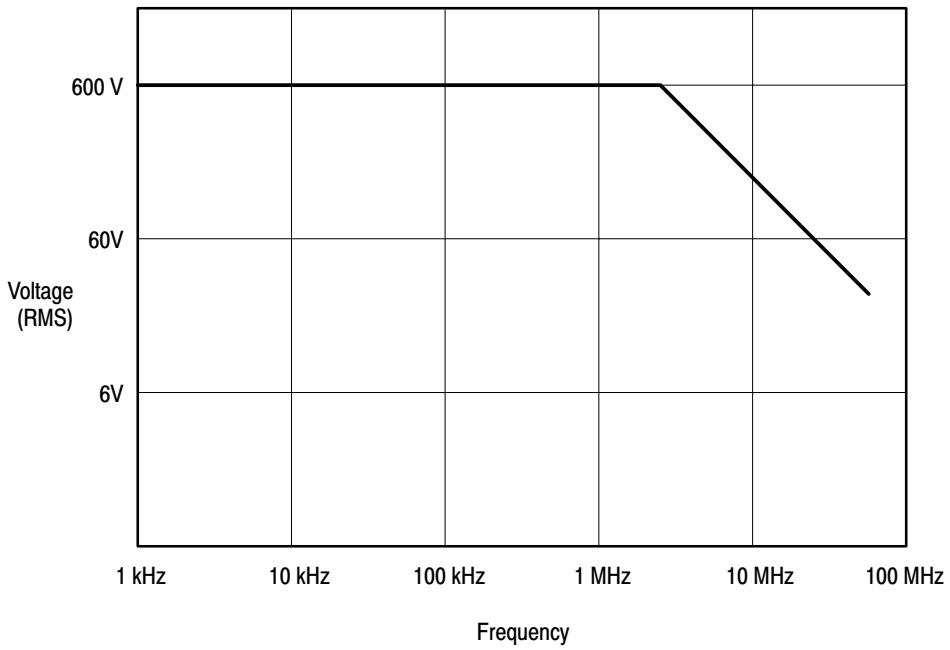


Figure 4–1: Frequency Derating for the Maximum Normal Mode Voltage

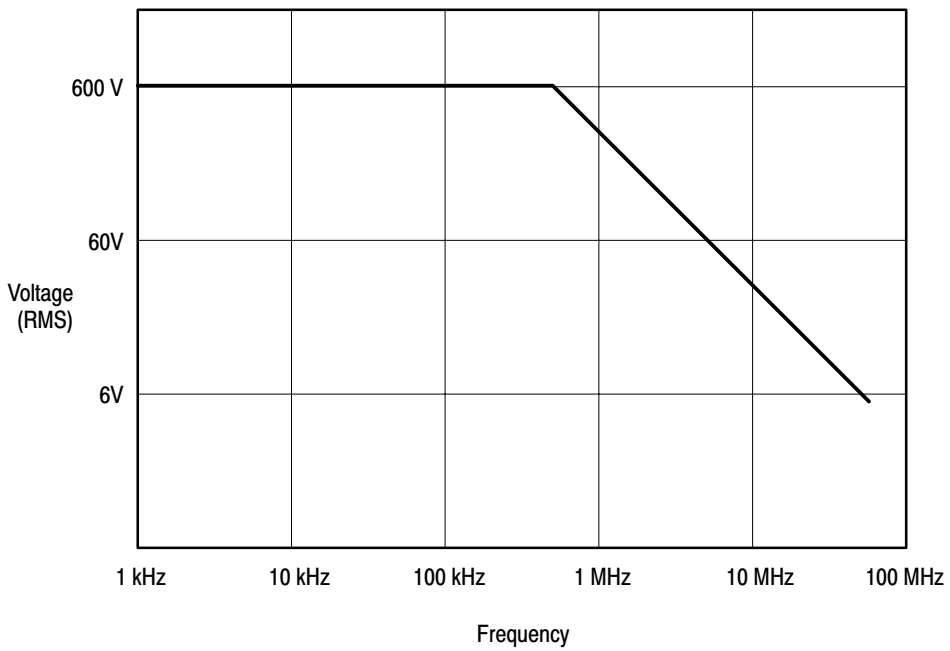


Figure 4–2: Frequency Derating for the Maximum Common Mode Voltage

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Mechanical Characteristics

Table 4–3 list the mechanical characteristics that define the form and fit of the isolators.

