

DEVICE SPECIFICATIONS

NI PXI-4110

Triple Output Programmable DC Power Supply

This document lists specifications for the NI PXI-4110 (NI 4110) programmable DC power supply.

Specifications are subject to change without notice. For the most recent NI 4110 specifications, visit ni.com/manuals.



Caution Using the NI 4110 in a manner not described in this document might impair the protection the NI 4110 provides.



Caution To ensure the specified EMC performance, the length of all attached cables must be no longer than 30 m (100 ft). In addition, the cable or cables connected to the Output port must be provided with an overall shield that is terminated to pin 2 ($\frac{1}{2}$).



Attention This icon denotes a warning advising you to take precautions to avoid electrical shock.



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.

National Instruments defines the capabilities and performance of its Test & Measurement instruments as *Specifications*, *Typical Specifications*, and *Characteristic or Supplemental Specifications*. Data provided in this document are *Specifications* unless otherwise noted.

Specifications characterize the warranted performance of the instrument within the recommended calibration interval and under the stated operating conditions.

Typical Specifications are specifications met by the majority of the instruments within the recommended calibration interval and under the stated operating conditions. The performance of the instrument is not warranted.

Characteristic or Supplemental Specifications describe basic functions and attributes of the instrument established by design or during development and not evaluated during Verification or Adjustment. They provide information that is relevant for the adequate use of the instrument that is not included in the previous definitions.

Unless otherwise noted, specifications are valid under the following conditions:

- Ensure an ambient temperature of $23\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$
- Ensure a calibration interval of 1 year.
- Allow 15 minutes warm-up time.
- Set the **niDCPower Samples to Average** property or
NIDCPOWER_ATTR_SAMPLES_TO_AVERAGE attribute set to 300 for optimal 50 Hz
and 60 Hz rejection.

To access NI 4110 documentation, navigate to **Start»All Programs»National Instruments»NI-DCPower»Documentation**.

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Cleaning Statement



Caution Clean the hardware with a soft, nonmetallic brush. Make sure that the hardware is completely dry and free from contaminants before returning it to service.

Device Capabilities

The following table and figure illustrate the voltage and current source ranges of the NI 4110.

Channel	DC voltage	Isolation ¹	DC current (power)			
			Auxiliary power		Internal power	
			20 mA range	1 A range	20 mA range	1 A range
0	0 V to +6 V	N/A	N/A	1 A (6 W)	N/A	1 A (6 W)
1	0 V to +20 V	60 VDC, CAT I	20 mA	1 A (20 W)	20 mA	100 mA (2 W) ²
2	0 V to -20 V	60 VDC, CAT I	20 mA	1 A (20 W)	20 mA	100 mA (2 W) ²

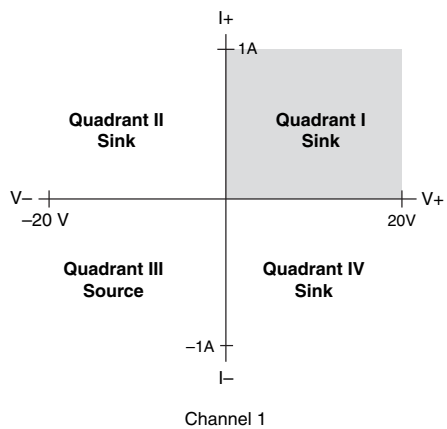
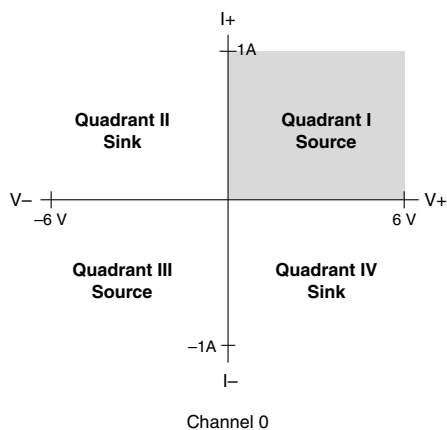


