1 General Information

1.1 Introduction

The Keithley Model 6512 Programmable Electrometer is a highly sensitive instrument designed to measure voltage, current, charge, and resistance. The measuring range of the Model 6512 is between 10µV and 200V for voltage measurements, from 0.1fA and 20mA for current measurements, between 0.1Ω and 200GΩ for resistance measurements, and in the range of 10fC and 20nC in the coulombs mode. Very high input impedance and extremely low input offset current allow accurate measurement in situations where many other instruments would have detrimental effects on the circuit being measured. A 4½ -digit display and standard IEEE-488 interface allow easy access to instrument data.

1.2 Features

Some important Model 6512 features include:

- Ideal for low-current measurements—Current resolution of 0.1fA makes the Model 6512 ideal for very low-current measurements.
- 4½ -Digit Display—An easy-to-read front panel LED display includes a 4½ -digit mantissa plus a two-digit alpha or numeric exponent.
- Auto-ranging—Included for all functions and ranges.
- Digital Calibration—The instrument may be digitally calibrated from the front panel or over the IEEE-488 bus.
- Zero Correct—A front panel zero correct control allows you to cancel internal voltage offsets, optimizing accuracy.
- Baseline Suppression—One-button suppression of a baseline reading is available from the front panel or over the IEEE-488 bus.
- One-shot Triggering—A front panel control for triggering one-shot readings from the front panel is included.
- Selectable Guarding—A selectable driven cable guard is included to minimize the effects of leakage resistance and stray capacitance.
- Standard IEEE-488 Interface—The IEEE-488 interface allows full bus programmable operation of the Model 6512.
- Analog Outputs—Both preamp and 2V full-range analog outputs are included on the rear panel.
- 100-Point Data Store—An internal buffer that can store up to 100 readings is accessible from either the front panel or over the IEEE-488 bus.
- Minimum and maximum data points can be stored and are accessible from the front panel or over the IEEE-488 bus.

1.3 Warranty information

Warranty information for your Model 6512 may be found inside the front cover of this manual. Should you need to use the warranty, contact your Keithley representative or the factory for information on obtaining warranty service.

1.4 Manual addenda

Information concerning improvements or changes to the instrument that occur after the printing of this manual will be found on an addendum sheet included with this manual. Please be sure that you read this information before attempting to operate or service your instrument.

1.5 Safety symbols and terms

The following safety symbols and terms are used in this manual and found on the instrument:

The ⚠ symbol on the instrument indicates that you should refer to the operating instructions in this manual for further details.

The **WARNING** heading as used in this manual explains dangers that might result in personal injury or death. Always read the associated information very carefully before performing the indicated procedure.

The **CAUTION** heading used in this manual explains hazards that could damage the instrument. Such damage may invalidate the warranty.

1.6 Specifications

Detailed Model 6512 specifications are located at the front of this manual. Note that accuracy specifications assume that the instrument has been properly zero corrected, as discussed in Section 2.

1.7 Unpacking and inspection

The Model 6512 Programmable Electrometer was carefully inspected before shipment. Upon receiving the instrument, carefully unpack all items from the shipping carton and check for any obvious signs of physical damage that might have occurred during shipment. Report any damage to the shipping agent at once. Retain the original packing material in case shipment becomes necessary.

1.7.1 Shipment contents

The following items are included with every Model 6512 shipment:

- Model 6512 Programmable Electrometer
- Model 237-ALG-2 Triax Cable
- Model 6512 Instruction Manual
- Additional accessories as ordered

1.7.2 Instruction manual

If an additional instruction manual is required, order the manual package (Keithley Part Number 6512-901-00). The manual package includes an instruction manual and all pertinent addenda.

1.7.3 Repacking for shipment

Before shipping, the instrument should be carefully packed in its original packing material or the equivalent.

If the instrument is to be returned to Keithley Instruments for repair or calibration, include the following:

- Write ATTENTION REPAIR DEPARTMENT on the shipping label.
- Include the warranty status of the instrument.
- Complete the service form at the back of this manual.

1.8 Getting started

1.8.1 Preparation for use

Once the instrument is unpacked, it must be connected to an appropriate power source as described below.

Line power

The Model 6512 is designed to operate from 105-125V or 210-250V power sources. (A factory configuration is available for 90-110V and 195-235V ranges. Contact applications department for details.) The factory set range is marked on the rear panel of the instrument. Note that the line plug is designed to mate with the supplied 3-wire power cord.

CAUTION

Do not attempt to operate the instrument on a supply voltage outside the indicated range, or instrument damage might occur.

Line voltage selection

The operating voltage of the instrument is internally selectable. Refer to Section 7 for the procedure to change or verify the line voltage setting.

Line frequency

The Model 6512 may be operated from either 50 or 60Hz power sources.

IEEE-488 primary address

If the Model 6512 is to be programmed over the IEEE-488 bus, it must be set to the correct primary address. The primary address is set to 27 at the factory, but it may be programmed from the front panel, as described in Section 3.

1.8.2 Quick start procedure

The Model 6512 Programmable Electrometer is a highly sophisticated instrument with many capabilities. Although there are a number of complex aspects about the instrument, you can use the following basic procedure to get your instrument up and running quickly. For more detailed information, you should consult the appropriate section of the manual. Complete, detailed operation concerning Model 6512 front panel operation may be found in Section 2. If you wish to control these functions over the IEEE-488 bus, consult Section 3.

