

24-Channel Low-Voltage Multiplexer/Matrix

NI PXI-2501, NI PXI-2503

- Configuration determined by terminal block
- 48x1 (1-wire), 24x1 (2-wire), and 12x1 (4-wire) configurations
- 4x6 2-wire matrix
- 1,024-step scanlist for deterministic scanning
- Fully software programmable

NI PXI-2501

- NI FET switches
- Up to +10 VDC capacity
- 250,000 operations/s max

NI PXI-2503

- Electromechanical relay
- Up to ±60 VDC/30 V_{rms}
- Up to 1A switching
- 100 operations/s

Operating Systems

- Windows 2000/NT/XP

Recommended Software

- LabVIEW
- LabVIEW Real-Time Module
- LabWindows/CVI
- Measurement Studio
- NI Switch Executive

Other Compatible Software

- Visual Basic
- C/C++

Driver Software (included)

- NI-SWITCH

Compliance

- CE



Overview

The National Instruments PXI-2501 and PXI-2503 are multiplexer and matrix switch modules for use in automated measurements. The NI PXI-2501 is ideal for applications that require high-speed scanning of short voltage signals (± 10 V) because it uses FET switches with very short settling times (30 μ s). Its fast scanning speeds also make it a highly effective solution for expanding the number of channels for a DAQ device. The PXI-2503 routes signals up to 60 VDC or 30 V_{rms}. For low-voltage sources, such as thermocouples, the PXI-2503 relays have very low thermal offset (less than 2 μ V) to ensure accurate measurements. For low resistance measurements, use the PXI-2503 with its very low-contact resistance. For automotive-level voltage measurements, the PXI-2503 handles up to 1 A at 30 VDC.

These switch modules deliver maximum flexibility in managing a wide variety of test signals. Through software configuration, the uses of these modules range from a 48-channel, 1-wire mode for making a large number of common-reference measurements to a 12-channel, 4-wire mode for precision resistive and temperature measurements using thermistors or RTDs. Finally, with the use of the TB-2606 terminal block, you can instantly configure either of the switch modules as a 4x6, 2-wire matrix. All of these configurations are outlined in Table 1.

Module	Topology	Configuration	Terminal Block
PXI-2503, PXI-2501	Multiplexer	48x1 1-wire 24x1 2-wire 12x1 4-wire	TB-2605
PXI-2503, PXI-2501	Matrix	4x6 2-wire	TB-2606

Table 1. PXI-2501 and PXI-2503 Configurations

Analog Signal Routing

An external analog bus routes the output of a module to adjacent switch modules in order to expand the multiplexer architecture to include two or more modules. Connection is made with the analog plug that is shipped with every TB-2605 terminal block, see Figure 3. The analog bus consists of 4 wires for easy expansion of 4-wire, 2-wire, and 1-wire configurations. With this flexibility, you can create large switching solutions and keep the wiring of the modules to a minimum.

For example, if you have two PXI multiplexers in two adjacent slots, you can connect their analog bus via the analog plug and create either a 48-channel, 2-wire multiplexer or a 96-channel 1-wire multiplexer. In the same way, with five switching modules and the analog plugs, you can create a 240-channel, 1-wire multiplexer. If you need to connect the common terminal of the resulting multiplexer to a DMM, use the LV6-to-BAN4 cable for direct connectivity between the analog bus plug and the banana connectors of a DMM. If you have space restrictions in front of your terminal blocks, use the P-3 Probe set, which connects to screw terminals on one side and to banana plugs on the other.

Extended Features and Specifications

National Instruments switch modules are built with a number of core features that are covered in detail in the Switch Overview section.

For additional information about the PXI-2501 and PXI-2503, including software, certifications and compliance, relay control, etc., please see page 20. For detailed specifications, please see page 502.

