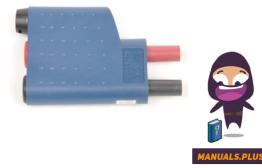


NATIONAL INSTRUMENTS NI CSM-10A Current Shunt Module



NATIONAL INSTRUMENTS NI CSM-10A Current Shunt Module Installation Guide

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NATIONAL INSTRUMENTS NI CSM-10A Current Shunt Module



Product Information

- **Specifications:**

- CSM Models: NI 4050, NI 4060, NI 4070, or a third-party DMM
- CSM Ratings: 10A or 200mA
- Test Probes: One pair (red and black)
- Additional Tools: Flat-head screwdriver

- **Installation Guide:**

- Before proceeding with the installation of the NI CSM-10A/200mA, please refer to the Read Me First: Safety and Electromagnetic Compatibility document at ni.com/manuals for important safety and compliance information.

- **Safety Instructions:**

- Do not operate the CSM in a manner not specified in this installation guide. Misuse of the product can result in a hazard.
- 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.
- 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 marked on the hardware label.

- **Installation Categories:**

- Measurement circuits are subjected to working voltages² 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.
- Installation categories also referred to as measurement categories, are defined in electrical safety standard IEC 61010-1.
- Working voltage is the highest rms value of an AC or DC voltage that can occur across any particular insulation.

Product Usage Instructions

1. Ensure that you have all the necessary components: CSM (NI 4050, NI 4060, NI 4070, or a third-party DMM), test probes (red and black), and a flat-head screwdriver.
2. Refer to the safety instructions mentioned above before proceeding with the usage of the CSM.
3. Connect the CSM to the appropriate device or DMM using the provided cable.
4. Ensure that the CSM is properly insulated for the maximum voltage it is rated for.
5. Insert the test probes into the respective connectors on the CSM, ensuring correct polarity (red for positive, black for negative).

6. If necessary, use the flat-head screwdriver to secure the test probes in place.
7. You are now ready to use the CSM for current measurement or testing as per your specific requirements.

FAQs

- **Q: What CSM models are compatible with the NI CSM-10A/200mA?**
 - **A:** The NI CSM-10A/200mA is compatible with NI 4050, NI 4060, NI 4070, or a third-party DMM.
- **Q: Can I modify or substitute parts of the CSM?**
 - **A:** No, it is important not to modify or substitute any parts of the CSM. Use only the specified modules, accessories, and cables mentioned in the installation instructions.
- **Q: How should I clean the CSM?**
 - **A:** To clean the CSM, use a soft nonmetallic brush. Ensure that the product is completely dry and free from contaminants before returning it to service.
- **Q: Can I operate the CSM in an explosive atmosphere?**
 - **A:** No, the CSM should not be operated in an explosive atmosphere or the presence of flammable gases or fumes. If necessary, use a suitably rated enclosure for operating the CSM in such environments.
- **Q: What are installation categories and why are they important?**
 - **A:** Installation categories establish standard impulse withstand voltage levels commonly found in electrical distribution systems. They help ensure the safe operation of measurement circuits and protection against transient stresses.

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.

Get Started

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. 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 marked on the hardware label.
- Measurement circuits are subjected to working voltages² 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:
- Installation Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as MAINS¹ 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 the 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

