



A621
1000 Amp AC Current Probe
Instructions



070-8882-05



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Contacting Tektronix

Tektronix, Inc.
14150 SW Karl Braun Drive
P.O. Box 500
Beaverton, OR 97077
USA

For product information, sales, service, and technical support:

- In North America, call 1-800-833-9200.
- Worldwide, visit www.tek.com to find contacts in your area.

Warranty

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Parts, modules and replacement products used by Tektronix for warranty work may be new or reconditioned to like new performance. All replaced parts, modules and products become the property of Tektronix.

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

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

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[W2 – 15AUG04]

Important safety information

This manual contains information and warnings that must be followed by the user for safe operation and to keep the product in a safe condition.

To safely perform service on this product, see the *Service safety summary* that follows the *General safety summary*.

General safety summary

Use the product only as specified. Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. Carefully read all instructions. Retain these instructions for future reference.

This product shall be used in accordance with local and national codes.

For correct and safe operation of the product, it is essential that you follow generally accepted safety procedures in addition to the safety precautions specified in this manual.

The product is designed to be used by trained personnel only.

Only qualified personnel who are aware of the hazards involved should remove the cover for repair, maintenance, or adjustment.

Before use, always check the product with a known source to be sure it is operating correctly.

This product is not intended for detection of hazardous voltages.

Use personal protective equipment to prevent shock and arc blast injury where hazardous live conductors are exposed.

To avoid fire or personal injury

Observe all terminal ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Before using the product, consult the product manual for further ratings. Do not exceed the Measurement Category (CAT) ratings and voltage or current rating.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal. Do not use the probe anywhere beyond the tactile barrier.

Do not operate without covers. Do not operate this product with covers or panels removed, or with the case open. Hazardous voltage exposure is possible.

Avoid exposed circuitry. Do not touch exposed connections and components when power is present.

Use only specified replacement parts.

Do not operate in wet/damp conditions. Be aware that condensation may occur if a unit is moved from a cold to a warm environment.

Do not operate in an explosive atmosphere.

Keep product surfaces clean and dry. Remove the input signals before you clean the product.

Probes and test leads

Connect and disconnect properly. Connect the probe output to the measurement product before connecting the probe to the circuit under test. Disconnect the probe from the circuit under test before disconnecting the probe from the measurement product.

Do not connect a current probe to any wire that carries voltages, current, or frequencies above the current probe rating. The tactical barrier is located at the base of the jaw. Refer to the A621 current probe figure in the section of this document.

Inspect the probe and accessories. Before each use, inspect probe and accessories for damage (cuts, tears, or defects in the probe body, accessories, or cable jacket). Do not use if damaged.

Service safety summary

The *Service safety summary* section contains additional information required to safely perform service on the product. Only qualified personnel should perform service procedures. Read this *Service safety summary* and the *General safety summary* before performing any service procedures.

To avoid electric shock. Do not touch exposed connections.

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

Disconnect power. To avoid electric shock, remove the current probe from the circuit before removing any covers or panels, or opening the case for servicing.

Use care when servicing with power on. Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

Verify safety after repair. Always recheck operation after performing a repair.

Terms in the 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:

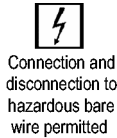
- DANGER indicates an injury hazard immediately accessible as you read the marking.
- WARNING indicates an injury hazard not immediately accessible as you read the marking.
- CAUTION indicates a hazard to property including the product.

Symbols on the product



When this symbol is marked on the product, be sure to consult the manual to find out the nature of the potential hazards and any actions which have to be taken to avoid them. (This symbol may also be used to refer the user to ratings in the manual.)

The following symbols may appear on the product:



Compliance information

This section lists European contact information, safety, and environmental standards with which the instrument complies.

European contact:

Tektronix UK, LTD
Western Peninsula
Western Road
Bracknell, RG12 1RF
United Kingdom

Safety compliance

This section lists the safety standards with which the product complies and other safety compliance information.

