

# Series 3700A System Switch/Multimeter Quick Start Guide



## Safety precautions

Observe the following safety precautions 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 qualified 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 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 Instruments products are designed for use with electrical signals that are rated Measurement Category I and Measurement Category II, as described in the International Electrotechnical Commission (IEC) Standard IEC 60664. Most measurement, control, and data I/O signals are Measurement Category I and must not be directly connected to mains voltage or to voltage sources with high transient overvoltages. Measurement Category II connections require protection for high transient overvoltages often associated with local AC mains connections. Assume all measurement, control, and data I/O connections are for connection to Category I sources unless otherwise marked or described in the user documentation. Main supply voltage fluctuations not to exceed  $\pm 10\%$  of the nominal voltage.

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 V DC 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.

The instrument and accessories must be used in accordance with its specifications and operating instructions, or the safety of the equipment may be impaired.

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

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 safety earth 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 safety earth ground using the wire recommended in the user documentation.



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



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



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



This symbol indicates a connection terminal to the equipment frame.



If the mercury 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.

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

**CAUTION** This heading in the user documentation explains hazards that could damage the instrument. Such damage 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 Instruments. Standard fuses with applicable national safety approvals may be used if the rating and type are the same. 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 Instruments to maintain accuracy and functionality of the product). If you are unsure about the applicability of a replacement component, call a Keithley Instruments office for information.

To clean an instrument, remove power from the instrument. Use a damp cloth 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 and servicing.



## CAUTION

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

# Introduction to the Series 3700A System Switch/Multimeter

The Series 3700A System Switch/Multimeter offers scalable, instrument-grade switching and multi-channel measurement solutions that are optimized for automated testing of electronic products and components. The Series 3700A instruments include four versions of the Model 3706A system switch mainframe along with a growing family of plug-in switch and control cards. When the Model 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 four versions of the Model 3706A include:

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

The Series 3700A instrument documentation includes:

- **Quick Start Guide:** Shows you how to unpack and set up the instrument to determine that the instrument is functional.
- **User's Manual:** Provides a starting point for creation of applications with a variety of application-based examples.
- **Reference Manual:** Provides comprehensive information about the instrument's features and programming commands.
- **Switching and Control Cards Reference Manual:** Provides detailed information on all the switch cards that are compatible with Series 3700A instruments.

The manuals are in PDF format on the CD-ROM that is included with the instrument. If you do not have Adobe Reader® to view the files, you can download a free copy of it at <http://get.adobe.com/reader/>.

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## CD-ROM contents

The CD-ROMs that are included with your instrument contain:

- The Test Script Builder (TSB) Software and Series 3700A TSB Add-in, which is a software tool you can use to create, modify, debug, and store Test Script Processor (TSP®) test scripts
- Product documentation, including PDFs of this Quick Start Guide, User's Manual, Reference Manual, Switching and Control Cards Reference Manual, the product data sheet, product specifications, and rack-mount kit instructions

- IVI Instrument Driver, driver for National Instruments LabVIEW™, and related release notes
- J2SE™ Runtime Environment
- Keithley I/O layer and release notes
- Keithley LXI Discovery Utility

For the latest drivers and additional support information, see <http://www.keithley.com/support>.

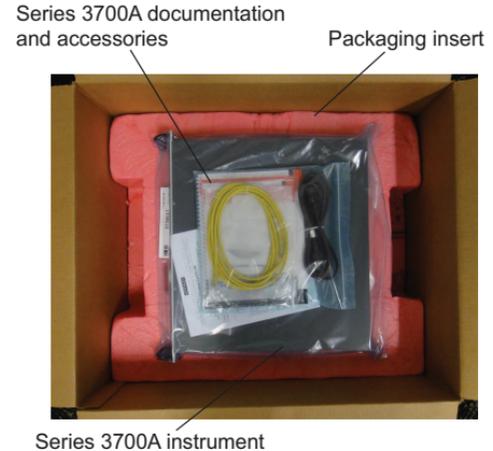
# Unpack and inspect the instrument

## *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, accessories, and CD-ROMs.



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.

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



#### Model 3706A-S six-slot system switch without DMM



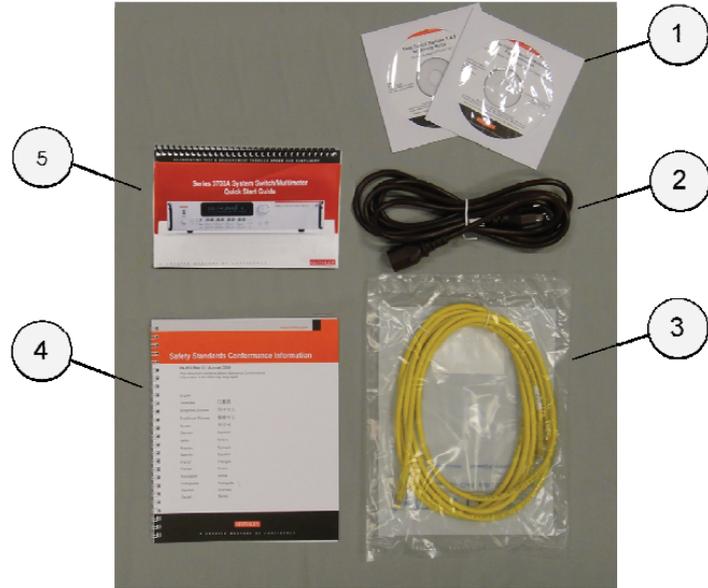
#### Model 3706A-NFP six-slot system switch with high-performance DMM, without front-panel display and keypad and Model 3706A-SNFP six-slot system switch without DMM and front-panel display and keypad



