

Tektronix PA3000 Power Analyzer Installation & Safety Instructions



071-3447-00

Tektronix

Tektronix PA3000 Power Analyzer Installation & Safety Instructions

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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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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, additional information is provided at the end of this section. (See page v, *Service 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.

Comply with local and national safety 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.

While using this product, you may need to access other parts of a larger system. Read the safety sections of the other component manuals for warnings and cautions related to operating the system.

When incorporating this equipment into a system, the safety of that system is the responsibility of the assembler of the system.

To avoid fire or personal injury

Use proper power cord. Use only the power cord specified for this product and certified for the country of use.

Do not use the provided power cord for other products.

Use proper voltage setting. Before applying power, make sure that the line selector is in the proper position for the source being used.

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, make sure that the product is properly grounded.

Do not disable the power cord grounding connection.

Power disconnect. The power cord disconnects the product from the power source. See instructions for the location. Do not position the equipment so that it is difficult to operate the power cord; it must remain accessible to the user at all times to allow for quick disconnection if needed.

Connect and disconnect properly. Do not connect or disconnect probes or test leads while they are connected to a voltage source.

Use only insulated voltage probes, test leads, and adapters supplied with the product, or indicated by Tektronix to be suitable for the product.

Observe all terminal ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product. Do not exceed the Measurement Category (CAT) rating and voltage or current rating of the lowest rated individual component of a product, probe, or accessory. Use caution when using 1:1 test leads because the probe tip voltage is directly transmitted to the product.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

Do not float the common terminal above the rated voltage for that terminal.

The measuring terminals on this product are not rated for connection to Category III, or IV circuits.

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.

Do not operate with suspected failures. If you suspect that there is damage to this product, have it inspected by qualified service personnel.

Disable the product if it is damaged. Do not use the product if it is damaged or operates incorrectly. If in doubt about safety of the product, turn it off and disconnect the power cord. Clearly mark the product to prevent its further operation.

Before use, inspect voltage probes, test leads, and accessories for mechanical damage and replace when damaged. Do not use probes or test leads if they are damaged, if there is exposed metal, or if a wear indicator shows.

Examine the exterior of the product before you use it. Look for cracks or missing pieces.

Use only specified replacement parts.

Replace batteries properly. Replace batteries only with the specified type and rating.

Recharge batteries properly. Recharge batteries for the recommended charge cycle only.

Use proper fuse. Use only the fuse type and rating specified for this product.

Wear eye protection. Wear eye protection if exposure to high-intensity rays or laser radiation exists.

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.

Provide proper ventilation. Refer to the installation instructions in the manual for details on installing the product so it has proper ventilation.

Slots and openings are provided for ventilation and should never be covered or otherwise obstructed. Do not push objects into any of the openings.

Provide a safe working environment. Always place the product in a location convenient for viewing the display and indicators.

Avoid improper or prolonged use of keyboards, pointers, and button pads. Improper or prolonged keyboard or pointer use may result in serious injury.

Be sure your work area meets applicable ergonomic standards. Consult with an ergonomics professional to avoid stress injuries.

Use care when lifting and carrying the product. This product is provided with handles for lifting and carrying.

Use only the Tektronix rackmount hardware specified for this product.

Probes and test leads

Before connecting probes or test leads, connect the power cord from the power connector to a properly grounded power outlet.

Keep fingers behind the finger guards on the probes.

Remove all probes, test leads and accessories that are not in use.

Use only correct Measurement Category (CAT), voltage, temperature, altitude, and amperage rated probes, test leads, and adapters for any measurement.



WARNING. *To prevent electrical shock, do not exceed the maximum measurement or maximum floating voltage for the test lead.*

Connect and disconnect properly. Connect the test leads to the measurement product before connecting it to the circuit under test. Connect the reference test lead to the circuit under test before connecting the test lead input. Disconnect the test lead input and the reference test lead from the circuit under test before disconnecting the test leads from the measurement product.

Connect and disconnect properly. De-energize the circuit under test before connecting or disconnecting the test leads.

Do not connect a test lead to any circuit that carries voltages above the voltage rating of the test lead.

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

Floating measurement use. Do not float the reference lead above the rated float voltage.

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, switch off the product power and disconnect the power cord from the mains power 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 ground continuity and mains dielectric strength after performing a repair.

