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Analog Input Modules for Compact FieldPoint and FieldPoint

NEW

NI [c]FP-AI-100, NI [c]FP-AI-102, NI [c]FP-AI-110, NI [c]FP-AI-111

- 8 or 16 voltage or current inputs
  - ±120 V input range, maximum
  - 0 to 20, 4 to 20 mA input ranges
- Built-in signal conditioning
  - 50, 60, and 500 Hz noise rejection
- 12 and 16-bit resolution
- Software-configurable input ranges per channel
- 2,300 V_{rms} bank isolation for transient overvoltage protection
- Hot-swappable with autoconfiguration
- -40 to 70 °C operating range



Module	Input Channels	Resolution	Input Type	Input Ranges (Software Configurable per Channel)	50/60 Hz Noise Filter	All-Channel Update Rate
[c]FP-AI-100	8	12 bits	Voltage	±1 V, ±5 V, ±15 V, ±30 V, 0 to 1 V, 0 to 5 V, 0 to 15 V, 0 to 30 V	–	360 Hz
			Current	0 to 20 mA, 4 to 20 mA, ±20 mA		
[c]FP-AI-102	8	12 bits	Voltage	±20 V, ±60 V, ±120 V, 0 to 20 V, 0 to 60 V, 0 to 120 V	–	360 Hz
[c]FP-AI-110	8	16 bits	Voltage	±60 mV, ±300 mV, ±1 V, ±5 V, ±10 V, 0 to 1 V, 0 to 5 V, 0 to 10 V	✓ (software selectable)	5 Hz to 0.66 Hz (rate varies with filter settings)
			Current	0 to 20 mA, 4 to 20 mA, ±20 mA		
[c]FP-AI-111	16	16 bits	Current	0 to 20 mA, 4 to 20 mA, ±20 mA	✓ (software selectable)	3 Hz to 0.83 Hz (rate varies with filter settings)

Overview

The National Instruments [c]FP-AI-1xx devices are versatile analog input modules for Compact FieldPoint and FieldPoint that can be used to measure voltages ranging from the millivolt level to the 120 V high-voltage level in applications such as battery-pack monitoring, fuel-cell testing, and general measurement from transducers. These modules can also measure 0 to 20 or 4 to 20 mA current loops from industrial sensors and transmitters. All the modules include overranging and onboard diagnostics to ensure trouble-free installation and maintenance. The modules measure and linearize signals on-board to return scaled values to your control or monitoring software. The [c]FP-AI-1xx modules come with NIST-traceable calibration certificates, ensuring accurate and reliable analog measurements.

Smart I/O Modules

With [c]FP-AI-1xx analog input modules, you can directly connect to your industrial sensors or units under test and get high-accuracy measurements. The I/O modules filter, calibrate, and scale raw sensor signals to engineering units, as well as performing self-diagnostics to look for problems with the module or the wiring. With FieldPoint modules, your software application reads a linearized, calibrated, and scaled value from the I/O module, eliminating the error-prone step of converting binary values to voltage or current values. For increased accuracy and noise rejection, the [c]FP-AI-110 and [c]FP-AI-111 use a 16-bit delta-sigma ADC with an integrated lowpass filter on each channel, which you can configure for 50 Hz, 60 Hz, or no rejection. With high-accuracy 12-bit ADCs or 16-bit delta-sigma ADCs on the I/O modules, you also get instrument-quality measurements on an industrially rugged, distributed, embedded system.

[c]FP-AI-1xx modules offer a variety of update rates to fit your application, ranging from 0.66 to 360 Hz. These rates vary based on the module used and on the noise filter settings selected on the module. Overall data throughput depends on software loop speeds and network speeds. With overranging and underranging, the [c]FP-AI-1xx analog input modules can measure inputs or sensors that are not calibrated to standard ranges. For example, when configured for an input range of 4 to 20 mA, the modules actually measure inputs from 3.5 to 21 mA.

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Analog Input Modules for Compact FieldPoint and FieldPoint

Isolation

[c]FP-AI-1xx modules feature optical bank isolation with 2,300 V_{rms} of breakdown isolation. In addition, the [c]FP-AI-100, [c]FP-AI-102, and [c]FP-AI-110 modules provide double insulation for up to 250 V_{rms} of operational isolation. Compact FieldPoint can safely be used in applications where hazardous voltages are present with the cFP-CB-1 connector block. FieldPoint can safely be used in applications where hazardous voltages are present with the FP-TB-x terminal base. These Compact FieldPoint and FieldPoint modules do not have channel-to-channel isolation.

Field I/O Connections

Compact FieldPoint and FieldPoint modules include a built-in power distribution bus that provides multiple power connections on the module. A field-wired power supply connected to the voltage (V) and common (C) terminals is internally connected to a power distribution bus that provides additional breakout terminals for voltage supply (V_{SUP}) and common (COM). These terminals provide a convenient way to distribute power to field devices that require external power.