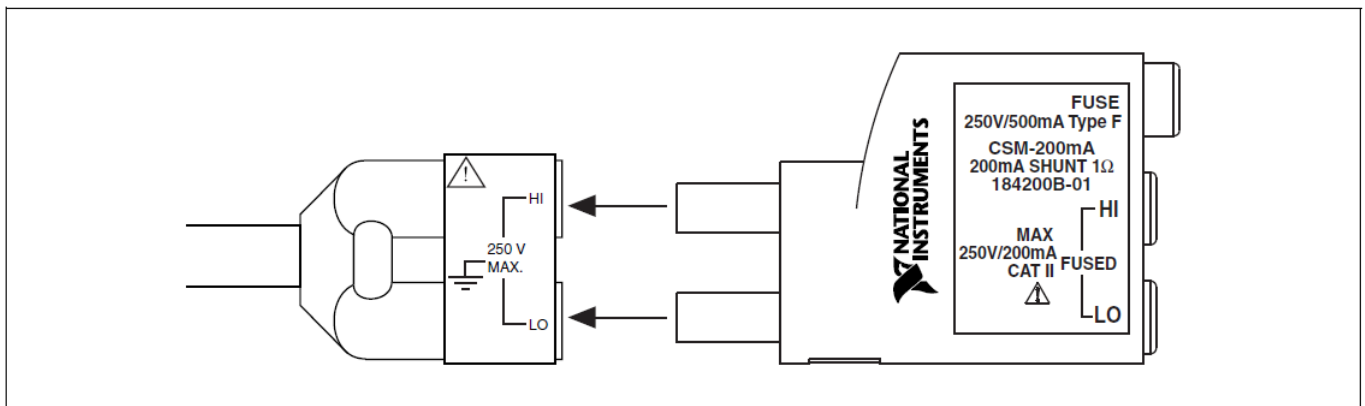


Figure 1. Connecting the CSM to the P4-BJ2 Cable Included with the NI 4050

NI 4060

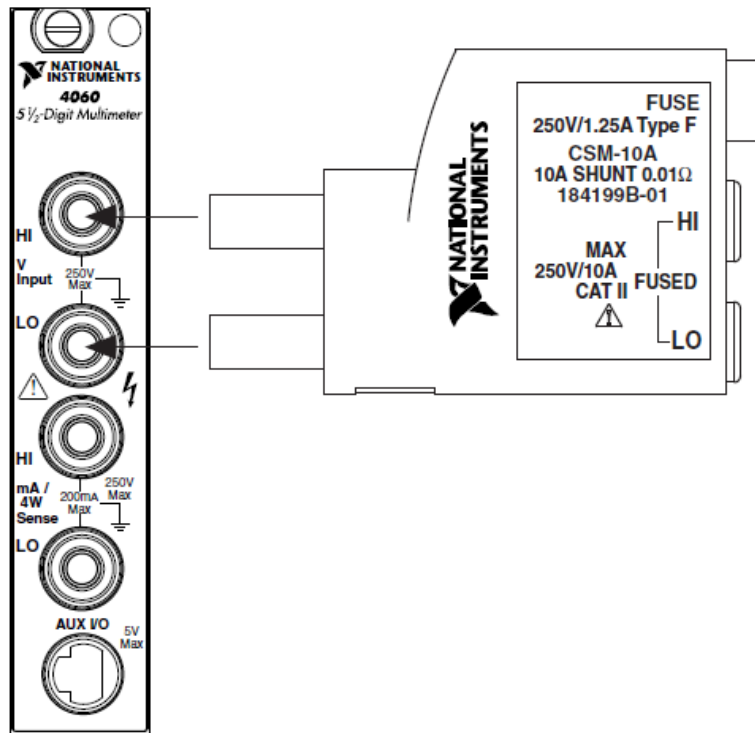


Figure 2. Connecting the CSM to the NI 4060

NI 4070

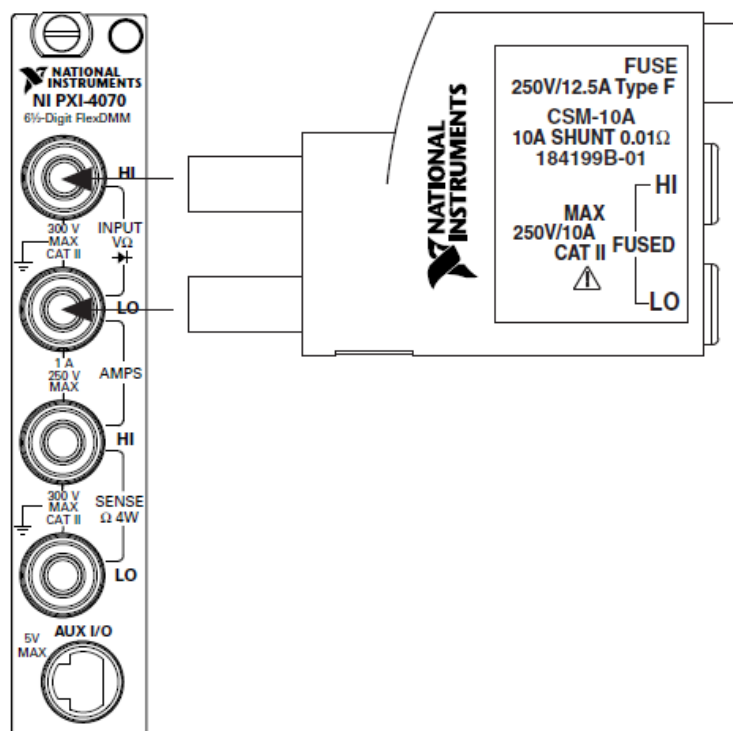


Figure 3. Connecting the CSM to the NI 4070

Third-Party DMMs