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.*

Symbols and terms on the product

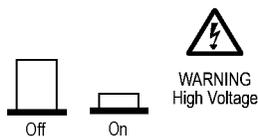
These terms may appear on the product:

- 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.



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 symbol(s) may appear on the product:



Preface

This document provides the minimum required safety and compliance information for the Tektronix PA3000 Power Analyzer. It includes high-level operating requirements, installation information, and high-level descriptions of instrument controls and connectors.

The Tektronix PA3000 Power Analyzer delivers highly accurate, multi-channel power, energy, and efficiency measurements. Precisely-matched inputs, unique Spiral Shunt™ technology, and advanced signal processing deliver high accuracy even with highly modulated waveforms and crest factors as high as 10. The versatile PA3000 offers comprehensive power measurements. Dual current shunts provide optimal resolution from microwatts to kilowatts. Harmonics analysis up to the 100th harmonic, and motor analysis with torque and speed inputs are included in the standard instrument. Every instrument comes with multiple PC interfaces, PC software, and USB flash drive support to help you collect and analyze data.

Tektronix recommends that you read the Important safety information at the beginning of this document before installing and using the power analyzer.

For more detailed information on your Tektronix power analyzer, please refer to the documents listed below. These documents are downloadable from the Tektronix Web Site at www.tektronix.com.

- PA3000 Power Analyzer User Manual, English, Tektronix part number: 077-1152-xx
- PA3000 Power Analyzer User Manual, German, Tektronix part number: 077-1154-xx
- PA3000 Power Analyzer User Manual, Japanese, Tektronix part number: 077-1155-xx
- PA3000 Power Analyzer User Manual, Korean, Tektronix part number: 077-1156-xx
- PA3000 Power Analyzer User Manual, Simplified Chinese, Tektronix part number: 077-1157-xx
- PA3000 Power Analyzer User Manual, Traditional Chinese, Tektronix part number: 077-1158-xx
- PA3000 Power Analyzer User Manual, Russian, Tektronix part number: 077-1159-xx

Operating requirements

Environmental requirements

The following table describes the maximum operating environmental ratings for your instrument.

Table 1: Maximum operating environmental considerations

Feature	Description
Temperature	40 °C (104 °F)
Operating	0 °C to 40 °C (32 °F to 104 °F)
Storage	-20 °C to +60 °C (-4 °F to 140 °F)
Humidity	80% for temperatures up to 31 °C (88 °F) decreasing linearly to 50% at 40 °C (104 °F)
Altitude	2000 m (6562 ft.)

Physical characteristics

Dimensions **Height.** 13.2 cm, (5.2 in.) without feet; 14.6 cm. (5.73 in) with feet

Width . 42 cm (16.5 in.)

Depth. 31 cm (12.5 in.)

Weight For four-phase instrument with the GPIB options (without lead set)
8.8 kg (19.5 lb).

Ventilation requirements

The unit has fans in the rear, as well as cooling vents on the bottom and side panels to keep it from overheating.



CAUTION. *Inadequate ventilation can damage the instrument; to avoid damaging the instrument, observe the following precautions:*

Do not block the cooling vents.

Do not position any devices adjacent to the instrument that force air (heated or unheated) into or onto the instrument surfaces or cooling vents. This additional airflow could compromise performance.

Power requirements



CAUTION. *Operating the instrument on an incorrect line voltage can cause damage, possibly voiding the warranty. To avoid this, operate the instrument with the correct line voltage.*

The instrument operate from a single-phase line voltage listed in the following table. Line voltage and line frequency are automatically sensed; there are no switches to set. Check to ensure the operating voltage in your area is compatible.

Table 2: Power requirements

Item	Description
Voltage	100 V to 240 V
Frequency	50 Hz to 60 Hz
Power consumption	120 VA maximum
Power Fuse	T4AH, 250 V, 5 x 20 mm fuse (time-delayed, high breaking capacity)

The power cord supplied with the instrument contains a separate ground for use with grounded outlets. When proper connections are made, the instrument chassis is connected to power line ground through the ground wire in the power cord providing protection against electric shock.

Installation

Before installing the instrument, verify that you have received all of the standard and optional accessories for the instrument.