EU declaration of conformity – low voltage

Compliance was demonstrated to the following specification as listed in the Official Journal of the European Union:

Low Voltage Directive 2014/35/EU

- EN 61010-1. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.
- EN 61010-2-032. Particular requirements for handheld current clamps for electrical measurement and test equipment.

U.S. nationally recognized testing laboratory listing

- UL 61010-1. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.

Canadian certification

- CAN/CSA-C22.2 No. 61010-1. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.

Additional compliances

- IEC 61010-1. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.
- IEC 61010-2-032. Particular requirements for handheld current clamps for electrical measurement and test equipment.

Equipment type

Test and measuring equipment.

Safety class

Class 2

Pollution degree description

A measure of the contaminants that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated.

- Pollution Degree 1. No pollution or only dry, nonconductive pollution occurs. Products in this category are generally encapsulated, hermetically sealed, or located in clean rooms.
- Pollution Degree 2. Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.
- Pollution Degree 3. Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation. These are sheltered locations where neither temperature nor humidity is controlled. The area is protected from direct sunshine, rain, or direct wind.
- Pollution Degree 4. Pollution that generates persistent conductivity through conductive dust, rain, or snow. Typical outdoor locations.

Pollution degree

Pollution Degree 2 (as defined in IEC 61010-1). Note: Rated for indoor, dry location use only.

IP rating

IP20 (as defined in IEC 60529).

Measurement and overvoltage category descriptions

Measurement terminals on this product may be rated for measuring mains voltages from one or more of the following categories (see specific ratings marked on the product and in the manual).

- Measurement Category II. For measurements performed on circuits directly connected to the low-voltage installation.
- Measurement Category III. For measurements performed in the building installation.
- Measurement Category IV. For measurements performed at the source of low-voltage installation.

NOTE. *Only mains power supply circuits have an overvoltage category rating. Only measurement circuits have a measurement category rating. Other circuits within the product do not have either rating.*

Environmental compliance

This section provides information about the environmental impact of the product.

Product end-of-life handling

Observe the following guidelines when recycling an instrument or component:

Equipment recycling. Production of this equipment required the extraction and use of natural resources. The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. To avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle this product in an appropriate system that will ensure that most of the materials are reused or recycled appropriately.



This symbol indicates that this product complies with the applicable European Union requirements according to Directives 2012/19/EU and 2006/66/EC on waste electrical and electronic equipment (WEEE) and batteries. For information about recycling options, check the Tektronix Web site (www.tek.com/productrecycling).

Operating basics

The Tektronix A621 current probe enables the display of current waveforms up to 1000 amps RMS on Tektronix TDS, TAS, or general purpose oscilloscopes. The A621 is especially useful where the display and measurement of distorted current waveforms and harmonics is required. The A621 is also compatible with DMMs by using the BNC-to-banana plug adapter (see [Replaceable parts](#) on page 12).

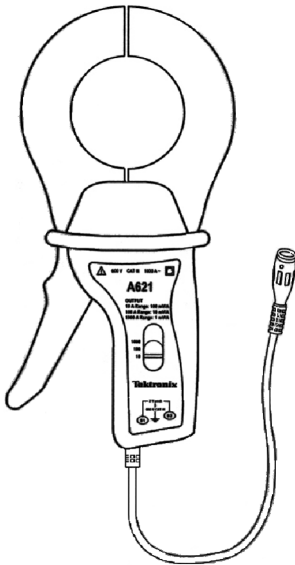

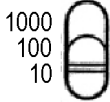


Figure 1: A621 current probe

Symbol	Description
	Current flow symbol This arrow shows the probe's polarity convention for measuring current flowing from positive to negative.
	Range switch Slide to select the measurement range of the probe - 10/100/1000 A.

Operating procedure



WARNING. To avoid personal injury or damage to the probe, do not clamp the probe onto circuits with voltages greater than 600 VAC.

Always connect the probe to the instrument before clamping onto the circuit under test.

1. Connect the probe BNC connector to the oscilloscope input. Start by setting the oscilloscope channel vertical coupling to AC volts, the vertical deflection to 0.1 V/div, and the probe to 1 mV/A.
2. Connect the probe to the circuit by opening the jaws and clamping around the conductor. Refer to the following figure.

