NI-9239 Specifications

Ihr NI-Partner:

AMC – Analytik & Messtechnik GmbH Chemnitz

Heinrich-Lorenz-Str. 55
09120 Chemnitz
E-Mail: info@amc-systeme.de

Tel.: +49/371/38388-0
Fax: +49/371/38388-99
Web: www.amc-systeme.de

Integration Partner

SYSTEM INTEGRATOR

Contents

NI-9239 Specifications. 3

NI-9239 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

The following specifications are typical for the range -40 °C to 70 °C unless otherwise noted. All voltages are relative to the AI- signal on each channel unless otherwise noted.

Connector Types

The NI-9239 has more than one connector type: NI-9239 with screw terminal and NI-9239 with BNC. Unless the connector type is specified, NI-9239 refers to both connector types.

NI-9239 with Screw Terminal Safety Voltages

Connect only voltages that are within the following limits:

Isolation	
Channel-to-channel	
Continuous	250 V RMS, Measurement Category II
Withstand	1,390 V, verified by a 5 s dielectric withstand test
Channel-to-earth ground	
Continuous	250 V RMS, Measurement Category II
Withstand	2,300 V, verified by a 5 s dielectric withstand test
Explosive atmospheres	
Channel-to-channel	60 V DC, Measurement Category I
Channel-to-earth ground	60 V DC, Measurement Category I

Measurement Categories

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.

Measurement Category II

> **Caution** If using in explosive atmospheres, do not connect the NI-9239 with screw terminal to signals or use for measurements within Measurement Categories II, III, or IV.

> **Attention** En cas d'utilisation en atmosphère explosive, 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.

> **Caution** Do not connect the NI-9239 with screw terminal 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-9239 with BNC Safety Voltages

Connect only voltages that are within the following limits:

Isolation	
Channel-to-channel	
Continuous	60 V DC, Measurement Category I
Withstand	1,000 V, verified by a 5 s dielectric withstand test

Channel-to-earth ground	
Continuous	60 V DC, Measurement Category I
Withstand	1,000 V, verified by a 5 s dielectric withstand test

Measurement Category I

Caution Do not connect the NI-9239 with BNC 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 NI-9239 with BNC 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	
NI-9239 with screw terminal	2,000 m
NI-9239 with BNC	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.

Power Requirements

Power consumption from chassis	
Active mode	
NI-9239 with screw terminal	740 mW maximum
NI-9239 with BNC	800 mW maximum
Sleep mode	25 µW maximum

Thermal dissipation	
Active mode	
NI-9239 with screw terminal	760 mW maximum
NI-9239 with BNC	820 mW maximum
Sleep mode	16 mW maximum

Physical Characteristics

Dimensions	Visit ni.com/dimensions and search by module number.
Weight	
NI-9239 with screw terminal	147 g (5.2 oz.)
NI-9239 with BNC	169 g (6.0 oz.)
Screw-terminal wiring	
Gauge	0.05 mm to 1.5 mm (30 AWG to 14 AWG) copper conductor wire
Wire strip length	6 mm (0.24 in.) of insulation stripped from the end
Temperature rating	90 °C, minimum
Torque for screw terminals	0.22 N · m to 0.25 N · m (1.95 lb · in. to 2.21 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 to 1.5 mm
Connector securement	
Securement type	Screw flanges provided
Torque for screw flanges	0.2 N · m (1.80 lb · in.)

Input Characteristics

Number of channels	4 analog input channels
ADC resolution	24 bits
Type of ADC	Delta-Sigma (with analog prefiltering)
Sampling mode	Simultaneous
Internal master timebase (f_M)	
Frequency	12.8 MHz
Accuracy	±100 ppm maximum
Data rate range (f_S) using internal master timebase	
Minimum	1.613 kS/s
Maximum	50 kS/s
Data rate range (f_S) using external master timebase	
Minimum	390.625 S/s
Maximum	51.2 kS/s

Figure 1. Data Rates (f_S)

$$\frac{f_M \div 256}{n}, n = 1, 2, \ldots, 31$$

Input voltage ranges (AI+ to AI-)	
Nominal	±10 V
Typical	±10.52 V
Minimum	±10.3 V
Overvoltage protection	±100 V
Input coupling	DC
Input impedance (AI+ to AI-)	1 MΩ

Table 1. NI-9239 Accuracy

Measurement Conditions		Percent of Reading (Gain Error)	Percent of Range (Offset Error)
Calibrated	Typical (25 °C, ±5 °C)	±0.03%	±0.008%
	Maximum (-40 °C to 70 °C)	±0.13%	±0.06%
Uncalibrated	Typical (25 °C, ±5 °C)	±0.3%	±0.11%
	Maximum (-40 °C to 70 °C)	±1.4%	±0.70%

Input noise	70 µVrms
Stability	
Gain drift	±5 ppm/°C
Offset drift	±26 µV/°C

Post-calibration gain match (channel-to-channel, 20 kHz)	0.22 dB maximum
Phase mismatch	
Channel-to-channel	0.075°/kHz maximum
Module-to-module	$(0.075°/kHz \cdot f_{in}) + (360° \cdot f_{in}/f_M)$
Phase nonlinearity (f_S = 50 kS/s)	0.11° maximum

Figure 2. Input delay

$$40 + \frac{5}{512} / f_s + 3.3\ \mu s$$

Passband	
Frequency	$0.453 \cdot f_S$
Flatness (f_S = 50 kS/s)	±100 mdB maximum
Stopband	
Frequency	$0.547 \cdot f_S$
Rejection	100 dB
Alias-free bandwidth	$0.453 \cdot f_S$
-3 dB prefilter bandwidth (f_S = 50 kS/s)	24.56 kHz
Crosstalk (1 kHz)	-130 dB
CMRR (f_{in} = 60 Hz)	126 dB
SFDR (1 kHz, -60 dBFS)	128 dBFS

Total Harmonic Distortion (THD)	
1 kHz, -1 dBFS	-99 dB
1 kHz, -20 dBFS	-105 dB
MTBF	
NI-9239 with screw terminal	662,484 hours at 25 °C; Bellcore Issue 6, Method 1, Case 3, Limited Part Stress Method
NI-9239 with BNC	864,132 hours at 25 °C; Bellcore Issue 6, Method 1, Case 3, Limited Part Stress Method

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