SAFETY, ENVIRONMENTAL, AND REGULATORY INFORMATION

PXIe-4135

PXIe, ±200 V, 3 A, 10 fA Precision PXI Source Measure Unit

Read this document before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards. Visit *ni.com/manuals* for more information about your product, including specifications, pinouts, and instructions for connecting, installing, and configuring your system.

Note In this document, the PXIe-4135 (40W) and the PXIe-4135 (20W) are referred to inclusively as the PXIe-4135 . The information in this document applies to all versions of the PXIe-4135 unless otherwise specified. To determine which version of the module you have, locate the device name in one of the following places:

- **In MAX**—The PXIe-4135 (40W) shows as *PXIe-4135 (40W)*, and the PXIe-4135 (20W) shows as *PXIe-4135*.
- **Device front panel**—The PXIe-4135 (40W) shows *PXIe-4135 40W System SMU*, and the PXIe-4135 (20W) shows *NI PXIe-4135 Precision System SMU* on the front panel.

Icons

Refer to the following descriptions if one of these icons is marked on your product or used in this guide.

Notice Take precautions to avoid data loss, loss of signal integrity, degradation of performance, or damage to the product.

Caution Take precautions to avoid injury. Consult the product documentation for cautionary statements when you see this icon printed on the product. Cautionary statements are localized into French for compliance with Canadian requirements.

Caution: Possibility of Electric Shock Take precautions to avoid electrical shock.

Caution: Hot Surface Take precautions to avoid physical burns.

Safety Guidelines

Caution Observe all instructions and cautions in the user documentation. Using the product in a manner not specified can damage the product and compromise the built-in safety protection.

Attention Suivez toutes les instructions et respectez toutes les mises en garde de la documentation d'utilisation. L'utilisation du produit de toute autre façon que celle spécifiée risque de l'endommager et de compromettre la protection de sécurité intégrée.

Caution If the product has been in use, it may exceed safe handling temperatures and cause burns. Allow the product to cool before handling.

Attention Si le produit a été utilisé, il peut avoir atteint des températures trop élevées pour être manipulé en toute sécurité, ce qui peut provoquer des brûlures. Laissez le produit refroidir avant de le manipuler.

Safety Guidelines for Hazardous Voltages

Caution Ensure that hazardous voltage wiring is performed only by qualified personnel adhering to local electrical standards.

Attention S'assurer que le câblage à tension dangereuse est effectué par du personnel qualifié respectant les normes électriques locales.

Caution Do not mix hazardous voltage circuits and human-accessible circuits on the same product.

Attention Ne pas combiner des circuits avec des tensions dangereuses et des circuits accessibles aux personnes sur le même produit.

Caution When product terminals are hazardous voltage LIVE, you must ensure that devices and circuits connected to the product are properly insulated from human contact.

Attention Lorsqu'une haute tension dangereuse est appliquée aux bornes du produit, vous devez vous assurer que les appareils et les circuits auxquels il est connecté sont correctement isolés de tout contact humain.

Safety Voltages

DC voltage	±200 V
Channel-to-earth ground isolation	
Continuous	250 V DC, Measurement Category I
Withstand	1000 V_{rms}, verified by a 5 s withstand

Measurement Category

Caution Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV.

Attention Ne pas connecter le produit à des signaux dans les catégories de mesure II, III ou IV et ne pas l'utiliser pour effectuer des mesures dans ces catégories.

Warning Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV, or for measurements on MAINs circuits or on circuits derived from Overvoltage Category II, III, or IV which may have transient overvoltages above what the product can withstand. The product must not be connected to circuits that have a maximum voltage above the continuous working voltage, relative to earth or to other channels, or this could damage and defeat the insulation. The product can only withstand transients up to the transient overvoltage rating without breakdown or damage to the insulation. An analysis of the working voltages, loop impedances, temporary overvoltages, and transient overvoltages in the system must be conducted prior to making measurements.

Mise en garde Ne pas connecter le produit à des signaux dans les catégories de mesure II, III ou IV et ne pas l'utiliser pour des mesures dans ces catégories, ou des mesures sur secteur ou sur des circuits dérivés de surtensions de catégorie II, III ou IV pouvant présenter des surtensions transitoires supérieures à ce que le produit peut supporter. Le produit ne doit pas être raccordé à des circuits ayant une tension maximale supérieure à la tension de fonctionnement continu, par rapport à la terre ou à d'autres voies, sous peine d'endommager et de compromettre l'isolation. Le produit peut tomber en panne et son isolation risque d'être endommagée si les tensions transitoires dépassent la surtension transitoire nominale. Une analyse des tensions de fonctionnement, des impédances de boucle, des surtensions temporaires et des surtensions transitoires dans le système doit être effectuée avant de procéder à des mesures.