Table 4–3: Mechanical Characteristics

Weight	6.4 kg
Dimensions	
Height (with feet)	120 mm
Width	327 mm
Depth	450 mm

Environmental Characteristics

Table 4–4 lists guaranteed operating and storage conditions for the isolators.

Table 4–4: Environmental Characteristics

Temperature	
Operating	0° C to +50° C
Non-operating	–25° C to +70° C
Humidity	
Operating and Non-operating	Stored at 95% to 97% relative humidity for five cycles (120 hours) from 30° C to 50° C.
Altitude	
Operating	To 4.5 km (15,000 feet)
Non-operating	To 15 km (50,000 feet)
Vibration	
Operating	0.31 g_{RMS}, from 5 to 500 Hz, 10 minutes each axis
Non-operating	2.46 g_{RMS}, from 5 to 500 Hz, 10 minutes each axis
Shock	
Non-operating	50 g, half sine, 11 ms duration, three shocks on each face, for a total of 18 shocks.
Packaged Product Vibration and Shock	Meets Tektronix Std 062-2858-00, Rev B.

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Certifications and Compliances

Table 4–5: Certifications and Compliances

EC Declaration of Conformity – EMC	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:	
	EN 50081-1 Emissions:	
	EN 55011	Class A Radiated and Conducted Emissions
	EN 50082-1 Immunity:	
	IEC 801-2	Electrostatic Discharge Immunity
	IEC 801-3	RF Electromagnetic Field Immunity
	IEC 801-4	Electrical Fast Transient/Burst Immunity
EC Declaration of Conformity – Low Voltage	Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities:	
	Low Voltage Directive 73/23/EEC	
	EN 61010-1:1993	Safety requirements for electrical equipment for measurement, control, and laboratory use
	HD401S1	Safety requirements for electronic apparatus

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Theory of Operation

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Theory of Operation

The isolator consists of three major circuit sections: power, signal, and control and calibration. This chapter discusses the operation and relationships of each of these sections.

Power

The isolator has ground-referenced and floating power supplies to support instrument control and signal conversion. The isolation integrity of the floating power supplies is critical to the safe operation of the isolator.

A50 Distribution Board

The A50 controls AC and DC power distribution throughout the isolator. The assembly is controlled by the front panel ON/STBY switch and applies DC power to the floating power supplies when placed in the ON condition. The assembly also contains a lithium battery that provides back up power for memory functions, and a +5 volt regulator for front panel power.

U10 and U20 15 Volt Supplies

U10 and U20 are 15 volt power supplies in a bipolar configuration. AC power is routed to the supplies from the A50 assembly that distributes the DC output of the supplies. The DC supplies are powered on when the the rear panel POWER switch is placed in the ON position.

A30 Floating Power Supply

The A30 floating power supply converts the ±15 volts from the A50 to an isolated ±15 volts to power the electrical to optical (E/O) converters. The A30 uses a 500 kHz oscillator and transformer assembly to transfer the power while electrically isolating it. The secondary potential is full-wave rectified and filtered before being passed on to the E/O converter where it is regulated. The typical output voltage is an isolated ±9 VDC.

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Signal

The A6907 and A6909 electrically isolate the input signal by coupling an analogue of it through an internal optical link.

Electrical to Optical (E/O)

A signal acquired between the probe tip and the “common” lead is routed to the electrical-to-optical (E/O) converter. The signal is scaled by the attenuator and then used to amplitude modulate an LED. The LED is mounted on top of the converter and illuminates a receiver photodetector in the optical-to-electrical (O/E) converter. All of the circuits within the isolator are isolated from other channels and are floating in respect to ground.

Optical to Electrical (O/E)

The optical-to-electrical converter receives the modulated light beam from the E/O converter and demodulates it into an electrical signal.

Control and Calibration

The front panel provides control and display for each channel. The front panel microprocessor controls the power-on sequence as well as calibration and operation. The front panel also supports a GPIB processor (if installed).

The front-panel assembly receives power from the A50 assembly. +5 V from the lithium battery is provided for memory backup power, as well as ±15 V and +5 V for processor operation.

