DEVICE SPECIFICATIONS

NI 2813

1 A Matrix Card for the NI SwitchBlock

This document lists specifications for the NI 2813A/B matrix relay card. All specifications are subject to change without notice. Visit *ni.com/manuals* for the most current specifications. Refer to the *NI Switches Help* for detailed topology information.

Topology.....2-wire 4 × 21 matrix

Contents

About These Specifications

Specifications characterize the warranted performance of the instrument under the stated operating conditions.

NATIONAL INSTRUMENTS

Typical Specifications are specifications met by the majority of the instrument under the stated operating conditions and are tested at 23 °C ambient temperature. Typical specifications are not warranted.

All voltages are specified in DC, AC_{pk}, or a combination unless otherwise specified.

Clean devices and terminal blocks by brushing off light dust with a soft, nonmetallic brush. Remove other contaminants with a soft, lint-free, dampened cloth. Do not use detergent or chemical solvents. The unit must be completely dry and free from contaminants before returning to service.

Cautions

Caution This module is rated for Measurement Category I and intended to carry signal voltages no greater than 100 V_{rms}/150 V_{pk}/150 VDC. This module can withstand up to 800 V impulse voltage. Do not use this module for connection to signals or for measurements within Categories II, III, or IV. Do not connect to MAINS supply circuits (for example, wall outlets) of 115 VAC or 230 VAC. Refer to the *Read Me First: Safety and Electromagnetic Compatibility* document for more information on measurement categories.

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

Caution In systems that include cards with different maximum voltages, the lowest safety voltage rating as specified on the front of the card applies for the entire system. The system can include all cards in the carrier, and all cards in other carriers that are connected with the NI 2806 expansion bridge.

Caution When hazardous voltages (>42.4 V_{pk}/60 VDC) are present on any channel, safety low-voltage (≤42.4 V_{pk}/60 VDC) cannot be connected to any other channel.

Caution Refer to the *Read Me First: Safety and Electromagnetic Compatibility* document for important safety and electromagnetic compatibility information. To obtain a copy of this document online, visit *ni.com/manuals*, and search for the document title.

Caution To ensure the specified EMC performance, operate this product only with shielded cables and accessories.

Caution The protection provided by the NI 2813A/B can be impaired if it is used in a manner not described in this document.

Caution Always disconnect or turn off power sources before powering on a chassis.

Input Characteristics

Maximum switching voltage

- Row/column-to-ground.....150 V, CAT I
- Row-to-column.....150 V

Maximum switching current.....1.0 A (per channel)

Maximum carry current.....1.0 A (per channel)

Maximum switching power

- Per channel.....20 W
- Per crosspoint.....20 W

DC path resistance

- Initial.....<1 Ω
- End-of-life.....≥2 Ω
- Open channel.....>1 × 10^9 Ω

Note DC path resistance typically remains low for the life of the relay. At the end of relay life, the path resistance rises rapidly above the specified value. Load ratings apply to relays used within the specification before the end of relay life.

Thermal EMF, typical.....<150 μV

Bandwidth, typical (-3 dB, 50 Ω termination, column-row-column).....≥8 MHz

Crosstalk, typical (50 Ω termination) channel-to-channel

- 10 kHz.....<-70 dB
- 100 kHz.....<-55 dB
- 1 MHz.....<-35 dB

Isolation, typical (50 Ω termination) open channel

- 10 kHz.....>70 dB
- 100 kHz.....>55 dB
- 1 MHz.....>35 dB

Analog bus line connections.....AB <0...7> (8 lines)

Dynamic Characteristics

Simultaneous drive limit[1].....176 relays

Relay operate/release time
(simultaneous relays), typical[2]

Up to 8 relays.....<1 ms

Up to 50 relays.....<2 ms

Expected relay life, mechanical.....1×10^9 cycles
(no load)

Expected relay life, electrical
(resistive, <10 pF load)

10 V,100 mA.....1×10^8 cycles

20 V, 500 mA.....1×10^7 cycles

20 V, 1 A.....4×10^6 cycles

100 V, 10 mA.....1×10^6 cycles

Note Optional 100 Ω series protection resistance, available for the interface cable, increases the expected relay life at higher voltages by protecting the reed relays from the effects of cable and load capacitance. For more information about increasing the life of your relay, visit *ni.com/info* and enter the Info Code `relaylifetime`.

Note Reed relays are highly susceptible to damage caused by switching capacitive and inductive loads. Capacitive loads can cause high inrush currents, and inductive loads can cause high flyback voltages. The addition of appropriate protection can greatly improve contact lifetime. For more information about adding protection circuitry to a capacitive load, visit *ni.com/info* and enter the Info Code `relaylifetime`. For information about inductive loads, enter the Info Code `relayflyback`.

