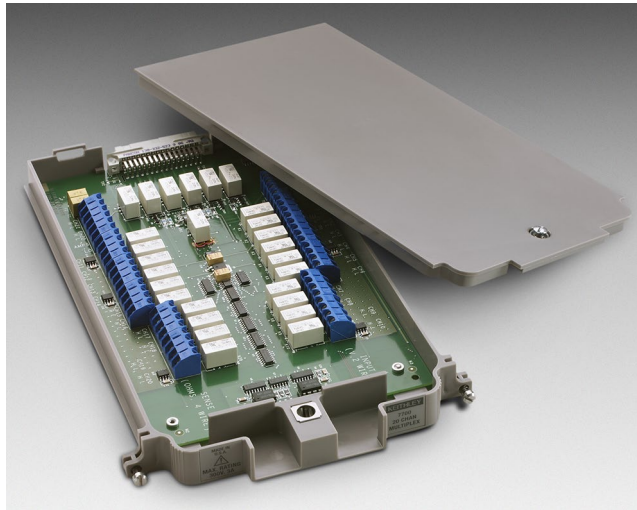


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Introduction

The 7700 20-Channel Differential Multiplexer Plug-In Module offers 20 channels of 2-pole or 10 channels of 4-pole multiplexer switching that can be configured as two independent banks of multiplexers. There are two additional protected channels for current measurements. Automatic cold junction compensation (CJC) is provided so that no other accessories are required to make thermocouple temperature measurements. In addition, the 7700 contains latching electromechanical relays that enable signal bandwidths of up to 50 MHz. The 7700 is ideal for RTD, thermistor, and thermocouple temperature applications.

Figure 1: 7700 20-Channel Differential Multiplexer Module



Item shipped may vary from model pictured here.

The 7700 includes the following features:

- 2-wire or 4-wire resistance measurements (automatically pairs switches for 4-wire measurements — $n + 10$)
- Screw terminal connections
- Built-in cold junction reference
- Latching type relays (relays hold their position after power is removed)
- Two protected channels for current measurements (external shunts not required)

The 7700 can be used with the DAQ6510 Data Acquisition and Multimeter System and the 2750 Multimeter/Switch System. If you are using the 7700 with a DAQ6510, refer to *Model 7700 Multiplexer Module Instructions for use with DAQ6510*, document number 0771443xx.



Switching module capabilities

Channels 1 through 20: The 7700 can multiplex one of 20 2-pole signals, or one of 10 4-pole signals into the input of the 2750.

Channels 21 and 22: The 7700 can multiplex one of two 2-pole current signals into the input of the 2750.

NOTE

When you use system channel operation, only one channel or channel pair can be closed at the same time. When you close a channel or channel pair, all other measurement channels open. The user has no control of channels 23, 24, and 25. The open and close states of these channels are determined by the selected function.

The 7700 has six temperature transducers to monitor the cold junction temperature at the screw terminals. For temperature measurements, this internal reference junction allows thermocouples to be connected directly to the screw terminals of the module.

When the 2750 is on the DCV, ACV, Ω 2, CONT, Ω 4, FREQ, PERIOD, or TEMP function, channels 1 through 20 are available. When on a current function (DCI or ACI), channels 21 and 22 are the only available channels.

The 7700 can accommodate 4-wire measurements by using channel pairs. Primary channels 1 through 10 become paired to channels 11 through 20. For example, with the Ω 4 function selected, channel 1 becomes paired to channel 11. For example, when you close channel 1, channel 11 will also close.

The 2-wire functions include DCV, ACV, DCI, ACI, Ω 2, CONT, FREQ, PERIOD, and TEMP (thermocouple and thermistor). The 4-wire functions/operations include Ω 4, TEMP (4-wire RTD), RATIO, and CH AVG.

