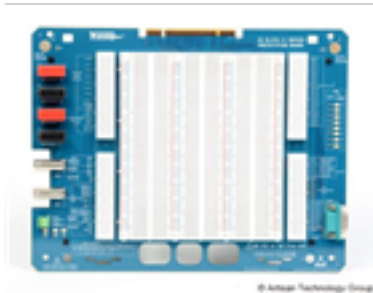


NI ELVIS II Prototyping Board



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NI ELVIS™ II Series Specifications

The specifications in this document refer to both the NI ELVIS II and the NI ELVIS II+ unless otherwise noted. These specifications are typical after a 30 minute warm-up time, at 25 °C, unless otherwise noted.

Analog Input

Number of channels	8 differential or 16 single ended
ADC resolution	16 bits
DNL	No missing codes guaranteed
INL	60 ppm max
Absolute accuracy	Refer to the AI Absolute Accuracy Table
Sample Rate	
Maximum	1.25 MS/s single channel, 1.00 MS/s multi channel (aggregate)
Minimum	No minimum
Timing accuracy	50 ppm of sample rate
Timing resolution	50 ns

Settling Time for Multichannel Measurements

Range	10 LSB for full scale	1 LSB for full scale
10 V, 5 V, 2 V, 1 V, 0.5 V	1 μ s	2 μ s
0.2 V, 0.1 V	2 μ s	8 μ s

Input coupling	DC
Input range	± 10 V, ± 5 V, ± 2 V, ± 1 V, ± 0.5 V, ± 0.2 V, ± 0.1 V
Maximum working voltage for analog inputs (signal + common mode)	± 11 V of AIGND
CMRR (DC to 60 Hz)	90 dB

Crosstalk @ 100 kHz	
(adjacent channel)	-70 dB
(non-adjacent channel)	-80 dB

Input Impedance	
Device on	
AI+ or AI- to AIGND	>10 G Ω 100 pF
Device off	
AI+ or AI- to AIGND	820 Ω

Input bias current	± 100 pA
Small signal bandwidth (-3 dB)	1.2 MHz
Input FIFO size	4095 samples
Scanlist memory	4095 entries
Data transfers	USB signal stream, programmed I/O

Overvoltage Protection (AI $\pm$, AISENSE)

Device on	± 25 V for up to four lines
Device off	± 15 V for up to four lines
Input current during overvoltage condition	± 20 mA max per line

Analog Triggers

Number of triggers	1
Source	AI<0..15>, ScopeCH0, ScopeCH1
Functions	Start Trigger, Reference Trigger, Pause Trigger, Sample Clock, Convert Clock, Sample Clock Timebase
Source level	$\pm$ Full scale
Resolution	10 bits

Accuracy.....	1%
Modes	Analog edge triggering, analog edge triggering with hysteresis, and analog window triggering

Arbitrary Waveform Generator/Analog Output

Number of channels.....	2
DAC resolution.....	16 bits
DNL.....	±1 LSB
Monotonicity	16 bit guaranteed
Accuracy.....	Refer to the AO Absolute Accuracy (No Load) Table
Maximum update rate	
1 channel	2.8 MS/s
2 channels	2.0 MS/s
Timing accuracy	50 ppm of sample rate
Timing resolution	50 ns
Output range.....	±10 V, ±5 V
Output coupling.....	DC
Output impedance.....	1 Ω
Maximum output drive current.....	±5 mA
Overdrive protection.....	±25 V
Maximum overdrive current.....	20 mA
Power-on state	±1 mV
Output FIFO size	8191 samples shared among channels used
Data transfer	USB signal stream, programmed I/O
AO waveform modes.....	Non-periodic waveform, periodic waveform regeneration from onboard FIFO, periodic waveform regeneration from host buffer including dynamic update
Slew rate	20 V/ μ s

