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# A6902 ISOLATOR

## OPERATOR

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**Beaverton, Oregon 97077**

070-2931-01
Product Group 60

INSTRUCTION MANUAL

Serial Number _____

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# OPERATORS SAFETY SUMMARY

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

## TERMS

### In This Manual

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

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

### As Marked on Equipment

CAUTION indicates either a personal injury hazard not immediately accessible as you read the marking or a hazard to property including the equipment itself.

DANGER or WARNING–HIGH VOLTAGE indicates a personal injury hazard immediately accessible as you read the marking.

## SYMBOLS

### As Marked on Equipment

DANGER – High voltage.

Protective ground (earth) terminal.

## PRECAUTIONS

### Power Source

This product is intended to operate from a power source that does not apply more than 250 volts rms between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.



### Grounding the Product

This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. A protective ground connection by way of the grounding conductor in the power cord is essential for safe operation.

### Use the Proper Power Cord

Use only the power cord and connector specified for your product.

Use only a power cord that is in good condition.

For detailed information on power cords and connectors, see Figure 5 and the "Accessories" page in this manual.

### Use the Proper Fuse

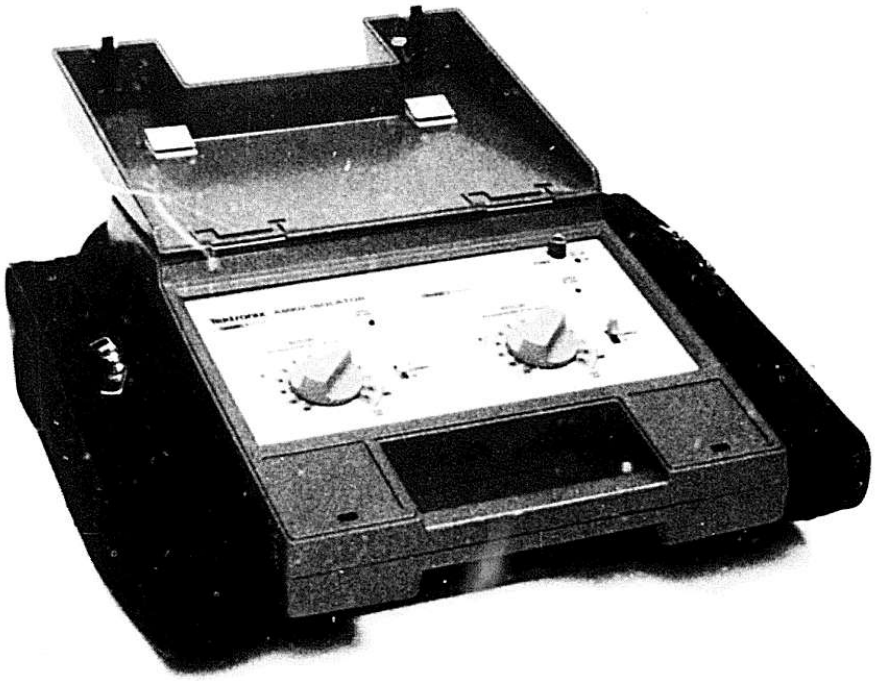
To avoid fire hazard, use only a fuse of the correct type, voltage rating, and current rating as specified in the parts list for your product.

### Do Not Operate in Explosive Atmospheres

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

### Do Not Remove Covers or Panels

To avoid personal injury, do not remove the product covers or panels. Do not operate the product without the covers and panels properly installed.



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**The A6902 Isolator.**

# SPECIFICATION

## INTRODUCTION

The TEKTRONIX A6902 Isolator is a two-channel instrument which will permit safe floating measurements of voltages up to 1500 V (dc + peak ac) above or below ground. It substitutes for the vertical amplifier of an oscilloscope when either high-voltage signals or small signals at a high voltage level are to be measured. These signals are isolated from the oscilloscope by a combination of optical and transformer coupling. This type of isolation, together with the all-plastic construction of the external controls, protects the operator from exposure to high voltage levels when making control settings on the A6902 front panel.

Voltage to be measured is applied between the A6902 input probe tip and its common lead. Two pairs of input probes are provided, each having a different size and rating. With the larger probes, if both channels are used simultaneously, the maximum differential voltage between channels is 1500 V (dc + peak ac). When using the smaller probes simultaneously on both channels, the maximum differential voltage between channels is 1000 V (dc + peak ac). All measurements must be made with an oscilloscope having a 1-MΩ input resistance, an input capacitance of up to 47 pF, and a vertical deflection factor of 10 mV per division.

The A6902 features include:

- Two probe sizes and ratings (1500 V and 500 V) which are interchangeable via a quick-disconnect connector.
- Dc to 15 MHz bandwidth.
- Plastic case and controls to provide a wide margin of operator safety.
- Two pairs of input probes and two output cables stored in the side pouches.
- Floating inputs that meet the requirements of UL1244, IEC 348, CSA Electronic Bulletin No. 556B.
- Two isolated channels that may be used simultaneously, either at different points in the same circuit or on separate circuits.



## ACCESSORIES

Standard accessories provided with the A6902 include two pairs of input probes and two 2-meter coaxial cables for connecting the Isolator output to oscilloscope inputs. For more information on accessories used with the A6902, refer to the "Accessories" page at the rear of the manual.

## PERFORMANCE CONDITIONS

The electrical specifications listed in Table 1 are valid under the following conditions: The A6902 Isolator was adjusted at an ambient temperature between +20°C and +30°C, it is operating at an ambient temperature between 0°C and +50°C, and it has had a warmup period of at least 30 minutes.

Environmental characteristics are presented in Table 2, and physical characteristics are listed in Table 3.

**Table 1**

**Electrical Characteristics**

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| | **PROBES AND AMPLIFIER** | |
| Deflection Factor | | |
| Sensitivity | 20 mV/div to 200 V/div in a 1, 2, 5 sequence with oscilloscope set to 10 mV/div. | |
| Accuracy | ≤ ± 3% of indicated VOLTS/DIV switch setting at 15°C to 40°C derated to ≤ ± 10% at 0° to +50°C. | |

Table 1 (cont)

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| | PROBES AND AMPLIFIER (cont) | |
| Maximum Working Voltage | | |
| Large Probe (1500 V) | | |
| Probe Center Tip to Earth Ground | 1500 V (dc + peak ac). | |
| Probe Center Tip to Probe Common | 1500 V (dc + peak ac) to 900 kHz. Derated to 105 V (dc + peak ac) at 15 MHz. | See Figure 1. |
| Probe Common to Earth Ground | 1500 V (dc + peak ac) to 440 kHz. Derated to 520 V (dc + peak ac) at 5.8 MHz, then to 200 V (dc + peak ac) at 15 MHz. | See Figure 2. |
| Small Probe (500 V) | | |
| Probe Center Tip to Earth Ground | 500 V (dc + peak ac). | |
| Probe Center Tip to Probe Common | 500 V (dc + peak ac) to 3 MHz. Derated to 105 V (dc + peak ac) at 15 MHz. | See Figure 1. |
| Probe Common to Earth Ground | 500 V (dc + peak ac) to 6 MHz. Derated to 200 V (dc + peak ac) at 15 MHz. | See Figure 2. |