1. Carefully unpack your instrument, as described in paragraph 1.7.
2. Locate the power cord, and plug it into the rear panel power jack. Plug the other end of the line cord into an appropriate power source that uses a grounded outlet. See Section 2 for more complete information.
3. Connect a suitable triaxial cable to the rear panel INPUT jack. (See paragraph 1.9 below for recommended triaxial cables.) Make sure the rear panel V, Ω/GUARD switch is in the OFF position.
4. Press in on the front panel POWER switch to turn on the power. The instrument will power up the auto-range volts mode with zero check enabled.
5. Connect the input cable to the signal source to be measured. Remember that the Model 6512 measures DC voltages up to 200V.
6. Disable zero check to make a measurement.
7. Take the reading from the display.
8. To change to a different measuring function, simply press the desired function button. For example, to measure current, simply press the AMPS button.

1.9 Accessories

The following accessories are available for use with the Model 6512.

INPUT cables

The triaxial cables listed below are recommended for making connections to the Model 6512 INPUT jack.

Model 237-ALG-2 Triax Cable—2m (6 ft.) of low-noise triax cable (SC-22) terminated with a 3-slot male triax connector on one end, and three alligator clips on the other end. (This cable is supplied with the Model 6512.)

Model 7078-TRX-3 Triax Cable—A low-noise triax cable 0.9m (3 ft.) in length, terminated at both ends with 3-slot male triax connectors. Also available in 3m (10 ft.) and 6m (20 ft.) versions (Models 7078-TRX-10 and 7078-TRX-20 respectively).

SC-22 Triax Cable—Unterminated triax cable available in custom lengths. Use with appropriate triax connector (such as CS-631 described below) to construct complete cables.

IEEE-488 cables

Model 7007 IEEE-488 Cables—The Model 7007 cables are shielded cables designed to connect the Model 6512 to the IEEE-488 bus and are available in two similar versions. The Model 7007-1 is 1m (3.3 ft.) in length, while the Model 7007-2 is 2m (6.6 ft.) long. Each cable is terminated with a shielded IEEE-488 connector on each end, and each connector has two metric screws.

Model 7008 IEEE-488 Cables—The Model 7008 cables are similar IEEE-488 cables available in three lengths. The Model 7003-3 is 0.9m (3 ft.) in length, while the Models 7008-6 and Model 7008-13 are 1.8m (6 ft.) and 4m (13 ft.) in length respectively. Each cable is terminated with an IEEE-488 connector on each end, and each connector has two metric screws.

Trigger cables

The following cables are recommended for connecting the Model 6512 METER COMPLETE OUTPUT and EXTERNAL TRIGGER INPUT jacks to other instruments for external triggering:

Model 7051-2 BNC Cable—A 0.6m (2 ft.) BNC to BNC cable (RG-58C) with a 50Ω characteristic impedance. Also available in 1.5m (5 ft.) and 3.0m (10 ft.) lengths (Models 7051-5 and 7051-10 respectively).

Connectors and adapters

The following connectors and adapters are recommended for use with the Model 6512:

- Model 237-TRX-T—3-slot male to dual female triax tee adapter for use with Model 7078-TRX or other similar 3-slot triax cables.
- Model 6171—3-slot male to 2-lug female triax adapter. Useful for connecting 2-slot triax cables to the Model 6512 INPUT jack.
- Model 7078-TRX-BNC—3-slot male triax to BNC adapter. Allows connecting BNC cables to the Model 6512 INPUT jack.
- Model 7078-TRX-TBC—3-lug female triax bulkhead connector with cap for assembly of custom panels and interface connections.
- Model CAP-31—Protective cap/shield for the Model 6512 INPUT connector.
- Model CS-631—3-slot male triax cable mount connector for use with SC-22 low-noise triax cable. Useful for making custom cables for connections to the Model 6512 INPUT jack.

Test fixtures

Models 6105 and 8008 Resistivity Chambers—The Models 6105 and 8008 are guarded test fixtures for measuring volume and surface resistivities. The units assure good electrostatic shielding and high insulation resistance. The complete system requires the use of an external voltage source such as the Model 230 as well as the Model 6512. Volume resistivity up to 10^{9}Ω-cm and surface resistivity up to 10^{18}Ω can be measured in accordance with ASTM test procedures. Sheet samples 64 to 102mm (2½ × 4”) in diameter and up to 6.4mm (¼”) thickness can be accommodated. Excitation voltages up to 1000V may be used.

Model 8006 Component Test Fixture—The Model 8006 is specifically designed for making sensitive measurements on standard package devices. Individual devices may be connected to one of eight device sockets, including axial, 4-, 8-, 10-, and 12-lead TO, and 28-pin DIPs. Instruments may be connected using rear panel binding posts, BNC, or triax connectors.

Rack mount kits

Model 1019 Rack Mounting Kits—The Model 1019A kits are fixed or stationary rack mounting kits intended for mounting instruments in standard 19-inch racks. The Model 1019A-1 mounts a single Model 6512 or other similar instrument, while the Model 1019A-2 mounts two Model 6512s or similar instruments in a side-by-side configuration. The Models 1019S-1 and 1019S-2 are similar rack mounting kits with a sliding mount configuration.