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# NI-9215 and sbRIO-9215 Specifications

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# NI-9215 and sbRIO-9215 Specifications

## Definitions

**Warranted** specifications describe the performance of a model under stated operating conditions and are covered by the model warranty.

**Characteristics** describe values that are relevant to the use of the model under stated operating conditions but are not covered by the model warranty.

- **Typical** specifications describe the performance met by a majority of models.
- **Nominal** specifications describe an attribute that is based on design, conformance testing, or supplemental testing.

Specifications are **Typical** unless otherwise noted.

### Related information:

- [Software Support for CompactRIO, CompactDAQ, Single-Board RIO, R Series, and EtherCAT](#)

## Conditions

Specifications are valid for the range -40 °C to 70 °C unless otherwise noted.

## Connector Types

The NI-9215 has more than one connector type: NI-9215 with screw terminal, NI-9215 with spring terminal, and NI-9215 with BNC. Unless the connector type is specified, NI-9215 refers to all connector types.

# Input Characteristics

|                                        |                                                                 |  |
|----------------------------------------|-----------------------------------------------------------------|--|
| Number of channels                     | 4 analog input channels                                         |  |
| ADC resolution                         | 16 bits                                                         |  |
| Type of ADC                            | Successive approximation register (SAR)                         |  |
| Input range                            | ±10.0 V                                                         |  |
| Input Voltage Ranges                   |                                                                 |  |
| Measurement Voltage, AI+ to AI-        |                                                                 |  |
| Minimum <sup>1</sup> (V)               | ±10.2                                                           |  |
| Typical (V)                            | ±10.4                                                           |  |
| Maximum (V)                            | ±10.6                                                           |  |
| Maximum Voltage (Signal + Common Mode) |                                                                 |  |
| NI-9215 with screw terminal            | Each channel must remain within ±10.2 V of common.              |  |
| NI-9215 with spring terminal           | Each channel must remain within ±10.2 V of common.              |  |
| NI-9215 with BNC                       | All inputs must remain within 10.2 V of the average AI- inputs. |  |

1. The minimum measurement voltage range is the largest voltage the NI-9215 is guaranteed to accurately measure.

|                         |        |
|-------------------------|--------|
| Overvoltage protection  | ±30 V  |
| <b>Conversion time</b>  |        |
| Channel 0 only          | 4.4 μs |
| Channels 0 and 1        | 6 μs   |
| Channels 0, 1, and 2    | 8 μs   |
| Channels 0, 1, 2, and 3 | 10 μs  |

**Table 1. Accuracy**

| Measurement Conditions    |                           | Percent of Reading<br>(Gain Error) | Percent of<br>Range <sup>2</sup><br>(Offset Error) |
|---------------------------|---------------------------|------------------------------------|----------------------------------------------------|
| Calibrated                | Maximum (-40 °C to 70 °C) | 0.2%                               | 0.082%                                             |
|                           | Typical (23 °C ±5 °C)     | 0.02%                              | 0.014%                                             |
| Uncalibrated <sup>3</sup> | Maximum (-40 °C to 70 °C) | 1.05%                              | 0.82%                                              |
|                           | Typical (23 °C ±5 °C)     | 0.6%                               | 0.38%                                              |

|                  |           |
|------------------|-----------|
| <b>Stability</b> |           |
| Gain drift       | 10 ppm/°C |
| Offset drift     | 60 μV/°C  |

2. Range equals ±10.4 V.

3. Uncalibrated accuracy refers to the accuracy achieved when acquiring in raw or unscaled modes where the calibration constants stored in the module are not applied to the data.

|                                                  |                        |
|--------------------------------------------------|------------------------|
| CMRR ( $f_{in} = 60 \text{ Hz}$ )                | 73 dB min              |
| Input bandwidth (-3 dB)                          | 420 kHz minimum        |
| <b>Input impedance</b>                           |                        |
| <b>Resistance</b>                                |                        |
| NI-9215 with screw terminal (AI-to-COM)          | 1 G $\Omega$           |
| NI-9215 with spring terminal (AI-to-COM)         | 1 G $\Omega$           |
| NI-9215 with BNC (Between any two AI- terminals) | 200 k $\Omega$         |
| Input bias current                               | 10 nA                  |
| <b>Input noise</b>                               |                        |
| RMS                                              | 1.2 LSB <sub>rms</sub> |
| Peak-to-peak                                     | 7 LSB                  |
| Crosstalk                                        | -80 dB                 |
| <b>Settling time (to 2 LSBs)</b>                 |                        |
| <b>NI-9215 with screw terminal</b>               |                        |
| 10 V step                                        | 10 $\mu\text{s}$       |

|                                     |                                                                                          |
|-------------------------------------|------------------------------------------------------------------------------------------|
| 20 V step                           | 15 $\mu$ s                                                                               |
| <b>NI-9215 with spring terminal</b> |                                                                                          |
| 10 V step                           | 10 $\mu$ s                                                                               |
| 20 V step                           | 15 $\mu$ s                                                                               |
| <b>NI-9215 with BNC</b>             |                                                                                          |
| 10 V step                           | 25 $\mu$ s                                                                               |
| 20 V step                           | 35 $\mu$ s                                                                               |
| No missing codes                    | 15 bits guaranteed                                                                       |
| DNL                                 | -1.9 to 2 LSB                                                                            |
| INL                                 | $\pm$ 6 LSB maximum                                                                      |
| MTBF                                | 1,167,174 hours at 25 °C; Bellcore Issue 6, Method 1, Case 3, Limited Part Stress Method |