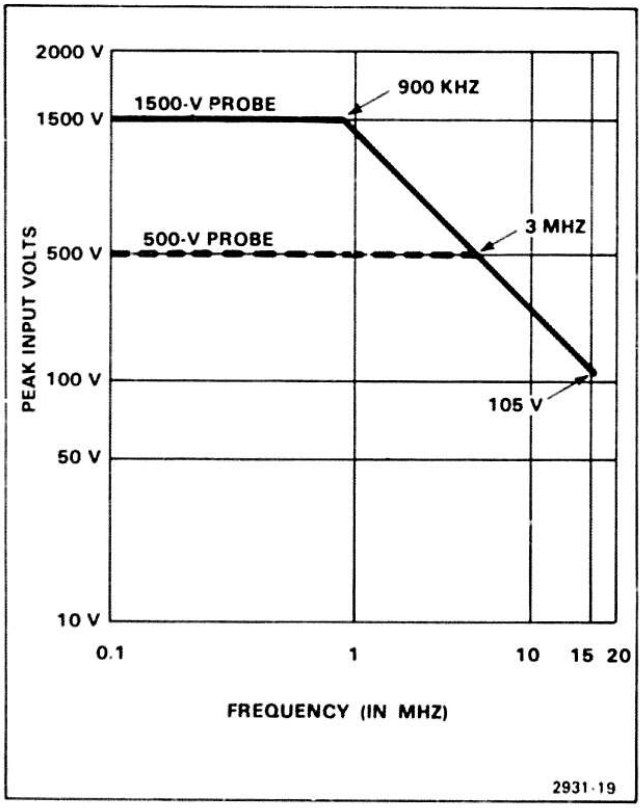



Figure 1. Maximum working voltage between probe input and probe common (all temperatures).

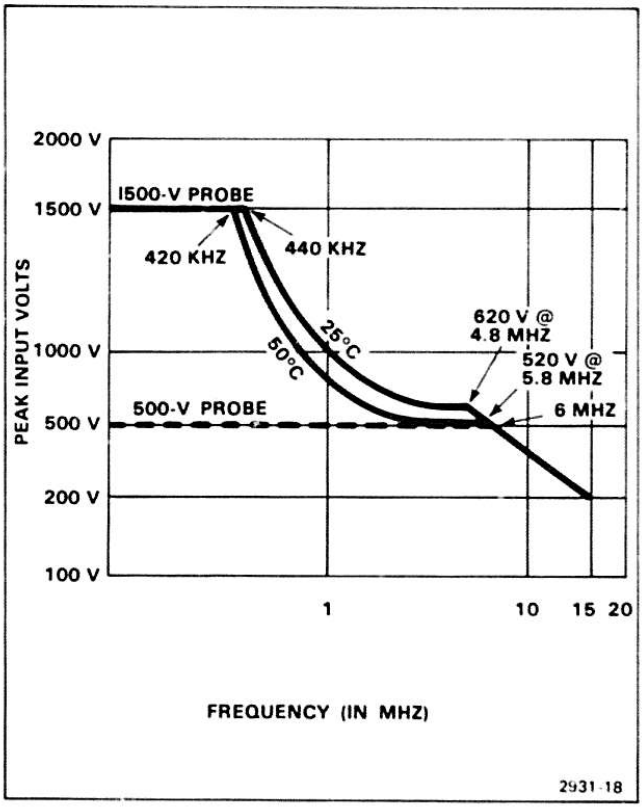



Figure 2. Maximum working voltage between probe common and earth ground.

Table 1 (cont)

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| **PROBES AND AMPLIFIER (cont)** | | |
| Frequency Response | | |
| Bandwidth, Dc Coupled (to −3 dB Point) | ⩾ 15 MHz. | |
| Lower −3 dB Point, Ac Coupled | ⩽ 1 Hz. | |
| Transient Response | | |
| Rise Time | 23 ns or less. | |
| Input Impedance | | |
| Resistance | 10 MΩ ±3%. | |
| Capacitance | | |
| Large Probe (1500 V) | Approximately 21 pF. | |
| Small Probe (500 V) | Approximately 17.4 pF. | |
| Output Impedance | ≈ 50 Ω. | |



Table 1 (cont)

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| **PROBES AND AMPLIFIER (cont)** | | |
| Common-Mode Capacitance | ≈ 150 pF from probe common to earth ground. | |
| Tangential Noise | 2.0 mV. | |
| Dc Drift with Temperature | ⩽ 1 mV/°C or 0.1 div/°C at output. | |
| Range of OUTPUT DC LEVEL Control | At least ±5 divisions from center screen with oscilloscope set to 10 mV/div vertical deflection factor. | |
| Channel Isolation | | |
| Maximum Voltage | | |
| Using Two 1500-V Probes | 1500 V (dc + peak ac). | |
| Using Two 500-V Probes | 1000 V (dc + peak ac). | |
| Overdrive Recovery | 0.5 μs or less to recover to within 1 division of initial location after removing overdrive signal of up to ±25 divisions, regardless of duration of overdrive signal. | |

Table 1 (cont)

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| | **PROBES AND AMPLIFIER (cont)** | |
| Delay | | |
| Large Probe (1500 V) | 48 ns ±3 ns from probe tip to output bnc. | |
| Small Probe (500 V) | 48 ns ±3 ns from probe tip to output bnc. | |
| Delay Difference Between Two Channels | ≤ 3 ns from probe input to output bnc; when used with an oscilloscope having a 1-MΩ input resistance and up to 47 pF input capacitance and when both probes are same type and properly compensated. | |
| Common-Lead Signal Feedthrough | −110 dB from probe input to output bnc; when used with an oscilloscope having a 1-MΩ input resistance and up to 47 pF input capacitance. Derated to −80 dB at 10 kHz through 100 kHz and derated to −50 dB at 3.3 MHz. | See Figure 3. Measured with VOLTS/DIV switch set at 20 mV and AC-COMMON-DC switch set in common position. |



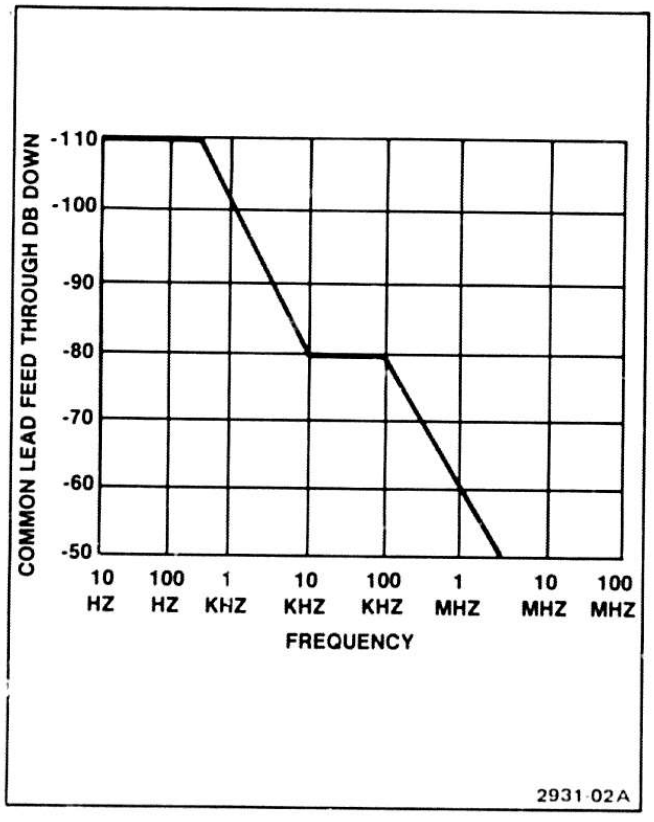



**Figure 3. Common-lead feedthrough characteristics.**

Table 1 (cont)

| Characteristics | Performance Requirements | Supplemental Information |
|---|---|---|
| | **POWER SOURCE** | |
| Line Voltage Ranges (rms) | | |
| Low | 90 to 132 V. | |
| High | 180 to 250 V. | |
| Line Frequency Range | 48 to 440 Hz. | |
| Power Consumption, Maximum | 15 W at 115 V, 60 Hz. | |
| Fuses for Line Voltage | 0.15 A, 250 V, for 90- to 132-V range.<br>0.10 A, 250 V, for 180- to 250-V range. | |
| Power Supply Voltages | | Ripple ≤ 1 mV p-p for all power supplies. |
| Ground Referenced | +5 V ±0.5 V.<br>−5 V ±0.5 V. | |
| Floating | +5 V ±0.5 V.<br>−5 V ±0.5 V. | |