Measurement Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as *MAINS* voltage. MAINS is a hazardous live electrical supply system that powers equipment. 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.

Note Measurement Categories CAT I and CAT O are equivalent. These test and measurement circuits are for other circuits not intended for direct connection to the MAINS building installations of Measurement Categories CAT II, CAT III, or CAT IV.

Current Ratings

DC current range	±1 A; ±3 A, pulse only

Safety Compliance Standards

This product is designed to meet the requirements of the following electrical equipment safety standards for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA C22.2 No. 61010-1

Note For safety certifications, refer to the product label or the *Product Certifications and Declarations* section.

Safety Guidelines for System Design and Implementation

The PXIe-4135 is capable of generating hazardous voltages and working within hazardous voltage systems. It is the responsibility of the system designer, integrator, installer, maintenance personnel, and service personnel to ensure the system is safe during use.

- Ensure operators cannot access the PXIe-4135, cables, the device under test (DUT), or any other instruments in the system while hazardous voltages are present.
- Operator access points can include, but are not limited to, guards, gates, sliding doors, hinge doors, lids, covers, and light curtains.
- If using a test fixture enclosure, ensure that it is properly connected to safety ground.
- Ensure that the PXIe-4135 is properly secured to the chassis using the two front panel mounting screws.
- Double insulate all electrical connections that are accessible by an operator. Double insulation ensures protection if one layer of insulation fails. Refer to IEC 61010-1 for specific insulation requirements.

Mechanical Detection Switch Recommendations

- Use high-reliability, fail-safe, normally open mechanical detection switches on all access points to the test fixture enclosure.
- Use two normally open switches wired in series so that a single switch failure does not compromise safety protections.
- Isolate switches so the operator cannot trigger or bypass the switches without the use of a tool.
- Ensure the switches' certifications meet your test application requirements. NI recommends UL-certified safety switches to ensure reliability.
- Install the switches in accordance with the switch manufacturer specifications.
- Test the switches periodically to ensure proper implementation and reliability.

Safety Guidelines for System Operation

Caution Hazardous voltages of up to the maximum voltage of the PXIe-4135 may appear at the output terminals if the safety interlock terminal is closed. Open the safety interlock terminal when the output connections are accessible. With the safety interlock terminal open, the output voltage level/limit is limited to ±40 V DC, and protection will be triggered if the voltage measured between the device HI and LO terminals exceeds ±(42 V peak ±0.4 V).

Attention Des tensions dangereuses allant jusqu'à la tension maximale du PXIe-4135 peuvent apparaître aux terminaux de sortie si le terminal de verrouillage de sécurité est fermé. Ouvrez le terminal de verrouillage de sécurité lorsque les connexions de sortie sont accessibles. Lorsque le terminal de verrouillage de sécurité est ouvert, le niveau ou la limite de tension de sortie est limité à ± 40 V CC, et la protection se déclenchera si la tension mesurée entre les terminaux HI et LO de l'appareil dépasse ± (42 Vpic ± 0,4 V).

Caution Do not apply voltage to the safety interlock connector inputs. The interlock connector is designed to accept passive, normally open contact closure connections only.

Attention N'appliquez pas de tension aux entrées du connecteur de verrouillage de sécurité. Le connecteur de verrouillage est conçu pour accepter uniquement des connexions à fermeture de contact passives, normalement ouvertes.

To ensure a system containing the PXIe-4135 is safe for operators, components, or conductors, take the following safety precautions:

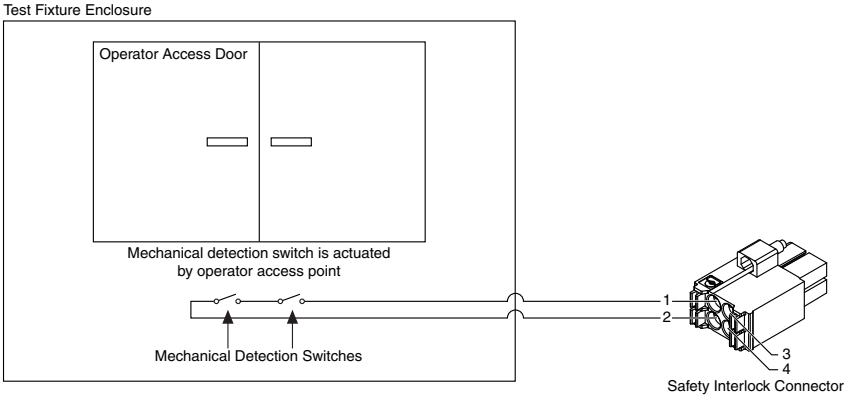
- Ensure proper warnings and signage exist for workers in the area of operation.
- Provide training to all system operators so that they understand the potential hazards and how to protect themselves.
- Inspect connectors, cables, switches, and any test probes for any wear or cracking before each use.
- Before touching any of the connections to the high terminal or high sense on the PXIe-4135, discharge all components connected to the measurement path. Verify with a DMM before interaction with connections.