Each input channel on the AI-100 and AI-110 has four terminals:

1. Voltage input (V_{IN})
2. Current input (I_{IN})
3. Common (COM)
4. Power connection to power field devices or loop powered current loops (V_{SUP})

The AI-111 has:

- 16 current input terminals (I_{IN})
- 8 common terminals (COM)
- 8 power connections for field devices or current loops (V_{SUP})

The AI-102 module has:

- 8 voltage input terminals (V_{IN})
- 16 common terminals (COM)
- 8 power connections to power field devices (V_{SUP})

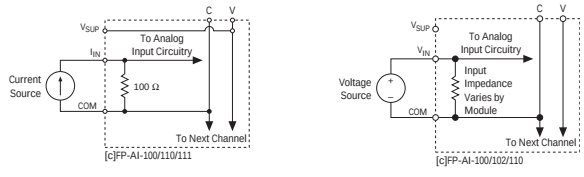


Figure 1. Schematics for the AI Module Wiring

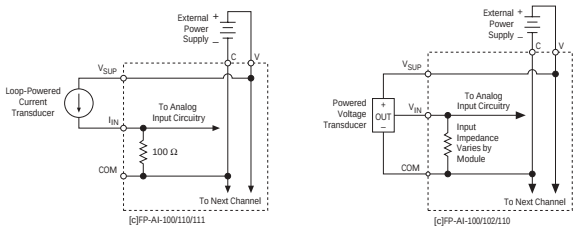


Figure 2. Schematics for the AI Module Wiring

Ordering Information

Compact FieldPoint

NI cFP-AI-100 777318-100
NI cFP-AI-102 777318-102
NI cFP-AI-110 777318-110
NI cFP-AI-111 777318-111

Recommended Compact FieldPoint System Products

NI cFP-2020 777317-2020
NI cFP-BP-4 778617-04
NI cFP-CB-1 778618-01
NI PS-5 Power Supply 778805-90
NI Developer Suite Professional Control Edition.....777906-03

FieldPoint

NI FP-AI-100 777518-100
NI FP-AI-102 777518-102
NI FP-AI-110 777518-110
NI FP-AI-111 777518-111

Recommended FieldPoint System Products

NI FP-1601 777792-01
NI FP-TB-1 777519-01
NI PS-4 Power Supply 778586-90
NI Developer Suite Standard Control Edition 777905-03

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Visit ni.com/info and enter cfpai100, cfpai102, cfpai110, cfpai111, fpai100, fpai102, fpai110, and/or fpai111.

Specifications

Typical for -40 to 70 °C unless otherwise noted.

Input Characteristics

Number of inputs
- [c]FP-AI-100, [c]FP-AI-102, [c]FP-AI-110 .... 8 single-ended
- [c]FP-AI-111..... 16 single-ended

ADC resolution
- [c]FP-AI-110, [c]FP-AI-111..... 16 bits, 1 in 65,536
- [c]FP-AI-100, [c]FP-AI-102..... 12 bits, 1 in 4,096

Filters
- [c]FP-AI-110, [c]FP-AI-111..... 50, 60, or 500 Hz, software configurable per channel
- [c]FP-AI-100, [c]FP-AI-102..... 170 Hz, first-order analog filter
- NMR ([c]FP-AI-110 and [c]FP-AI-111 only)... 95 dB (at 50/60 Hz, with filter enabled)

Input impedance, voltage inputs
- [c]FP-AI-100..... 1.5 MΩ
- [c]FP-AI-102..... 1 MΩ
- [c]FP-AI-110..... 100 MΩ

Input impedance, current inputs..... 100 Ω

Overvoltage protection (voltage inputs only)
- [c]FP-AI-100, [c]FP-AI-102..... 250 V
- [c]FP-AI-110..... 40 V

Overcurrent protection (current inputs only).... 30 mA

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Analog Input Modules for Compact FieldPoint and FieldPoint

Specifications (continued)