Table 2

Environmental Characteristics

| Characteristics | Description |
|---|---|
| Temperature | |
| Operating | 0°C to +50°C. |
| Nonoperating (Storage) | −55°C to +75°C. |
| Altitude | |
| Operating | To 4.5 km (15,000 ft). |
| Nonoperating (Storage) | To 15 km (50,000 ft). |
| Humidity (Operating and Nonoperating) | Five cycles (120 hr total) with equipment tested nonoperating to MIL-STD-810C, Method 507.1, Procedure IV, modified as specified in MIL-T-28800B paragraph 4.5.5.1.1.2 at 90% to 95% Relative Humidity and at 30°C to 60°C. |
| Vibration (Operating) | 0.64 mm (0.025 in) p-p, 10 to 55 Hz sine wave. Total time of test, 75 minutes. |
| Shock | 50 g, half-sine, 11-ms duration, for a total of 18 shocks. |
| Bench Handling | Instrument will withstand a drop from approximately 100 mm (3.9 in) at an angle of 45°. |
| Package Transportation | |
| Vibration | 25 mm (1 in) at 270 vpm. |
| Drop | Package will withstand 10 drops from a height of 1 m (3.3 ft). |

Table 3

Physical Characteristics

| Characteristics | Description |
|---|---|
| Weight, With Accessories | 5.7 kg (12.6 lb). |
| Shipping Weight | 7.5 kg (16.6 lb). |
| Dimensions | See Figure 4. |
| Isolator | |
| Height | 136 mm (5.4 in). |
| Width | 394 mm (15.5 in). |
| Length | 344 mm (13.5 in). |
| Large Probe (1500 V) | |
| Probe Cable Length | 1.9 m (6.2 ft). |
| Probe Head Length | 200 mm (7.9 in). |
| Probe Common Lead Length | 300 mm (11.8 in). |

Table 3 (cont)

| Characteristics | Description |
|---|---|
| Dimensions (cont) | |
| Small Probe (500 V) | |
| Probe Cable Length | 2 m (6.6 ft). |
| Probe Head Length | 64 mm (2.5 in). |
| Probe Common Lead Length | 300 mm (11.8 in). |
| Power Cable Length | 3 m (9.8 ft). |
| Output Cable Length | 2 m (6.6 ft). |



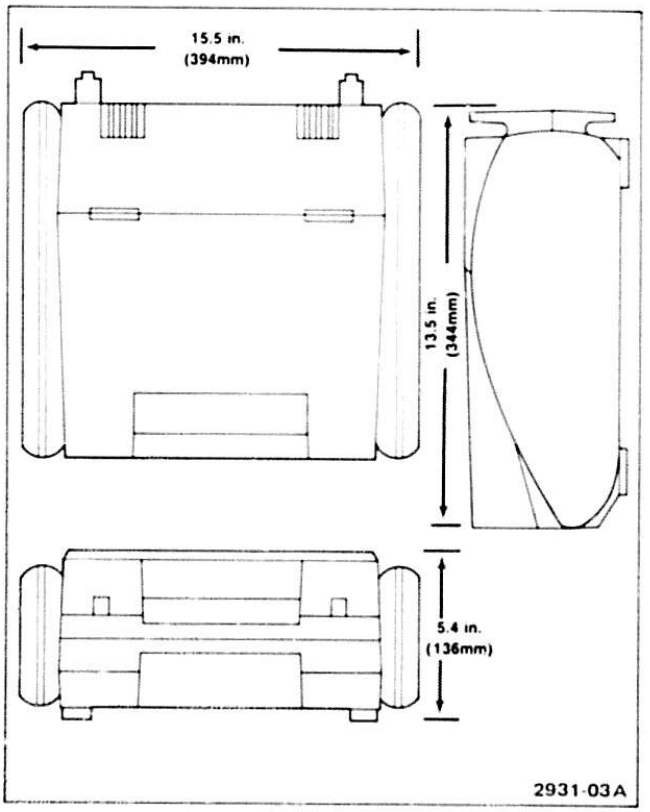



Figure 4. A6902 dimensional drawing.

# PREPARATION FOR USE

## INSTALLATION

Installation of the A6902 consists of verifying the proper power cord, performing the "Line Voltage Selection" procedure, connecting the input probe(s) to the circuit under test, and connecting the output bnc connector(s) to an oscilloscope.

## POWER CORDS

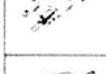
The A6902 has a detachable three-wire power cord with a three-terminal, polarized plug for connection to a power-input source. The grounding terminal of the plug is connected directly to the instrument frame as recommended by national and international safety codes. For electrical-shock protection, this plug should only be inserted into a power-input source socket that has a securely grounded, protective-ground contact. Refer to qualified service personnel to verify the protective-ground contact.

The power cord is detachable and when not in use should be wrapped around the feet of the A6902. Instruments are factory equipped with a standard 120-V power cord unless otherwise ordered. Other power cords that can be used with the A6902 are shown in Figure 5. Part numbers for the power cords are listed on the "Accessories" page at the back of this manual. For more information on power cords, contact your Tektronix representative or your local Tektronix Field Office.

## POWER REQUIREMENTS

The A6902 is designed to be used with a three-wire ac power system. It operates from either a 120-V or a 240-V nominal power input source from 48 to 440 Hz. Before connecting the instrument to a power-input source, verify that the Line Voltage Selector card is set for the line voltage being used, the proper fuse is installed, and the line cord plug matches the power-input source to be used. This procedure is described in the next paragraph and must be performed before operating the A6902. Refer to the Safety Summary in the front of this manual for power source, grounding, and other safety considerations pertaining to the use of this instrument.



| Plug Configuration | Usage | Nominal Line Voltage (AC) | Reference Standards | Option # |
|---|---|---|---|---|
|  | North American 120V, 15A | 120 V | ANSI C73.11, NEMA 5-15-P, IEC 83 | STANDARD |
|  | Universal Euro 240V, 10-16A | 240 V | *CEE (7, II, IV, VII), IEC 83 | A1 |
|  | UK 240V, 13A | 240 V | †BS 1363, IEC 83 | A2 |
|  | Australian 240V, 10A | 240 V | ‡AS C112 | A3 |
|  | North American 240V, 15A | 240 V | ANSI C73.20, NEMA 6-15-P, IEC 83 | A4 |
|  | Switzerland 220V, 10A | 220 V | SEV | A5 |

ANSI - American National Standards Institute.
NEMA - National Electrical Manufacturers Association.
IEC - International Electrotechnical Commission.
*CEE - International Commission on Rules for the Approval of Electrical Equipment.
†BS - British Standards Institute.
‡AS - Standards Association of Australia.
SEV - Schweizerischen Elektrotechnischen Verein.