AI Absolute Accuracy Table

Nominal Range		Residual Gain Error (ppm of Reading)	Gain Tempco (ppm/°C)	Reference Tempco (ppm/°C)	Residual Offset Error (ppm of Range)	Offset Tempco (ppm of Range/°C)	INL Error (ppm of Range)	Noise (μV_{rms})	Absolute Accuracy at Full Scale ¹ (μV)	Sensitivity ² (μV)
Positive Full Scale	Negative Full Scale									
10	-10	60	13	1	20	21	60	280	1,920	112.0
5	-5	70	13	1	20	21	60	140	1,010	56.0
2	-2	70	13	1	20	24	60	57	410	22.8
1	-1	80	13	1	20	27	60	32	220	12.8
0.5	-0.5	90	13	1	40	34	60	21	130	8.4
0.2	-0.2	130	13	1	80	55	60	16	74	6.4
0.1	-0.1	150	13	1	150	90	60	15	52	6.0

AbsoluteAccuracy = Reading · (GainError) + Range · (OffsetError) + NoiseUncertainty

GainError = ResidualGainError + GainTempco · (TempChangeFromLastInternalCal) + ReferenceTempco · (TempChangeFromLastExternalCal)

OffsetError = ResidualOffsetError + OffsetTempco · (TempChangeFromLastInternalCal) + INL_Error

NoiseUncertainty = $\frac{\text{RandomNoise} \cdot 3}{\sqrt{100}}$ For a coverage factor of 3 σ and averaging 100 points.

¹ Absolute accuracy at full scale on the analog input channels is determined using the following assumptions:

TempChangeFromLastExternalCal = 10 °C

TempChangeFromLastInternalCal = 1 °C

number_of_readings = 100

CoverageFactor = 3 σ

For example, on the 10 V range, the absolute accuracy at full scale is as follows:

GainError = 60 ppm + 13 ppm · 1 + 1 ppm · 10

GainError = 83 ppm

OffsetError = 20 ppm + 21 ppm · 1 + 60 ppm

OffsetError = 101 ppm

NoiseUncertainty = $\frac{280 \mu\text{V} \cdot 3}{\sqrt{100}}$ NoiseUncertainty = 84 μV

AbsoluteAccuracy = 10 V · (GainError) + 10 V · (OffsetError) + NoiseUncertainty AbsoluteAccuracy = 1920 μV

² Sensitivity is the smallest voltage change that can be detected. It is a function of noise.

Accuracies listed are valid for up to one year from the device external calibration.

AO Absolute Accuracy (No Load) Table

Nominal Range		Residual Gain Error (ppm of Reading)	Gain Tempco (ppm/°C)	Reference Tempco	Residual Offset Error (ppm of Range)	Offset Tempco (ppm of Range/°C)	INL Error (ppm of Range)	Absolute Accuracy at Full Scale ¹ (μV)
Positive Full Scale	Negative Full Scale							
10	-10	75	17	1	40	2	64	2,080
5	-5	85	8	1	40	2	64	1,045

¹ Absolute Accuracy at Full Scale is valid immediately following internal calibration and assumes the device is operating within 10 °C of the last external calibration. Accuracies listed are valid for up to one year from the device external calibration.

AbsoluteAccuracy = OutputValue · (GainError) + Range · (OffsetError)

GainError = ResidualGainError + GainTempco · (TempChangeFromLastInternalCal) + ReferenceTempco · (TempChangeFromLastExternalCal)

OffsetError = ResidualOffsetError + AOffsetTempco · (TempChangeFromLastInternalCal) + INL_Error

Digital I/O and PFI

Number of channels.....24 DIO (Port 0),
15 PFI (Ports 1 and 2)

Direction control.....Each line individually programmable as input or output

Pull-down resistor.....50 kΩ typ, 20 kΩ min

Input voltage protection.....±20 V on up to two pins



Note Stresses beyond those listed under *Input voltage protection* may cause permanent damage to the device.

