FD-11603

Contents

FD-11603 Specifications

Conditions

Specifications are typical and valid from -40 °C to +85 °C unless otherwise noted.

Input Characteristics

Number of channels	8 analog input channels
Isolation	Galvanic isolation between channels and to chassis
Input voltage range (AI+ to AI-)	±10.5 V
ADC resolution	24 bits
Type of ADC	Delta-Sigma (with analog prefiltering)
Sample mode	Simultaneous

Timebases (f_M)[1]

Frequency	13.1072 MHz, 12.8 MHz, 12.288 MHz, 10.24 MHz
Accuracy	±30 ppm maximum

Sampled data rate range (f_S)	
Minimum	500 Samples/s
Maximum	102.4 kSamples/s
Sampled data rates (f_S)	Refer to the following table for sample data rates supported for each timebase

Table 1. Timebases (f_M) and Supported Sampled Data Rates (f_S), (kSamples/s)

13.1072 MHz	12.8 MHz (Default)	12.288 MHz	10.24 MHz
102.4	100.0	96.0	80.0
51.2	50.0	48.0	40.0
34.133	33.333	32.0	26.667
25.6	25.0	24.0	20.0*
20.48	20.0	19.2	16.0
17.067	16.667	16.0*	13.333
12.8	12.5	12.0	10.0*
10.24	10.0	9.6	8.0
8.533	8.333	8.0*	6.667
6.4	6.25	6.0	5.0*
5.12	5.0	4.8	4.0
4.267	4.167	4.0*	3.333
3.2	3.125	3.0	2.5
2.56	2.5	2.4	2.0
2.133	2.083	2.0*	1.667
1.6	1.563	1.5	1.25*
1.28	1.25	1.2	1.0

13.1072 MHz	12.8 MHz (Default)	12.288 MHz	10.24 MHz
1.067	1.042	1.0*	0.833
0.8	0.781	0.75	0.625
0.64	0.625	0.6	0.5

Note: For sample rates that can be obtained using two different timebases, the lowest noise (highest resolution) option is indicated with an asterisk (*).

Input impedance (AI+ to AI-)	>1 GΩ
Input capacitance (AI+ to AI-)	440 pF

Table 2. Accuracy

Temperature	Gain Error (% of Reading)	Offset Error (% of Range, mV)[2]
5 °C to 40 °C, typical	0.013%	0.001%, 0.105 mV
5 °C to 40 °C, maximum	0.037%	0.01%, 1.05 mV
-40 °C to 85 °C, maximum	0.062%	0.02%, 2.1 mV

Sampled data rate noise	
1 kSample/s	7 µV RMS
10 kSamples/s	20 µV RMS
102.4 kSamples/s	40 µV RMS
Stability	

Gain drift	±4 ppm/°C
Offset drift	±5 µV/°C
Gain mismatch (channel-to-channel, 40 kHz)	0.034 dB maximum
Phase mismatch (channel-to-channel)	0.02°/kHz maximum
Phase nonlinearity (f_s = 102.4 kSamples/s)	0.1° maximum
Input delay	$36/f_s$ + 1.65 µs
Input delay tolerance	±150 ns
Passband	
Frequency	DC to $0.4 \cdot f_s$
Flatness	
0 kHz to 10 kHz	-0.02 dB maximum
0 kHz to 20 kHz	-0.04 dB maximum
0 kHz to 40 kHz	-0.1 dB maximum
Stopband	

Frequency	At or above $0.5 \cdot f_s$
Rejection	100 dB
Alias-free bandwidth	$0.5 \cdot f_s$
Crosstalk (1 kHz)	-110 dB
CMRR to chassis/earth (f_{in} = 60 Hz)	130 dB
Spurious Free Dynamic Range (SFDR), (1 kHz, -60 dBFS)	130 dBFS
Total Harmonic Distortion (THD), (1 kHz, -1 dBFS)	-102 dB
MTBF	864,132 hours at 25 °C; Bellcore Issue 6, Method 1, Case 3, Limited Part Stress Method

Time-Based Triggers

Type	Start Trigger, Sync Pulse

Timing and Synchronization

Protocol	IEEE 802.1AS for network synchronization over 1000 Base-TX, full-duplex
Network synchronization accuracy[3]	<1 µs
Network synchronization accuracy with optimized configuration[4]	<100 ns

Network Interface

Network protocols	TCP/IP, UDP
Network ports used	HTTP:80 (configuration only), TCP:3580; UDP:5353 (configuration only), TCP:5353 (configuration only); TCP:31415; UDP:7865 (configuration only), UDP:8473 (configuration only)
Network IP configuration	DHCP + Link-Local, DHCP, Static, Link-Local
Default MTU size	1500 bytes

Ethernet

Number of ports	2 8-pin X-coded M12 ports, internally switched[5]
Network interface	1000 Base-TX, full-duplex; 1000 Base-TX, half-duplex; 100 Base-TX, full-duplex; 100 Base-TX, half-duplex; 10 Base-T, full-duplex; 10 Base-T, half-duplex
Communication rates	10/100/1000 Mbps, auto-negotiated
Maximum cabling distance	100 m/segment
Maximum hops per line[6]	15

Power Requirements

> (!) **Notice** The protection provided by the FD-11603 can be impaired if it is used in a manner not described in the *FD-11603 User Guide*.