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**Figure 5. Optional power cords and plugs.**

## LINE VOLTAGE SELECTION

The power-input module located on the rear panel of the instrument houses a Line Voltage Selector card, a line fuse, and a power-cord connector. To verify correct line voltage selection (or to convert the instrument for operation with a different line voltage range) perform the following procedure (refer to Figure 6).

1. Ensure that the power cord is disconnected from both the power-input source and the instrument and that both of the input probes and their common leads are disconnected from any electrical power source.

2. Slide the clear plastic cover to its extreme left position to expose the line fuse and the Line Voltage Selector card. The number you see on the Line Voltage Selector card is the system line voltage to which the instrument is set (refer to Table 4).

3. Pull out the lever marked FUSE PULL and rotate it to the left, disengaging the fuse from its holder.

Table 4

Line Voltage Ranges

| System Line Voltage | Voltage Range | Line Voltage Selector Card Position |
|---|---|---|
| 120 | 90 to 132 | 120 |
| 240 | 180 to 250 | 240 |

**CAUTION**

*This instrument may be damaged if operated with the Line Voltage Selector card set for the wrong applied line voltage or if the wrong line fuse is used.*

4. If it is necessary to change the line voltage range, use needle-nose pliers to grasp the Line Voltage Selector card (located under the fuse holder) at its center hole and pull straight out; otherwise, proceed to step 7.

5. From Table 4, determine the range for your average line voltage. Opposite that range, read the correct Line Voltage Selector card position.

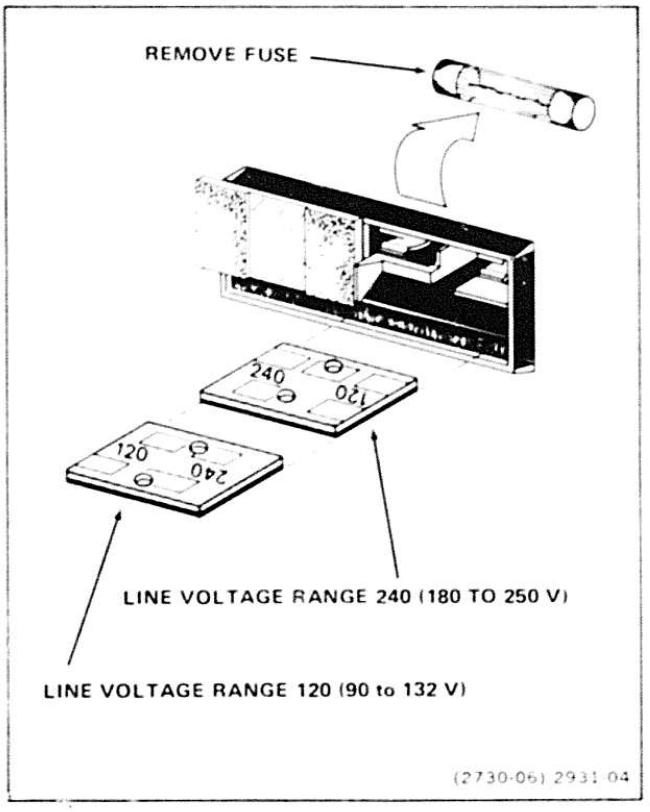


Figure 6. Line voltage selector card positioning.



6. Orient the Line Voltage Selector card to its proper position (see Figure 6) and insert it into the power-input module of the A6902.

7. Insert the proper fuse (selected from Table 5) into its holder and slide the clear plastic cover to the extreme right position.

8. Verify that you can read the proper voltage on the Line Voltage Selector card through the clear plastic window.

**WARNING**

*This instrument is designed for operation from a power input source with its neutral at or near earth (ground) potential with a separate safety-earth conductor.*

9. Verify that your power cord matches the power-input source being used (see Figure 5).

10. Set the POWER switch to OFF and connect the receptacle end of the power cord to the power-input module.

Table 5

Fuse Selection

| System Line Voltage | Fuse Size (250 V) |
|---|---|
| 120 | 0.15 A, 3AG, Fast-blow |
| 240 | 0.10 A, 3AG, Fast-blow |

## CONNECTING THE A6902 ISOLATOR

**WARNING**

*Before connecting any A6902 input probe(s) to a circuit under test, ensure that the Maximum Working Voltage limits and/or the Channel Isolation Maximum Voltage limits will not exceed those values listed in the Specification (Table 1).*

Figure 7 shows an example of how to connect an A6902 input probe. Although this illustration shows the 1500-V probe, it is equally applicable for the 500-V probe.

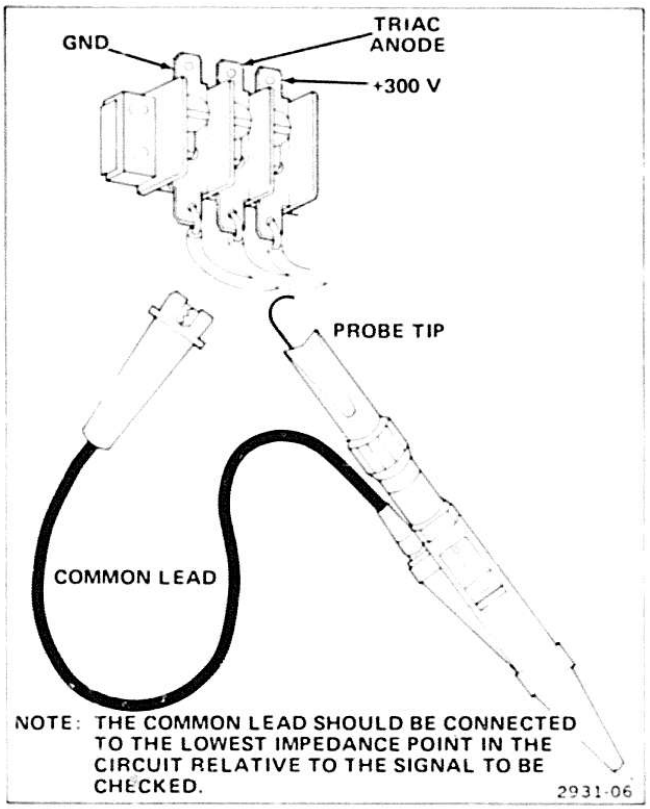


**Figure 7. Example of connecting an input probe.**

The common lead of the probe should always be connected to the lowest impedance point in the circuit under test (relative to the probe tip) to obtain the most accurate waveform.

Whenever the type of input probe is changed (for example, changing from the 1500-V probe to the 500-V probe), a compensation adjustment must be made. Refer to the "Gain Check and Probe Compensation" procedure in the "Operators Checks and Adjustments" part of this manual.

Figure 8 shows how the output bnc connectors are connected to an oscilloscope using the coaxial cables.