NOTE. Clamping around both the “hot” and neutral wires may give you a zero reading.

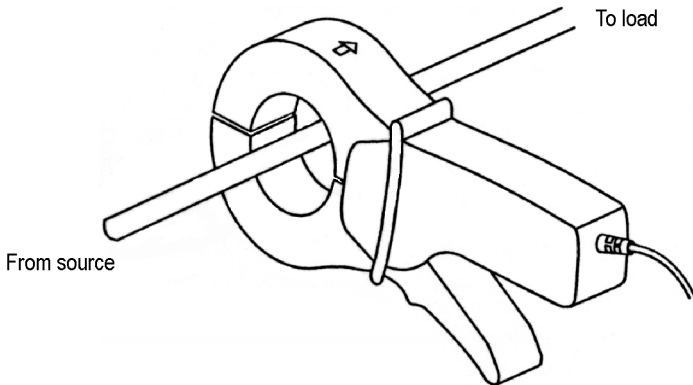


Figure 2: Connecting the A621

(Remember to unclamp the probe from the conductor before disconnecting it from your meter or instrument.)

3. Adjust the probe range and oscilloscope channel as necessary to get a clear view of the signal.

The current drawn by some devices will look much different than that of others. While the RMS current may be low, the momentary peaks may be quite high. The following figure shows the difference between the line current drawn by a resistive load and a motor controller.

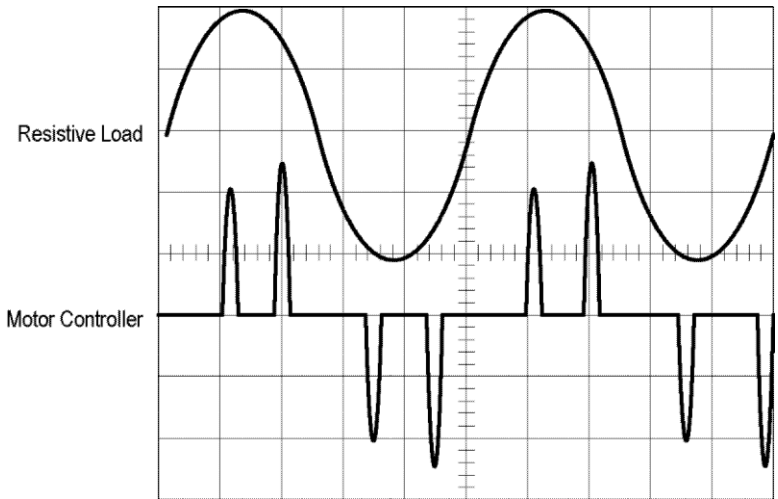


Figure 3: Typical current waveforms

If you are using the A621 with a multimeter, use the BNC-to-banana adapter (recommended accessory) to connect the probe. Connect the black lead to the meter **COM**, and the red lead to the **VΩ** input. Set the meter to the AC Volts position.

To increase the measurement sensitivity of the A621, loop additional turns of the wire under test through the jaws. See Figure 3. The sensitivity of the A621 will be multiplied times the number of loops in the jaws. For example: $10 \text{ mV/A} \times 4 \text{ turns} = 40 \text{ mV/A}$.



CAUTION. To prevent damage to the probes, do not force the jaw closed. If you cannot close the jaw around the conductor(s), either reduce the number of conductors you are measuring, or, if possible, take your measurement on a smaller conductor.

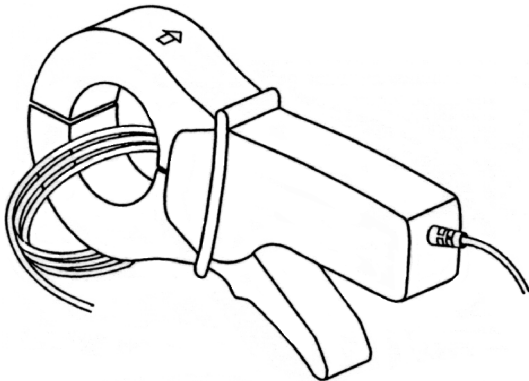


Figure 4: Increasing the A621 sensitivity

Maintenance

Use the information in this section to properly maintain the operation of your current probe.