Determine the best location for the instrument. The instrument is designed to operate on a bench or cart in the normal position (on the front feet).

This product is intended to be operated by qualified personnel only. This means only persons who are familiar with the installation, assembly, connection, inspection of connections, and operation of the power analyzer and who have been trained in the following areas:

- Switching on/off, enabling, earth-grounding and identification of electrical circuits and services/systems according to the applicable safety standards
- Maintenance and operation of appropriate safety gear, in accordance with the applicable safety standards
- First aid

Ensure that all persons using the device have read and fully understood the user manual and safety instructions.

Before connecting the power cord, review the *Operating requirements* in the previous section of this document.

Before you begin - safety

Carefully read and adhere to the following warning statements before you connect the power analyzer.



WARNING. *To avoid possible electric shock or personal injury please be aware of the following items:*

By connecting the power analyzer to active circuits, the terminals and certain parts inside the power analyzer are live.

If possible, open the circuit before establishing a connection to the power analyzer.

Before connecting the circuits, ensure that the maximum measuring voltage and maximum voltage to earth ground (600 Vrms, CAT II) is not exceeded.

Do not use leads and accessories that do not comply with relevant safety standards, as this could lead to serious injury or death from electric shock.

Shunts and conductors can generate heat when in use and surfaces can burn the skin.

- Before each use**
- Ensure that the power and connecting cables as well as all accessories and connected devices used in conjunction with this product are in proper working order and clean.
 - Ensure that any third-party accessories used in conjunction with the device conform to the applicable IEC 61010-031 / IEC 61010-2-032 standards and are suitable for the respective measuring voltage range.
- During use**
- For connecting cables and instruments, work in teams of at least two people.
 - If you detect any damage to the housing, controls, power cable, connecting leads, or connected devices, immediately disconnect the unit from the power supply.
 - If you are in doubt as regards the safe operation of the device, immediately shut down the unit and the respective accessories, secure them against inadvertent switching on, and have them serviced by a qualified service person.

Connection sequence



WARNING. *To avoid possible electric shock or personal injury:*

When the measuring circuit is used to measure MAINS, the voltage to earth must not exceed 600 V_{rms} in a CAT II environment.

For safety reasons, when connecting a circuit to the power analyzer, proceed in the sequence outlined as follows:

1. Check that the power analyzer is in good condition with no signs of damage.
2. Connect the instrument power cord to a properly grounded mains outlet. The power analyzer is now connected to the protective earth ground wire.
3. Momentarily push the front panel on/off switch and observe the following:
 - The instrument will start the power on sequence. This takes approximately 15 seconds.
 - The instrument displays the serial number and firmware version.
 - The Main menu displays on the screen.
4. The instrument is now ready for use. Connect the measuring circuit according to all instructions and as shown in the connection diagrams in the user manual.

Power off the instrument

To power off the instrument, push the front panel on/off switch.

Controls and connectors

This section provides a high-level description of the control and connectors on the instrument.

Front panel controls and connectors

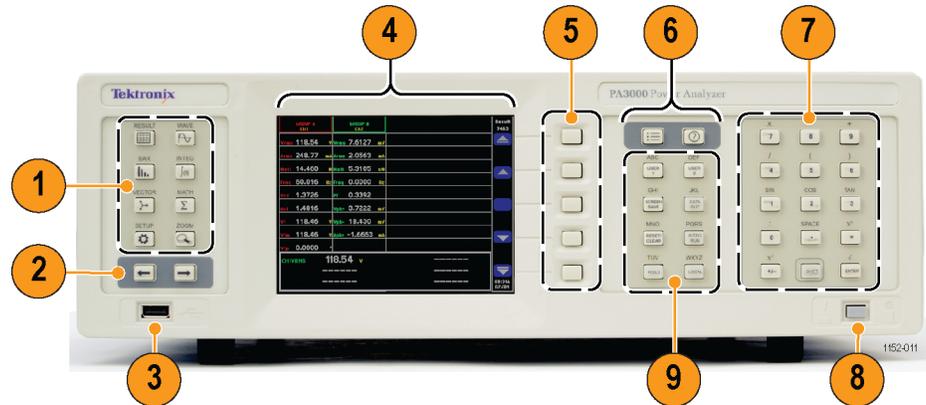


Figure 1: Front panel controls and connectors

1	Quick View keys
2	Left and right arrow hard keys
3	USB connection for flash drives
4	640 x 480 TFT display
5	Soft keys
6	Menu and Help keys
7	Number and formula keys
8	Front mounted on / off switch
9	Operational and alphabet keys

