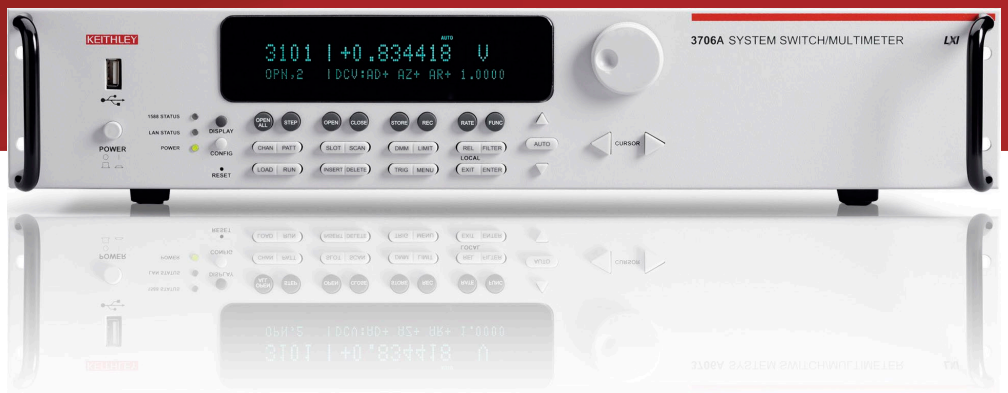
Series 3700A System Switch/Multimeter Quick Start Guide



KEITHLEY
A Tektronix Company

Safety precautions

The following safety precautions should be observed before using this product and any associated instrumentation. Although some instruments and accessories would normally be used with nonhazardous voltages, there are situations where hazardous conditions may be present.

This product is intended for use by personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury. Read and follow all installation, operation, and maintenance information carefully before using the product. Refer to the user documentation for complete product specifications.

If the product is used in a manner not specified, the protection provided by the product warranty may be impaired.

The types of product users are:

Responsible body is the individual or group responsible for the use and maintenance of equipment, for ensuring that the equipment is operated within its specifications and operating limits, and for ensuring that operators are adequately trained.

Operators use the product for its intended function. They must be trained in electrical safety procedures and proper use of the instrument. They must be protected from electric shock and contact with hazardous live circuits.

Maintenance personnel perform routine procedures on the product to keep it operating properly, for example, setting the line voltage or replacing consumable materials. Maintenance procedures are described in the user documentation. The procedures explicitly state if the operator may perform them. Otherwise, they should be performed only by service personnel.

Service personnel are trained to work on live circuits, perform safe installations, and repair products. Only properly trained service personnel may perform installation and service procedures.

Keithley products are designed for use with electrical signals that are measurement, control, and data I/O connections, with low transient overvoltages, and must not be directly connected to mains voltage or to voltage sources with high transient overvoltages. Measurement Category II (as referenced in IEC 60664) connections require protection for high transient overvoltages often associated with local AC mains connections. Certain Keithley measuring instruments may be connected to mains. These instruments will be marked as category II or higher.

Unless explicitly allowed in the specifications, operating manual, and instrument labels, do not connect any instrument to mains.

Exercise extreme caution when a shock hazard is present. Lethal voltage may be present on cable connector jacks or test fixtures. The American National Standards Institute (ANSI) states that a shock hazard exists when voltage levels greater than 30 V RMS, 42.4 V peak, or 60 VDC are present. A good safety practice is to expect that hazardous voltage is present in any unknown circuit before measuring.

Operators of this product must be protected from electric shock at all times. The responsible body must ensure that operators are prevented access and/or insulated from every connection point. In some cases, connections must be exposed to potential human contact. Product operators in these circumstances must be trained to protect themselves from the risk of electric shock. If the circuit is capable of operating at or above 1000 V, no conductive part of the circuit may be exposed.

Do not connect switching cards directly to unlimited power circuits. They are intended to be used with impedance-limited sources. NEVER connect switching cards directly to AC mains. When connecting sources to switching cards, install protective devices to limit fault current and voltage to the card.