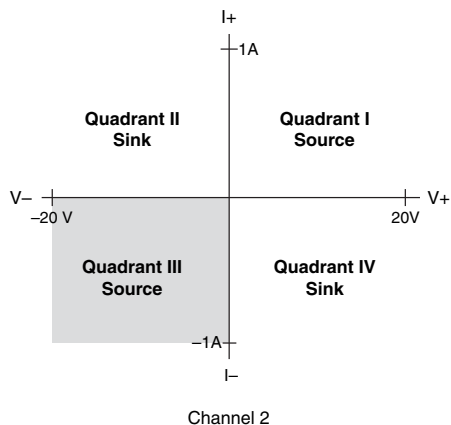
Note The NI 4110 is a single-quadrant power supply with three output channels. In this document, channel 0 refers to the 0 V to +6 V output, channel 1 refers to the 0 V to +20 V output, and channel 2 refers to the 0 V to -20 V output.

¹ Channels 1 and 2 are isolated from the ground but not from each other.

² When internally powered, the combined outputs of channels 1 and 2 must not exceed 3 W total.

Figure 1. Quadrant Diagrams





Voltage Programming Accuracy/Resolution

Table 1. Voltage Programming Accuracy/Resolution

Channel	Range	Resolution	Accuracy ± (% of voltage + offset)	
			1 year 23 °C ± 10 °C	Tempco/°C ³ 0 °C to 55 °C
0	+6 V	0.12 mV	0.05% + 4 mV	0.005% + 0.3 mV
1	+20 V	0.40 mV	0.05% + 10 mV	0.005% + 1 mV
2	-20 V	0.40 mV	0.05% + 10 mV	0.005% + 1 mV

³ Tempco refers to the temperature coefficient.

Current Programming Accuracy/Resolution

Table 2. Current Programming Accuracy/Resolution⁴

Channel	Range ⁵	Resolution	Accuracy ± (% of current + offset)	
			1 year 23 °C ± 10 °C	Tempco/°C ⁶ 0 °C to 55 °C
0	1 A	0.02 mA	0.15% + 4 mA	0.02% + 0.2 mA
1 and 2	20 mA	0.40 µA	0.15% + 60 µA	0.01% + 3 µA
	1 A	0.02 mA	0.15% + 4 mA	0.02% + 0.2 mA

Related Information

[Accuracy Specification Derating versus Output Current](#) on page 8

Voltage Measurement Accuracy/Resolution

Table 3. Voltage Measurement Accuracy/Resolution⁷

Channel	Range	Resolution	Accuracy ± (% of voltage + offset)	
			1 year 23 °C ± 10 °C	Tempco/°C ⁶ 0 °C to 55 °C
0	+6 V	0.06 mV	0.05% + 4 mV	0.005% + 0.2 mV
1	+20 V	0.20 mV	0.05% + 5 mV	0.005% + 0.5 mV
2	-20 V	0.20 mV	0.05% + 5 mV	0.005% + 0.5 mV

⁴ Calibrated at half of voltage range on channel. Applies to current limits greater than 2% of range. Applies to output current up to 500 mA. For output current greater than 500 mA, accuracy is derated.

⁵ Minimum programmable current limit is 2% of range.

⁶ Tempco refers to the temperature coefficient.

⁷ Using the **niDCPower Samples to Average** property or the `NIDCPOWER_ATTR_SAMPLES_TO_AVERAGE` attribute set to 300.