Cleaning

To clean the probe body, use a soft cloth dampened in a solution of mild detergent and water. To clean the core, open the jaw and clean the exposed core surfaces with a cotton swab dampened with isopropyl alcohol (isopropanol) or ethyl alcohol (fotocol or ethanol). Lubricate the jaws mating surfaces with a light oil.

Do not use chemicals containing benzine, benzene, toluene, xylene, acetone, or similar solvents.

Do not immerse the probe in liquids or use abrasive cleaners.

Specifications

These characteristics apply to an A621 probe installed on a Tektronix TDS320 oscilloscope. The oscilloscope must be warmed up for at least 20 minutes and be in an environment within the limits specified in [Table 3: Environmental characteristics](#) on page 7.

Table 1: Electrical characteristics

Characteristics	Description
Output	1/10/100 mV/A
Accuracy	±2% at 1 mV/A and 10 mV/A ±3% at 100 mV/A
Maximum working current	2000 A _{peak} at 1 mV/A 1000 A _{RMS} at 1 mV/A 200 A _{peak} at 10 mV/A 20 A _{peak} at 100 mV/A
Maximum working voltage	600 V CAT III
Frequency range	5 Hz to 50 kHz

Table 2: Physical characteristics

Dimensions	206 mm x 48 mm x 105 mm (8.11 x 1.89 x 4.13 inches)
Maximum conductor size	54 mm (2.13 inches)
Cable length	1.5 m (5 feet)
Weight	650 g (1.43 lb)