DIO/PFI Recommended Operation Conditions

Level	Min	Max
Input high voltage (V _{IH})	2.2 V	5.25 V
Input low voltage (V _{IL})	0 V	0.8 V
Output high current (I _{OH})		
P0.<0..23>	—	-24 mA
PFI <0..14>	—	-16 mA
Output low current (I _{OL})		
P0.<0..23>	—	24 mA
PFI <0..14>	—	16 mA

DIO/PFI Electrical Characteristics

Level	Min	Max
Positive-going threshold (VT+)	—	2.2 V
Negative-going threshold (VT-)	0.8 V	—
Delta VT hysteresis (VT+ - VT-)	0.2 V	—
I _{IL} input low current (V _{in} = 0 V)	—	-10 μA
I _{IH} input high current (V _{in} = 5 V)	—	250 μA

PFI / Port 1 / Port 2 Functionality

Functionality Static digital input, static digital output, timing input, timing output

Debounce filter settings 125 ns, 6.425 μs, 2.56 ms, disable; high and low transitions; selectable per input

General Purpose Counter/Timers

Number of counter/timers	2
Resolution	32 bits
Counter measurements	Edge counting, pulse, semi period, period, two-edge separation
Position measurements	X1, X2, X4 quadrature encoding with Channel Z reloading; two-pulse encoding
Output applications	Pulse, pulse train with dynamic updates, frequency division, equivalent time sampling
Internal base clocks	80 MHz, 20 MHz, 0.1 MHz
External base clock frequency	0 MHz to 20 MHz
Base clock accuracy	50 ppm
Maximum frequency	1 MHz
Inputs	Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down
Default Routing	
CTR0_SOURCE	PFI8
CTR0_GATE	PFI9
CTR0_OUT	PFI12
CTR1_SOURCE	PFI3
CTR1_GATE	PFI4
CTR1_OUT	PFI13
FIFO	2 samples
Data transfers	USB signal stream, programmed I/O

Digital Frequency Generator

Number of channels	1
Base clocks	10 MHz, 100 kHz
Divisors	1 to 16
Maximum frequency	1 MHz
Base clock accuracy	50 ppm
Default output line	PFI 14 / FREQ_OUT

External Digital Triggers

Source	TRIG BNC or any PFI
Polarity	Software selectable for most signals
Analog input function	Start trigger, reference trigger, pause trigger, sample clock, convert clock, sample clock timebase
Analog output function	Start trigger, pause trigger, sample clock, sample clock timebase
Counter/timer function	Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down

DMM

Isolated functions	DC voltage, AC voltage, DC current, AC current, resistance, diode
Isolation level	60 VDC / 20 V _{rms} , Installation Category I
Connectivity	Banana jacks
Resolution	5.5 digits
Input impedance	11 M Ω
Input coupling	DC (DC voltage, DC current, resistance, diode) AC (AC voltage, AC current)
Non-isolated functions	Capacitance, inductance
Connectivity	Prototyping board terminals

Voltage Measurement

DC Ranges	100 mV, 1 V, 10 V, 60 V
AC Ranges	200 mV _{rms} , 2 V _{rms} , 20 V _{rms}
Input frequency range (AC voltage)	40 Hz to 20 kHz

DC Voltage Measurement Accuracy
±(ppm of reading + ppm of range)

Range	1 Year (Tcal ±5 °C)	Tempco/°C (15 to 35 °C)
100 mV	225 +280	33 + 50
1 V	225 + 60	33 + 5
10 V	225 + 40	33 + 0.5
60 V	1250 + 150	125 + 7

AC Voltage Measurement Accuracy
±(% of reading + % of range)

Range (rms)	1 Year (Tcal ±5 °C)	Tempco/°C (15 to 35 °C)
200 mV	0.3 + 0.05	0.015 + 0.003
2 V		
20 V		