- You can measure DC and ACrms current with the CSM and a third-party DMM, provided the DMM is capable of measuring DC and ACrms 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 the ground of the measuring device should never exceed ± 250 V or 250 Vrms.

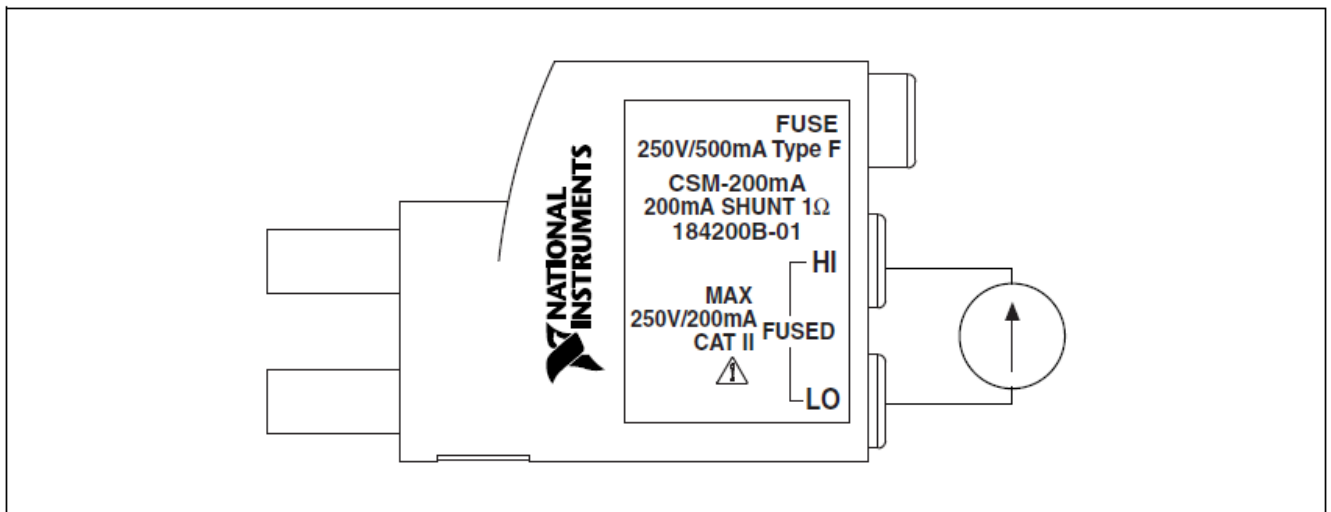


Figure 4. Connecting Current to the CSM

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.