**NOTE**

*If both outputs of the A6902 are to be used at the same time, both cables should be the same length and impedance. Cable length should not exceed two meters and should be of 50-Ω impedance. Do not use any termination with the cables.*



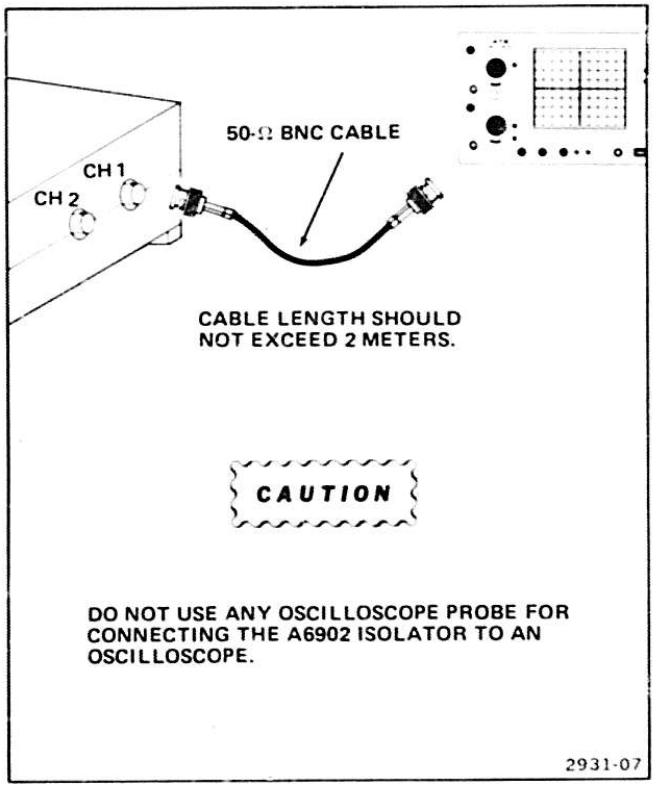


**Figure 8. Connecting the A6902 outputs to an oscilloscope.**

# CONTROLS, CONNECTORS, AND INDICATORS

## FRONT PANEL

Refer to Figure 9 for the location of items 1 through 5.

**NOTE**

*Only CHANNEL 2 controls (items 1 through 3) and the POWER switch (item 4) are shown. CHANNEL 1 controls are identical to CHANNEL 2.*

(1) **VOLTS/DIV Switches**—Establish the sensitivity of the oscilloscope-isolator system. The sensitivity is adjustable from 20 mV/division to 200 V/division in a 1, 2, 5 sequence.

(2) **AC-COMMON-DC Switches**—Select the coupling between the input probe and the input stage of the Isolator. In DC the input is directly coupled; in AC the input is connected to the Isolator via a capacitor; and in COMMON the input is connected to the Common terminal within the Isolator. The COMMON is analogous to the GND position on a conventional oscilloscope. It connects the input to a reference level so the operator can set the POSITION control.

(3) **OUTPUT DC LEVEL Controls**—Used for vertically positioning the waveform display on the screen of the oscilloscope's crt with 0-V output from the A6902. The Position control on the oscilloscope should be centered prior to using the A6902 OUTPUT DC LEVEL control. Thereafter the oscilloscope's Position control should be used.

(4) **POWER Control and Indicator**—Push button controls application of ac power to the Isolator. A mechanically-operated green indicator appears in the center of the POWER control when the Isolator is energized.

(5) **PROBE COMP Controls**—Used to compensate the input stages for the particular type of input probe being used (either 1500-V or 500-V).



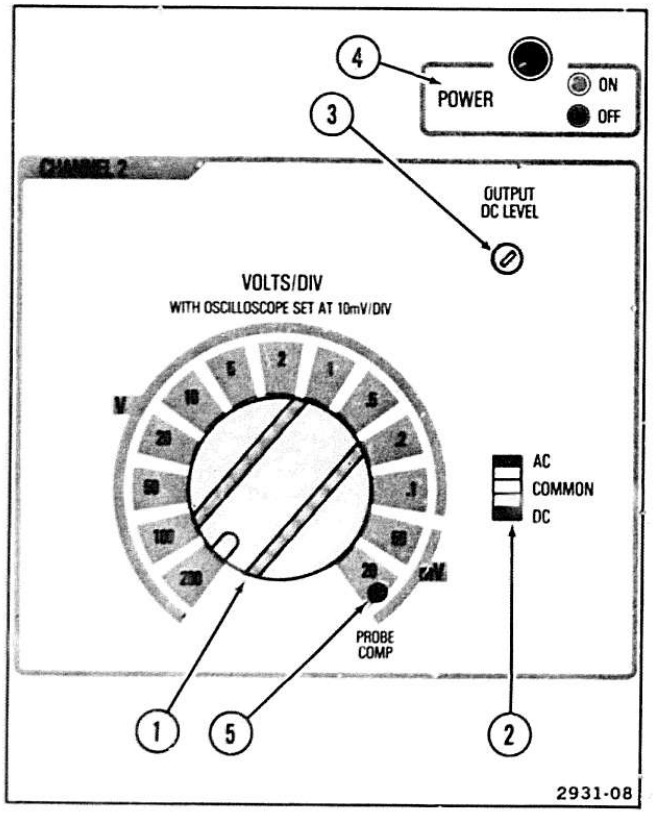


Figure 9. Front-panel controls and indicator.

## REAR PANEL

Refer to Figure 10 for the location of items 6 and 7.

(6) **Output Connectors**—CHANNEL 1 makes available the output of the Isolator's Channel 1. CHANNEL 2 makes available the output of the Isolator's Channel 2. Both outputs are terminated inside the Isolator, and use of an external termination will reduce signal amplitude.

(7) **POWER Input Connector**—Allows the connection of the ac power cord to the Isolator. The connector is an IEC connector.

## BOTTOM PANEL

Refer to Figure 11 for the location of item 8.

(8) **CAUTION Label**—Warns operators not to open the A6902 case.

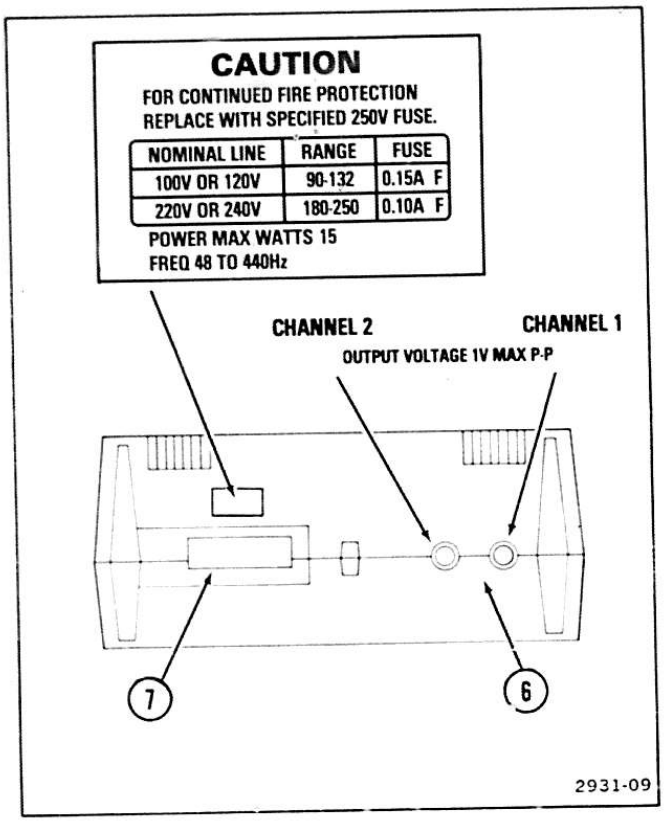


Figure 10. Rear-panel connectors.

