DEVICE SPECIFICATIONS

NI 2816

0.3 A Matrix Card for NI SwitchBlock

This document lists specifications for the NI 2816A/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...1-wire 8 × 46 matrix

Contents

About These Specifications

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

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.

NATIONAL INSTRUMENTS™

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 70 V_{rms}/100 V_{pk}/100 VDC. This module can withstand up to 500 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 2816A/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............................100 V, CAT I

    Row-to-column...100 VDC/70 VAC

Maximum switching current.............................0.25 A (per channel)

Maximum carry current....................................0.3 A (per channel)

Maximum switching power

    Per channel...3 W

    Per crosspoint...3 W

DC path resistance

    Initial...$<1\ \Omega$

    End-of-life..$\geq 2\ \Omega$

    Open channel...$>1 \times 10^9\ \Omega$

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.......................................$<50\ \mu V$

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

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

    10 kHz..<-60 dB

    100 kHz..<-50 dB

    1 MHz...<-30 dB

Isolation, typical (50 Ω termination) open
channel

    10 kHz..>65 dB

    100 kHz..>50 dB

    1 MHz...>30 dB

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

Related Information

Peak Switching Voltage Versus Current on page 4

Peak Switching Voltage Versus Current

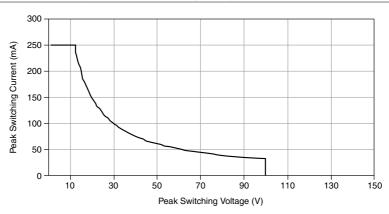The following figure shows the peak switching voltage in relation to the peak switching current.

Figure 1. Peak Switching Voltage Versus Current

Dynamic Characteristics

Simultaneous drive limit[1].................................61 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.........................2.5×10^8 cycles
(no load)

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[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`.

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

    5 V, 10 mA...1×10^9 cycles

    10 V, 100 mA..4×10^6 cycles

    100 V, 10 mA...5×10^5 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.

Relays are field replaceable. Refer to the NI Switches Help for information about replacing failed relays.

Power

Power consumption per relay.............................63 mW

Power consumption limit[3].................................3.9 W

Power dissipation limit

    Card...3.9 W

    Carrier...3.9 W

Physical Characteristics

Relay type..Reed

Relay contact material..Ruthenium

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

I/O connectors..96 position, plastic SCSI

Power requirement, carrier..................................10 W at 5 V, 2 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...320 g (11.3 oz)

Connector Pinout

Figure 2. NI 2816A/B Connector Pinout

Left signal	Left pin	Right pin	Right signal
AB0[(A)] / NO CONNECT[(B)]	49	1	AB1[(A)] / NO CONNECT[(B)]
AB2[(A)] / NO CONNECT[(B)]	50	2	AB3[(A)] / NO CONNECT[(B)]
AB4[(A)] / NO CONNECT[(B)]	51	3	AB5[(A)] / NO CONNECT[(B)]
AB6[(A)] / NO CONNECT[(B)]	52	4	AB7[(A)] / NO CONNECT[(B)]
C0	53	5	C1
C2	54	6	C3
C4	55	7	C5
C6	56	8	C7
C8	57	9	C9
C10	58	10	C11
C12	59	11	C13
C14	60	12	C15
C16	61	13	C17
C18	62	14	C19
C20	63	15	C21
C22	64	16	C23
C24	65	17	C25
C26	66	18	C27
C28	67	19	C29
C30	68	20	C31
C32	69	21	C33
C34	70	22	C35
C36	71	23	C37
C38	72	24	C39
C40	73	25	C41
C42	74	26	C43
C44	75	27	C45
NO CONNECT	76	28	NO CONNECT
NO CONNECT	77	29	NO CONNECT
NO CONNECT	78	30	NO CONNECT
NO CONNECT	79	31	NO CONNECT
NO CONNECT	80	32	NO CONNECT
NO CONNECT	81	33	NO CONNECT
NO CONNECT	82	34	NO CONNECT
NO CONNECT	83	35	NO CONNECT
NO CONNECT	84	36	NO CONNECT
NO CONNECT	85	37	NO CONNECT
NO CONNECT	86	38	NO CONNECT
NO CONNECT	87	39	NO CONNECT
NO CONNECT	88	40	NO CONNECT
NO CONNECT	89	41	NO CONNECT
NO CONNECT	90	42	NO CONNECT
NO CONNECT	91	43	NO CONNECT
NO CONNECT	92	44	NO CONNECT
NO CONNECT	93	45	NO CONNECT
INTERLOCK ENABLE	96	48	GND

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 2816A/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

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 $C \epsilon$

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*.

电子信息产品污染控制管理办法（中国 RoHS）

中国客户   National Instruments 符合中国电子信息产品中限制使用某些有害物质指令（RoHS）。关于 National Instruments 中国 RoHS 合规性信息，请登录 ni.com/environment/rohs_china。（For information about China RoHS compliance, go to ni.com/environment/rohs_china.）