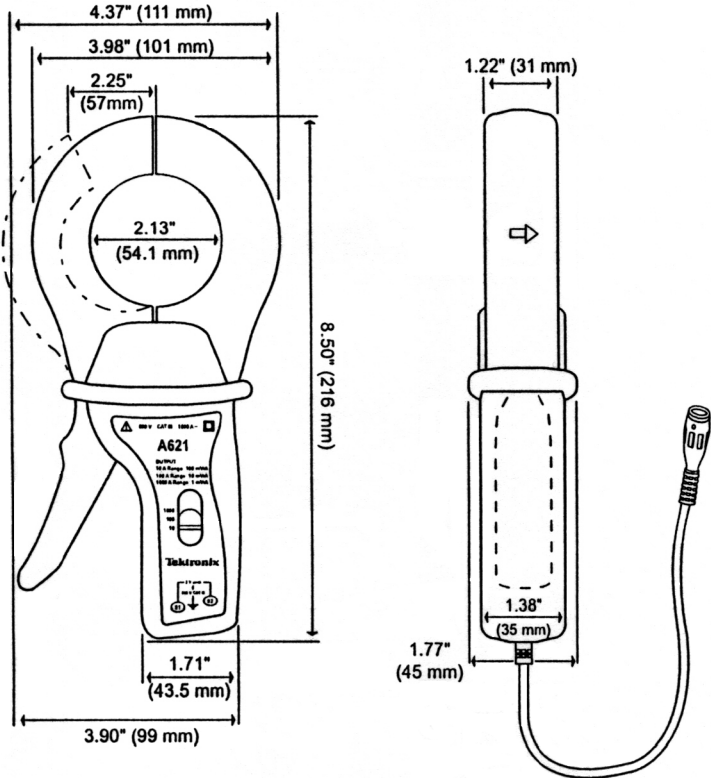
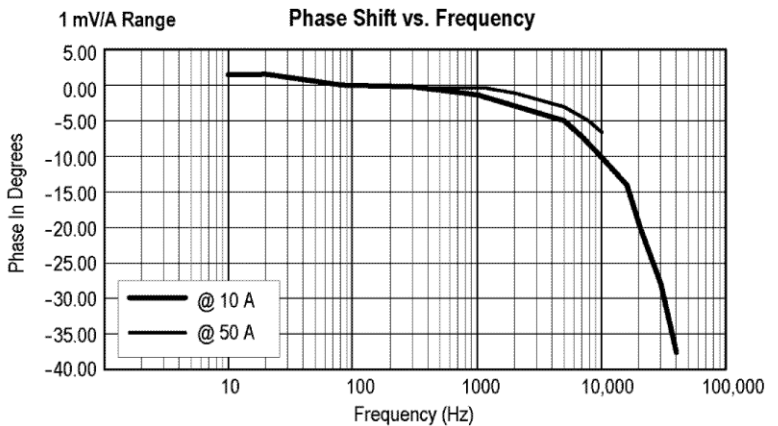
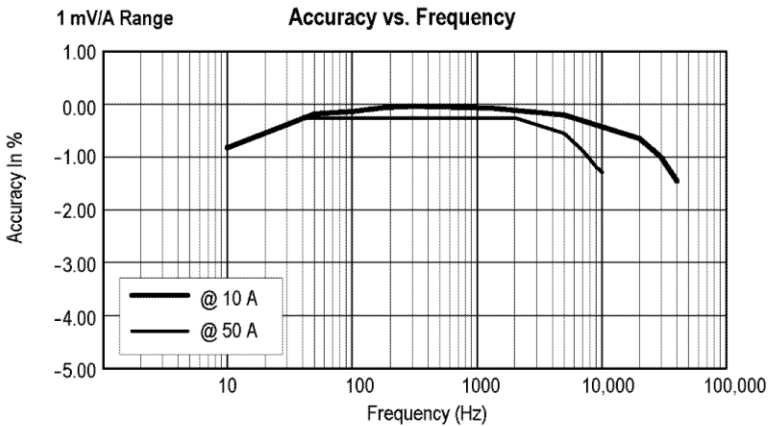
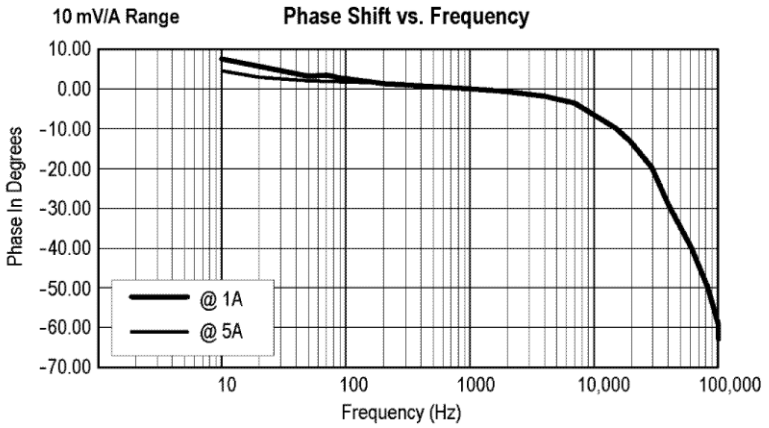
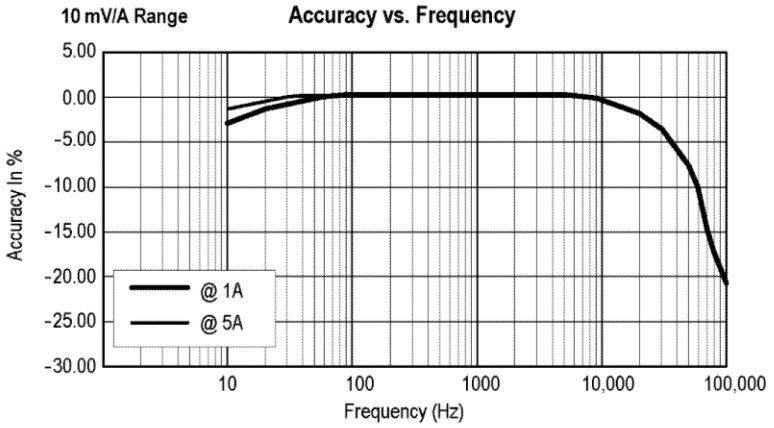