Before operating an instrument, ensure that the line cord is connected to a properly-grounded power receptacle. Inspect the connecting cables, test leads, and jumpers for possible wear, cracks, or breaks before each use.

When installing equipment where access to the main power cord is restricted, such as rack mounting, a separate main input power disconnect device must be provided in close proximity to the equipment and within easy reach of the operator.

For maximum safety, do not touch the product, test cables, or any other instruments while power is applied to the circuit under test. ALWAYS remove power from the entire test system and discharge any capacitors before: connecting or disconnecting cables or jumpers, installing or removing switching cards, or making internal changes, such as installing or removing jumpers.

Do not touch any object that could provide a current path to the common side of the circuit under test or power line (earth) ground. Always make measurements with dry hands while standing on a dry, insulated surface capable of withstanding the voltage being measured.

For safety, instruments and accessories must be used in accordance with the operating instructions. If the instruments or accessories are used in a manner not specified in the operating instructions, the protection provided by the equipment may be impaired.

Do not exceed the maximum signal levels of the instruments and accessories. Maximum signal levels are defined in the specifications and operating information and shown on the instrument panels, test fixture panels, and switching cards.

When fuses are used in a product, replace with the same type and rating for continued protection against fire hazard.

Chassis connections must only be used as shield connections for measuring circuits, NOT as protective earth (safety ground) connections.

If you are using a test fixture, keep the lid closed while power is applied to the device under test. Safe operation requires the use of a lid interlock.

If a ⏚ screw is present, connect it to protective earth (safety ground) using the wire recommended in the user documentation.

The ⚠ symbol on an instrument means caution, risk of hazard. The user must refer to the operating instructions located in the user documentation in all cases where the symbol is marked on the instrument.

The ⚠ symbol on an instrument means warning, risk of electric shock. Use standard safety precautions to avoid personal contact with these voltages.

The ⚠ symbol on an instrument shows that the surface may be hot. Avoid personal contact to prevent burns.

The ⏚ symbol indicates a connection terminal to the equipment frame.

If this Hg symbol is on a product, it indicates that mercury is present in the display lamp. Please note that the lamp must be properly disposed of according to federal, state, and local laws.

The **WARNING** heading in the user documentation explains hazards that might result in personal injury or death. Always read the associated information very carefully before performing the indicated procedure.

The **CAUTION** heading in the user documentation explains hazards that could damage the instrument. Such damage may invalidate the warranty.

The **CAUTION** heading with the ⚠ symbol in the user documentation explains hazards that could result in moderate or minor injury or damage the instrument. Always read the associated information very carefully before performing the indicated procedure. Damage to the instrument may invalidate the warranty.

Instrumentation and accessories shall not be connected to humans.

Before performing any maintenance, disconnect the line cord and all test cables.

To maintain protection from electric shock and fire, replacement components in mains circuits — including the power transformer, test leads, and input jacks — must be purchased from Keithley. Standard fuses with applicable national safety approvals may be used if the rating and type are the same. The detachable mains power cord provided with the instrument may only be replaced with a similarly rated power cord. Other components that are not safety-related may be purchased from other suppliers as long as they are equivalent to the original component (note that selected parts should be purchased only through Keithley to maintain accuracy and functionality of the product). If you are unsure about the applicability of a replacement component, call a Keithley office for information.

Unless otherwise noted in product-specific literature, Keithley instruments are designed to operate indoors only, in the following environment: Altitude at or below 2,000 m (6,562 ft); temperature 0 °C to 50 °C (32 °F to 122 °F); and pollution degree 1 or 2.

To clean an instrument, use a cloth dampened with deionized water or mild, water-based cleaner. Clean the exterior of the instrument only. Do not apply cleaner directly to the instrument or allow liquids to enter or spill on the instrument. Products that consist of a circuit board with no case or chassis (e.g., a data acquisition board for installation into a computer) should never require cleaning if handled according to instructions. If the board becomes contaminated and operation is affected, the board should be returned to the factory for proper cleaning/servicing.