Current Measurement Accuracy/Resolution

Table 4. Current Measurement Accuracy/Resolution⁸

Channel	Range	Resolution	Accuracy ± (% of current + offset) ⁹	
			1 year 23 °C ± 10 °C	Tempco/°C ¹⁰ 0 °C to 55 °C
0	1 A	0.01 mA	0.15% + 4 mA	0.02% + 0.2 mA
1 and 2	20 mA	0.20 µA	0.15% + 35 µA	0.01% + 3 µA
	1 A	0.01 mA	0.15% + 4 mA	0.02% + 0.2 mA

Related Information

[Accuracy Specification Derating versus Output Current](#) on page 8

Voltage Output Speed, Typical

Table 5. Voltage Output Speed,¹¹ Typical

Channel	Auxiliary power				Internal power			
	Rise time ¹²		Fall time ¹³		Rise time ¹²		Fall time ¹³	
	Full load	No load	Full load	No load	Full load	No load	Full load	No load
0	<1 ms	<1 ms	<1 ms	<25 ms	same as auxiliary power			
1 and 2	<1 ms	<1 ms	<2 ms	<56 ms	<20 ms	<10 ms	<15 ms	<56 ms

⁸ Using the **niDCPower Samples to Average** property or the `NIDCPOWER_ATTR_SAMPLES_TO_AVERAGE` attribute set to 300.

⁹ For output current greater than 500 mA, accuracy is derated.

¹⁰ Tempco refers to the temperature coefficient.

¹¹ Current limit set to 1 A for auxiliary power or 100 mA for internal power, resistive load. For 20 mA range, all voltage output speeds are <80 ms.

¹² Rise time is from 10% to 90% of programmed voltage change at maximum current.

¹³ Fall time is from 90% to 10% of programmed voltage change at maximum current.

Line and Load Regulation

Line Regulation¹⁴ (per volt of change in auxiliary power input) ± (% of output + offset)

- Voltage, channel 1 and 2.....0.01 + 1 mV
- Current, channel 1 and 2.....0.01 + 0.02% of range

Load Regulation

Voltage (% of voltage range, per amp of output load, measured at output channel terminals)

- Channel 0.....0.42%
- Channel 1 and 2.....0.1%

Current (% of current range, per volt of output change)

- Channel 0.....0.02%
- Channel 1 and 2, 1 A range.....0.007%
- Channel 1 and 2,.....0.003%
20 mA range

Ripple and Noise, Typical

Table 6. Ripple and Noise, Typical

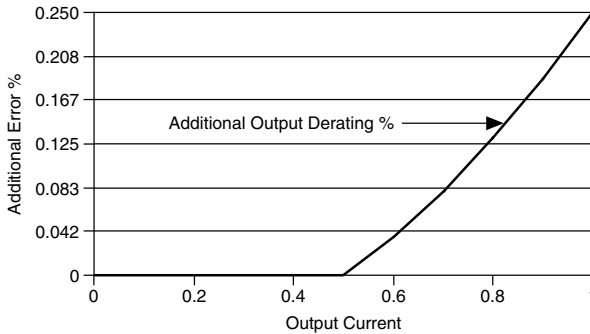
Channel	RMS normal-mode voltage (20 Hz to 20 MHz)	RMS normal-mode current (20 mA into 500 Ω load) ¹⁵
0	<1.5 mV	<8 μA
1 and 2	<1 mV	<8 μA (<3 μA for 20 mA range)

Accuracy Specification Derating versus Output Current

The following figure illustrates accuracy specification derating as a function of output current for the NI 4110.

¹⁴ Line regulation applies to the auxiliary power input only.
¹⁵ Current noise bandwidth is limited to 10 kHz for 1 A range and 400 Hz for 20 mA range.

Figure 2. Accuracy Specification Derating versus Output Current



Transient Response, Typical

Transient response.....Recovers to <0.1% of voltage range within
50 μ s after a change in load current from 50%
to 100% of current range, typical.

Measurement Timing Characteristics

Sample rate
Default.....300 S/s
Maximum.....3,000 S/s

Absolute Maximum Limit Characteristics

Maximum Voltage¹⁶
Channel-to-COM.....14 VDC over rated output, CAT I
Cascading multiple channels,.....60 VDC max
channel-to-chassis ground

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,

¹⁶ The maximum voltage that can be applied or output between any port or V_{SUP} terminal and a COM terminal without creating a safety hazard.

special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.



