

# USB-2404-UI

## Specifications



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# Specifications

All specifications are subject to change without notice.  
Typical for the range 0 to 60 °C unless otherwise noted.

## Analog input

Table 1. Analog input specifications

Parameter	Conditions	Specification
Number of channels		4
A/D converter resolution		24-bit
A/D converter type		Delta-Sigma with analog pre-filtering
Sampling mode		Simultaneous
TEDS sensor type supported		IEEE 1451.4 TEDS Class II (interface)
Input mode		<ul style="list-style-type: none"><li>▪ Voltage</li><li>▪ Current</li><li>▪ Resistance (4-wire and 2-wire)</li><li>▪ RTD (3-wire and 4-wire)</li><li>▪ Thermocouple</li><li>▪ Quarter-bridge</li><li>▪ Half-bridge</li><li>▪ Full-bridge</li></ul>
Conversion time (No channels in TC mode)	High speed	10 ms for all channels
	Best 60 Hz rejection	110 ms for all channels
	Best 50 Hz rejection	130 ms for all channels
	High resolution	500 ms for all channels
Conversion time (One or more channels in TC mode)	High speed	20 ms for all channels
	Best 60 Hz rejection	120 ms for all channels
	Best 50 Hz rejection	140 ms for all channels
	High resolution	510 ms for all channels
Overvoltage protection	Terminals 1 and 2	±30 V
	Terminals 3 through 6, across any combination	±60 V
Input impedance	Voltage mode (±60 V, ±15 V, ±4 V)	1 MΩ
	Current mode	<40 Ω
	All other modes	>1 GΩ
Input bias current		<1 nA
Integral non-linearity (INL)		±15 ppm
Common mode rejection ratio (CMRR)	$f_{in} = 60$ Hz	>100 dB
Normal mode rejection ratio (NMRR)	Best 60 Hz rejection	90 dB at 60 Hz
	Best 50 Hz rejection	80 dB at 50 Hz
	High resolution	65 dB at 50 Hz and 60 Hz

## Input mode ranges

Table 2. Input mode range specifications

Input mode	Nominal range(s)	Actual range(s)
Voltage	$\pm 60\text{ V}$ , $\pm 15\text{ V}$ , $\pm 4\text{ V}$ , $\pm 1\text{ V}$ , $\pm 125\text{ mV}$	$\pm 60\text{ V}$ , $\pm 15\text{ V}$ , $\pm 4\text{ V}$ , $\pm 1\text{ V}$ , $\pm 125\text{ mV}$
Current	$\pm 25\text{ mA}$	$\pm 25\text{ mA}$
4-wire and 2-wire resistance	10 k $\Omega$ , 1 k $\Omega$	10.5 k $\Omega$ , 1.05 k $\Omega$
Thermocouple	$\pm 125\text{ mV}$	$\pm 125\text{ mV}$
4-wire and 3-wire RTD	Pt 1000, Pt 100	5.05 k $\Omega$ , 505 $\Omega$
Quarter-bridge	350 $\Omega$ , 120 $\Omega$	390 $\Omega$ , 150 $\Omega$
Half-bridge	$\pm 500\text{ mV/V}$	$\pm 500\text{ mV/V}$
Full-bridge	$\pm 62.5\text{ mV/V}$ , $\pm 7.8\text{ mV/V}$	$\pm 62.5\text{ mV/V}$ , $\pm 7.8125\text{ mV/V}$