Signals controlling the attenuator range, input coupling and calibration are isolated by an optical isolator located in the E/O converter.

Calibration references are derived from the power supplies on the E/O converter module. When the CAL button is pressed, the system balances and calibrates the gain of each channel by applying an appropriate voltage to the input of the attenuator and by measuring the output of the O/E converter. This eliminates any drift in the LED, photodetector or amplifier in each channel.

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Performance Verification

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Performance Verification

This section contains procedures for checking that the isolator performs as warranted.

NOTE. *Table 6–3 on page 6–15 is provided as a blank qualification test record. Copy the table and use it to record the performance verification results.*

Prerequisites

To ensure the validity of these performance check procedures, the test environment must meet these qualifications:

- The cabinet must be in place.
- You must perform and pass the self-calibration routine.
- The isolator must have been last adjusted at an ambient temperature between +20° C and +30° C, must have been operating for a warm-up period of at least 20 minutes, and must be operating at an ambient temperature between 0° C and +50° C.
- All probes must be fitted with 6-inch common leads.

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Required Equipment

Table 6–1 lists all the test equipment required to do the performance check procedure. Test equipment specifications described are the minimum necessary to provide accurate results. For test equipment operation information, refer to the appropriate test equipment instruction manual.

Table 6–1: Required Test Equipment

Description	Minimum Requirements	Example	Purpose
Oscilloscope	Bandwidth: 350 MHz	Tektronix TDS460	Various Tests
Digital Multimeter	$4^1/_2$ Digit; DCV range: ±20 V; DCV accuracy: 0.1%;	Tektronix DM2510	Checking Offset and Gain
DC Calibration Generator	Variable amplitude: ±100 V; Accuracy: 0.2%	Fluke 5700A	Checking Offset and Gain
Calibration Generator	Fast-rise signal level: 100 mV to 1 V; Repetition rate: 100 kHz; Rise time: 1 ns or less; Flatness: ±2%	Tektronix PG506A	Checking Rise Time and Aberration
Leveled Sine-Wave Generator	250 kHz to 100 MHz; Variable amplitude to 5 Vp-p into 50 Ω; 50 kHz reference	Tektronix SG503	Checking Bandwidth
50 Ω Precision Coaxial Cable	50 Ω, precision cable for SG503	Tektronix part number 012-0482-00	Signal connection
50 Ω Coaxial Cable	50 Ω, 43 in, male-to-male BNC connectors	Tektronix part number 012-0057-01	Signal connection
50 Ω Termination	Impedance 50 Ω; connectors: female BNC input, male BNC output	Tektronix part number 011-0049-01	Signal termination
Dual-Banana Connector (2 required)	Female BNC to dual banana	Tektronix part number 103-0090-00	Signal connection

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Offset and Gain Check

Required Equipment

- Digital Multimeter
- DC Calibration Generator
- 50 Ω Coaxial Cable
- 50 Ω Feedthrough Termination
- BNC-to-Terminal Adapter
- Dual-Banana Connector

