
NI-9401 and sbRIO-9401 Specifications

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In this document, NI-9401 and sbRIO-9401 are referred to inclusively as NI-9401.

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. All voltages are relative to COM unless otherwise noted.

Input/Output Characteristics

Number of channels	8 DIO channels
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Default power-on line direction	Input	
Input/output type	TTL, single-ended	
Digital logic levels		
Input		
Voltage	5.25 V maximum	
High, V_{IH}	2 V minimum	
Low, V_{IL}	0.8 V maximum	
Output High, V_{OH} (5.25 V maximum)		
Sourcing 100 μ A	4.7 V minimum	
Sourcing 2 mA	4.3 V minimum	
Output Low, V_{OL}		
Sinking 100 μ A	0.1 V maximum	
Sinking 2 mA	0.4 V maximum	
Maximum signal switching frequency, per channel		
Input		
8 input channels	9 MHz	

4 input channels	16 MHz
2 input channels	30 MHz
Output¹	
8 output channels	5 MHz
4 output channels	10 MHz
2 output channels	20 MHz
I/O propagation delay	100 ns maximum
I/O pulse width distortion	10 ns
Input current ($0\text{ V} \leq V_{IN} \leq 4.5\text{ V}$)	$\pm 250\ \mu\text{A}$
Input capacitance	30 pF
Input rise/fall time	500 ns maximum
Overvoltage protection, channel-to-COM ²	$\pm 30\text{ V}$ maximum on one channel at a time

1. By number of output channels with an output load of 1 mA, 50 pF
2. Continued use at this level will degrade the life of the module.

MTBF	1,244,763 hours at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method
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Safety Voltages

Connect only voltages that are within the following limits:

Maximum voltage³	
Channel-to-COM	±30 V maximum on one channel at a time, Measurement Category I
Isolation voltages	
Channel-to-channel	None
Channel-to-earth ground	
Continuous	60 V DC, Measurement Category I
Withstand	1,000 V RMS, verified by a 5 s dielectric withstand test

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.

- The maximum voltage that can be applied or output between any channel and COM without damaging the module or other devices.



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

Power Requirements

Power consumption from chassis	
Active mode	580 mW maximum
Sleep mode	1 mW maximum
Thermal dissipation (at 70 °C)	
Active mode	580 mW maximum
Sleep mode	1 mW maximum

Physical Characteristics

Dimensions	Visit ni.com/dimensions and search by module number.
Weight	145 g (5.1 oz)