Safety Interlock System Integration

The PXIe-4135 includes a safety interlock circuit that places the outputs of the SMU in a safe state, regardless of the programmed state of the module.

- Do not short the safety interlock pins directly at the connector under any circumstances.
- Confirm on a regular basis that the safety interlock is functioning by performing a safety interlock test.
- Install mechanical detection switches that open the safety interlock circuit when the operator attempts to access the test fixture, disabling the hazardous voltage ranges of the instrument.
- Ensure the mechanical detection switches close the safety interlock circuit only when the operator has properly closed all entry points to the test fixture enclosure, enabling hazardous voltage ranges on the instrument.

Figure 1. System Level Connection, Typical



1. Safety Interlock Input
2. Safety Interlock Ground
3. Safety Interlock Pass Thru - Input
4. Safety Interlock Pass Thru - Ground

Safety Interlock

The safety interlock feature is designed to prevent users from coming in contact with hazardous voltage generated by the SMU in systems that implement protective barriers with controlled user access points.

Caution Hazardous voltages of up to the maximum voltage of the PXIe-4135 may appear at the output terminals if the safety interlock terminal is closed. Open the safety interlock terminal when the output connections are accessible. With the safety interlock terminal open, the output voltage level/limit is limited to ±40 V DC, and protection will be triggered if the voltage measured between the device HI and LO terminals exceeds ±(42 V peak ±0.4 V).

Attention Des tensions dangereuses allant jusqu'à la tension maximale du PXIe-4135 peuvent apparaître aux terminaux de sortie si le terminal de verrouillage de sécurité est fermé. Ouvrez le terminal de verrouillage de sécurité lorsque les connexions de sortie sont accessibles. Lorsque le terminal de verrouillage de sécurité est ouvert, le niveau ou la limite de tension de sortie est limité à ± 40 V CC, et la protection se déclenchera si la tension mesurée entre les terminaux HI et LO de l'appareil dépasse ± (42 Vpic ± 0,4 V).

Caution Do not apply voltage to the safety interlock connector inputs. The interlock connector is designed to accept passive, normally open contact closure connections only.

Attention N'appliquez pas de tension aux entrées du connecteur de verrouillage de sécurité. Le connecteur de verrouillage est conçu pour accepter uniquement des connexions à fermeture de contact passives, normalement ouvertes.

Safety interlock terminal open	
Output	<±42.4 V peak
Setpoint	<±40 V DC
Safety interlock terminal closed	
Output	Maximum voltage of the device
Setpoint	Maximum selected voltage range

EMC Guidelines

This product was tested and complies with the regulatory requirements and limits for electromagnetic compatibility (EMC) as stated in the product specifications. These requirements and limits are designed to provide reasonable protection against harmful interference when the product is operated in its intended operational electromagnetic environment.

This product is intended for use in commercial and light-industrial locations. However, harmful interference may occur in some installations, when the product is connected to a peripheral device or test object, or if the product is used in residential areas. To minimize interference with radio and television reception and prevent unacceptable performance degradation, install and use this product in strict accordance with the instructions in the product documentation.

Furthermore, any changes or modifications to the product not expressly approved by NI could void your authority to operate it under your local regulatory rules.

EMC Notices

Refer to the following notices for cables, accessories, and prevention measures necessary to ensure the specified EMC performance.

Notice For EMC declarations and certifications, and additional information, refer to the *Product Certifications and Declarations* section.

Notice Changes or modifications to the product not expressly approved by NI could void your authority to operate the product under your local regulatory rules.

Notice To ensure the specified EMC performance, operate this product only with shielded cables and accessories. Only twisted, shielded pair cable(i.e. Belden 83321E) should be used to connect the signals of the LO/Sense LO connector. Any compatible unshielded twisted-pair cable may be used for the safety interlock connector.

Notice The length of all I/O cables must be no longer than 3 m (10 ft).