Rear panel controls and connectors

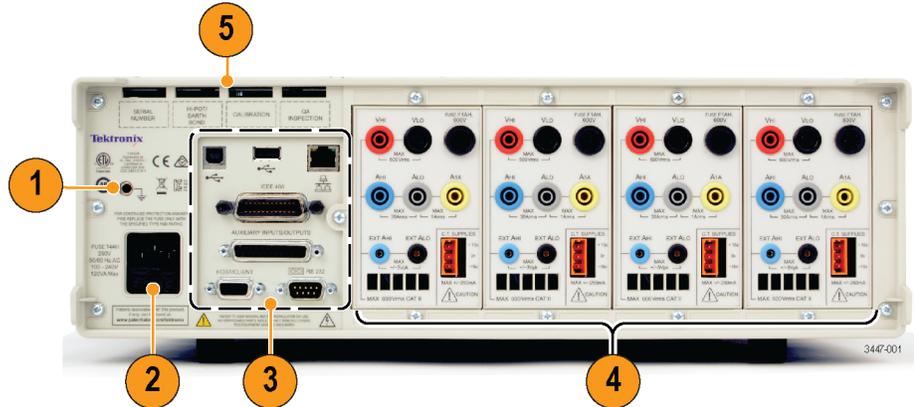


Figure 2: Rear panel controls and connectors

Refer to the user manual for information on the pin connections of the communication ports.

Item	Description
1	Earth ground
2	Power cord and fuse
3	Communication ports (USB, Ethernet, GPIB, Auxiliary inputs and outputs, and RS-232)
4	Signal input module connectors
5	Rear panel air vents

Signal input connections

Depending on the instrument model, the power analyzer can have up to four input modules (number of channels) on the rear of the instrument. The following figure and table describe the connectors of a single channel.

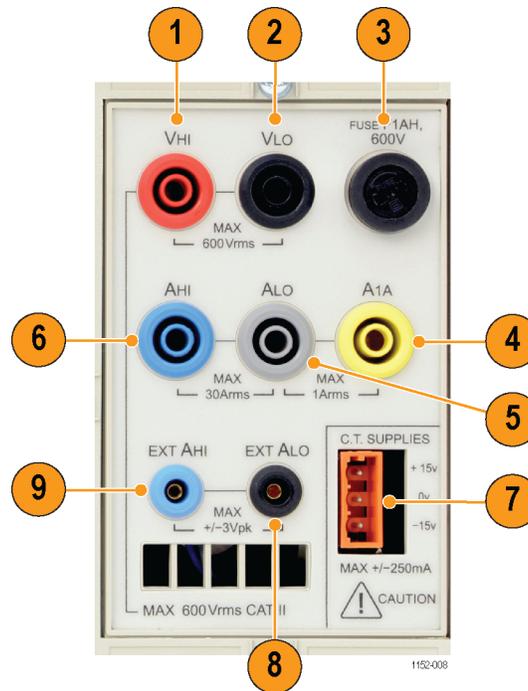


Figure 3: Signal inputs on rear panel (Channel 1 shown)

Item	Description
1	Voltage high connection (VHI)
2	Voltage low connection (VLO)
3	T1AH, 250 V fuse to protect the 1 A shunt
4	30 A current high connection (AHI)
5	Current low connection (ALO, common to both the 30 A and 1 A shunt)
6	1 A current high connection (A1A)
7	External shunt current input high (EXT AHI)
8	External shunt current input low (EXT ALO)
9	± 15 V supply for powering external transducers

Cleaning

Periodic cleaning reduces instrument breakdown and increases reliability. Clean the instrument as needed, based on the operating environment. Dirty conditions may require more frequent cleaning than computer room conditions.

Clean the flat panel display

The flat panel display is a soft plastic display and must be treated with care during cleaning.