24-Channel Low-Voltage Multiplexer/Matrix

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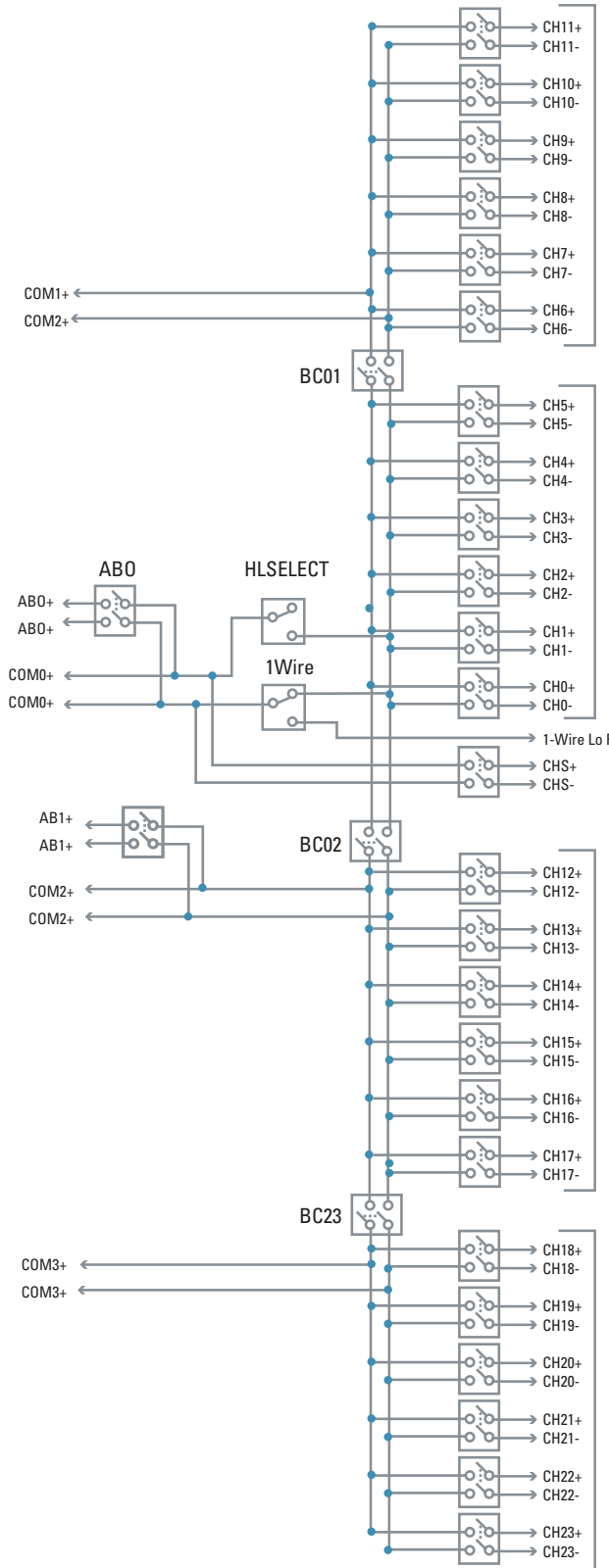


Figure 1. NI PXI-2501 and NI PXI-2503 Hardware Diagram



Figure 2. Analog plugs used with the TB-2605.

Ordering Information

NI PXI-2501	777696-01
NI PXI-2503	777697-01

Includes the switch module and NI-SWITCH driver software.

Accessories

TB-2605 multiplexing terminal block	777878-01
TB-2606 matrix terminal block.....	777879-01

For information on extended warranty and value added services, see page 20.
See page 499 for accessory and cable information.

BUY ONLINE!

Visit ni.com/products and enter pxi2501 and/or pxi2503.

Switches



Switch Specifications

Specifications

SCXI-1129

Input Characteristics

Input voltage, node to node.....	150 V _{rms} or 150 VDC
Maximum switching voltage	
AC	150 V _{rms}
DC	150 VDC
Maximum current switching capacity	
AC (resistive load)	250 mA
DC (resistive load)	1 A
Maximum relay switching power	37.5 VA, 30 W
Maximum combined channel current	5 A
Path resistance (HVAB)	1 Ω
Contact material.....	Gold-clad AgPd

Transfer Characteristics

Thermal emf (differential)	9 μV (worst case)
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Bandwidth (-3 dB)

1 row – 1 column	10 MHz
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Crosstalk¹ (Adjacent Rows and Columns)

Frequency	Crosstalk (dB)
10 KHz	-80
100 KHz	-66
1 MHz	-50

¹50 Ω termination

Dynamic Characteristics

Maximum operating speed	Between 22 and 250 operations/s depending on the number of relays operated
Relay operate time (at 20 °C)	
Set/release	4 ms max
Expected life	
Mechanical (at 3 operations/s).....	5x10 ⁷ operations

Stability

Recommended warm-up time	5 minutes
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Physical

Dimensions	3.0 by 17.2 by 20.3 cm (1.18 by 6.9 by 8.0 in.)
I/O connector.....	180-pin HDI

Environment

Operating temperature.....	0 to 50 °C
Storage temperature.....	-20 to 70 °C
Relative humidity	5% to 85% noncondensing
IEC-1010, voltage insulation category I double insulation, EMI, CE	