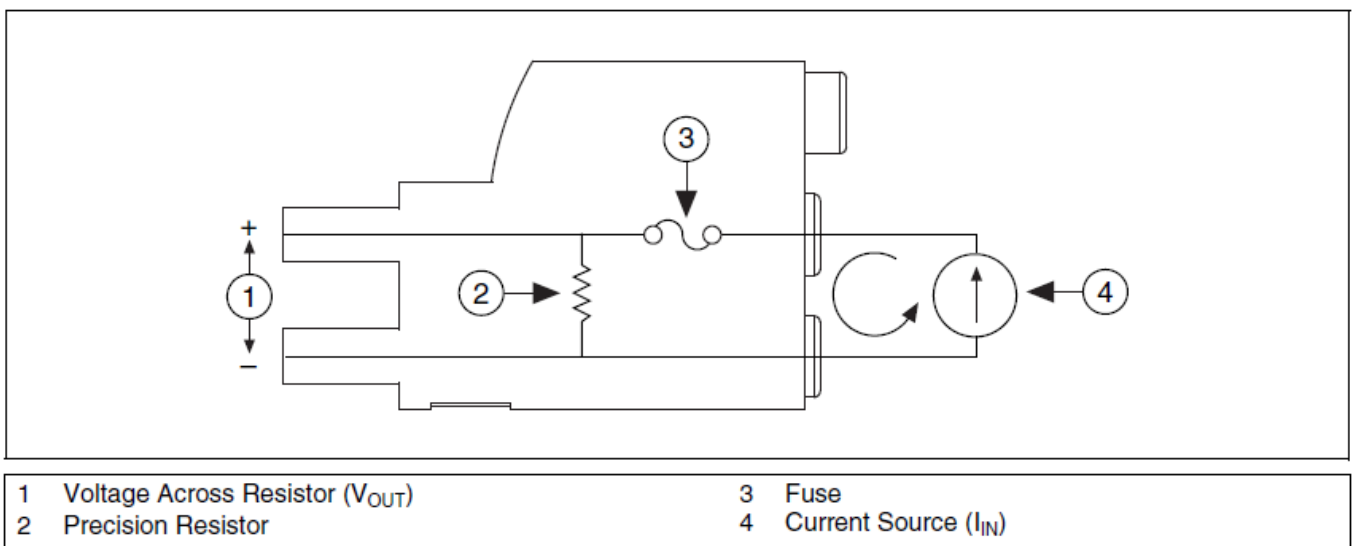


Figure 5. CSM Internal Construction

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 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.

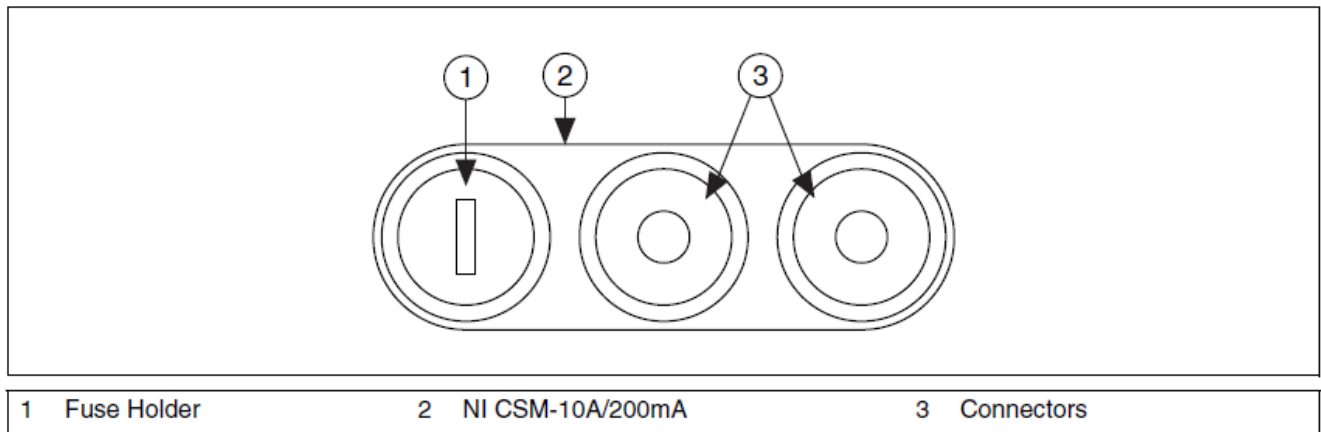


Figure 6. CSM Fuse Holder Location (Front View)

- 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.