## Power Requirements

|                                                                    |                |
|--------------------------------------------------------------------|----------------|
| <b>Power consumption from chassis (full-scale input, 100 kS/s)</b> |                |
| Active mode                                                        | 560 mW maximum |

|                                       |                    |
|---------------------------------------|--------------------|
| Sleep mode                            | 25 $\mu$ W maximum |
| <b>Thermal dissipation (at 70 °C)</b> |                    |
| Active mode                           | 560 mW maximum     |
| Sleep mode                            | 25 $\mu$ W maximum |

## Physical Characteristics

|                               |                                                                                     |
|-------------------------------|-------------------------------------------------------------------------------------|
| <b>Screw-terminal wiring</b>  |                                                                                     |
| Gauge                         | 0.2 mm <sup>2</sup> to 2.5 mm <sup>2</sup> (26 AWG to 14 AWG) copper conductor wire |
| Wire strip length             | 13 mm (0.51 in.) of insulation stripped from the end                                |
| Temperature rating            | 90 °C minimum                                                                       |
| Torque for screw terminals    | 0.5 N · m to 0.6 N · m (4.4 lb · in to 5.3 lb · in)                                 |
| Wires per screw terminal      | One wire per screw terminal; two wires per screw terminal using a 2-wire ferrule    |
| Ferrules                      | 0.25 mm <sup>2</sup> to 2.5 mm <sup>2</sup>                                         |
| <b>Spring-terminal wiring</b> |                                                                                     |

|                              |                                                                                     |                           |
|------------------------------|-------------------------------------------------------------------------------------|---------------------------|
| Gauge                        | 0.2 mm <sup>2</sup> to 2.5 mm <sup>2</sup> (24 AWG to 12 AWG) copper conductor wire |                           |
| Wire strip length            | 10 mm (0.39 in.) of insulation stripped from the end                                |                           |
| Temperature rating           | 90 °C minimum                                                                       |                           |
| Wires per screw terminal     | One wire per spring terminal; two wires per spring terminal using a 2-wire ferrule  |                           |
| Ferrules                     | 0.25 mm <sup>2</sup> to 2.5 mm <sup>2</sup>                                         |                           |
| Connector securement         |                                                                                     |                           |
| Securement type              |                                                                                     | Screw flanges provided    |
| Torque for jackscrews        |                                                                                     | 0.2 N · m (1.80 lb · in.) |
| Weight                       |                                                                                     |                           |
| Dimensions                   | Visit <b><i>ni.com/dimensions</i></b> and search by module number.                  |                           |
| NI-9215 with screw terminal  | 150 g (5.3 oz)                                                                      |                           |
| NI-9215 with spring terminal | 138 g (4.9 oz)                                                                      |                           |
| NI-9215 with BNC             | 173 g (6.1 oz)                                                                      |                           |

# NI-9215 with Screw Terminal and NI-9215 with Spring Terminal Safety Voltages

Connect only voltages that are within the following limits.

|                                |                                                          |               |
|--------------------------------|----------------------------------------------------------|---------------|
| Channel-to-COM                 |                                                          | ±30 V maximum |
| <b>Isolation</b>               |                                                          |               |
| Channel-to-channel             |                                                          | None          |
| <b>Channel-to-earth ground</b> |                                                          |               |
| Continuous                     | 250 V RMS, Measurement Category II                       |               |
| Withstand                      | 2,300 V RMS, verified by a 5 s dielectric withstand test |               |

## Measurement Category II



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



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

Measurement 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.

## NI-9215 with BNC Safety Voltages

Connect only voltages that are within the following limits.

|                         |                                                          |  |
|-------------------------|----------------------------------------------------------|--|
| AI+-to-AI-              | ±30 V maximum                                            |  |
| Isolation               |                                                          |  |
| Channel-to-channel      | None                                                     |  |
| Channel-to-earth ground |                                                          |  |
| Continuous              | 60 V DC, Measurement Category I                          |  |
| Withstand               | 1,500 V RMS, verified by a 5 s dielectric withstand test |  |

### Measurement Category I



**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.

## Environmental Characteristics

| Temperature |                                 |
|-------------|---------------------------------|
| Operating   | -40 °C to 70 °C                 |
| Storage     | -40 °C to 85 °C                 |
| Humidity    |                                 |
| Operating   | 10% RH to 90% RH, noncondensing |

|                     |                                                                          |  |
|---------------------|--------------------------------------------------------------------------|--|
| Storage             | 5% RH to 95% RH, noncondensing                                           |  |
| Ingress protection  | IP40                                                                     |  |
| Pollution Degree    | 2                                                                        |  |
| Maximum altitude    | 2,000 m                                                                  |  |
| Shock and Vibration |                                                                          |  |
| Operating vibration |                                                                          |  |
| Random              | 5 g RMS, 10 Hz to 500 Hz                                                 |  |
| Sinusoidal          | 5 g, 10 Hz to 500 Hz                                                     |  |
| Operating shock     | 30 g, 11 ms half sine; 50 g, 3 ms half sine; 18 shocks at 6 orientations |  |

To meet these shock and vibration specifications, you must panel mount the system.

## Calibration

You can obtain the calibration certificate and information about calibration services for the NI-9215 at [ni.com/calibration](https://ni.com/calibration).

|                      |        |
|----------------------|--------|
| Calibration interval | 1 year |
|----------------------|--------|