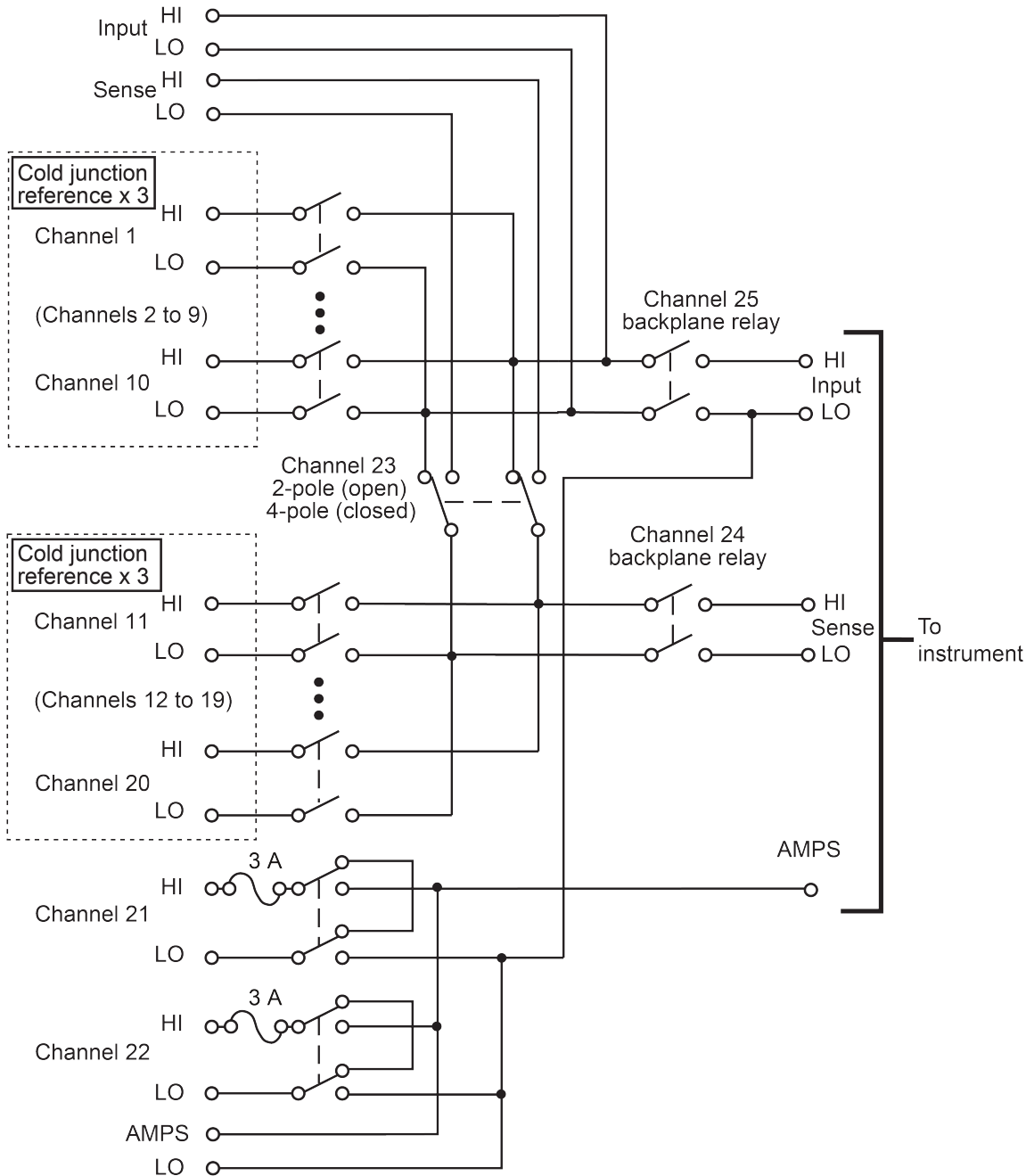
When automatically configured for 4-wire measurements (including 4-wire Ω , RTD temperature, ratio, and channel average) the channels are paired as follows:

- CH1 and CH11
- CH2 and CH12
- CH3 and CH13
- CH4 and CH14
- CH5 and CH15
- CH6 and CH16
- CH7 and CH17
- CH8 and CH18
- CH9 and CH19
- CH10 and CH20

Schematic

The simplified schematic of the 7700 is shown in the following figure.