## Accuracy

Table 3. Accuracy specifications

Mode, range	Gain error (percent of reading)	Offset error (ppm of range)
	Typical 25 °C, $\pm 5\text{ °C}$ , $-40\text{ to }70\text{ °C}$ maximum	
Voltage, $\pm 60\text{ V}$	$\pm 0.3$ , $\pm 0.4$	$\pm 20$ , $\pm 50$
Voltage, $\pm 15\text{ V}$	$\pm 0.3$ , $\pm 0.4$	$\pm 60$ , $\pm 180$
Voltage, $\pm 4\text{ V}$	$\pm 0.3$ , $\pm 0.4$	$\pm 240$ , $\pm 720$
Voltage, $\pm 1\text{ V}$	$\pm 0.1$ , $\pm 0.18$	$\pm 15$ , $\pm 45$
Voltage/Thermocouple, $\pm 125\text{ mV}$	$\pm 0.1$ , $\pm 0.18$	$\pm 120$ , $\pm 360$
Current, $\pm 25\text{ mA}$	$\pm 0.1$ , $\pm 0.6$	$\pm 30$ , $\pm 100$
4-wire and 2-wire (note 1) resistance, 10 k $\Omega$	$\pm 0.1$ , $\pm 0.5$	$\pm 120$ , $\pm 320$
4-wire and 2-wire (note 1) resistance, 1 k $\Omega$	$\pm 0.1$ , $\pm 0.5$	$\pm 1200$ , $\pm 3200$
4-wire and 3-wire RTD, Pt 1000	$\pm 0.1$ , $\pm 0.5$	$\pm 240$ , $\pm 640$
4-wire and 3-wire RTD, Pt 100	$\pm 0.1$ , $\pm 0.5$	$\pm 2400$ , $\pm 6400$
Quarter-bridge, 350 $\Omega$	$\pm 0.1$ , $\pm 0.5$	$\pm 2400$ , $\pm 6400$
Quarter-bridge, 120 $\Omega$	$\pm 0.1$ , $\pm 0.5$	$\pm 2400$ , $\pm 6400$
Half-bridge, $\pm 500\text{ mV/V}$	$\pm 0.03$ , $\pm 0.07$	$\pm 300$ , $\pm 450$
Full-bridge, $\pm 62.5\text{ mV/V}$	$\pm 0.03$ , $\pm 0.08$	$\pm 300$ , $\pm 1000$
Full-bridge, $\pm 7.8\text{ mV/V}$	$\pm 0.03$ , $\pm 0.08$	$\pm 2200$ , $\pm 8000$
Cold-junction compensation sensor accuracy		$\pm 1\text{ °C}$ , typical

**Note 1:** 2-wire resistance mode accuracy depends on the lead wire resistance. This table assumes 0  $\Omega$  of lead wire resistance.

## Stability

Table 4. Stability specifications

Measurement conditions	Gain drift (ppm of reading/ °C)	Offset drift (ppm of range/ °C)
Voltage, $\pm 60$ V	$\pm 20$	$\pm 0.2$
Voltage, $\pm 15$ V	$\pm 20$	$\pm 0.8$
Voltage, $\pm 4$ V	$\pm 20$	$\pm 3.2$
Voltage, $\pm 1$ V	$\pm 10$	$\pm 0.2$
Voltage/thermocouple, $\pm 125$ mV	$\pm 10$	$\pm 1.6$
Current, $\pm 25$ mA	$\pm 15$	$\pm 0.4$
4-wire and 2-wire resistance, 10 k $\Omega$	$\pm 15$	$\pm 3$
4-wire and 2-wire resistance, 1 k $\Omega$	$\pm 15$	$\pm 30$
4-wire and 3-wire RTD, Pt 1000	$\pm 15$	$\pm 6$
4-wire and 3-wire RTD, Pt 100	$\pm 15$	$\pm 60$
Quarter-bridge, 350 $\Omega$	$\pm 15$	$\pm 120$
Quarter-bridge, 120 $\Omega$	$\pm 15$	$\pm 240$
Half-bridge, $\pm 500$ mV/V	$\pm 3$	$\pm 20$
Full-bridge, $\pm 62.5$ mV/V	$\pm 3$	$\pm 20$
Full-bridge, $\pm 7.8$ mV/V	$\pm 3$	$\pm 20$

## Input noise

Table 5. Input noise (ppm of range<sub>rms</sub>) specifications

Mode, range	Conversion time			
	High speed	Best of 60 Hz rejection	Best of 50 Hz rejection	High resolution
Voltage, $\pm 60$ V	7.6	1.3	1.3	0.5
Voltage, $\pm 15$ V	10.8	1.9	1.9	0.7
Voltage, $\pm 4$ V	10.8	2.7	2.7	1.3
Voltage, $\pm 1$ V	7.6	1.3	1.3	0.5
Voltage/Thermocouple, $\pm 125$ mV	10.8	1.9	1.9	1.0
Current, $\pm 25$ mA	10.8	1.9	1.9	1.0
4-wire and 2-wire resistance, 10 k $\Omega$	4.1	1.3	0.8	0.3
4-wire and 2-wire resistance, 1 k $\Omega$	7.1	1.8	1.2	0.7
4-wire and 3-wire RTD, Pt 1000	7.6	1.7	1.1	0.4
4-wire and 3-wire RTD, Pt 100	10.8	1.9	1.9	0.9
Quarter-bridge, 350 $\Omega$	5.4	1.0	1.0	0.7
Quarter-bridge, 120 $\Omega$	5.4	1.0	1.0	0.7
Half-bridge, $\pm 500$ mV/V	3.8	0.5	0.5	0.2
Full-bridge, $\pm 62.5$ mV/V	5.4	1.0	1.0	0.8
Full-bridge, $\pm 7.8$ mV/V	30	4.7	4.7	2.3