SCXI-1127, SCXI-1128

Input Characteristics

Input voltage	
Channel-to-channel	250 VDC/V _{rms}
Channel-to-earth.....	250 VDC/V _{rms}
Maximum switching voltage	
differential or single ended.....	250 VDC/V _{rms}
Maximum switching capacity – differential mode or single ended	
AC	
SCXI-1127 (resistive load)	200 mA at 250 V _{rms} , 500 mA at 125 V _{rms}
SCXI-1128 (resistive load)	30 mA at 10 V _{rms} , 1 mA at 250 V _{rms}
DC	
SCXI-1127 (resistive load)	1 A at 30 VDC
SCXI-1128 (resistive load)	30 mA at 10 VDC 1 mA at 300 VDC
Maximum switching power per differential channel or single ended	
SCXI-1127	60 VA, 30 W
SCXI-1128	300 mW
Path resistance	
SCXI-1127	<1 Ω
SCXI-1128	<1.2 kΩ
Contact material (SCXI-1127).....	Gold-clad silver alloy

Transfer Characteristics

Thermal emf (differential) (SCXI-1127)	≤3 μV
Thermal offset voltage (SCXI-1128).....	<100 μV

Maximum Bandwidth

SCXI-1127	11 MHz
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Channel-to-Channel Isolation

SCXI-1127 (50 Ω termination)		SCXI-1128 (50 Ω termination)	
Frequency	Isolation (dB)	Frequency	Isolation (dB)
10 KHz	> 70	100 Hz	> 80
100 KHz	> 55	1 KHz	> 70
1 MHz	> 50	10 KHz	> 55
5 MHz	> 40	100 KHz	> 35
11 MHz	> 25	1 MHz	> 20

Dynamic Characteristics

Maximum operating speed	
SCXI-1127	100 operations/s
SCXI-1128	1200 operations/s
Relay operate time (at 20 °C)	
SCXI-1127	3 ms typical, 5 ms maximum
SCXI-1128	0.25 ms typical, 0.5 ms maximum
Relay release time (at 20 °C)	
SCXI-1127	1.5 ms typical, 5 ms maximum
SCXI-1128	0.08 ms typical, 0.2 ms maximum
Mechanical (at 3 operations/s)	
SCXI-1127	5x10 ⁷ operations
SCXI-1128	unlimited
SCXI-1127 relay lifetime	(operating life varies with switching conditions)
Expected Life	

Voltage	Current	Expected Operations
30 VDC	1 A	200,000
250 V _{rms}	200 mA	50,000
250 V _{rms}	250 μA	100,000

Stability

Recommended warm-up time	5 minutes
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Physical

Dimensions	3.0 by 17.2 by 20.3 cm (1.18 by 6.9 by 8.0 in.)
I/O connector.....	96-pin HDI

Environment

Operating temperature.....	0 to 50 °C
Storage temperature.....	-20 to 70 °C
Relative humidity	5% to 85% noncondensing
IEC-1010, voltage insulation category I double insulation, EMI, CE	

PXI-2501

Input Characteristics

Maximum working voltage	±10 VDC from chassis ground
Overvoltage protection (signals CH<0:2>, COM<0:3>)	
Powered on or off.....	±25 VDC from ground
Overvoltage protection (signals AB<0:1>)	
Powered on.....	±25 VDC from ground
Powered off	±15 VDC from ground
FET switch on-resistance	
At 25 °C.....	50 Ω typical; 85 Ω maximum
At 85 °C.....	100 Ω
Total signal path resistance (channel x to analog bus x)	1,650 Ω typical; 1,900 Ω maximum
Total signal path resistance (channel x to common x)	1,900 Ω typical; 2,150 Ω maximum

Transfer Characteristics

Channel amplifier (unity gain)	
Offset voltage (differential).....	1.2 mV, maximum
Cold-junction sensor channel buffer	
Offset voltage.....	60 μV, maximum



Switch Specifications

Specifications (continued)

Frequency bandwidth (50 Ω source, 1 MΩ, 25 pF load)
 -3 dB 400 kHz
 -10 dB 1 MHz

Dynamic Characteristics

Operating speed 25,000 operation/s typical, 250,000 operation/s max
 Settling time* (+5 to -5 V step) using a 6 in. cable to measurement device
 0.012% accuracy
 With output buffer selected 8.5 μs
 Without output buffer 9.0 μs
 0.006% accuracy
 With output buffer selected 10 μs
 Without output buffer 11.5 μs
 0.0015% accuracy
 With output buffer selected 16 μs
 Without output buffer 18 μs
 Settling time* (+5 to -5 V step) using a 3 m cable to measurement device
 0.012% accuracy
 With output buffer selected 21 μs
 Without output buffer 45 μs
 0.006% accuracy
 With output buffer selected 30 μs
 Without output buffer 60 μs
 0.0015% accuracy
 With output buffer selected 80 μs
 Without output buffer 160 μs

*Minimizing wiring from the analog bus connection to the measurement device improves settling time.