Setup

1. Assemble the test setup as shown in Figure 6–1.

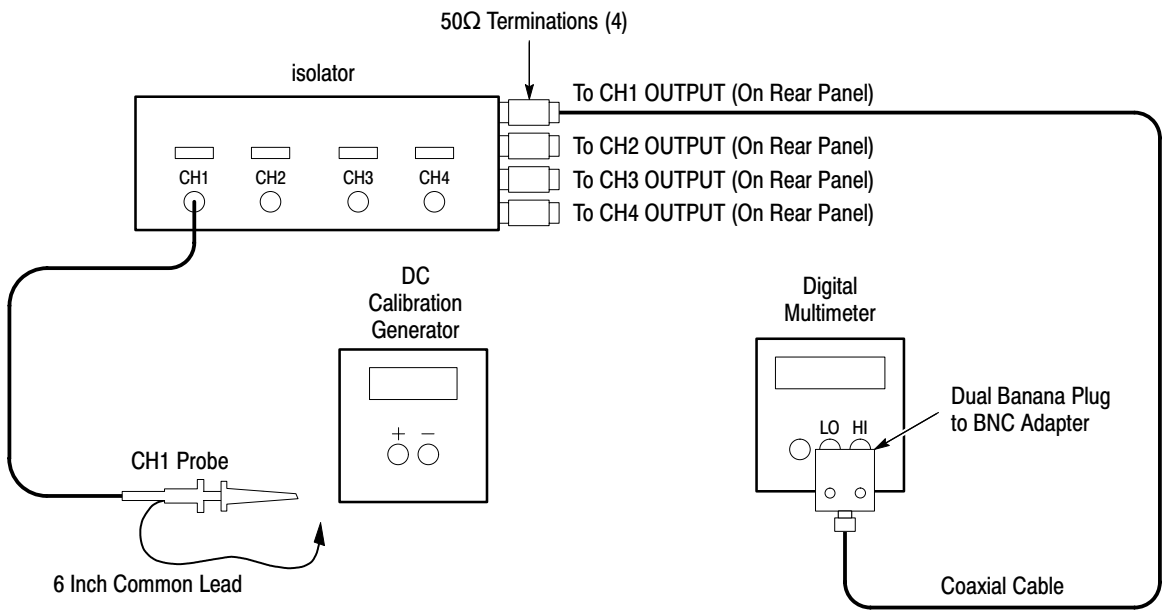


Figure 6–1: DC Offset and Gain Test Setup

2. Set the multimeter mode to DC voltage.
3. Press the **CAL** button on the isolator to start the self-calibration.

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Procedure

1. Connect the isolator CH1 probe tip and common together.
2. Connect the **CH1 OUTPUT** of the isolator to the multimeter input.
3. Set the **CH1 VOLTS/DIV** control on the isolator to 100 mV and the **CH1 COUPLING** to DC.
4. Check the offset accuracy by checking that the multimeter reading is within ±20 mV of zero when stepping through the **CH1 VOLTS/DIV** ranges.
5. Connect the probe to the generator as shown in Figure 6–2.
6. Set the **CH1 VOLTS/DIV** control on the isolator to 100 mV.

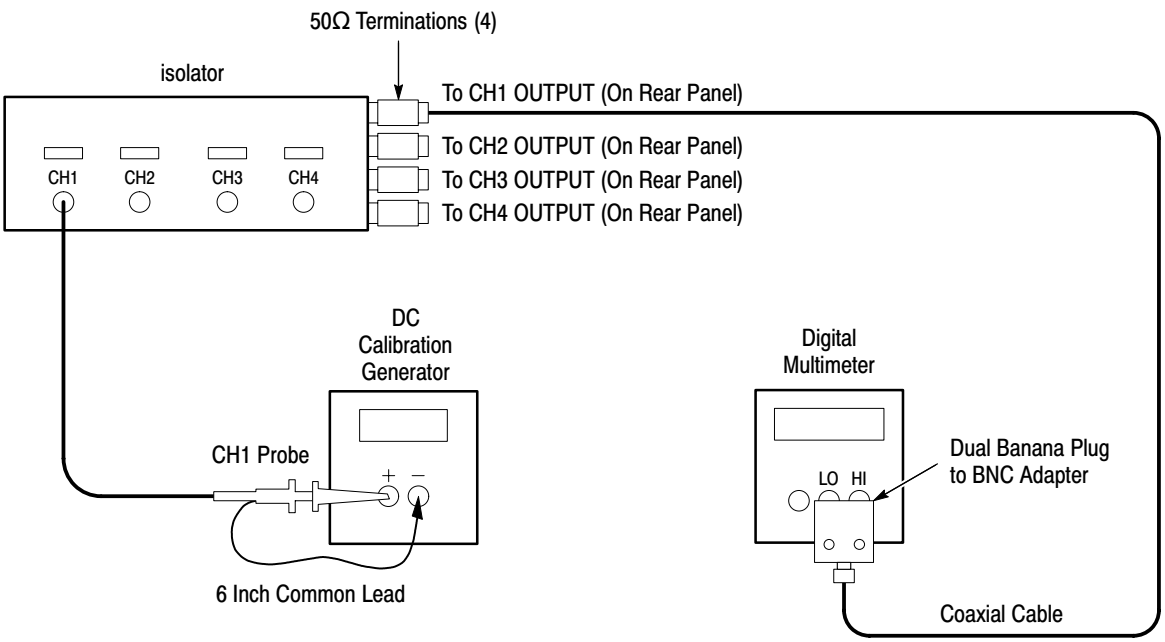


Figure 6–2: Positive DC Gain Test Setup

7. Set the generator output to 500 mV.
8. Measure and record the multimeter reading as E_1 in Table 6–2 on page 6–6.
9. Turn off the generator output.