Safety precaution revision as of June 2017.

Safety

Power and environmental ratings

For indoor use only.

Power supply	100 V ac to 240 V ac, 50 Hz and 60 Hz (automatically sensed at power up)
Power consumption	28 VA with DMM and display, up to 140 VA with six 3700 cards
Operating altitude	Maximum 2000 m (6562 ft) above sea level
Operating temperature	0 °C to 50 °C, up to 80% relative humidity at 35 °C
Storage temperature	–40 °C to 70 °C
Pollution degree	1 or 2

CAUTION

Carefully consider and configure the appropriate output-off state, source levels, and compliance levels before connecting the instrument to a device that can deliver energy. Failure to consider the output-off state, source levels, and compliance levels may result in damage to the instrument or to the device under test.

Introduction

The Series 3700A System Switch/Multimeter offers scalable, instrument-grade switching and multichannel measurement solutions that are optimized for automated testing of electronic products and components. The Series 3700A instruments include four versions of the 3706A system switch mainframe and a growing family of plug-in switch and control cards. When the 3706A instrument is ordered with the high-performance multimeter, you receive a tightly integrated switch and measurement system that can meet the demanding application requirements in a functional test system or provide the flexibility needed in stand-alone data acquisition and measurement applications.

The versions of the 3706A include:

- 3706A six-slot system switch with high-performance DMM
- 3706A-S six-slot system switch without DMM
- 3706A-SNFP six-slot system switch without DMM and without front-panel display and keypad

Complete documentation for the Series 3700A instruments is available for download on the Keithley web page at tek.com/keithley.

The documentation includes:

- **Quick Start Guide:** This document. Provides unpacking instructions, describes basic connections, reviews basic operation information, and provides a quick test procedure to ensure the instrument is operational.
- **User Manual:** Provides an overview of the instrument, information on how to set up remote communications, and basic operating information.
- **Application Manual:** Provides detailed applications to help you scan, read, write, and control channels.
- **Reference Manual:** Provides comprehensive information about the features, operation, optimization, maintenance, troubleshooting, and programming commands of the instrument.

- **Switch and Control Cards Reference Manual:** Contains card installation and operation instructions for the model 3720, 3721, 3722, 3723, 3724, 3730, 3731, 3732, and 3740 switch cards.
- **Series 3700 Cables and Connector Kits Installation Instructions:** Provides information about the cables and connector kits that are used with the Series 3700A cards.
- **Screw Terminal Assemblies Installation Instructions:** Contains handling and installation instructions for Series 3700A screw terminal assemblies.
- Information on accessories.

Software for the Series 3700A is also available for download from the Keithley web page at tek.com/keithley. You can search for the specific software you need. Available software includes:

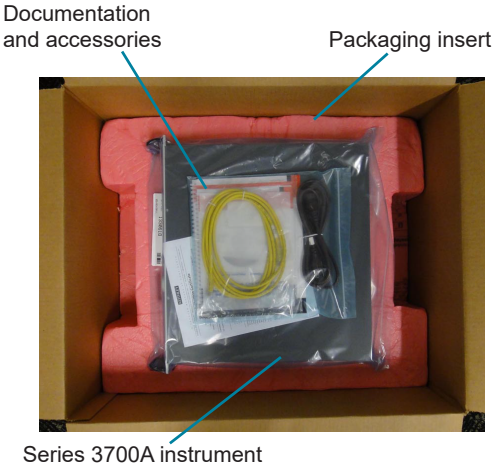
- **Keithley KickStart Instrument Control Software:** Lets you start making measurements in minutes without complex instrument programming. Free 30-day trial.
- **Test Script Builder:** This software provides an environment to develop a test program and the ability to load the test program onto the instrument.
- **IVI-COM Driver:** A IVI instrument driver you can use to create your own test applications in C/C++, VB.NET or C#. It can also be called from other languages that support calling a DLL or ActiveX(COM) object.
- **LabVIEW™ Software drivers:** Drivers to communicate with National Instruments LabVIEW Software.
- **Keithley I/O layer:** Manages communications between Keithley instrument drivers and software applications and the instrument.