Related Information

Certain applications may require additional time for proper settling. Refer to the NI Switches Help for information about including additional settling time.

Power

Power consumption per relay.....50 mW

Power consumption limit[3].....8.8 W

[1] The overall carrier drive limit prevents simultaneous drive of relays under the card limit on some cards in some configurations. Refer to the *NI 2800 Specifications* for information about carrier drive limit.

[2] Relay operate and release times depend on PC and PXI bus performance and application software. For more information about NI SwitchBlock relay operate times, visit *ni.com/info* and enter the Info Code `exa9ee`.

Power dissipation limit

Card.....8.8 W

Carrier.....8.8 W

Physical Characteristics

Relay type.....Reed

Relay contact material.....Iridium

I/O connectors.....96 position, plastic SCSI

Power requirement, carrier.....20 W at 5 V, 5 W at 3.3 V

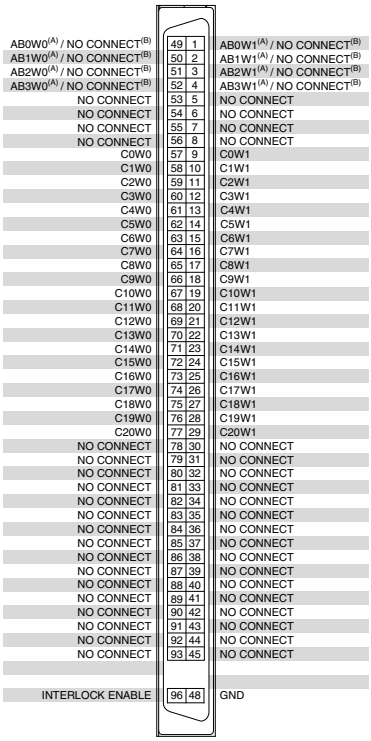
Dimensions (L × W × H).....11.2 cm × 1.2 cm × 17.1 cm (4.4 in. × 0.5 in. × 6.7 in.)

Weight.....240 g (8.5 oz)

[3] For more information about NI SwitchBlock power limits, visit *ni.com/info* and enter the Info Code `sbpwrlim`.

Connector Pinout

Figure 1. NI 2813A/B Connector Pinout



Related Information

For topology-specific connection information, refer to your device in the NI Switches Help and the installation instructions for any associated accessories or terminal blocks.

Accessories

Refer to *ni.com* for more information about the following accessories.

Caution Use only NI cables. Cables with metal connectors might expose the user to hazardous voltages.

Note To ensure the specified EMC performance, operate this product only with shielded cables and accessories. Do not use unshielded cables or accessories unless they are installed in a shielded enclosure with properly designed and shielded input/output ports and are connected to the NI product using a shielded cable. If

unshielded cables or accessories are not properly installed and shielded, the EMC specifications for the product are no longer guaranteed.

Table 1. NI Accessories for the NI 2813A/B

Accessory	Part number
SH96F-96M-NI SwitchBlock Cable	150275-01
SH96F-96M-RES-NI SwitchBlock Cable with 100 Ω resistance	150579-01
NI TBX-2809 Screw Terminal Accessory (unshielded)	781420-09

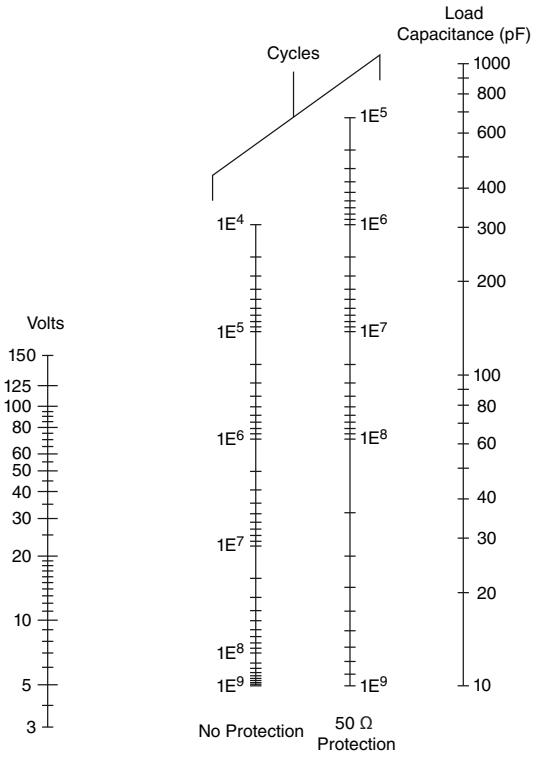
Reed Relay Life

Reed Relay Life Nomograph

The following figure shows the reed relay lifetime nomograph. The purpose of this graph is to estimate reed relay lifetime.