Current Measurement

DC range.....2 A

AC ranges500 mA_{rms}, 2 A_{rms}

Shunt resistance.....0.1 Ω

Voltage burden<0.6 V

Input frequency range

(AC current)40 Hz to 5 kHz

Input protectionF 3.15 A 250 V,
Fast-acting
user-replaceable fuse

DC Current Measurement Accuracy
±(ppm of reading + ppm of range)

Range	1 Year (Tcal ±5 °C)	Tempco/°C (15 to 35 °C)
2 A	1350 + 180	85 + 2.5

AC Current Measurement Accuracy
±(% of reading + % of range)

Range (rms)	1 Year (Tcal ±5 °C)	Tempco/°C (15 to 35 °C)
500 mA	0.5 + 0.07	0.025 + 0.003
2 A		

Resistance Measurement

Ranges 100 Ω , 1 k Ω , 10 k Ω ,
100 k Ω , 1 M Ω , 100 M Ω

Resistance Measurement Accuracy $\pm$ (ppm of Reading + ppm of Range)

Range	Test Current	Max Test Voltage	1 Year (Tcal ± 5 °C)	Tempco/°C (15 to 35 °C)
100 Ω	1 mA	100 mV	450 + 310	70 + 55
1 k Ω	1 mA	1 V	450 + 100	70 + 12
10 k Ω	100 μ A	1 V	450 + 100	70 + 12
100 k Ω	10 μ A	1 V	450 + 100	70 + 12
1 M Ω	5 μ A	5 V	450 + 100	70 + 8
100 M Ω	500 nA	5 V	8000 + 75	400 + 4

Capacitance Measurement

Range 50 pF to 500 μ F

Accuracy 1%

Test voltage 1 V_{pk}

Test Frequency

50 pF to 500 pF 10 kHz

500 pF to 5 nF 1 kHz

5 nF to 50 nF 1 kHz

50 nF to 1 μ F 1 kHz

1 μ F to 500 μ F 100 Hz

Inductance Measurement

Range 100 μ H to 100 mH

Accuracy 1%

Test voltage

100 μ H to 1 mH 0.5 V_{pk}

1 mH to 10 mH 0.5 V_{pk}

10 mH to 100 mH 1 V_{pk}

Test frequency

100 μ H to 1 mH 10 kHz

1 mH to 10 mH 1 kHz

10 mH to 100 mH 1 kHz

Diode Measurement¹

Ranges 1 V, 10 V

Nominal test current 1 mA (1 V range)
100 μ A (10 V range)

Function Generator

Channels 1

Output waveform type Sine, square, triangle

Frequency range 0.186 Hz to 5 MHz (sine)
0.186 Hz to 1 MHz
(square and triangle)

Frequency resolution 0.186 Hz

DDS resolution 10 bits

Waveform amplitude range 10 V_{p-p}

Waveform amplitude resolution 10 bits

Waveform amplitude accuracy 1% $\pm$ 15 mV

Waveform offset range $\pm$ 5 V

Waveform offset resolution 10 bits

Waveform offset accuracy 1% $\pm$ 15 mV

Duty cycle range 0 to 100%

Duty cycle resolution 10 bits

Duty cycle accuracy 1%

Output impedance 50 Ω

¹ The Two-Wire Current Voltage Analyzer SFP is the recommended instrument for diode measurement.

NI ELVIS II+

Range (V _{pk-pk})	Programmable Vertical Offset		Typical Noise (V _{rms})
	Range (V)	Offset Accuracy	
0.04	±0.4	±2 mV	0.00022
0.1	±0.4	±10 mV	0.00035
0.2	±0.4	±10 mV	0.0007
0.4	±0.4	±10 mV	0.0014
1	±4	±100 mV	0.0035
2	±4	±100 mV	0.007
4	±4	±100 mV	0.014
10	±25	±625 mV	0.035
20	±20	±625 mV	0.07
40	±10	±625 mV	0.14

Accuracy ±(2% of Input +
1% of Full Scale
Range + 300 µV)



Note Accuracy is calculated with the
programmable offset = 0 V and at ±5 °C from the
self-calibration temperature.