Unpack and inspect the instrument

To unpack and inspect the instrument:

1. Inspect the box for damage.
2. Open the top of the box.
3. Remove the packaging insert.

4. Remove the bag that contains the documentation and accessories.



5. Carefully lift the instrument out of the box.
6. Inspect the instrument for any obvious signs of physical damage. Report any damage to the shipping agent immediately.

You have received one of the following Series 3700A System Switch/Multimeters.

3706A six-slot system switch with high-performance DMM

3706A-S six-slot system switch without DMM

3706A SNFP six-slot system switch without DMM and front-panel display and keypad

You receive the 3700A with these accessories and documents:

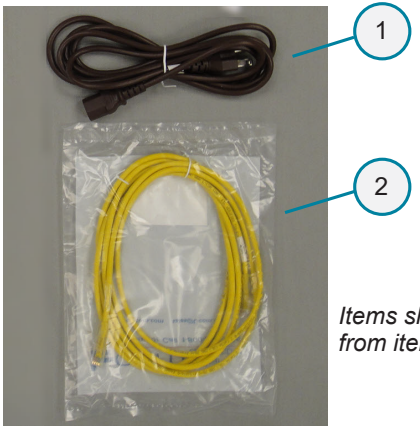
1 Power line cord

2 RJ 45 LAN crossover cable

Series 3700A Quick Start Guide (not shown, this document)

Safety precautions (not shown)

Software and documentation downloads document (not shown)



Items shipped may vary from items shown here

Connect the instrument

Important test system safety information

This product is sold as a stand-alone instrument that may become part of a system that could contain hazardous voltages and energy sources. It is the responsibility of the test system designer, integrator, installer, maintenance personnel, and service personnel to make sure the system is safe during use and is operating properly.

You must also realize that in many test systems a single fault, such as a software error, may output hazardous signal levels even when the system indicates that there is no hazard present.

It is important that you consider the following factors in your system design and use:

- The international safety standard IEC 61010-1 defines voltages as hazardous if they exceed 30 V_{RMS} and 42.4 V_{PEAK} or 60 V dc for equipment rated for dry locations. Keithley Instruments products are only rated for dry locations.
- Read and comply with the specifications of all instruments in the system. The overall allowed signal levels may be constrained by the lowest rated instrument in the system. For example, if you are using a 500 V power supply with a 300 V dc rated switch, the maximum allowed voltage in the system is 300 V dc.
- Cover the device under test (DUT) to protect the operator from flying debris in the event of a system or DUT failure.
- Make sure any test fixture connected to the system protects the operator from contact with hazardous voltages, hot surfaces, and sharp objects. Use shields, barriers, insulation, and safety interlocks to accomplish this.
- Double-insulate all electrical connections that an operator can touch. Double insulation ensures the operator is still protected even if one insulation layer fails. Refer to IEC 61010-1 for specific requirements.
- Make sure all connections are behind a locked cabinet door or other barrier. This protects the system operator from accidentally removing a connection by hand and exposing hazardous voltages. Use high-reliability fail-safe interlock switches to disconnect power sources when a test fixture cover is opened.
- Where possible, use automatic handlers so that operators are not required to access the DUT or other potentially hazardous areas.
- Provide training to all users of the system so that they understand all potential hazards and know how to protect themselves from injury.

- In many systems, during power up, the outputs may be in an unknown state until they are properly initialized. Make sure the design can tolerate this situation without causing operator injury or hardware damage.

NOTE

To keep users safe, always read and follow all safety warnings provided with each of the instruments in your system.

Install and connect a switching card

Unqualified personnel can install a switching card. However, external connections to the switching module must be performed by qualified service personnel.