Figure 2: 7700 simplified schematic



Channels 1 through 20 are used for all measurements except current. Channels 21 and 22 are used for current only.

There are two backplane relays (channels 24 and 25) that connect the input channels to the backplane of the instrument. With a 2-wire function (except current) selected, channel 25 closes. With a 4-wire function selected, both channels 24 and 25 close.

There is a 2-pole/4-pole relay (channel 23) between channels 1 to 10 and channels 11 to 20. When a 2-wire function (such as DCV) is selected, channel 23 opens (2-pole position) to allow any of the 20 channels to be connected to the input backplane.

When a 4-wire function is selected, channel 23 closes (4-pole position) to isolate channels 1 through 10 from channels 11 through 20. When one of channels 1 to 10 is closed, its paired channel (11 through 20) also closes to connect the sense channel to the sense backplane.

For the two current channels (21 and 22), signal HI and LO are routed directly to the backplane when the channel is closed.

The Input and Sense screw terminals are connected to the inputs of channels 24 and 25 (backplane isolation relays). The AMPS screw terminal is connected directly to the instrument.

NOTE

Channels 23, 24, and 25 in this schematic refer to designations used for control and not actual available channels. For more information, refer to the instrument reference manual. Also, AMPS and LO can be connected to another instrument, but you cannot control them through the front panel or by using remote communications.

If channels 1 through 20 are not connected to the internal DMM, channels 24 and 25 can be controlled independently using multiple channel operation. Refer to the *Model 2750 Multimeter/Switch System User's Manual*, part number 2750-900-01, for more information on multiple channel operation.

Connections

WARNING

Connection and wiring procedures in this document are intended for use by qualified personnel only, as described by the types of product users in the [Safety precautions](#) (on page 13). Do not perform these procedures unless qualified to do so. Failure to recognize and observe normal safety precautions could result in personal injury or death.

⚠ WARNING

To prevent electric shock that could result in serious injury or death, comply with these safety precautions:

- Before making or breaking any connections to the switching card, make sure the instrument is turned off and power is removed from all external circuitry.
- Do not connect signals that will exceed the maximum specifications of any installed switching card.

Dangerous arcs of an explosive nature in a high-energy circuit can cause severe personal injury or death if contacted. If the instrument is connected to a high-energy circuit when set to a current range, low-resistance range, or any other low-impedance range, the circuit is virtually shorted. Dangerous arcing can result even when the multimeter is set to a voltage range if the minimum voltage spacing is reduced in the external connections. For details about how to safely make high-energy measurements, see “High-energy circuit safety precautions” in the Reference Manual for the instrument.

⚠ WARNING

Do not exceed the maximum specifications for the 7700. Refer to the specifications provided in the datasheet. Failure to recognize and observe normal safety precautions could result in personal injury or death.

The following information describes how to make connections to the switching module and define the channel designations. A connection log is provided that you can use to record your connections. See [Connection log](#) (on page 10).

This section describes how to make connections to the terminal screws in the module. You can make:

- Current connections, provided through two protected channels (channels 21 and 22)
- INPUT connections
- SENSE (4-wire resistance) connections
- AMP and LO common connections to the instrument

Channel 23 (2W/4W Configuration), Channel 24 (Sense Isolation), and Channel 25 (Input Isolation) are normally automatically configured by the 2750 for system channel operation. However, by using multiple channel operation, channels can be individually controlled.

NOTE

Connect 4-wire sense leads using channels 11 to 20. To disconnect channels 11 to 20 from channels 1 to 10, send:

```
ROUT:MULT:CLOS (@123)
```

Note opposite logic.

Wiring procedure

Use the following procedure to wire the 7700 module. Make all connections using the correct wire size (up to 20 AWG).

⚠ WARNING

All wiring must be rated for the maximum voltage in the system. For example, if 1000 V is applied to the front terminals of the instrument, the switching module wiring must be rated for 1000 V. Failure to recognize and observe normal safety precautions could result in personal injury or death.