- Turn the fuse holder counter-clockwise with a flathead screwdriver and pull the fuse holder out to expose the fuse in the housing.

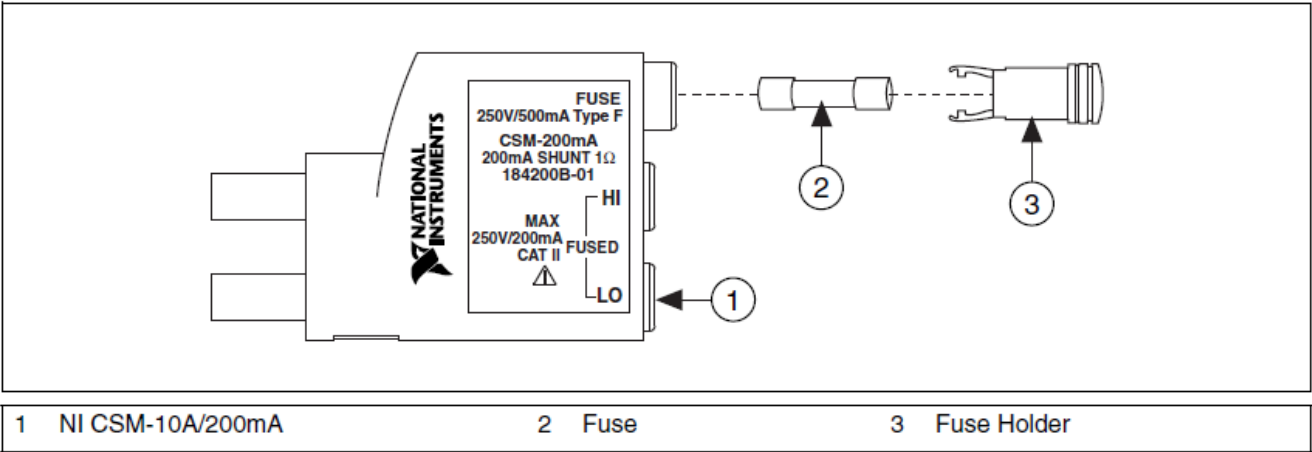


Figure 7. Removing the Fuse

- Remove the old fuse.
- Install the new fuse.
- 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 °C unless otherwise stated.

NI CSM-10A

- Current shunt.....10 A
- Conversion factor1 mV = 100 mA

Max working current

- HI to LO.....10 A
- Sense resistor value.....0.01
- Accuracy (DC–25 kHz)± 0.5%
- Sense resistor temperature coefficient20 ppm/°C
- Burden voltage400 mV
- Fuse type12.5 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 temperature0 to 55 °C
- Storage temperature–55 to 150 °C
- Humidity5 to 90% RH, non-condensing
- Maximum altitude.....2,000 m
- Pollution Degree (indoor use only).....2

NI CSM-200mA

- Current shunt.....200 mA
- Conversion factor100 mV = 100 mA
- Max working current
- HI to LO.....200 mA
- Sense resistor value.....1
- Accuracy (DC–25 kHz)± 0.075%
- Sense resistor temperature coefficient20 ppm/°C
- Burden voltage325 mV
- Fuse type500 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 temperature0 to 55 °C
- Storage temperature–55 to 150 °C
- Humidity5 to 90% RH, non-condensing

- Maximum altitude.....2,000 m
- Pollution Degree (indoor use only).....2

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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.

Documents / Resources

	<p>NATIONAL INSTRUMENTS NI CSM-10A Current Shunt Module [pdf] Installation Guide NI CSM-10A Current Shunt Module, NI CSM-10A, Current Shunt Module, Shunt Module, Modul e</p>
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References

- [NI Test and Measurement Systems, a part of Emerson - NI](#)
- [NI Product Documentation - NI](#)
- [NI National Instruments Patents - NI](#)
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