The Series 3700A instruments support the following cards:

- Model 3720 Dual 1×30 Multiplexer Card (automatic CJC with 3720-ST accessory)
- Model 3721 Dual 1×20 Multiplexer Card (automatic CJC with 3721-ST accessory)
- Model 3722 Dual 1×48 High Density Multiplexer Card
- Model 3723 Dual 1×30 High Speed Reed Relay Multiplexer Card
- Model 3724 Dual 1×30 FET Multiplexer Card (60 differential channels, automatic CJC with 3724-ST accessory)
- Model 3730 6×16 High Density Matrix Card
- Model 3731 6x16 High Speed Reed Relay Matrix Card
- Model 3732 Quad 4×28 Ultra-High Density Reed Relay Matrix Card
- Model 3740 32-Channel Isolated Switch Card

For a complete list of cards that are available, see tek.com/keithley.

Equipment needed:

- Series 3700A system switch/multimeter
- Switching card
- Flat-bladed screwdriver

WARNING

To prevent electric shock that could result in injury or death, NEVER handle a switching card that has power applied to it.

Before installing or removing a switching card, make sure the instrument is turned off and disconnected from line power. Even when the instrument is powered off, hazardous voltages may be present in signal cables attached to the switch cards. Always disconnect all cables before removing or installing a switch card.

If the switching card is already connected to a device under test (DUT), make sure power is removed from all external circuitry.

NOTE

For inexperienced users, disconnect DUT and external circuitry from switching cards. This allows you to exercise safe close/open operations without the dangers associated with live test circuits.

WARNING

Slot covers must be installed on unused slots to prevent personal contact with high-voltage circuits.

To install a switching card in a Series 3700A instrument:

1. Turn the instrument power off.
2. Position the instrument so that you are facing the rear panel.

WARNING

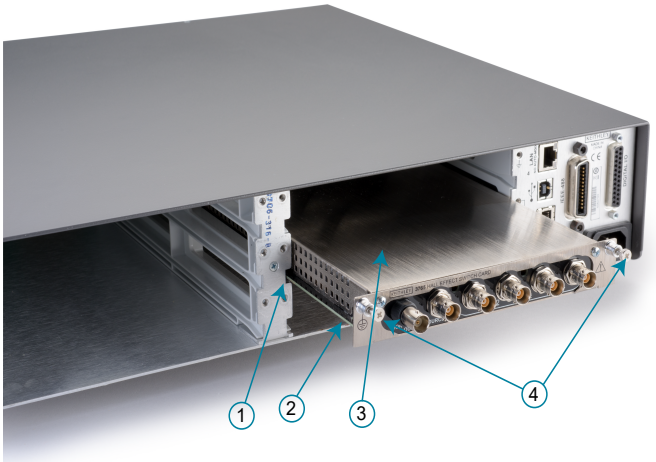
As described in the International Electrotechnical Commission (IEC) Standard IEC 664, the Series 3700A switch cards are Installation Category O and must not be connected to mains.

3. Disconnect the power line cord and any other cables connected to the rear panel.
4. Remove the slot cover plate from the slot. Retain the plate and screws for future use.

5. With the top cover of the switching card facing up, align the card edge into the card guide of the slot, as shown in the following figure.
6. Slide in the card. For approximately the last ¼ inch, press in firmly to mate the module connector to the mainframe connector.
7. On each side of the module, there is a mounting screw. Use the flat-bladed screwdriver to tighten these two screws to secure the module to the mainframe. Do not overtighten.
8. Reconnect the power line cable and any other cables to the rear panel.

NOTE

All signal wiring to devices and instruments is done through the switch cards. Refer to the switch card documentation for additional information.



1 Card guide (part of Series 3700A instrument)
2 Card edge (part of card)
3 Card
4 Mounting screws (part of card)

Install the instrument

You can use a Series 3700A instrument on a bench or in a rack. Please see the instructions that came with your rack-mount kit if you are installing a Series 3700A instrument in a rack.

Note that the air intakes for the fan are on the side panel of the instrument. The space around these areas should be free from obstruction to ensure proper fan operation.