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10. Connect the probe to the generator as shown in Figure 6–3. Note that the polarity of the CH1 probe connections have been reversed.

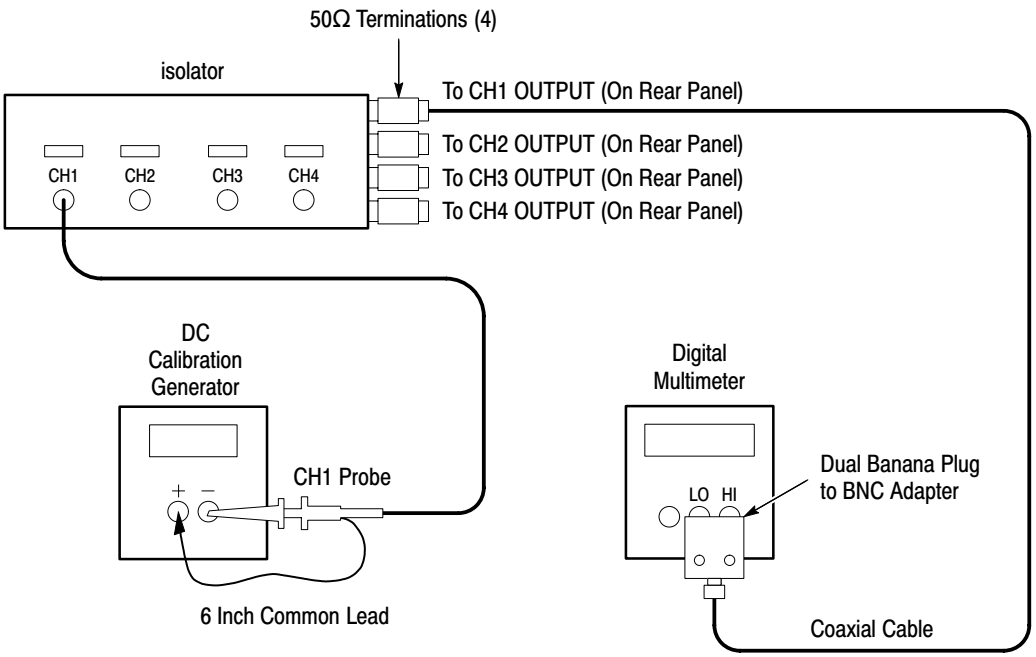


Figure 6–3: Negative DC Gain Test Setup

11. Set the generator output to 500 mV.

12. Measure and record the multimeter reading as E_2 in Table 6–2.

13. Check that the DC gain is within the limits given in Table 4–1 on page 4–1. Compute *%Error* as follows:

$$\%Error = \left[\frac{(E_1 - E_2) \times (5 \times Isolator\ \ Scale)}{Generator\ \ Output} - 1\right] \times 100$$

For example, using a test voltage of 49.5 V, with an isolator scale of 10 V/div, and measured voltages E_1 = 496 mV and E_2 = –499 mV, the *%Error* would be:

$$\%Error = \left[\frac{(0.496 - -0.499)(5 \times 10)}{49.5} - 1\right] \times 100 = 0.51\%$$

14. Repeat steps 5 through 13 using the CH1 VOLTS/DIV and DC calibration generator settings as shown in Table 6–2.

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Table 6–2: Isolator Gain Accuracy

VOLTS/DIV Setting	DC Calibration Generator Voltage	E_1	E_2	% Error
100 mV	500 mV			
200 mV	1 V			
500 mV	2.5 V			
1 V	5 V			
2 V	10 V			
5 V	25 V			
10 V	50 V			
20 V	100 V			
50 V	100 V			

15. Repeat steps 1 through 14 for all channels.

16. Disassemble the setup.

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Low-Frequency Pulse Response (Flatness) Check

Required Equipment

- Oscilloscope
- 50 Ω Coaxial Cable
- Calibration Generator
- BNC-to-Terminal Adapter