PXI Trigger Bus

Interface Slave
 Trigger lines 8
 Star trigger 1

Power Requirements

+5 VDC 300 mA, typical
 +12 VDC 30 mA, typical
 -12 VDC 30 mA, typical

Physical

Dimensions 10 by 16 cm (3.9 by 6.3 in.)
 I/O connector 68-pin male SCSI

Environment

Operating temperature 0 to 50 °C
 Storage temperature -20 to 70 °C
 Relative humidity 5 to 85% noncondensing

PXI-2503

Input Characteristics

Input voltage
 Channel-to-channel 30 V_{rms}/60 VDC
 Channel-to-earth 30 V_{rms}/60 VDC
 Maximum switching voltage – differential or single ended
 AC 30 V_{rms}
 DC 60 VDC
 Maximum switching capacity – differential or single ended
 30 VDC (resistive load) 1 A
 Maximum switching power per
 differential or single ended channel 30 W
 Path resistance < 1 Ω
 Contact material Gold-clad silver alloy

Transfer Characteristics

Thermal EMF (differential) < 2 μV
 Maximum frequency, 3 dB bandwidth, 50 Ω termination
 Worst case channel 10 MHz minimum
 Channel-to-channel isolation (2-wire) 50 Ω termination

Frequency	Isolation
10 kHz	> 100 dB
100 kHz	> 80 dB
1 MHz	> 55 dB
10 MHz	> 30 dB

Dynamic Characteristics

Operating speed 100 operation/s
 Relay operate time (20 °C) 3 ms typical, 5 ms maximum
 Relay release time (20 °C) 1.5 ms typical, 5 ms maximum
 Expected life (at 120 cpm)
 Mechanical (3 Hz rate) 5x10⁷ operations
 Electrical at maximum load 2x10⁶ operations

PXI Trigger Bus

Interface Slave
 Trigger lines 8
 Star trigger 1

Power Requirement

+5 VDC 370 mA, typical 700 mA, maximum

Physical

Dimensions 10 by 16 cm (3.9 by 6.3 in.)
 I/O connector 68 pin male SCSI

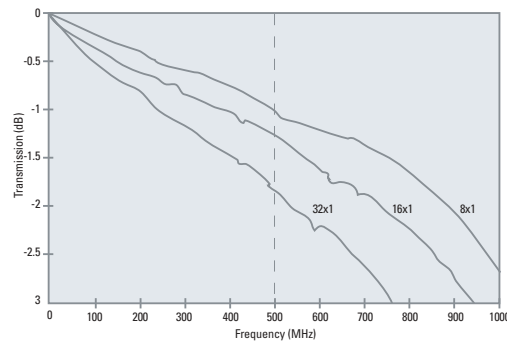
Environment

Operating temperature 0 to 50 °C
 Storage temperature -20 to 70 °C
 Relative humidity 5 to 85% noncondensing

PXI-2593, PXI-1193

RF Performance Characteristics

Characteristic impedance (Z₀) 50 Ω nominal
 Insertion loss
 8x1
 DC to 200 MHz <0.9 dB
 200 to 500 MHz <1.6 dB
 16x1
 DC to 200 MHz <1.2 dB
 200 to 500 MHz <1.9 dB
 32x1 (SCXI-1193 only)
 DC to 200 MHz <1.4 dB
 200 to 500 MHz <2.4 dB
 Typical bandwidth (3 dB)
 8x1 >900 MHz
 16x1 >750 MHz
 32x1 (SCXI-1193 only) >600 MHz



VSWR

8x1
 DC to 200 MHz <1.4
 200 to 500 MHz <1.8
 16x1
 DC to 200 MHz <1.4
 00 to 500 MHz <1.8
 32x1 (SCXI-1193 only)
 DC to 200 MHz <1.4
 200 to 500 MHz <1.8
 Maximum RF carry power 10 W up to 500 MHz (per channel)