Connect line power

Series 3700A instruments operate from a line voltage of 100 V to 240 V at a frequency of 50 Hz or 60 Hz. Line voltage is automatically sensed (there are no switches to set). Make sure the operating voltage in your area is compatible.

CAUTION

Operating the instrument on an incorrect line voltage may cause damage to the instrument, possibly voiding the warranty.

WARNING

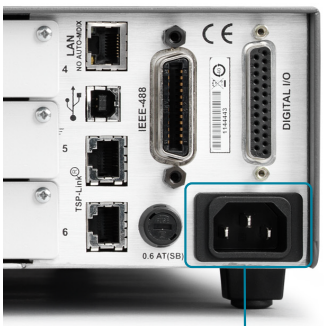
The power cord supplied with the Series 3700A contains a separate protective earth (safety ground) wire for use with grounded outlets. When proper connections are made, the instrument chassis is connected to power-line ground through the ground wire in the power cord. In the event of a failure, not using a properly grounded protective earth and grounded outlet may result in personal injury or death due to electric shock.

WARNING

Do not replace detachable mains supply cords with inadequately rated cords. Failure to use properly rated cords may result in personal injury or death due to electric shock.

To connect line power:

1. Make sure the front-panel power switch is in the off (O) position.
2. Connect the socket of the supplied power cord to the power module on the rear panel.



Connect power cord

3. Connect the plug of the power cord to a grounded ac outlet.

Turn on the instrument

Turn on the instrument by pressing the front-panel **POWER** switch to the on (|) position.

The Series 3700A instrument must be turned on and allowed to warm up for at least two hours to achieve rated accuracies.

Power switch

Power-up sequence

For instruments with a front panel, when the instrument is turned on, you should see:

- Three dots
- All segments of the display light
- A brief display showing “KEITHLEY Series 3700A”
- Line frequency detection and other startup checks

When initialization is complete, you will see the default display screen, as shown below.

For instruments that do not have a front-panel display, you should see the Power indicator illuminate, then all three indicator lights illuminate briefly.

Test the instrument

For instruments with a front-panel display (the Models 3706A and 3706A-S), you can view system information to check operation.

To view the system information:

1. Press the **MENU** key.
2. Turn the navigation wheel to select **UNIT INFO**.
3. Press the navigation wheel to see the system information menu.
4. Turn the navigation wheel to select **SERIAL#**.
5. Press the navigation wheel to view the serial number.
6. Press **EXIT** several times to return to the main display.

NOTE

These steps confirm basic functionality of your Series 3700A. Please turn instrument power OFF now.

FAQs

Where can I find updated drivers or firmware?

For the latest drivers and additional support information, see the Keithley Instruments support website.

To find drivers that are available for your instrument:

1. Go to tek.com/product-support.
2. Enter **3700A** and select **GO**.
3. Select **Software**.

What should I do if I see an error message when I turn the instrument on?

If an error message is displayed, press the **EXIT (LOCAL)** key. The Series 3700A instrument returns to the default display screen. For detailed information about error messages, see “Errors and status messages” in the *Series 3700A Reference Manual*.

When I connect a Model 3706A-SNFP to my computer, how can I find the IP address?

To find the IP address of the 3706A-SNFP from a computer, use the LXI Discovery Tool, a utility that is available from the Resources tab of the LXI Consortium website (https://www.lxistandard.org).

Next steps

Refer to the *User's Manual*, which provides an overview of the instrument, information on how to set up remote communications, and basic operating information.

Once you are familiar with the instrument, you can use the *Application Manual*. It provides detailed applications to help you scan, read, write, and control channels. The examples in the *Application Manual* demonstrate increasing levels of Series 3700A functionality.

For detailed information about all the features of the instrument, including TestScript Processor (TSP) commands, refer to the *Series 3700A Reference Manual*

For more information, refer to the Keithley Instruments website, tek.com/keithley, for support and additional information about the instrument.

Contact information: 1-800-833-9200
For additional contacts, see **https://www.tek.com/contact-us**

Find more valuable resources at TEK.COM.

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