Module	Input Range	Input Range: Nominal	Input Range: With Overranging	Effective Resolution	Offset Error: Typical 15 to 35 °C	Offset Error: Maximum –40 to 70 °C	Gain Error: Typical 15 to 35 °C	Gain Error: Maximum –40 to 70 °C
[c]FP-AI-100	Voltage	0 to 1 V	0 to 1.2 V	1.5 mV	1.5 mV	15 mV	0.09%	0.50%
		0 to 5 V	0 to 6 V	5 mV	6 mV	27 mV	0.09%	0.50%
		0 to 15 V	0 to 18 V	15 mV	15 mV	45 mV	0.12%	0.55%
		0 to 30 V	0 to 36 V	25 mV	30 mV	70 mV	0.22%	0.55%
		±1 V	±1.2 V	1.5 mV	2 mV	20 mV	0.08%	0.50%
		±5 V	±6 V	5 mV	10 mV	40 mV	0.08%	0.55%
		±15 V	±18 V	25 mV	30 mV	90 mV	0.11%	0.60%
		±30 V	±36 V	40 mV	60 mV	160 mV	0.20%	0.55%
	Current	0 to 20 mA	0 to 24 mA	15 µA	20 µA	45 µA	0.09%	0.51%
		4 to 20 mA	3.5 to 24 mA	15 µA	20 µA	45 µA	0.09%	0.51%
		±20 mA	±24 mA	20 µA	40 µA	110 µA	0.06%	0.55%
[c]FP-AI-102	Voltage	0 to 20 V	–	15 mV	20 mV	100 mV	0.1%	0.3%
		0 to 60 V	–	40 mV	50 mV	150 mV	0.1%	0.3%
		0 to 120 V	–	70 mV	100 mV	250 mV	0.1%	0.3%
		±20 V	–	25 mV	40 mV	175 mV	0.1%	0.3%
		±60 V	–	70 mV	120 mV	350 mV	0.1%	0.3%
		±120 V	–	125 mV	220 mV	700 mV	0.1%	0.3%
[c]FP-AI-110	Voltage	0 to 1 V	0 to 1.04 V	25 µV	50 µV	650 µV	0.03%	0.1%
		0 to 5 V	0 to 5.2 V	90 µV	180 µV	1500 µV	0.03%	0.1%
		0 to 10 V	0 to 10.4 V	190 µV	300 µV	2500 µV	0.03%	0.1%
		±60 mV	±65 mV	3 µV	30 µV	500 µV	0.03%	0.1%
		±300 mV	±325 mV	16 µV	40 µV	600 µV	0.03%	0.1%
		±1 V	±1.04 V	40 µV	75 µV	850 µV	0.03%	0.1%
		±5 V	±5.2 V	190 µV	300 µV	2500 µV	0.03%	0.1%
		±10 V	±10.4 V	380 µV	650 µV	4000 µV	0.03%	0.1%
	Current	0 to 20 mA	0 to 21 mA	500 nA	1 µA	10 µA	0.04%	0.2%
		4 to 20 mA	3.5 to 21 mA	500 nA	1 µA	10 µA	0.04%	0.2%
		±20 mA	±21 mA	700 nA	1 µA	10 µA	0.04%	0.2%

Isolation Voltage

Maximum isolation voltage ..... 250 V_{rms}, Installation Category II
Channel-to-channel isolation ..... No isolation between channels
Transient overvoltage ..... 2,300 V_{rms}

Physical Characteristics

LED indicators
POWER (green) ..... Power on and self-test passed
READY (green) ..... Module configured and ready
Dimensions (including terminal base) ..... 10.9 by 10.9 by 9.1 cm (4.3 by 4.3 by 3.6 in.)
Weight
[c]FP-AI-110, [c]FP-AI-111 ..... 136 g (4.8 oz)
[c]FP-AI-100, [c]FP-AI-102 ..... 145 g (5.1 oz)

Power Requirement

Power from network module
[c]FP-AI-110, [c]FP-AI-111 ..... 350 mW
[c]FP-AI-100, [c]FP-AI-102 ..... 400 mW

Environment

Operating temperature ..... -40 to 70 °C
Storage temperature ..... -55 to 85 °C
Relative Humidity ..... 10 to 90%, noncondensing

Shock and Vibration

These specifications apply only to Compact FieldPoint. NI recommends Compact FieldPoint if your application is subject to shock and vibration.
Operating vibration, random
(IEC 60068-2-64) ..... 10 to 500 Hz, 5 g_{rms}
Operating vibration, sinusoidal
(IEC 60068-2-6) ..... 10 to 500 Hz, 5 g
Operating shock
(IEC 60068-2-27) ..... 50 g, 3 ms half sine, 18 shocks at 6 orientations; 30 g, 11 ms half sine, 18 shocks at 6 orientations

Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 3121-1, UL 61010C-1
- CAN/CSA C22.2 No. 1010.1

For UL, hazardous location, and other safety certifications, refer to the product label or to ni.com

Electromagnetic Compatibility

CE, C-Tick, and FCC Part 15 (Class A) Compliant
Emissions ..... EN 55011 Class A at 10 m FCC Part 15A above 1 GHz
Immunity ..... EN 61326:1997 + A2:2001, Table 1
For EMC compliance, operate this device with shielded cabling.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE Marking, as follows:
Low-Voltage Directive (safety) 73/23/EEC
Electromagnetic Compatibility
Directive (EMC) 89/336/EEC
Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit ni.com/hardref.nsf/ and search by model number or product line.

Module	Filter Settings	Update Rate (All Channels)	Input Bandwidth (–3 dB)
[c]FP-AI-100, [c]FP-AI-102	–	2.8 ms	170 Hz
[c]FP-AI-110	50 Hz	1.470 s	13 Hz
	60 Hz	1.230 s	16 Hz
	500 Hz	0.173 s	130 Hz
[c]FP-AI-111	50 Hz	1.230 s	13 Hz
	60 Hz	1.050 s	16 Hz
	500 Hz	0.290 s	130 Hz

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