Note This nomograph is not meant to be an exact or guaranteed specification and should only be used as a guideline to estimate lifetime. Actual reed relay lifetimes may vary, depending on application.

Figure 2. Reed Relay Lifetime Nomograph



Estimating Reed Relay Life

Complete the following steps to estimate relay lifetimes using the nomograph:

1. Determine the peak voltage experienced across the relay while switching and mark this value on the *Volts* line.
2. Determine the sum of the DUT, cable, and instrumentation capacitances and mark this value on the *Load Capacitance* line.
3. Draw a straight line between both values.

   The intersection points of this line and the *No Protection* and *50 Ω Protection* axes are the corresponding estimated relay lifetimes in cycles.

Related Information

For more information on adding protection resistance, visit ni.com/info and enter the Info Code relaylifetime.

Estimating Reed Relay Life Example

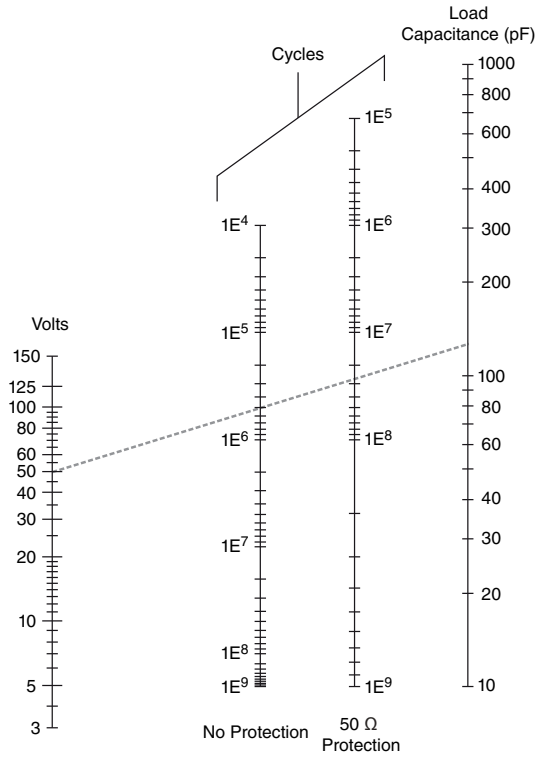
The reed relay module is connected to a DMM through 1 meter of cable. The DMM and cable capacitances are 100 pF and 30 pF respectively. The maximum voltage switched across the relay is 50 V. Determine the estimated number of relay cycles with and without protection resistance.

Estimating Reed Relay Life Solution

The total load capacitance is the sum of the cable and DMM capacitance, which is 130 pF. Draw a line between the 50 V point on the *Volts* axis and 130 pF on the *Load Capacitance* axis.

The line drawn intersects the *Cycles* axes at approximately 500,000 on the *No Protection* axis and about 25,000,000 on the *50 Ω Protection* axis (refer to the following figure). This series resistance should be placed as close as possible to the relay for maximum effect.

Figure 3. Reed Relay Life Nomograph Solution



Environment

Maximum altitude.....2,000 m (at 25 °C ambient temperature)

Pollution Degree.....2

Indoor use only.

Operating Environment

Ambient temperature range.....0 °C to 55 °C (Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.)

Relative humidity range.....10% to 90%, noncondensing (Tested in accordance with IEC-60068-2-56.)

Storage Environment

Ambient temperature range.....-20 °C to 70 °C (Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.)

Relative humidity range.....5% to 95%, noncondensing (Tested in accordance with IEC-60068-2-56.)

Operational shock.....30 g peak, half-sine, 11 ms pulse (Tested in accordance with IEC-60068-2-27. Test profile developed in accordance with MIL-PRF-28800F.)

Random vibration

- Operating.....5 Hz to 500 Hz, 0.3 g_{rms}
- Nonoperating.....5 Hz to 500 Hz, 2.4 g_{rms} (Tested in accordance with IEC-60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.)

Compliance and Certifications

Safety

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 61010-1

Note For UL and other safety certifications, refer to the product label or the *Online Product Certification* section.

Electromagnetic Compatibility

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
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions

Note In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia, and New Zealand (per CISPR 11), Class A equipment is intended for use only in heavy-industrial locations.

Note Group 1 equipment (per CISPR 11) 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 *Online Product Certification* section.

CE Compliance CE

This product meets the essential requirements of applicable European Directives, as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

Online Product Certification

To obtain product certifications and the DoC for this product, visit *ni.com/certification*, search by model number or product line, and click the appropriate link in the Certification column.

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 not only to the environment but also to NI customers.

For additional environmental information, refer to the *Minimize Our Environmental Impact* 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 products must be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste Electrical and Electronic Equipment, visit *ni.com/environment/weee.htm*.

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