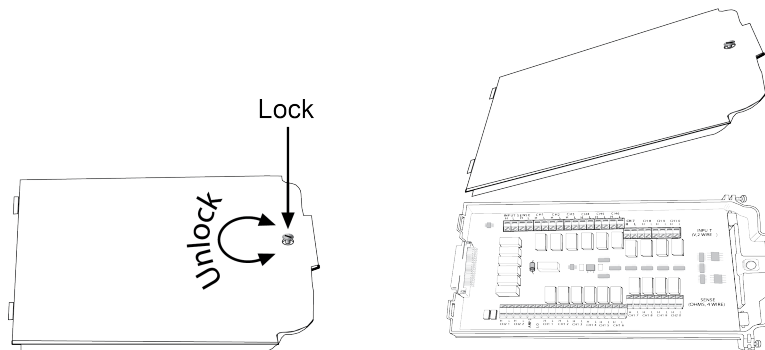
Equipment needed:

- Small flat-blade screwdriver
- Cable ties

To make connections to the 7700 module:

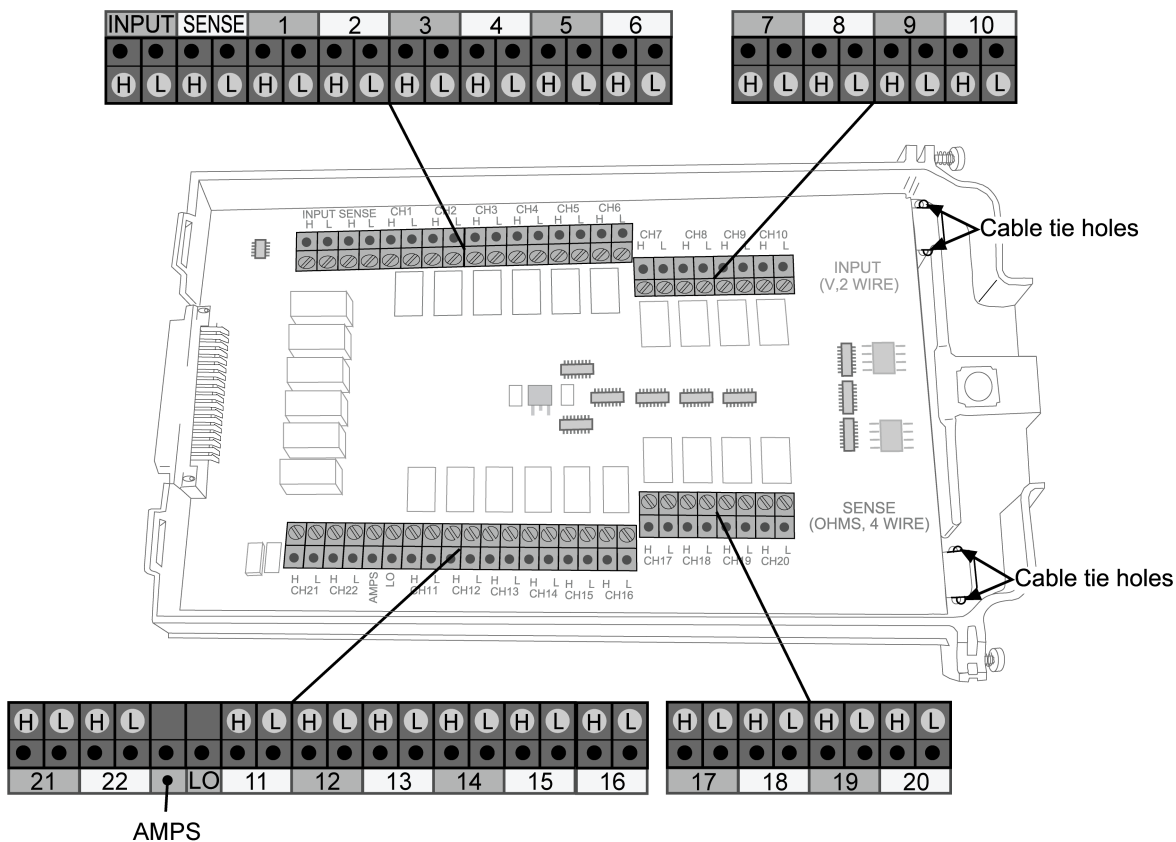
1. Make sure all power is discharged from the 7700 module.
2. Use a screwdriver to turn the access screw to unlock and open the cover.

Figure 3: Screw terminal access



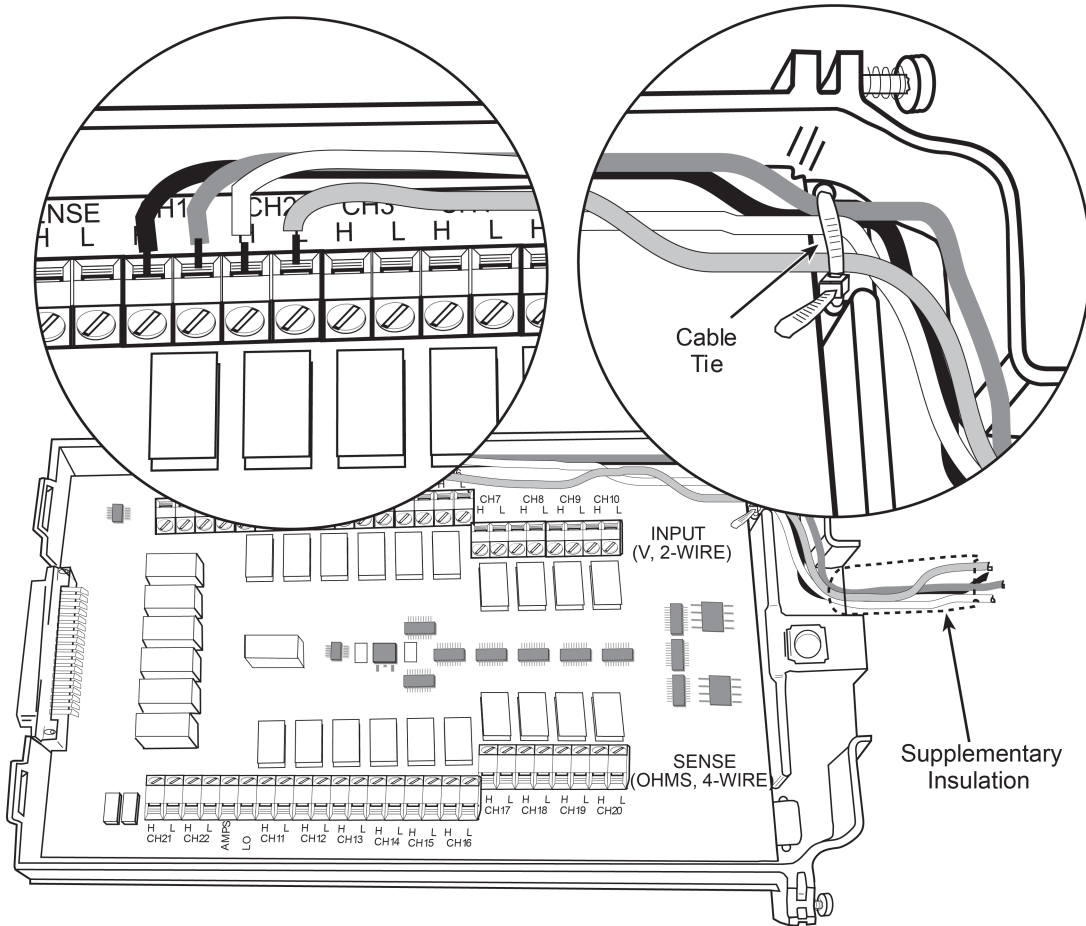
- Use a small flat-blade screwdriver to loosen the terminal screws and install the wires as needed.

Figure 4: 7700 screw terminal channel designations



- Route wire along the wire path and secure with cable tie as shown in the following figure. Make sure to add supplementary insulation around the harness for voltages above 42 V_{PEAK}. The following figure also shows connections to channels 1 and 2.

Figure 5: Model 7700 wire dressing



- Record the connections in the [Connection log](#) (on page 10).
- Close the cover.
- Use a screwdriver to press in the access screw and turn to lock the cover.

Typical wiring connections

The following examples show typical wiring connections for the following types of measurements:

- Thermocouple
- Two-wire resistance and thermistor
- Four-wire resistance and RTD
- DC or AC voltage
- DC or AC current

Figure 6: Thermocouple connections

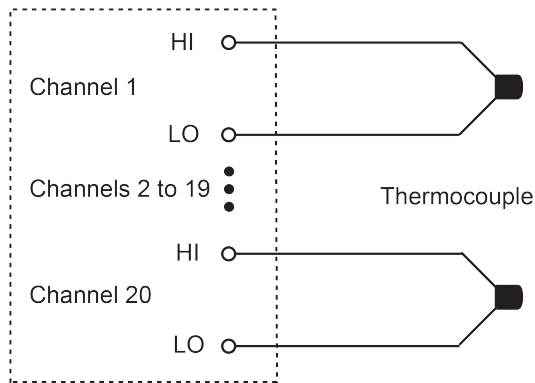


Figure 7: Two-wire resistance and thermistor connections

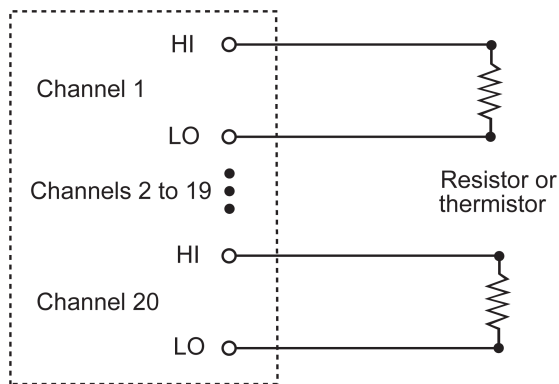


Figure 8: Four-wire resistance and RTD connections

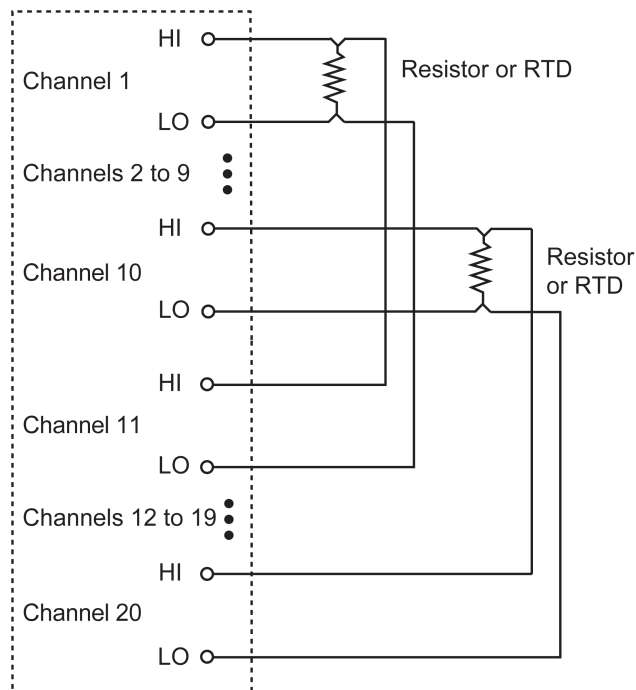


Figure 9: DC or AC voltage connections

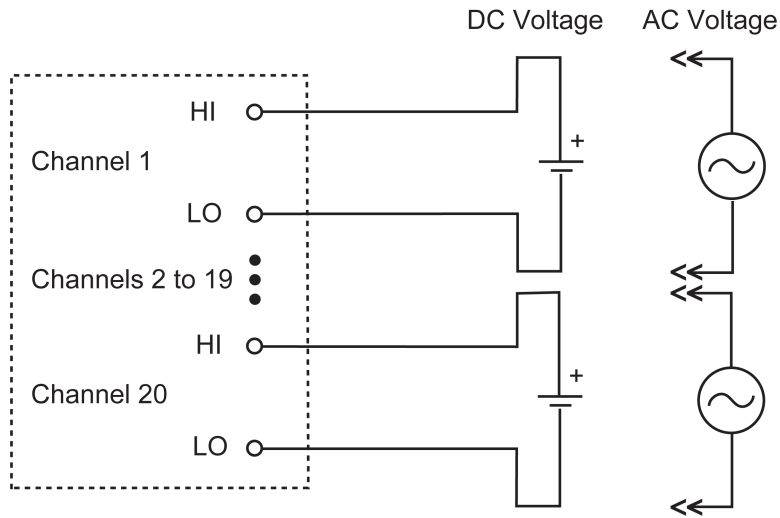
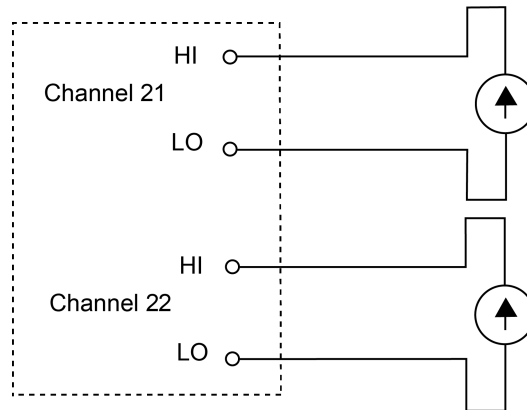


Figure 10: AC or DC current connections



Connection log

You can use the following table to record your connection information.

Connection log for the 7700

Channel		Color	Description
AMPS COM	H		
	L		
INPUT	H		
	L		
SENSE	H		
	L		
CH1	H		
	L		
CH2	H		
	L		
CH3	H		
	L		
CH4	H		
	L		
CH5	H		
	L		
CH6	H		
	L		
CH7	H		
	L		
CH8	H		
	L		
CH9	H		
	L		
CH10	H		
	L		
CH11	H		
	L		
CH12	H		
	L		
CH13	H		
	L		
CH14	H		