Setup

1. Assemble the test setup as shown in Figure 6–4.

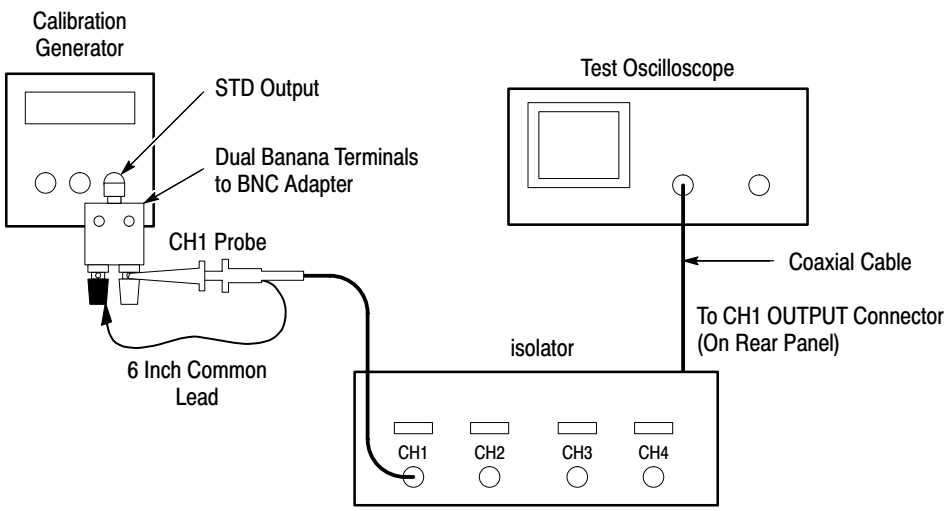


Figure 6–4: Low-Frequency Pulse Response Check Setup

2. Configure the oscilloscope:

Acquisition Mode	Sample
Record Length	1000 points
Horizontal Scale	200 µs/div
Vertical Scale	100 mV/div
Vertical Offset	0
Vertical Coupling	DC
Input Impedance	50 Ω
Bandwidth Limit	100 MHz

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Procedure

1. Connect the CH1 probe tip of the isolator to the generator output.
2. Set the output of the generator for a high-amplitude with a 1 ms period.
3. Connect the **CH1 OUTPUT** control on the isolator to the vertical input of the oscilloscope.
4. Set the **CH1 VOLTS/DIV** control on the isolator to 1 V.
5. Adjust the **AMPLITUDE** control on the generator for five divisions of display on the oscilloscope.
6. Check that the flatness is within the tolerance given in Table 4–1 on page 4–1.
7. Set the **CH1 VOLTS/DIV** control on the isolator to 10 V.
8. Adjust the **AMPLITUDE** control on the generator for five divisions of display on the oscilloscope.
9. Check that the flatness is within the tolerance given in Table 4–1 on page 4–1.
10. Set the **CH1 VOLTS/DIV** control on the isolator to 50 V.
11. Set the generator for a standard-amplitude mode output of 100 V.
12. Check that the flatness is within the tolerance given in Table 4–1 on page 4–1.
13. Set the generator for a high-amplitude output with a 0.1 ms period.
14. Connect the **CH1 OUTPUT** control on the isolator to the vertical input of the oscilloscope.
15. Set the **CH1 VOLTS/DIV** control on the isolator to 1 V.
16. Adjust the **AMPLITUDE** control on the generator for five divisions of display on the oscilloscope.
17. Check that the flatness is within the tolerance given in Table 4–1 on page 4–1.
18. Set the **CH1 VOLTS/DIV** control on the isolator to 10 V.
19. Adjust the **AMPLITUDE** control on the generator for five divisions of display on the oscilloscope.
20. Check that the flatness is within the tolerance given in Table 4–1 on page 4–1.

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21. Set the **CH1 VOLTS/DIV** control on the isolator to 50 V.
22. Set the generator for a standard-amplitude mode output of 100 V.
23. Check that the flatness is within the tolerance given in Table 4–1 on page 4–1.
24. Repeat steps 1 through 23 for all channels.
25. Disassemble the test setup.