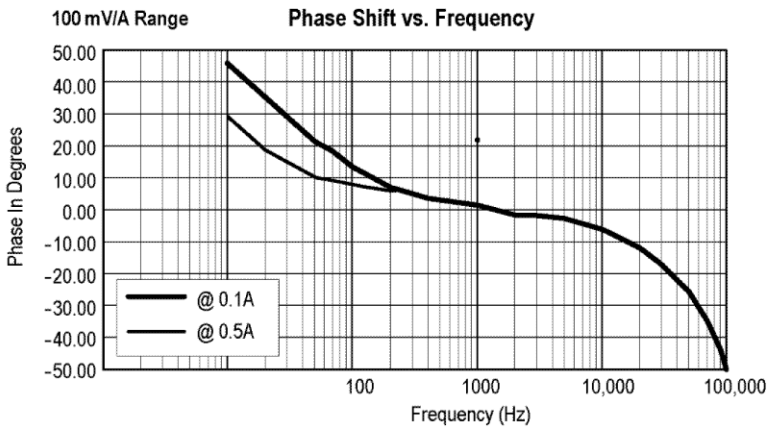
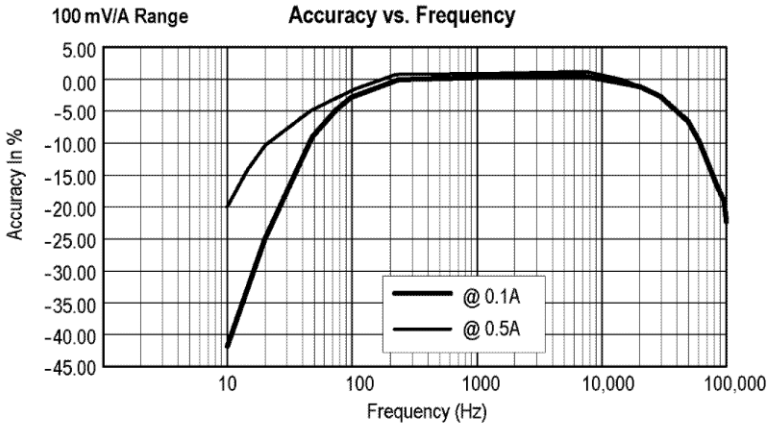
Figure 5: Physical dimensions

Table 3: Environmental characteristics

Temperature	
Operating	0 °C to +50 °C (+32 °F to +122 °F)
Non-operating (storage)	-20 °C to +80 °C (-4 °F to +176 °F)
Humidity	
	0° C to 40° C, 95% humidity 40° C to 50° C, 45% humidity

Typical response curves





Performance verification

This procedure verifies that the A621 performs as specified. It can also be an acceptance check. There are no A621 adjustments. This procedure is valid when:

- The system is operated in an environment that conforms to the A621 environmental specifications (0 °C to 50 °C unless otherwise stated).
- The oscilloscope is set to DC coupling, normal triggering.

The performance verification procedure requires the test equipment or equivalent listed in the following table. If different equipment is substituted, control settings or test equipment setup may need to be altered.

The performance verification consists of an accuracy check of the probe ranges.

Warm up the test equipment at least 20 minutes to stabilize it before performing the checks.

Table 4: Test equipment required for performance verification

Item	Minimum requirements	Recommended example
Oscilloscope	1 M Ω input, general purpose oscilloscope	Tektronix TAS/TDS series
Signal Generator	60 Hz Sine Wave, ≥ 50 mA _{RMS} into $< 1 \Omega$	Tektronix FG501A ¹ , FG 504 ¹ , or equivalent
Multimeter	≥ 0.5 A max. input current, accuracy $\leq 0.6\%$ of reading on AC Current measurement at 60 Hz	Tektronix DM504A or equivalent ¹
Current Loop, 100 turn	100 turns coated wire, 20 AWG (≈ 0.9 mm), loop diameter 7.5 cm (3 in), alligator clips on ends	See procedure
18 inch banana jack-to-banana jack patch cords, three required		Tektronix part numbers: 012-0031-XX, 012-0039-XX