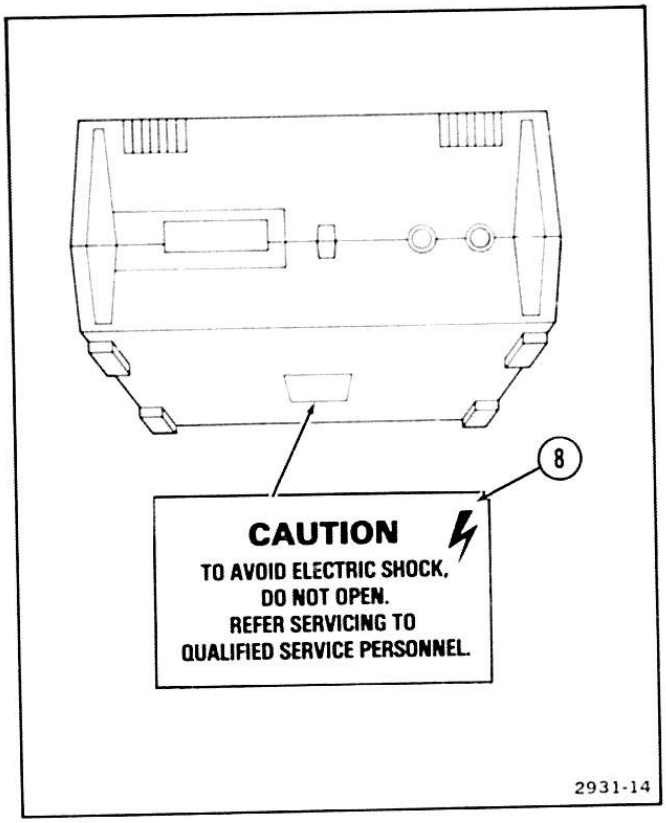


Figure 11. Bottom-panel caution label.



# INPUT PROBES

## SETTING PROBE-TIP ANGLES

The angle of the 500-V probe tip is continuously variable and may be rotated to any desired position.

The angle of the 1500-V probe tip may be rotated in 90° increments, if necessary, to make it easier to attach the probe to the circuit under test. To change the probe tip angle, refer to Figure 12 and perform the following steps:

1. Hold the probe with one hand, placing your forefinger and thumb behind the slide to maintain the slide in the forward position.

2. Loosen the collar by rotating it in the direction shown until it disengages from the probe body.

3. Pull the probe tip away from the probe body until the indexing guides on the shaft of the probe tip disengage from the guide slots in the probe body (approximately one-fourth inch).

4. Rotate the probe tip to the desired position (0°, 90°, 180°, or 270°).

5. Match the indexing guides with the corresponding guide slots for the position chosen and press the probe tip into the probe body until the indexing guides completely engage the guide slots.

6. Thread the collar onto the probe body until the collar is snugly seated.

7. The probe is now ready to be used.

## CHANGING INPUT PROBES

The input probes are attached to the instrument via coaxial connectors located inside the zippered pouch. To remove an input probe, grasp each connector (one attached to the probe cable and one attached to the instrument cable) and carefully disconnect them by pulling apart. To

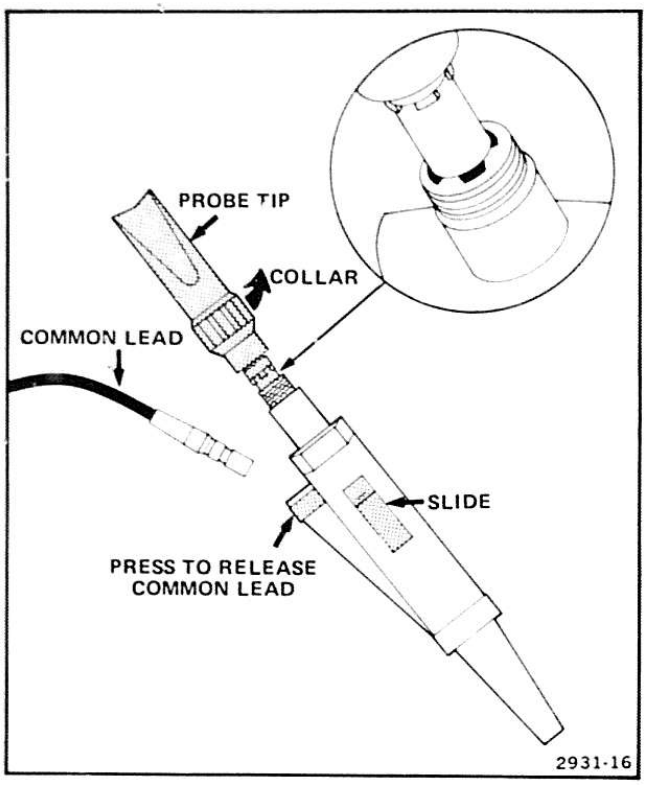


**Figure 12. Setting the 1500-V probe tip angle and replacing the common lead.**

install another input probe (either 500-V or 1500-V as required), align the two connectors and press them together until they snap into place and are firmly seated.

Whenever an input probe is changed, the PROBE COMP control must be adjusted. For these instructions, refer to the "Gain Check and Probe Compensation" procedure in the "Operator's Checks and Adjustments" part of this manual.

## REPLACING COMMON LEADS

To replace the common lead on the 500-V Probe, grasp the end closest to the probe and pull straight away from the probe body. Install the new common lead by inserting the round end into the connector on the probe body.

To replace the common lead on the 1500-V Probe, press and hold the release point shown in Figure 12. Pull the lead out of the probe body and remove pressure from the release point. Install the new common lead by pushing the lead end into the probe body until an audible click is heard.



## REPLACING THE 1500-V PROBE TIP

To replace the 1500-V Probe tip with a new one, refer to Figure 13 and perform the following steps:

1. Loosen the collar by rotating it in the direction shown until it disengages from the probe body.

2. Retract the slide to the position shown in Figure 13. The slide will stay in this position, and the spring inside the probe tip should cause the probe tip to return to its original position. If this does not occur, hold the slide in the retracted position and pull the probe tip away from the probe body until it reaches its original position.

3. Hold the probe body with one hand and rotate the probe tip in the direction shown until the probe tip completely disengages from the probe body.

4. To install a new probe tip, hold the probe body with the slide in the retracted position and insert the new probe tip into the probe body as far as it will easily go.

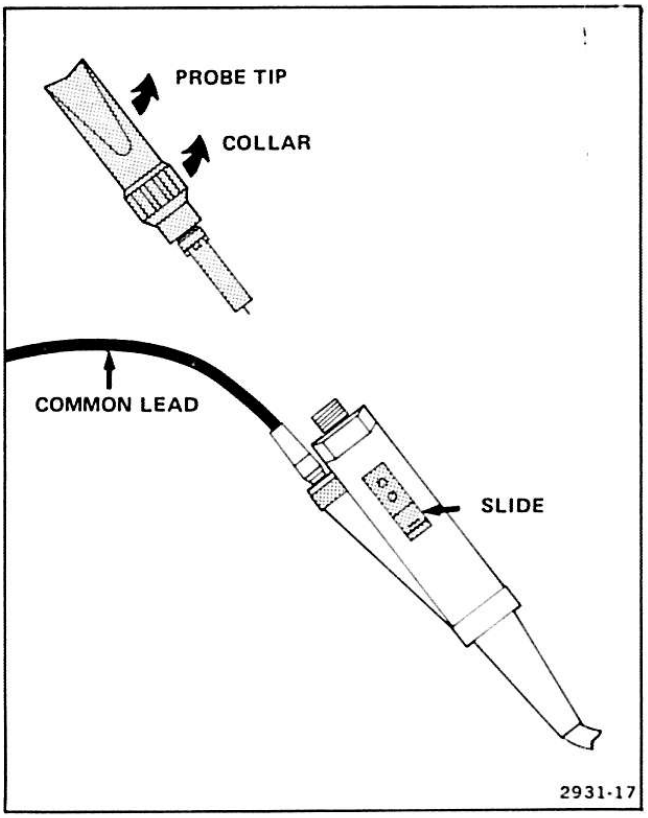


**Figure 13. Replacing the 1500-V probe tip.**

5. Thread the probe tip into the probe body until it seats snugly.

6. Move the slide forward to the position shown in Figure 12 and verify that there is approximately one-eighth inch clearance between the indexing guides on the shaft of the probe tip and the threaded portion of the probe body. If necessary, loosen the probe tip to achieve the correct clearance.