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Rise Time and Aberration Check

Required Equipment

- Oscilloscope
- 50 Ω Coaxial Cable
- 50 Ω Feedthrough Termination
- Calibration Generator
- BNC-to-Terminal Adapter

Setup

1. Assemble the test setup as shown in Figure 6–5.

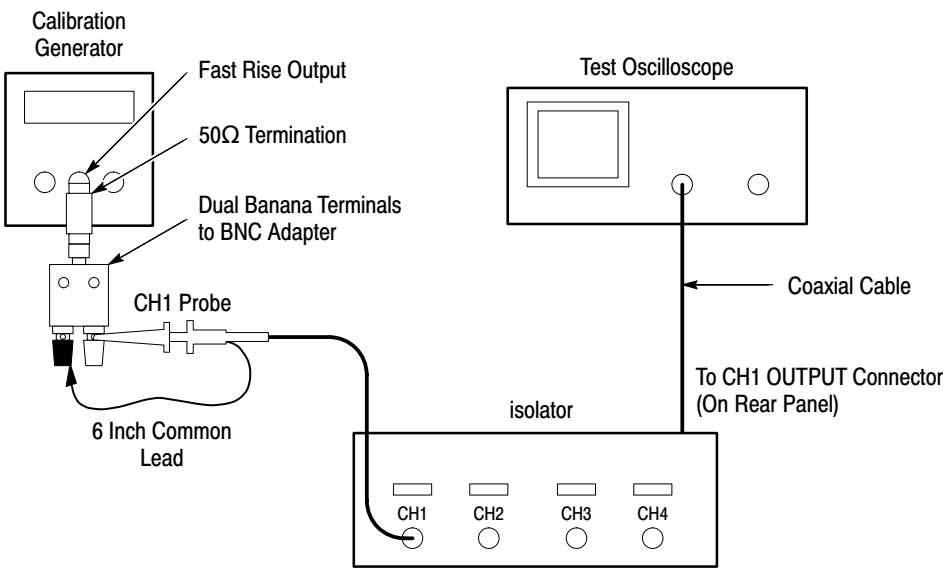


Figure 6–5: Rise Time and Aberrations Check Setup

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2. Set up the oscilloscope as follows:

Acquisition Mode	Average 32
Record Length	1000 points
Horizontal Scale	10 ns/div
Vertical Scale	100 mV/div
Vertical Offset	0
Vertical Coupling	DC
Input Impedance	50 Ω
Bandwidth Limit	Full
Measurement	Rise Time

Procedure

1. Connect the isolator CH1 probe tip to the generator **FAST RISE** output.
2. Set the generator for a fast-rise signal with a 10 µs period.
3. Connect the **CH1 OUTPUT** of the isolator to the vertical input of the oscilloscope.
4. Set the **CH1 VOLTS/DIV** control on the isolator to 100 mV.
5. Adjust the **AMPLITUDE** control on the generator for five divisions of display on the oscilloscope.
6. Check that the rise time is within the tolerance given in Table 4–1 on page 4–1.
7. Check that the aberrations are within the tolerance given in Table 4–1 on page 4–1.
8. Set the **CH1 VOLTS/DIV** control on the isolator to 500 mV.
9. Set the vertical scale on the oscilloscope to 50 mV/div.
10. Adjust the **AMPLITUDE** control on the generator for four divisions of display on the oscilloscope.
11. Check that the rise time is within the tolerance given in Table 4–1 on page 4–1.
12. Check that the aberrations are within the tolerance given in Table 4–1 on page 4–1.
13. Reset the vertical scale control on the oscilloscope to 100 mV/div.
14. Repeat steps 1 through 12 for all channels.
15. Disassemble the test setup.

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Bandwidth Check

Required Equipment

- Oscilloscope
- 50 Ω Precision Coaxial Cable
- 50 Ω Coaxial Cable
- 50 Ω Feedthrough Termination
- Leveled Sine-Wave Generator
- BNC-to-Terminal Adapter