100-turn current loop



CAUTION. *Magnetic fields are produced that can cause a malfunction in heart pacemakers, or damage to sensitive equipment. To avoid malfunctions, it is not recommended to make a coil with more than 100 turns. Coil currents in excess of 0.2 Amperes are not recommended.*

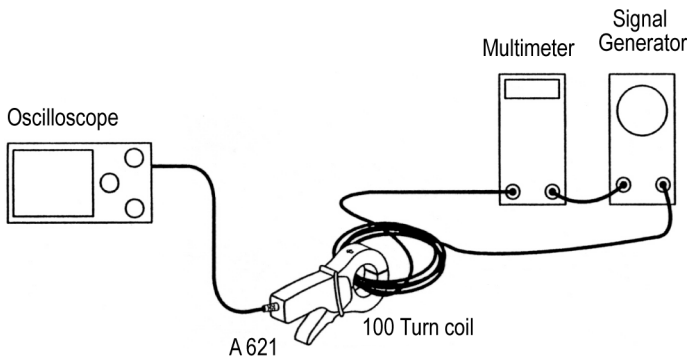
For the accuracy check you will need a simple current loop. Wind 100 turns of 20 AWG (≈ 0.9 mm diameter) coated wire around a cylindrical form approximately 7.5 cm (3 inches) in diameter.

¹ Requires Tektronix TM500 Series or Tektronix TM5000 Series Power Module

NOTE. Be sure the current loop has exactly 100 turns. A significant error will result for each extra or missing turn.

AC accuracy check

1. Connect the 100 turn current loop, the multimeter current inputs, and the signal generator output in series using the patch cords and adapters. Set the multimeter to display AC_{RMS} current. Refer to the following figure.



8882-010

Figure 6: Setup for maximum input current and accuracy checks

2. Adjust the signal generator output to between 49 mA_{RMS} and 51 mA_{RMS} as measured on the multimeter.
3. Connect the A621 to the oscilloscope, and make the following oscilloscope settings:
 - Time base to $5\text{ mS} / \text{div}$.
 - Vertical deflection to $500\text{ mV} / \text{div}$.
 - Coupling to DC
4. Set the A621 sensitivity switch to $100\text{ mV} / \text{A}$ and center the trace on the oscilloscope screen.
5. Clamp the A621 around the 100 turn current loop.
6. If necessary, readjust the signal generator output to read between 49 mA_{RMS} and 51 mA_{RMS} on the multimeter.

7. Check that the waveform peak to peak amplitude measures $1.4 \pm 0.1 V_{P-P}$ on the oscilloscope.
8. Continue to check the probe accuracy using the parameters in the following table.

Table 5: AC accuracy check parameters

Step	Probe range	Oscilloscope V/div setting	Multimeter reading	Oscilloscope display
1.	100 mV/A	200 mV/div.	50 ± 1 mA	$1.4 \pm 0.1 V_{P-P}$
2.	10 mV/A	20 mV/div.	50 ± 1 mA	$140 \pm 10 mV_{P-P}$
3.	1 mV/A	2 mV/div.	50 ± 1 mA	$14 \pm 1 mV_{P-P}$

Preparation for shipment

If the original packaging is unfit for use or not available, use the following packaging guidelines:

1. Use a corrugated cardboard shipping carton having inside dimensions at least one inch greater than the probe dimensions. The box should have a carton test strength of at least 200 pounds.
2. Put the probe into a plastic bag or wrap to protect it from dampness.
3. Place the probe into the box and stabilize it with light packing material.
4. Seal the carton with shipping tape.

Replaceable parts

The A621 is shipped with the following item(s):

- These instructions Tektronix part number 070-8882-XX

The following accessories are recommended:

- A BNC-to-banana plug adapter (for use with DMM's) Tektronix part number 012-1450-XX

The A621 does not have any user replaceable parts. If you should have trouble with your probe, contact your local Tektronix Service Center or representative for help.