CAUTION. *Improper cleaning agents or methods can damage the flat panel display.*

- Do not use abrasive cleaners or commercial glass cleaners to clean the display surface.
- Do not spray liquids directly on the display surface.
- Do not scrub the display with excessive force.
- Avoid getting moisture inside the instrument while cleaning the display; use only enough solution to dampen the wipe.
- Clean the flat panel display surface by gently rubbing the display with a cleanroom wipe (such as Wypall Medium Duty Wipes, #05701, available from Kimberly-Clark Corporation).
- If the display is very dirty, moisten the wipe with distilled water or a 75% isopropyl alcohol solution and gently rub the display surface. Avoid using excess force or you may damage the plastic display surface.

Clean the exterior surfaces

Clean the exterior surfaces with a dry, lint-free cloth or a soft-bristle brush. If dirt remains, use a cloth or swab dampened with a 75% isopropyl alcohol solution. A swab is useful for cleaning in narrow spaces around the controls and connectors. Do not use abrasive compounds on any part of the instrument.

To avoid damaging the instrument follow these precautions:

- Avoid getting moisture inside the instrument during external cleaning and use only enough solution to dampen the cloth or swab.
- Do not wash the front-panel power switch. Cover the switch while washing the instrument.

- Use only deionized water when cleaning. Use a 75% isopropyl alcohol solution as a cleanser and rinse with deionized water.
- Do not use chemical cleaning agents; they may damage the instrument. Avoid chemicals that contain benzene, toluene, xylene, acetone, or similar solvents.

Compliance information

This section lists the EMC (electromagnetic compliance), safety, and environmental standards with which the instrument complies.

EMC compliance

EC Declaration of Conformity – EMC

Meets intent of Directive for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

EN 61326-1, EN 61326-2-1. EMC requirements for electrical equipment for measurement, control, and laboratory use.^{1 2 3 4}

- CISPR 11. Radiated and conducted emissions, Group 1, Class A
- IEC 61000-4-2. Electrostatic discharge immunity
- IEC 61000-4-3. RF electromagnetic field immunity
- IEC 61000-4-4. Electrical fast transient/burst immunity
- IEC 61000-4-5. Power line surge immunity
- IEC 61000-4-6. Conducted RF immunity
- IEC 61000-4-11. Voltage dips and interruptions immunity

EN 61000-3-2. AC power line harmonic emissions

EN 61000-3-3. Voltage changes, fluctuations, and flicker

Mfr. Compliance Contact.

Tektronix, Inc. PO Box 500, MS 19-045
Beaverton, OR 97077, USA
www.tektronix.com

- ¹ This product is intended for use in nonresidential areas only. Use in residential areas may cause electromagnetic interference.
- ² Emissions which exceed the levels required by this standard may occur when this equipment is connected to a test object.
- ³ Equipment may not meet the immunity requirements of applicable listed standards when test leads and/or test probes are connected due to coupling of electromagnetic interference onto those leads/probes. To minimize the influence of electromagnetic interference, minimize the loop area between the unshielded portions of signal and associated return leads, and keep leads as far away as possible from electromagnetic disturbance sources. Twisting unshielded test leads together is an effective way to reduce loop area. For probes, keep the ground return lead as short as possible and close to the probe body. Some probes have accessory probe tip adapters to accomplish this most effectively. In all cases, observe all safety instructions for the probes or leads used.
- ⁴ For compliance with the EMC standards listed here, high quality shielded interface cables should be used.

**Australia / New Zealand
Declaration of
Conformity – EMC**

Complies with the EMC provision of the Radiocommunications Act per the following standard, in accordance with ACMA:

- CISPR 11. Radiated and Conducted Emissions, Group 1, Class A, in accordance with EN 61326-1.

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

- EN 61010-1. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements.
- EN 61010-2-030. Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 2-030: Particular requirements for testing and measuring circuits.

Equipment type

Test and measuring equipment.

Safety class

Class 1 – grounded product.

**Pollution degree
descriptions**

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 rating Pollution degree 2 (as defined in IEC 61010-1). 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).

- Category II. Circuits directly connected to the building wiring at utilization points (socket outlets and similar points).
- Category III. In the building wiring and distribution system.
- Category IV. At the source of the electrical supply to the building.

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.*

Mains overvoltage category rating Overvoltage category II (as defined in IEC 61010-1).

Environmental considerations

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 Support/Service section of the Tektronix Web site (www.tektronix.com).