Setup

1. Assemble the test setup as shown in Figure 6–6.

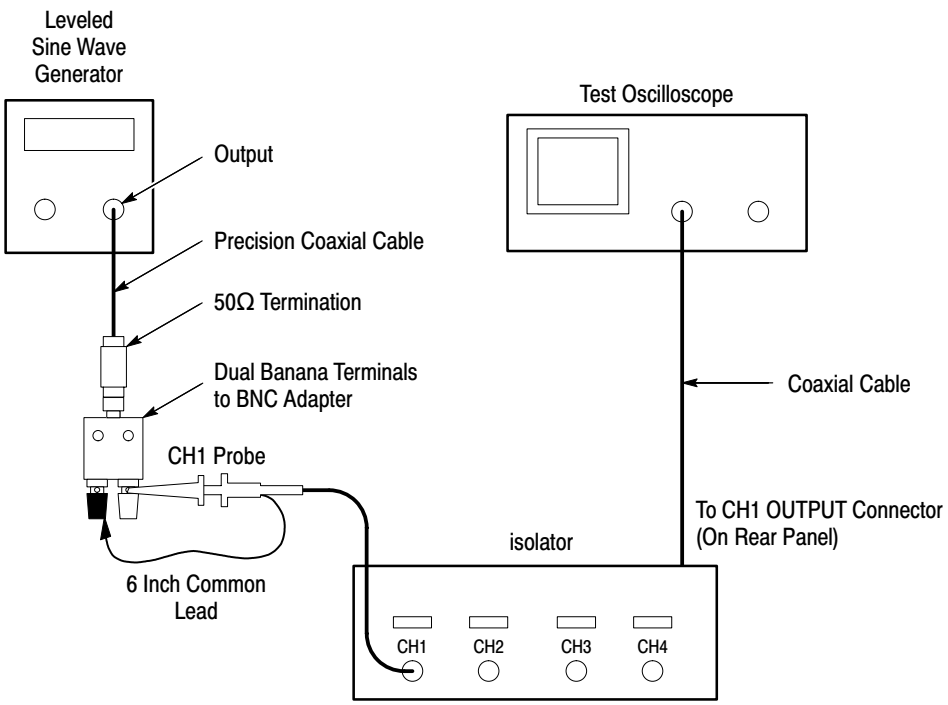


Figure 6–6: Bandwidth Check Setup

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2. Configure the oscilloscope:

Acquisition Mode	Sample
Record Length	1000 points
Horizontal Scale	100 µs/div
Vertical Scale	100 mV/div
Vertical Offset	0
Vertical Coupling	DC
Input Impedance	50 Ω
Bandwidth Limit	Full
Measurement	Amplitude

Procedure

1. Connect the CH1 probe tip of the isolator to the output of the generator.
2. Set the generator to a reference frequency of 50 kHz.
3. Connect the **CH1 OUTPUT** of the isolator to the vertical input of the oscilloscope.
4. Set the **CH1 VOLTS/DIV** control on the isolator to 100 mV.
5. Adjust the **OUTPUT AMPLITUDE** control on the generator so that the measured amplitude is 600 mV.
6. Increase the **FREQUENCY** control on the generator until the measured amplitude is 420 mV.

***NOTE**. Adjust the oscilloscope horizontal scale factor to display 10 to 20 cycles.*

7. Check that the generator output frequency is greater than the value given in Table 4–1 on page 4–1.
8. Reset the horizontal scale on the oscilloscope to 100 µs/div.
9. Set the **CH1 VOLTS/DIV** control on the isolator to 500 mV.
10. Set the output of the generator to the 50 kHz reference frequency.
11. Adjust the **OUTPUT AMPLITUDE** control on the generator so that the measured amplitude is 600 mV.
12. Increase the generator output frequency until the measured amplitude is 420 mV.

***NOTE**. Adjust the oscilloscope horizontal scale factor to display 10 to 20 cycles.*

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13. Check that the output frequency of the generator is greater than the value given in Table 4–1 on page 4–1.

14. Repeat steps 1 through 13 for all channels.

15. Disassemble the test setup.

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Table 6–3: Isolator Test Qualification Record

Test	CH1	CH2	CH3	CH4
Offset Voltage				
DC Gain Error				
100 mV				
200 mV				
500 mV				
1 V				
2 V				
5 V				
10 V				
20 V				
50 V				
Low-Frequency Pulse Response				
1 V at 1 kHz				
10 V at 1 kHz				
50 V at 1 kHz				
1 V at 10 kHz				
10 V at 10 kHz				
50 V at 10 kHz				
Rise Time				
100 mV				
500 mV				
Aberrations				
100 mV				
500 mV				
Bandwidth				
100 mV				
500 mV				

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