Caution Applying levels beyond the ratings specified in this section can result in permanent damage to the device.



Caution Connect only voltages that are within these limits.



Caution Do not connect to signals or use for the measurements within CAT II, III, or IV.



Note Measurement Categories CAT I and CAT O (Other) 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.

Protection Characteristics

Output channel protection

Overvoltage.....	Tolerates 14 VDC over rated output
Overcurrent or reverse voltage.....	Fused
Overtemperature.....	Automatic shutdown

Auxiliary power input protection

Overvoltage.....	>15.5 VDC shut-off; >20 VDC crowbar (fused), typical
Overcurrent or reverse voltage.....	Fused

Isolation Characteristics

Isolation voltage, channels 1- and 2- to-earth ground	60 VDC, CAT I, verified by dielectric withstand test, 5 s, continuous
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Caution Do not connect to MAINS. Do not connect to signals or use for the measurements within CAT II, III, or IV.



Caution Take precautions to avoid electrical shock when operating this product at hazardous voltages.



Note Measurement Categories CAT I and CAT O (Other) 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.

Accessories

Table 7. NI 4110 Accessories

Accessory	Manufacturer	Description	Part Number
NI APS-4100 auxiliary power source	National Instruments	Auxiliary power source for NI DC power supplies	779671-01
MINI-COMBICON, 3.81 mm (6 position)	Phoenix Contact	Mating connector for output channels	1714964
MINI-COMBICON, 3.81 mm (6 position) backshell	Phoenix Contact	Backshell for output channels mating connector	1714993
MINI-COMBICON, 3.5 mm (2 position)	Phoenix Contact	Mating connector for auxiliary power input	1714977
MINI-COMBICON, 3.5 mm (2 position) backshell	Phoenix Contact	Backshell for auxiliary power input	1714980
Chip fuse (F 1.5 A 125 V)	Littelfuse	Output channel fuse	045301.5
Glass fuse, 5 x 20 mm, (T 6.3 A L 250 V)	Littelfuse	Auxiliary power input fuse	21806.3



Caution You must install mating connectors according to local safety codes and standards and according to the specifications provided by the manufacturer. You are responsible for verifying the safety compliance of third-party connectors and their usage according to the relevant standard(s), including UL and CSA in North America and IEC and VDE in Europe.

Related Information

[Visit *ni.com* for more information about accessories.](#)

Calibration Interval

Recommended calibration interval.....1 year

Power Requirement Characteristics

PXI power requirement.....	10 W at 5 V, 1 W at 3.3 V, 6 W at 12 V, 3 W at -12 V
Auxiliary power source.....	11 VDC to 15.5 VDC, 5 A max
(optional, channels 1 and 2 only)	
input requirements	

Related Information

For information about cascading multiple NI PXI-4110 devices, refer to the [NI DC Power Supplies and SMUs Help](#).

Physical Characteristics

Dimensions.....	3U, one-slot, PXI/cPCI module; 2.0 cm × 13.0 cm × 21.6 cm (0.8 in. × 5.1 in. × 8.5 in.)
Weight.....	323 g
User-replaceable fuses	
Output channels.....	3, Littelfuse 045301.5 (F 1.5 A 125 V)
(internally socketed) ¹⁷	
Auxiliary power input.....	1, 5 x 20 mm glass fuse, Littelfuse 21806.3
(front panel mount)	
(T 6.3 A L 250 V)	



Note Fuses located on bottom of device underneath door. Use Phillips #1 screwdriver for removal.



Fuse When this fuse symbol is marked on a device, take proper precautions.