In addition to the Series 3700A System Switch/Multimeter, you should have received:

- 1 Series 3700A Product Information and Test Script Builder CD-ROMs
- 2 Power line cord
- 3 RJ-45 LAN crossover cable
- 4 Safety Standards Conformance Information
- 5 Series 3700A Quick Start Guide

Refer to the packing list for additional items that might have shipped with your instrument.



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## Connect the instrument

**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 6×16 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
- Model 3750 Multifunction Control Card (40 digital I/O bits, 2 analog output channels, and 4 counters)

For a complete list of cards that are available, see [www.keithley.com](http://www.keithley.com).

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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.

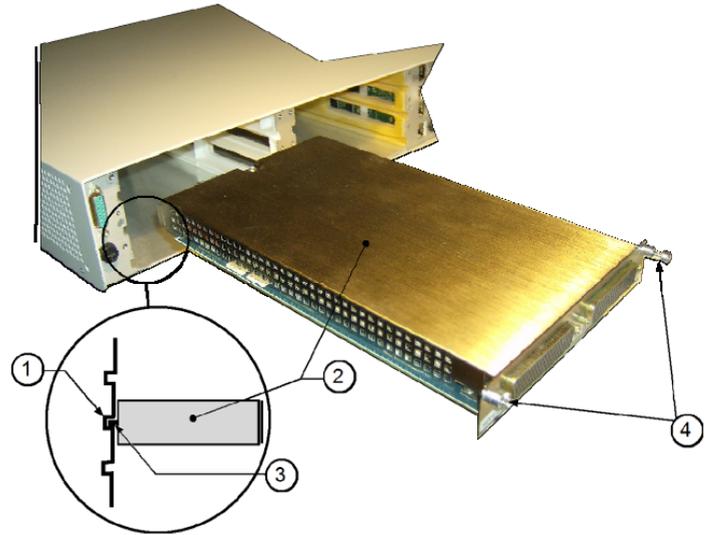


## WARNING

As described in the International Electrotechnical Commission (IEC) Standard IEC 664, the Series 3700A switch cards are Installation Category I 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 desired 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.

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



6. Slide in the card. For approximately the last  $\frac{1}{4}$  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 that all signal wiring to devices and instruments is done through the switch cards. Please refer to the switch card documentation for additional information.

## Install the instrument

A Series 3700A instrument can be used 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 located on the side panel of the Series 3700A 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.



### WARNING

**The power cord supplied with the Series 3700A instrument contains a separate 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. Failure to use a grounded outlet may result in personal injury or death due to electric shock.**



## CAUTION

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

### *To connect line power:*

1. Make sure the front-panel power switch is in the off (0) position.
2. Connect the socket of the supplied power cord to the power connection 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 (I) position.

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



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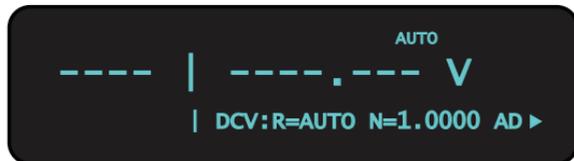
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## Power-up sequence

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 without a front-panel, you should see the Power indicator illuminate, then all three indicator lights illuminate briefly.

## Test the instrument

For instruments with a front panel (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.

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

The examples in the Series 3700A User's Manual are designed to demonstrate increasing levels of Series 3700A functionality. We strongly recommend first-time users complete the examples in the manual.

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## FAQs

### **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 will return 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-NFP or 3706A-SNFP to my computer, how can I find the IP address?**

Run the Keithley LXI Discovery Utility, provided on the CD-ROM. For information on using this utility, see the “Communication Interfaces” section in “General Operation” in the Series 3700A User’s Manual.

## Next steps

### **Refer to the Series 3700A User’s Manual**

This manual provides application-based examples that will help familiarize you with the instrument. This manual is on the Product Information CD-ROM that came with your instrument.

### **Refer to the Series 3700A Reference Manual**

It contains detailed information about all features of the instrument. This manual is on the Product Information CD-ROM that came with your instrument.

### **Refer to the Series 3700A Switching and Control Cards Reference Manual**

This manual provides information on all switch cards that are compatible with Series 3700A instruments. This manual is on the Product Information CD-ROM that came with your instrument.

### **Keithley Instruments website**

See [www.keithley.com](http://www.keithley.com) for support and additional information about the instrument.

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