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# NI-9401 and sbRIO-9401 Specifications

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## NI-9401 and sbRIO-9401 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.

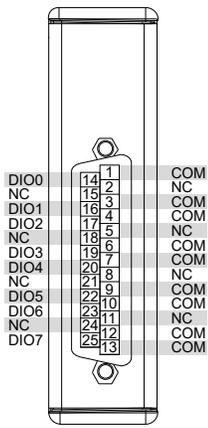
#### Related information:

- [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. All voltages are relative to COM unless otherwise noted.

### NI-9401 Pinout



**Table 1.** Signal Descriptions

| Signal | Description                                    |
|--------|--|
| COM    | Common reference connection to isolated ground |
| DIO    | Digital input/output signal connection         |
| NC     | No connection                                  |

## Input/Output Characteristics

|                                 |                   |
|---------------------------------|-------------------|
| Number of channels              | 8 DIO channels    |
| Default power-on line direction | Input             |
| Input/output type               | TTL, single-ended |
| <b>Digital logic levels</b>     |                   |
| <b>Input</b>                    |                   |
| Voltage                         | 5.25 V maximum    |

|  |               |  |
|--|---------------|--|
| High, $V_{IH}$   | 2 V minimum   |  |
| Low, $V_{IL}$  | 0.8 V maximum |  |
| <b>Output High, <math>V_{OH}</math> (5.25 V maximum)</b> |               |  |
| Sourcing 100 $\mu$ A                                     | 4.7 V minimum |  |
| Sourcing 2 mA  | 4.3 V minimum |  |
| <b>Output Low, <math>V_{OL}</math></b>                   |               |  |
| Sinking 100 $\mu$ A                                      | 0.1 V maximum |  |
| Sinking 2 mA   | 0.4 V maximum |  |
| <b>Maximum signal switching frequency, per channel</b>   |               |  |
| <b>Input</b>   |               |  |
| 8 input channels   | 9 MHz         |  |
| 4 input channels   | 16 MHz        |  |
| 2 input channels   | 30 MHz        |  |
| <b>Output<sup>1</sup></b>                                |               |  |
| 8 output channels  | 5 MHz         |  |

1. By number of output channels with an output load of 1 mA, 50 pF

|  |  |
|--|--|
| 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 <sup>2</sup>          | $\pm 30\text{ V}$ maximum on one channel at a time                                       |
| MTBF   | 1,244,763 hours at 25 °C; Bellcore Issue 2, Method 1, Case 3, Limited Part Stress Method |

## Safety Voltages

Connect only voltages that are within the following limits:

**Maximum voltage<sup>3</sup>**

- Continued use at this level will degrade the life of the module.
- The maximum voltage that can be applied or output between any channel and COM without damaging the module or other devices.

|                                |  |  |
|--------------------------------|--|--|
| Channel-to-COM                 | ±30 V maximum on one channel at a time, Measurement Category I |  |
| <b>Isolation voltages</b>      |  |  |
| Channel-to-channel             | None   |  |
| <b>Channel-to-earth ground</b> |  |  |
| 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.



**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.

## Power Requirements

| Power consumption from chassis |                |
|--------------------------------|----------------|
| Active mode                    | 580 mW maximum |

|                                       |                |
|---------------------------------------|----------------|
| Sleep mode                            | 1 mW maximum   |
| <b>Thermal dissipation (at 70 °C)</b> |                |
| Active mode                           | 580 mW maximum |
| Sleep mode                            | 1 mW maximum   |

## Physical Characteristics

|            |  |
|------------|--|
| Dimensions | Visit <a href="https://ni.com/dimensions">ni.com/dimensions</a> and search by module number. |
| Weight     | 145 g (5.1 oz)   |