7. While holding the slide in the forward position, align the indexing guides with the guide slots in the probe body for the desired probe tip angle. Press the probe tip into the probe body until the indexing guides completely engage the guide slots.

8. Thread the collar onto the probe body until the collar is snugly seated.

9. The probe is now ready for use.

# OPERATOR'S CHECKS AND ADJUSTMENTS

## INTRODUCTION

By using the calibrator output of an oscilloscope, proper functioning of the A6902 can be verified and the gain of each channel can be checked. At the same time, probe compensation can be checked and adjusted, if necessary. The equipment required includes the following items:

1. An oscilloscope with a vertical deflection factor of 10 mV/division, an input impedance of 1 MΩ, an input capacitance of up to 47 pF, and a frequency response from dc to 100 MHz (for example, the TEKTRONIX 465B).

2. A coaxial cable with a 50-Ω impedance and bnc connectors on both ends (provided as a Standard Accessory).

Detailed instructions for operating test equipment are not given in this procedure. Refer to the appropriate test equipment instruction manual if more information is needed. The A6902 bnc outputs are terminated internally.

## GAIN CHECK AND PROBE COMPENSATION

1. Perform the "Line Voltage Selection" procedure.

2. Connect the A6902 to the power input source, press the POWER ON button, and allow 30 minutes for the A6902 to stabilize.

3. Set the A6902 CHANNEL 1 AC-COMMON-DC switch to COMMON and the CHANNEL 1 VOLTS/DIV switch to 50 mV.

4. Connect the A6902 CHANNEL 1 output bnc connector to the oscilloscope Channel 1 input bnc connector using the 50-Ω cable.



5. Set the oscilloscope controls as follows:

Volts/Division. . . . . .10 mV
AC-GND-DC. . . . . .GND
Vertical . . . . . .Channel 1
Triggering Mode . . . . . .Auto
Coupling . . . . . .DC
Source. . . . . .Channel 1
Slope . . . . . .+
Level. . . . . .Midrange
Power . . . . . .On

6. Use the oscilloscope Position control to center the trace vertically on the center graticule line. Then set the oscilloscope AC-GND-DC switch to DC.

7. Use the A6902 OUTPUT DC LEVEL control to position the oscilloscope trace on the center graticule line.

8. Set the A6902 AC-COMMON-DC switch to DC.

9. Connect the A6902 CHANNEL 1 input probe tip to the oscilloscope calibrator output and connect the common lead clip to the oscilloscope ground.

10. CHECK—Oscilloscope display is 6 major divisions ±1 minor division (3%) at approximately 1 kHz.

**NOTE**

*This display is based on the CALIBRATOR output of the TEKTRONIX 465B Oscilloscope (300 mV at approximately 1 kHz) with the A6902 VOLTS/DIV control set for 50 mV/DIV. If a different calibrator output voltage is used, set the controls to maintain the same input/output ratio and measure for ±3% accuracy.*

11. Adjust the PROBE COMP control for the best flat-top square-wave.

12. Repeat parts 3 through 11 for CHANNEL 2 of the A6902.

# APPLICATION EXAMPLE

## INTRODUCTION

The following example is only one of the ways the TEKTRONIX A6902 Isolator may be used to look at high-voltage signals or signals riding at a high voltage level.

The test circuit (Figure 14) is a simplified diagram of a motor controller. A variable RC network is used to trigger a diac, which in turn triggers the gate of a triac. In this example both channels of the A6902 will be used to compare the phase relationships of the gate signal to the motor voltage waveform and to the triac waveform. The two channels of the A6902 are completely isolated from each other. This allows the common leads of the input probes to be placed at different places in the same circuit with no danger of either grounding a high-voltage point or creating a short. The only additional equipment required is an oscilloscope.

To initiate the testing sequence, the oscilloscope is triggered. Then the motor voltage and gate signal waveforms are examined, first at partial conduction and then at full conduction. Next the triac-voltage and gate-signal waveforms are checked. The common lead of the input probe is placed on either point A or point C, depending on which waveform is to be checked. This is necessary to keep the common lead at the lowest impedance point relative to the input probe tip so that the most accurate waveforms will be obtained.

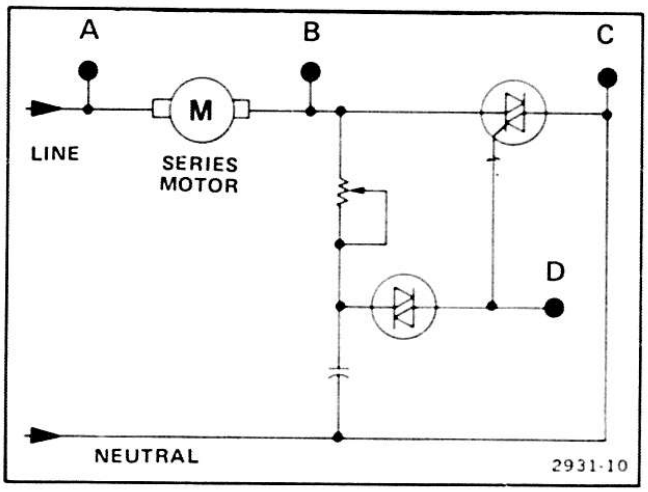


**Figure 14. Application example test circuit.**



## TEST SETUP

Connect the A6902 to the power source, press POWER ON and allow 30 minutes for the Isolator to stabilize. Connect the A6902 CHANNEL 1 and 2 outputs respectively to the oscilloscope Channel 1 and 2 inputs. Set the A6902 and oscilloscope control as follows:

**A6902**

CHANNEL 1 VOLTS/DIV . . . .0.5 V
CHANNEL 2 VOLTS/DIV . . . .100 V
AC-COMMON-DC . . . . . .COMMON
OUTPUT DC LEVEL. . . . . .Midrange

**Oscilloscope**

Volts/Division (Both channels). .10 mV
AC-GND-DC (Both channels). . .DC
Position (Both channels). . . . . .Midrange
Vertical Mode. . . . . .Alternate
Time/Division. . . . . .2 ms
Triggering Mode . . . . . .Auto
Source. . . . . .Line
Coupling . . . . . .DC
Slope . . . . . .+
Level. . . . . .Midrange
Power . . . . . .On

## TEST SEQUENCE

Use the oscilloscope Position controls to center the Channel 2 trace on the first major division line below the center horizontal graticule line and to set the Channel 1 trace one and one-half major divisions below the top horizontal graticule line. Change the oscilloscope Trigger Mode switch to Normal and set both A6902 AC-COMMON-DC switches to DC.

Connect the A6902 CHANNEL 1 input probe tip to point D and its common lead to point C. Connect the CHANNEL 2 input probe tip to point B and its common lead to point A. Adjust the oscilloscope Level control and the Motor Speed potentiometer to obtain waveforms similar to Figure 15. After the waveforms have been obtained, change the oscilloscope Trigger Source switch to Channel 2 and readjust the Trigger Level control if necessary.