Notice The performance of this product can be disrupted if subjected to Electrostatic Discharge (ESD) during operation. To prevent damage, industry-standard ESD prevention measures must be employed during installation, maintenance, and operation.

EMC Standards

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326-1 (IEC 61326-1): Class A emissions; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- AS/NZS CISPR 11: Group 1, Class A emissions

Note In Europe, Australia, and New Zealand (per CISPR 11) Class A equipment is intended for use in non-residential locations.

Note Group 1 equipment is any industrial, scientific, or medical equipment that does not intentionally generate radio frequency energy for the treatment of material or inspection/analysis purposes.

Note For EMC declarations, certifications, and additional information, refer to the Product Certifications and Declarations section.

Environmental Guidelines

Notice Failure to follow the mounting instructions in the product documentation can cause temperature derating.

Notice This product is intended for use in indoor applications only.

Notice Cover all empty slots using filler panels.

Environmental Characteristics

Temperature	
Operating	0 °C to 55 °C
Storage	-40 °C to 71 °C
Humidity	
Operating	10% to 90%, noncondensing
Storage	5% to 95%, noncondensing
Pollution Degree	2
Maximum altitude	2,000 m (800 mbar) (at 25 °C ambient temperature)
Shock and Vibration	
Operating vibration	5 Hz to 500 Hz, 0.3 g RMS
Non-operating vibration	5 Hz to 500 Hz, 2.4 g RMS
Operating shock	30 g, half-sine, 11 ms pulse

Environmental Standards

This product meets the requirements of the following environmental standards for electrical equipment.

- IEC 60068-2-1 Cold
- IEC 60068-2-2 Dry heat
- IEC 60068-2-78 Damp heat (steady state)
- IEC 60068-2-64 Random operating vibration
- IEC 60068-2-6 Sinusoidal operating vibration
- IEC 60068-2-27 Operating shock
- MIL-PRF-28800F
  - Low temperature limits for operation Class 3, for storage Class 3
  - High temperature limits for operation Class 2, for storage Class 3
  - Random vibration for non-operating Class 3
  - Shock for operating Class 2

Note To verify marine approval certification for a product, refer to the product label or visit *ni.com/certification* and search for the certificate.

Power Requirement

PXIe-4135 (40W)	3.0 A from the 3.3 V rail and 6.0 A from the 12 V rail
PXIe-4135 (20W)	2.5 A from the 3.3 V rail and 2.7 A from the 12 V rail

Physical

Dimensions	3U, one-slot, PXI Express/CompactPCI Express module 2.0 cm × 13.0 cm × 21.6 cm (0.8 in. × 5.1 in. × 8.5 in.)
Weight	
PXIe-4135 (20W)	419 g (14.8 oz)
PXIe-4135 (40W)	440 g (15.5 oz)
Front panel connectors	2 × 3 lug triaxial connectors, 1 × 4.08 mm (3 position) combicon

Export Compliance

This product is subject to control under the U.S. Export Administration Regulations (15 CFR Part 730 et. seq.) administered by the U.S. Department of Commerce's Bureau of Industry and Security (BIS) (*www.bis.doc.gov*) and other applicable U.S. export control laws and sanctions regulations. This product may also be subject to additional license requirements of other countries' regulations.

Additionally, this product may also require export licensing before being returned to NI. The issuance of a Return Material Authorization (RMA) by NI does not constitute export authorization. The user must comply with all applicable export laws prior to exporting or re-exporting this product. See *ni.com/legal/export-compliance* for more information and to request relevant import classification codes (e.g. HTS), export classification codes (e.g. ECCN), and other import/export data.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial to the environment and to NI customers.

For additional environmental information, refer to the *Commitment to the Environment* web page at *ni.com/environment*. This page contains the environmental regulations and directives with which NI complies, as well as other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers At the end of the product life cycle, all NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit *ni.com/environment/weee*.

电子信息产品污染控制管理办法（中国 RoHS）

NI 符合中国电子信息产品中限制使用某些有害物质指令(RoHS)。关于 NI 中国 RoHS 合规性信息，请登录 `ni.com/environment/rohs_china`。(For information about China RoHS compliance, go to `ni.com/environment/rohs_china`.)

Product Certifications and Declarations

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for NI products, visit *ni.com/product-certifications*, search by model number, and click the appropriate link.

NI Services

Visit *ni.com/support* to find support resources including documentation, downloads, and troubleshooting and application development self-help such as tutorials and examples.

Visit *ni.com/services* to learn about NI service offerings such as calibration options, repair, and replacement.

Visit *ni.com/register* to register your NI product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

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378460B-01 July 29, 2021