## Excitation level

Table 6. Half-bridge and full-bridge mode excitation level specifications

Measurement conditions	Load resistance ( $\Omega$ )	Excitation (V)
Half-bridge	700	2.5
Half-bridge	240	2.0
Full-bridge	350	2.7
Full-bridge	120	2.2

Table 7. Resistance, RTD, and quarter-bridge mode excitation level specifications

Load resistance ( $\Omega$ )	Excitation (V)
120	50
350	150
1,000	430
10,000	2,200

## Power

Table 8. Power specifications

Parameter	Specification
Current consumption from USB	500 mA, maximum

## Bus interface

Table 9. Bus interface specifications

Parameter	Specification
USB specification	USB 2.0 Hi-Speed

## Environmental

Table 10. Environmental specifications

Parameter	Specification
Operating temperature range	0 to 60 °C
Storage temperature range	–40 to 85 °C
Operating humidity	10 to 90% RH, non-condensing
Storage humidity	5 to 95% RH, non-condensing
Maximum altitude	2000 meter (6562 feet)

**Note 2:** The USB-2404-UI is intended for indoor use only, but may be used outdoors if installed in a suitable enclosure

## Mechanical

Table 11. Mechanical specifications

Parameter	Specification
Dimensions	5.27" (L) x 5.64" (W) x 1.54" (H) (134 mm x 143 mm x 39 mm)
Weight	1.25 lbs (567 grams)

## Safety voltages

Connect only voltages that are within the limits specified in this table.

Table 12. Safety specifications

Parameter	Conditions	Specification
Channel-to-earth ground isolation	Continuous	250 VAC, Measurement Category II (Note 3)
	Withstand	2300 VAC, verified by a 5 second dielectric withstand test
Channel-to-channel isolation	Continuous	250 VAC, Measurement Category II (Note 3)
	Withstand	1390 VAC, verified by a 5 second dielectric withstand test

**Note 3:** Measurement Category II is for measurements performed on circuits directly connected to the electrical distribution system. This category refers to local-level electrical distribution, such as that provided by a standard wall outlet, for example 115 V for US or 230 V for Europe.

**Caution!** Do *not* connect the device to signals or use for measurements within Measurement Categories III or IV.

## Spring terminal connectors

Table 13. Spring terminal specifications

Connector type	Four 6-position spring terminal connectors
Spring terminal wiring	18 to 28 AWG copper conductor wire with 7 mm (0.28 in.) of insulation stripped from the end.

Table 14. Signal names

Terminal number	Signal name	Signal description
1	T+	TEDS Data
2	T–	TEDS Common
3	EX+/HI (Note 4)	Positive excitation or input signal
4	HI	Positive input signal
5	EX–/LO (Note 4)	Negative excitation or input signal
6	LO	Negative input signal

**Note 4:** Depending on the input mode, terminals 3 and 5 are either excitation signals or input signals.

Table 15. Terminal assignments per input mode

Input mode	Signal terminals					
	1	2	3	4	5	6
Voltage	T+	T–	—	HI	LO	—
Current	T+	T–	HI	—	LO	—
4-wire resistance	T+	T–	EX+	HI	EX–	LO
2-wire resistance	T+	T–	HI	—	LO	—
Thermocouple	T+	T–	—	HI	LO	—
4-wire RTD	T+	T–	EX+	HI	EX–	LO
3-wire RTD	T+	T–	EX+	—	EX–	LO
Quarter-bridge	T+	T–	HI	—	LO	—
Half-bridge	T+	T–	EX+	HI	EX–	—
Full-bridge	T+	T–	EX+	HI	EX–	LO

## Accessory products

Table 16. Accessory products

ACC-164	6-position spring terminal connector block (quantity four)
ACC-176	Backshell for use with the ACC-164 6-position spring terminal connector blocks. Provides strain relief and operator protection from high-voltage signals (quantity four).

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