Voltage input range	
V_{in}	9 V DC to 30 V DC
V_{aux}	Up to 30 V DC

Maximum device power consumption[7]	7.5 W
Power input connector	5-pin L-coded male M12 connector
Power output connector	5-pin L-coded female M12 connector

Current Limits

⚠️ **Caution** Exceeding the current limits may cause damage to the device. Stay below a maximum of 10 A shared between both Input and Aux terminals.

Power IN/OUT terminals	
V_{in}	10 A maximum
V_{aux}	10 A maximum total (combined with V_{in})
Recommended external overcurrent protection	16 A, slow blow fuse

Physical Characteristics

Dimensions	198.5 mm × 77.4 mm × 47.1 mm (7.8 in. × 3.0 in. × 1.9 in.)
Weight	1.2 kg (2 lb 10 oz)
Input connection	

Number	8
Type	5-pin A-coded M12 connectors
Torque for M12 connectors (power, Ethernet, input connections)	0.6 N · m (5.31 lb · in.)

To clean the device, wipe it with a dry towel.

Calibration

Calibration interval	1 year

Environmental

Refer to the *FD-11603 User Guide* for more information about meeting these specifications.

Operating temperature	-40 °C to 85 °C
Storage temperature	-40 °C to 100 °C

Note Failure to follow the mounting instructions in the *FD-11603 User Guide* can cause temperature derating.

Ingress protection	IP65/IP67

Operating humidity	Up to 100% relative humidity, condensing or noncondensing
Pollution Degree	4
Maximum altitude	5,000 m

> **Note** M12 connectors must be mated to cables or have caps installed on them to meet IP65/IP67 requirements. Cover the unused connectors with the included plastic caps whenever water, dust, or dirt are present.

> **Note** Avoid long periods of exposure to sunlight.

To meet the following specifications, you must panel mount the system.

Operating vibration	
Random	10 g RMS, 5 Hz to 2,000 Hz
Sinusoidal	10 g, 5 Hz to 2,000 Hz
Operating shock	100 g, 11 ms half sine, 3 shocks at 6 orientations, 18 total 40 g, 6 ms half sine, 4,000 shocks at 6 orientations, 24,000 total

Environmental Standards

This model meets the requirements of the following electrical equipment environmental standards for measurement, control, and laboratory use:

- IEC 60068-2-1
- IEC 60068-2-2
- IEC 60068-2-6
- IEC 60068-2-27
- IEC 60068-2-30
- IEC 60068-2-64

Safety Voltages

Connect only voltages that are within the following limits:

Channel-to-channel isolation	
Continuous working voltage[8]	60 V DC (Dry Locations); 35 V DC (Wet Locations)
Transient overvoltage[9]	1,000 V RMS, verified by 5 s withstand
Channel-to-earth ground isolation	
Continuous working voltage	60 V DC (Dry Locations); 35 VDC (Wet Locations)
Transient overvoltage	1,000 V RMS, verified by 5 s withstand
Overvoltage protection[10]	±30 V between any two pins on the connector

These test and measurement circuits are rated for measurements performed on circuits not directly connected to the electrical distribution system referred to as MAINS.

MAINS is a hazardous live electrical supply system to which equipment is designed to be connected to for the purpose of powering equipment. This product is rated for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of

equipment, circuits powered by regulated low-voltage sources, and electronics.

> ⚠️ **Warning** Do not connect the FD-11603 to signals or use for measurements within Measurement Categories II, III, or IV, or for measurements on MAINs circuits or on circuits derived from Overvoltage Category II, III, or IV which may have transient overvoltages above what the product can withstand. The product must not be connected to circuits that have a maximum voltage above the continuous working voltage, relative to earth or to other channels, or this could damage and defeat the insulation. The product can only withstand transients up to the transient overvoltage rating without breakdown or damage to the insulation. An analysis of the working voltages, loop impedances, temporary overvoltages, and transient overvoltages in the system must be conducted prior to making measurements.

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 C22.2 No. 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; Industrial 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 and certifications, and additional information, refer to the Online Product Certification section.

> **Notice** To ensure the specified EMC performance, operate this product only with shielded Ethernet cables.

CE Compliance C E

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

- 2014/35/EU; Low-Voltage Directive (safety)
- 2014/30/EU; 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 <u>ni.com/environment</u>. 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 <u>ni.com/environment/weee</u>.

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`.)