The motor voltage waveform (CH 2) shows that the motor is not conducting for approximately 4 ms and conducting for approximately 4 ms of each half cycle. Since the common lead for CHANNEL 2 is on point A, the waveform appears as a straight line at ground for the nonconducting time and appears as a positive voltage for the conducting time. The gate waveform (CH 1) is exactly

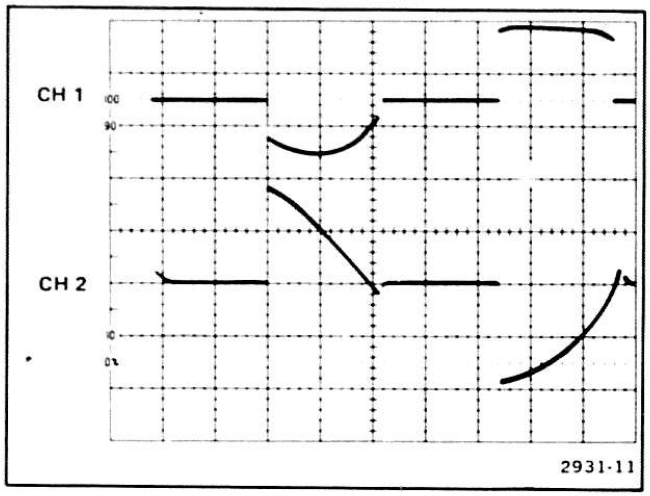


**Figure 15. Motor and gate waveforms at approximately 180° conduction.**

the opposite polarity because its common lead is connected to point C. The gate waveform is not symmetrical, since the diac's breakdown characteristics differ for positive and negative voltages.

Adjust the Motor Speed potentiometer for maximum speed. The waveforms now match Figure 16.

Readjust the Motor Speed potentiometer for approximately 180° conduction and move the CHANNEL 2 common lead to point C. The waveforms are now similar to Figure 17. Notice that the triac voltage (CH 2) goes almost to zero (approximately 4 ms after the start of each half cycle) when the diac avalanches (CH 1) and triggers the triac gate. The triac voltage (CH 2) is also the opposite polarity of the motor voltage waveform shown in Figure 15 (CH 2).



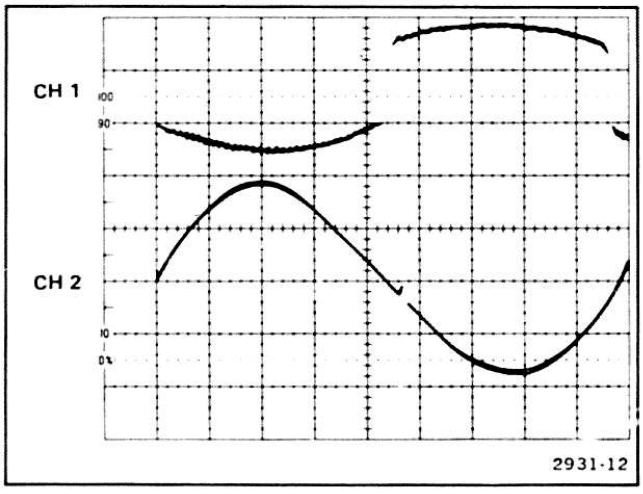


**Figure 16. Motor and gate waveforms at approximately 360° conduction.**

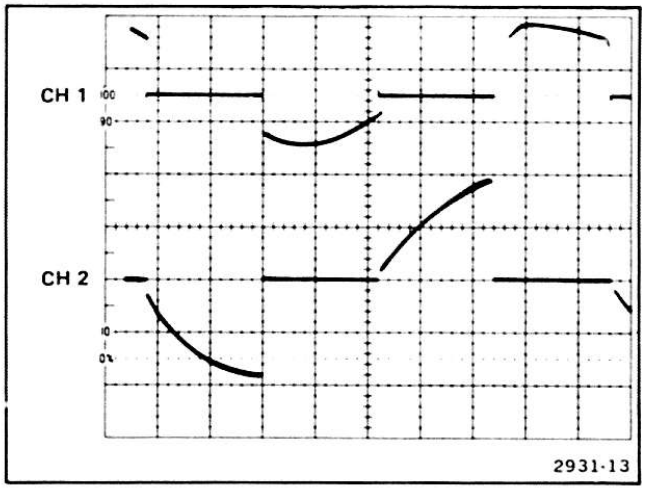


**Figure 17. Triac and gate waveforms at approximately 180° conduction.**

# ACCESSORIES

## STANDARD ACCESSORIES

| | |
|---|---|
| 2 Probes, isolation, 500 V | 010-0411-01 |
| 2 Probes, isolation, 1500 V | 010-0409-00 |
| 1 Operators Manual | 070-2931-01 |
| 1 Service Manual | 070-2905-02 |
| 1 Fuse,0.1 A, 250 V, fast-blow | 159-0171-00 |
| 2 Cables, output, 50 Ω, 2 meters | 012-0204-00 |
| 1 Power cord, right angle | 161-0117-00 |

## OPTIONAL POWER CORDS

| | |
|---|---|
| Option A1, 3-meter length | 161-0132-00 |
| Option A2, 3-meter length | 161-0133-00 |
| Option A3, 3-meter length | 161-0135-00 |
| Option A4, 3-meter length | 161-0134-00 |
| Option A5, 3-meter length | 161-0154-00 |

## OPTIONAL ACCESSORIES

| | |
|---|---|
| Bnc-to-probe-tip Adapter (for use with 010-0409-00) (For calibration purposes only) | 015-0405-00 |
| Bnc-to-probe-tip Adapter (for use with 010-0411-01) | 013-0084-02 |
| Accessory Package (for use with 010-0411-00) | 020-0643-00 |

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# MANUAL CHANGE INFORMATION

Date: 10-21-81 Change Reference: C1/1081

Product: A6902 ISOLATOR OPERATOR Manual Part No.: 070-2931-01

TEXT CORRECTION

Page 10

Change the Description of the Characteristic Humidity (Operating and Nonoperating to read as follows:

| | |
|---|---|
| Humidity (Operating and Nonoperating) | Five cycles (120 Hr total) with equipment tested operating and nonoperating to MIL-STD-810C, method 507.1, procedure IV, ELECTRICAL measurements performed at 50°C, 45% Relative Humidity and 30°C, 90-95% Relative Humidity. Meets and exceeds requirements as modified in MIL-T-28800B paragraph 4.5.5.1.1.2. |



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# MANUAL CHANGE INFORMATION

Date: 4-12-80 Change Reference: C2/482

Product: A6902 ISOLATOR Operators Manual Part No.: 070-2931-01

ADD: to Table 1 at the bottom of page 7.

| Characteristics | Performance Requirements |
|---|---|
| Voltage-Induced Baseline Drift | Baseline drift ≤±15% of applied dc voltage after 5 minutes. |

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# MANUAL CHANGE INFORMATION

Date: 8-10-82 Change Reference: C1/882

Product: A6902 ISOLATOR Operators Manual Part No.: 070-4269-00

ADD:

Add to Table 1 at the bottom of page 7:

| Characteristics | Performance Requirements |
|---|---|
| Voltage-Induced Baseline Drift | Baseline drift ≤±15% of applied dc voltage after 5 minutes. |

Add note after step 6 on page 16:

NOTE

The Line Voltage Selector card has four positions. Due to the regulation capabilities of the A6902, only the two positions shown in Figure 6 are required to accommodate the voltage ranges of 90 to 132 and 180 to 250.

CHANGE:

Change Table 4 on page 15:

| FROM: Line Voltage Selector Card Position | TO: Line Voltage Selector Card Position |
|---|---|
| 120 | 115/120 |
| 240 | 230/240 |



Product: A6902 Isolator Change Reference: C1/882 Date: 8-10-82

Change Figure 6, Page E-15 to the following: