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INSTALLATION GUIDE
NI CSM-10A/200mA

このドキュメントには、日本語ページも含まれています。

Introduction

This installation guide describes how to install and use the National Instruments current shunt module (CSM) family of products.

The NI CSM-10A and NI CSM-200mA allow a digital multimeter (DMM) to determine electrical current by measuring the voltage drop across a precision resistor. You can use these CSMs with the NI PCMCIA-4050 (NI 4050), NI PXI/PCI-4060 (NI 4060), and NI PXI-4070 (NI 4070) DMMs. The CSMs also are compatible with any third-party DMM whose voltage-measurement banana jacks are 0.75 inches apart.

Caution Refer to the *Read Me First: Safety and Electromagnetic Compatibility* document at `ni.com/manuals` for important safety and compliance information.

Note The NI 4050 requires a CSM to measure current.

Contents

NATIONAL INSTRUMENTS

What You Need to Get Started

To set up and use the CSM, you need the following:

- ❑ One of the following CSMs:
  - NI CSM-10A
  - NI CSM-200mA
- ❑ NI 4050 with cable, NI 4060, NI 4070, or a third-party DMM
- ❑ One pair of test probes (red and black)
- ❑ Flat-head screwdriver

Safety Instructions

This section contains important safety instructions that you *must* follow when installing and using the NI CSM-10A or NI CSM-200mA.

Do *not* operate the CSM in a manner not specified in this installation guide. Misuse of the product can result in a hazard. You can compromise the safety protection built into the product if the product is damaged in any way. If the product is damaged, return it to NI for repair.

Do *not* substitute parts or modify the CSM. Use the product only with the modules, accessories, and cables specified in the installation instructions.

Do *not* operate the CSM in an explosive atmosphere or where there may be flammable gases or fumes. If you need to operate the CSM in such an environment, the CSM *must* be in a suitably rated enclosure.

If you need to clean the CSM, use a soft nonmetallic brush. The product *must* be completely dry and free from contaminants before you return it to service.

Operate the CSM only at or below Pollution Degree 2. Pollution is foreign matter in a solid, liquid, or gaseous state that can reduce dielectric strength or surface resistivity. The following is a description of pollution degrees:

- Pollution Degree 1 means no pollution or only dry, nonconductive pollution occurs. The pollution has no influence.
- Pollution Degree 2 means that only nonconductive pollution occurs in most cases. Occasionally, however, a temporary conductivity caused by condensation must be expected.
- Pollution Degree 3 means that conductive pollution occurs, or dry, nonconductive pollution occurs which becomes conductive due to condensation.

You *must* insulate signal connections for the maximum voltage for which the CSM is rated. Do *not* exceed the maximum ratings for the product. Do *not* install wiring while the product is live with electrical signals. Do *not* remove or add connections when power is connected to the CSM.

Operate the CSM at or below the *installation category*[1] marked on the hardware label. Measurement circuits are subjected to *working voltages*[2] and transient stresses (overvoltage) from the circuit to which they are connected during measurement or test. Installation categories establish standard impulse withstand voltage levels that commonly occur in electrical distribution systems. The following is a description of installation categories:

[1] Installation categories, also referred to as *measurement categories*, are defined in electrical safety standard IEC 61010-1.

[2] Working voltage is the highest rms value of an AC or DC voltage that can occur across any particular insulation.

- Installation Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as MAINS[1] voltage. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.
- Installation Category II is for measurements performed on circuits directly connected to the electrical distribution system. This category refers to local-level electrical distribution, such as that provided by a standard wall outlet (for example, 115 V for U.S. or 230 V for Europe). Examples of Installation Category II are measurements performed on household appliances, portable tools, and similar products.
- Installation Category III is for measurements performed in the building installation at the distribution level. This category refers to measurements on hard-wired equipment such as equipment in fixed installations, distribution boards, and circuit breakers. Other examples are wiring, including cables, bus-bars, junction boxes, switches, socket-outlets in the fixed installation, and stationary motors with permanent connections to fixed installations.
- Installation Category IV is for measurements performed at the primary electrical supply installation (<1,000 V). Examples include electricity meters and measurements on primary overcurrent protection devices and on ripple control units.

Connecting the CSM to a DMM

This section illustrates how to connect a CSM to a DMM.

NI 4050

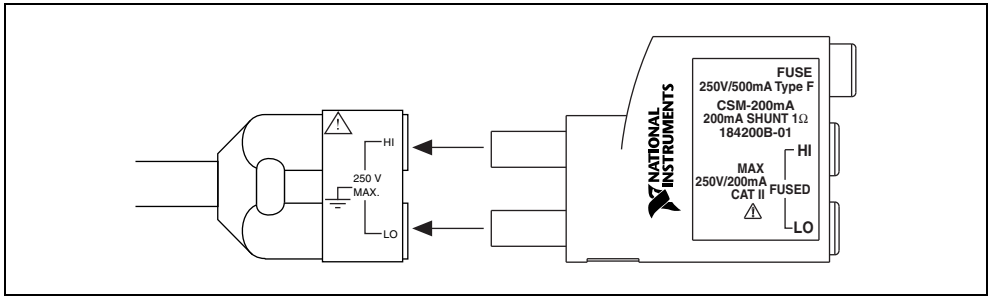


Figure 1. Connecting the CSM to the P4-BJ2 Cable Included with the NI 4050

[1] MAINS is defined as a hazardous live electrical supply system that powers equipment. Suitably rated measuring circuits may be connected to the MAINS for measuring purposes.

NI 4060

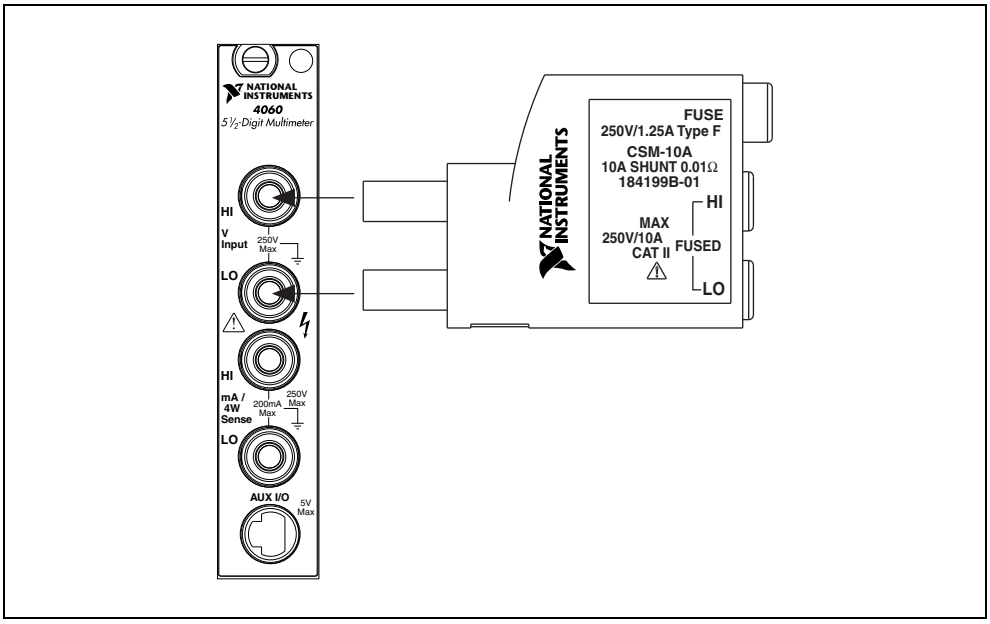


Figure 2. Connecting the CSM to the NI 4060

NI 4070

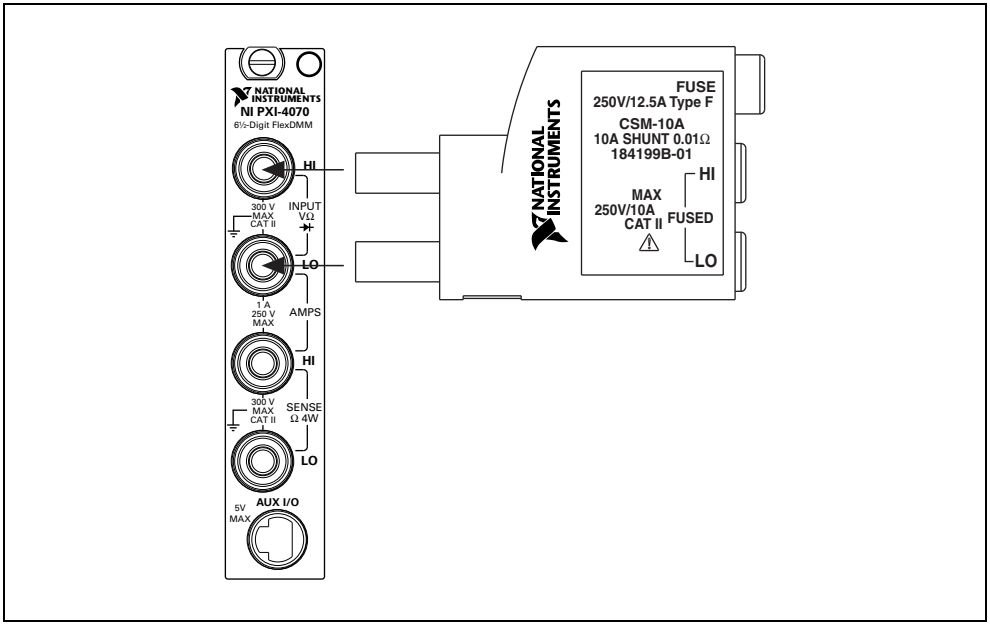


Figure 3. Connecting the CSM to the NI 4070

Third-Party DMMs

You can measure DC and AC_{rms} current with the CSM and a third-party DMM, provided the DMM is capable of measuring DC and AC_{rms} voltage. Refer to the DMM documentation for voltage measurement connection information.

Connecting Current to the CSM

The current to be measured connects to the HI (red) terminal of the CSM and returns through the LO (black) terminal.

Cautions The current must *never* exceed the maximum input current specification for the CSM you are using (10 A for the NI CSM-10A; 200 mA for the NI CSM-200mA).

To prevent possible safety hazards, the maximum voltage between either of the inputs and ground of the measuring device should *never* exceed ±250 V or 250 V_{rms}.

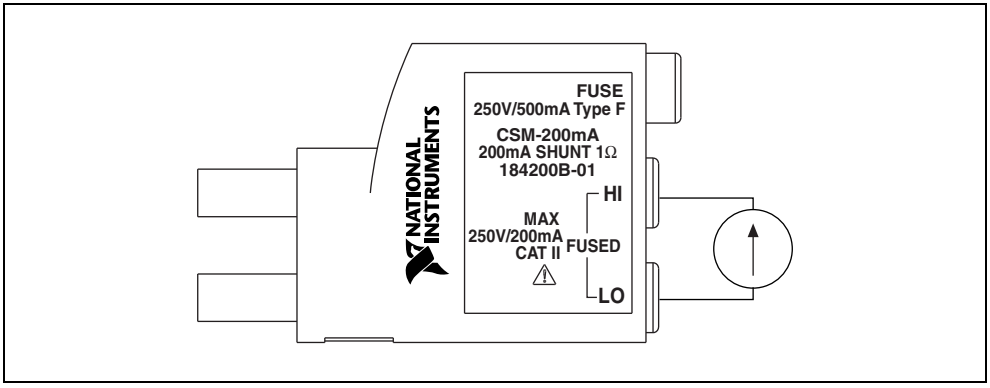
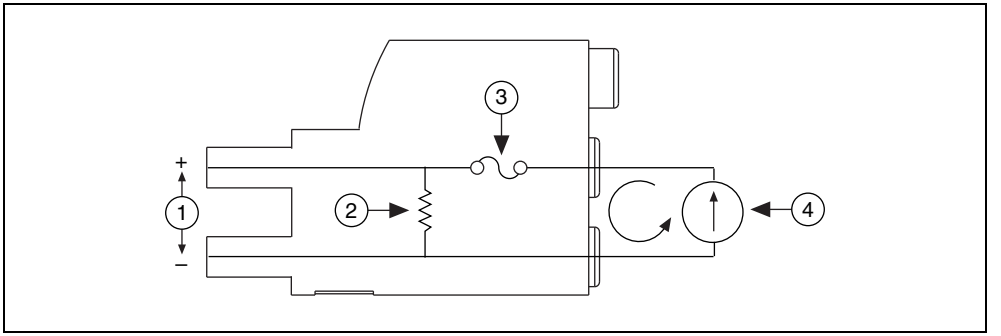


Figure 4. Connecting Current to the CSM

Calculating Current

The CSM operates by passing the input current through a precision resistor. Figure 5 shows the internal circuitry of the CSM. You can find the resistance of the precision resistor in the *Specifications* section of this document.



1	Voltage Across Resistor (V_{OUT})	3	Fuse
2	Precision Resistor	4	Current Source (I_{IN})

Figure 5. CSM Internal Construction

Measure the voltage drop across the resistor of the CSM. Use this value to calculate the current using Ohm's Law:

$$I_{IN} = \frac{V_{OUT}}{R}$$

where I is the input current

V is the voltage across the precision resistor

R is the resistance of the precision resistor

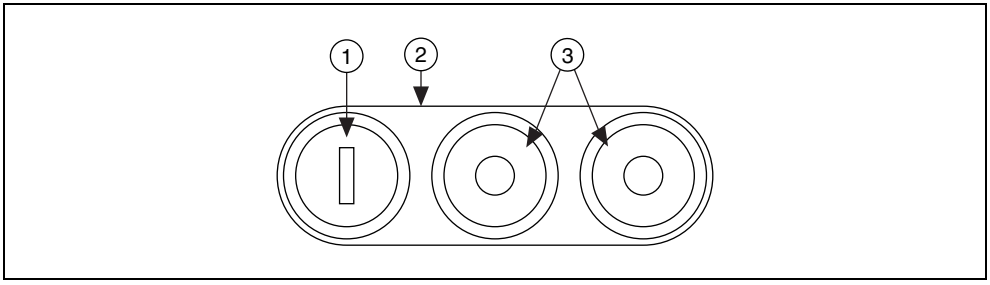
For example, assume you are using the CSM-200mA, which has a 1 Ω precision resistor, and the measured voltage is 50 mV. Apply these values to Ohm's Law to determine the current, as follows:

$$50\ \text{mA} = \frac{50\ \text{mV}}{1\ \Omega}$$

Replacing the Fuse

Caution For continued protection against fire, replace the fuse only with a fuse of the same type and rating.