I/O connectors

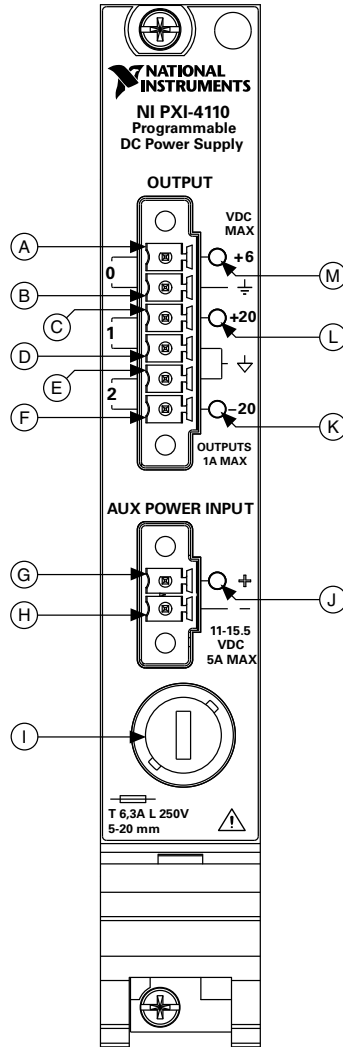
Output channels.....	MINI-COMBICON, 3.81 mm (6 position)
Auxiliary power input.....	MINI-COMBICON, 3.5 mm (2 position)



Note I/O connectors can accept wire gauges from 16 AWG to 28 AWG. NI recommends 18 AWG or lower.

¹⁷ A spare output channel fuse is located near the rear PXI connector of the NI 4110.

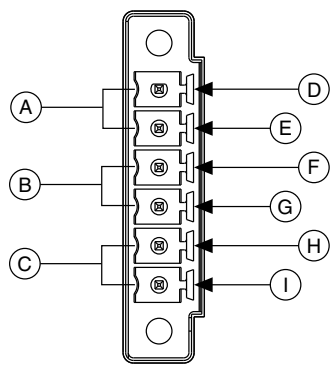
Figure 3. NI 4110 Front Panel



Item		Description
A	Output Connector, Terminal 0	Channel 0 (0 to +6 V)
B	Output Connector, Terminal 1	GND
C	Output Connector, Terminal 2	Channel 1 (0 to +20 V)

Item		Description
D	Output Connector, Terminal 3	Common Floating GND
E	Output Connector, Terminal 4	Common Floating GND
F	Output Connector, Terminal 5	Channel 2 (0 to -20 V)
G	Auxiliary Power Input Connector, Terminal 0	Auxiliary Power Input (+11 V to +15.5 V)
H	Auxiliary Power Input Connector, Terminal 1	GND
I	Auxiliary Power Input Fuse Holder	—
J	Auxiliary Power Input Status Indicator	LED
K	Channel 2 Output Status Indicator	LED
L	Channel 1 Output Status Indicator	LED
M	Channel 0 Output Status Indicator	LED

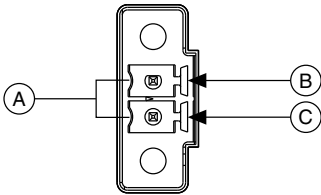
Figure 4. NI 4110 Output Connector



A	Channel 0
B	Channel 1
C	Channel 2
D	0 V to +6 V
E	GND
F	0 V to +20 V

G	Common Floating GND
H	Common Floating GND
I	0 V to -20 V

Figure 5. NI 4110 Auxiliary Power Input Connector



A	Auxiliary Power Input
B	+11 V to +15.5 V
C	GND

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.....-40 °C to 71 °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.)

Shock and Vibration

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, 0.31 g _{rms}
Nonoperating.....	5 Hz to 500 Hz, 2.46 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
- EN 55022 (CISPR 22): Class A emissions
- EN 55024 (CISPR 24): Immunity
- AS/NZS CISPR 11: Group 1, Class A emissions
- AS/NZS CISPR 22: 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

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

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. 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 to the environment and 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 NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit ni.com/environment/weee.

电子信息产品污染控制管理办法（中国 RoHS）



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