	L		
CH15	H		
	L		
CH16	H		
	L		
CH17	H		
	L		
CH18	H		
	L		
CH19	H		
	L		
CH20	H		
	L		
AMPS21	H		
	L		
AMPS22	H		
	L		

Installation

For information on installing the switching module into the 2750, refer to the *Model 2750 User's Manual*, 2750-900-0xx available at [tek.com/keithley](https://www.tek.com/keithley).

Operation

CAUTION

To prevent overheating or damage to the 7700 switching module relays, never exceed the following maximum signal levels between any two inputs or chassis:

- Channels 1 to 20: 300 V dc or 300 V_{RMS} (425 V_{PEAK}) for ac waveforms, 1 A switched, 60 W, 125 VA.
 - Channels 21, 22: 60 V dc or 30 V_{RMS}, 3 A switched, 60 W, 125 VA.
-

Refer to the instrument documentation for operating instructions.

Performance verification and calibration

To verify and calibrate measurement accuracy of the 7700, refer to the *Model 2750 Multimeter/Switch System Service Manual*, document number 2750-902-01, available at [tek.com/keithley](https://www.tek.com/keithley).

Factory service

To return your 7700 for repair or calibration, call 1-800-408-8165 or complete the form at [tek.com/services/repair/rma-request](https://www.tek.com/services/repair/rma-request). When you request service, you need the serial number and firmware or software version of the instrument.

To see the service status of your instrument or to create an on-demand price estimate, go to [tek.com/service-quote](https://www.tek.com/service-quote).

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  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 2018.