Figure 6 shows the location of the fuse on the front panel of the CSM. The fuse protects the current shunt resistor if inputs exceed the maximum specified current rating provided in the *Specifications* section of this document.



1	Fuse Holder	2	NI CSM-10A/200mA	3	Connectors

Figure 6. CSM Fuse Holder Location (Front View)

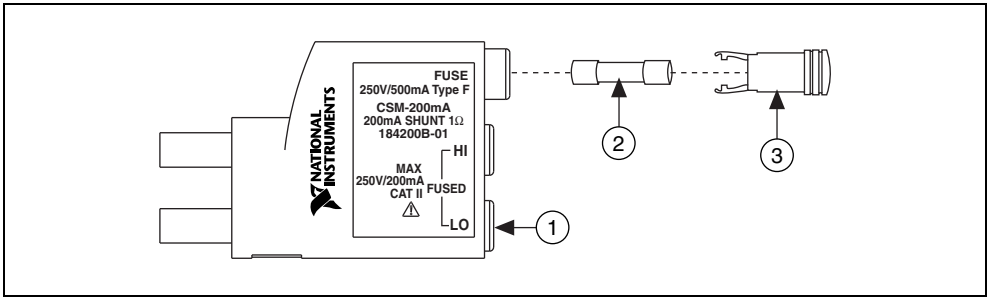
The fuse is a 5 × 20 mm quick-acting fuse. Table 1 lists the appropriate fuses for each CSM.

Table 1. CSM Fuse Values

Module	Fuse Rating	Fuse Type	Manufacturer
NI CSM-10A	12.5 A/250 V	Quick-acting	Schurter
NI CSM-200mA	500 mA/250 V	Quick-acting	Schurter

Complete the following steps to replace the CSM fuse:

1. Power down all equipment connected to the CSM.
2. Remove all connections from the CSM.
3. Turn the fuse holder counter-clockwise with a flathead screwdriver and pull the fuse holder out to expose the fuse in the housing.



1	NI CSM-10A/200mA	2	Fuse	3	Fuse Holder

Figure 7. Removing the Fuse

4. Remove the old fuse.
5. Install the new fuse.
6. Push the fuse holder back into the housing and turn it clockwise until it tightens completely.

Compliance

These products are designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control and laboratory use:

- IEC/EN 61010-1
- UL 3111-1

Specifications

The following sections list the specifications of the NI CSM-10A and NI CSM-200mA.

Note These specifications are typical at 25 ºC unless otherwise stated.

NI CSM-10A

Current shunt.....10 A

Conversion factor.....1 mV = 100 mA

Max working current

HI to LO.....10 A

Sense resistor value.....0.01 Ω

Accuracy (DC–25 kHz) .....± 0.5%

Sense resistor temperature coefficient .....20 ppm/ºC

Burden voltage.....400 mV

Fuse type.....12.5 A/250 V
5 × 20 mm
quick-acting

Banana jack spacing.....0.75 in. (19 mm)

Maximum Working Voltage

Maximum working voltage refers to the signal voltage plus the common-mode voltage.

HI to earth ground.....250 V max,
Installation Category II

LO to earth ground.....250 V max,
Installation Category II

Environmental

Operating temperature .....0 to 55 °C

Storage temperature .....–55 to 150 °C

Humidity .....5 to 90% RH, noncondensing

Maximum altitude.....2,000 m

Pollution Degree (indoor use only).....2

NI CSM-200mA

Current shunt.....200 mA

Conversion factor.....100 mV = 100 mA

Max working current

HI to LO.....200 mA

Sense resistor value.....1 Ω

Accuracy (DC–25 kHz).....± 0.075%

Sense resistor temperature coefficient.....20 ppm/°C

Burden voltage.....325 mV

Fuse type.....500 mA/250 V
5 × 20 mm
quick-acting

Banana jack spacing.....0.75 in. (19 mm)

Maximum Working Voltage

Maximum working voltage refers to the signal voltage plus the common-mode voltage.

HI to earth ground.....250 V max,
Installation Category II

LO to earth ground.....250 V max,
Installation Category II

Environmental

Operating temperature.....0 to 55 °C

Storage temperature.....–55 to 150 °C

Humidity.....5 to 90% RH, noncondensing

Maximum altitude.....2,000 m

Pollution Degree (indoor use only).....2

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