DC drift ±(0.033% of Input +
0.06% of Full Scale
Range + 40 µV) per °C

Dynamic Signal Analyzer

Frequency resolution Software controllable
(200, 400, 800, 1600,
3200 lines)

Accuracy

NI ELVIS II Refer to the *Analog Input*
section.

NI ELVIS II+
(using scope channels) Refer to the *Oscilloscope*
section.

Frequency range

NI ELVIS II Up to 625 kHz

NI ELVIS II+
(using scope channels) Up to 50 MHz

Bode Analyzer

Amplitude accuracy

NI ELVIS II Refer to the *Analog Input*
section.

NI ELVIS II+
(using scope channels) Refer to the *Oscilloscope*
section.

Frequency range

NI ELVIS II 1 Hz to 200 kHz

NI ELVIS II+
(using scope channels) 1 Hz to 5 MHz

Two-Wire Current-Voltage Analyzer

Current range ±40 mA

Voltage sweep range ±10 V

Three-Wire Current-Voltage Analyzer

Supported devices NPN and PNP transistors

Minimum base current step 0.48 µA

Maximum collector current ±40 mA

Maximum collector voltage ±10 V

Impedance Analyzer

Excitation frequency 1 Hz to 35 kHz

Resistance measurement range 5 Ω to 3 MΩ

Capacitance measurement range Refer to the *DMM*,
Capacitance
Measurement section.

Inductance measurement range Refer to the *DMM*,
Inductance Measurement
section.

Power Supplies¹

+15 V Supply

Output voltage (no load).....	+15 V $\pm 5\%$
Maximum output current.....	500 mA
Ripple and noise	1% peak-to-peak max.
Load regulation.....	5%
Short circuit protection	Resettable circuit breaker

-15 V Supply

Output voltage (no load).....	-15 V $\pm 5\%$
Maximum output current.....	500 mA
Ripple and noise	1% peak-to-peak max.
Load regulation.....	5%
Short circuit protection	Resettable circuit breaker

+5 V Supply

Output voltage (no load).....	+5 V $\pm 5\%$
Maximum output current.....	2 A
Ripple and noise	1% peak-to-peak max.
Load regulation.....	5%
Short circuit protection	Resettable circuit breaker

Positive Variable Supply

Output voltage ²	0 to +12 V
Voltage setpoint resolution.....	10 bits
Voltage accuracy (no load).....	100 mV
Maximum output current.....	500 mA
Ripple and noise	25 mV
Short circuit protection	Self-resetting current limiter

Negative Variable Supply

Output voltage.....	0 to -12 V
Voltage setpoint resolution	10 bits
Voltage accuracy (no load).....	100 mV
Maximum output current	500 mA
Ripple and noise.....	25 mV
Short circuit protection	Self-resetting current limiter

Calibration

Recommended warm-up time	30 minutes
Calibration interval	1 year

Communication

Bus interface	USB 2.0 Hi-Speed
USB signal stream	4 streams; can be used for analog input, analog output, and counter/timers

Physical

Dimensions	34.3 $\times$ 28.0 $\times$ 7.6 cm (14.5 $\times$ 11.0 $\times$ 3 in.)
Weight.....	1.9 kg (4.2 lb)

Environmental

Operating temperature	10 to 35 °C
Storage temperature	-20 to 70 °C
Humidity	10 to 90% relative humidity, noncondensing
Maximum altitude.....	2,000 m
Pollution Degree (indoor use only).....	2

¹ Total output power of all DC and variable power supplies is 30 W.

² At least 1 mA of load current is required for voltage setpoints lower than +250 mV.

Safety

This product meets the requirements of the following standards of safety for electrical equipment 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 (IEC 61326): 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 For the standards applied to assess the EMC of this product, refer to the *Online Product Certification* section.



Note For EMC compliance, operate this product according to the documentation.

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 *NI and the Environment* 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)



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