

# USB-7204

## Specifications



**MEASUREMENT  
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# Specifications

All specifications are subject to change without notice.

Typical for 25°C unless otherwise specified.

Specifications in *italic text* are guaranteed by design.

## Analog input

Table 1. Analog input specifications

Parameter	Conditions	Specification
A/D converter type		Successive approximation type
Input modes		Single-ended or differential (default)
Input voltage range for linear operation, single-ended mode	CHx to GND	±10 volts (V) maximum
Input common-mode voltage range for linear operation, differential mode	CHx to GND	-10 V minimum, +20 V maximum
<i>Absolute maximum input voltage</i>	<i>CHx to GND</i>	<i>±28 V maximum</i>
<i>Input impedance</i>		<i>122KOhm</i>
Input current (Note 1)	V <sub>in</sub> = +10 V	70 microamperes (µA) typical
	V <sub>in</sub> = 0 V	-12 µA typical
	V <sub>in</sub> = -10 V	-94 µA typical
Number of channels		8 single-ended / 4 differential, software selectable
Input ranges, single-ended mode		±10 V, G=2
Input ranges, differential mode		±20 V, G=1 ±10 V, G=2 (default) ±5 V, G=4 ±4 V, G=5 ±2.5 V, G=8 ±2.0 V, G=10 ±1.25 V, G=16 ±1.0 V, G=20 Software selectable
Throughput (Note 2)	Software paced	250 samples per second (S/s) typical, PC-dependent
	Scan to system memory	0.56 S/s to 50 (kS/s)
Channel Gain Queue	Up to 16 elements	Software configurable channel, range.
Resolution (Note 3)	Differential	12 bits, no missing codes
	Single-ended	11 bits (shifted for 12-bit representation, even numbers only)
Integral linearity error		±1 least significant bit (LSB) typical
Differential linearity error		±0.5 LSB typical
Repeatability		±1 LSB typical
Trigger source	Software selectable	External digital: TRIG_IN
Pacer source	Software selectable	<ul style="list-style-type: none"> <li>▪ Internal</li> <li>▪ External (SYNC), rising edge triggered</li> <li>▪ External Gated (SYNC), see Note 4</li> <li>▪ Programmed IO</li> </ul>
Calibration		Factory Cal factors stored in firmware. Cal factors must be applied via application software.

**Note 1:** Input current is a function of applied voltage on the analog input channels. For a given input voltage, V<sub>in</sub>, the input leakage is approximately equal to (8.181\*V<sub>in</sub>-12) µA.

**Note 2:** Maximum throughput scanning to PC memory is machine dependent. The rates specified are for Windows XP only.

**Note 3:** The AD7870 converter only returns 11-bits (0-2047 codes) in single-ended mode; firmware shifts it to 12-bit.

**Note 4:** External Gated Sync holds off the first clock pulse after setting up a scan to ensure adequate setup time for the first conversion.

Table 2. Accuracy, differential mode

Range	Accuracy (LSB)
±20 V	5.1
±10 V	6.1
±5 V	8.1
±4 V	9.1
±2.5 V	12.1
±2 V	14.1
±1.25 V	20.1
±1 V	24.1

Table 3. Accuracy, single-ended mode

Range	Accuracy (LSB)
±10 V	4.0

Table 4. Accuracy components, differential mode - All values are (±)

Range	% of Reading	Gain Error at full scale (FS) (millivolts (mV))	Offset (mV)	Accuracy at FS (mV)
±20 V	0.2	40	9.766	49.766
±10 V	0.2	20	9.766	29.766
±5 V	0.2	10	9.766	19.766
±4 V	0.2	8	9.766	17.766
±2.5 V	0.2	5	9.766	14.766
±2 V	0.2	4	9.766	13.766
±1.25 V	0.2	2.5	9.766	12.266
±1 V	0.2	2	9.766	11.766

Table 5. Accuracy components, single-ended mode - All values are (±)

Range	% of Reading	Gain Error at FS (mV)	Offset (mV)	Accuracy at FS (mV)
±10 V	0.2	20	19.531	39.531

Table 6. Noise performance, differential mode

Range	Typical counts	Least significant bit <sub>root mean square</sub> (LSB <sub>rms</sub> )
±20 V	2	0.30
±10 V	2	0.30
±5 V	3	0.45
±4 V	3	0.45
±2.5 V	4	0.61
±2 V	5	0.76
±1.25 V	7	1.06
±1 V	8	1.21

Table 7. Noise performance, single-ended mode

Range	Typical Counts	LSB <sub>rms</sub>
±10 V	2	0.30

## Analog output

Table 8. Analog output specifications

Parameter	Conditions	Specification
Resolution		12-bits, 1 in 4096
Output range		0 – 4.096 V, 1 mV per LSB.
Number of channels		2
Throughput (Note 5)	Software paced	250 S/s single channel typical, PC dependent
	Single channel, continuous scan	10 kS/s
	Dual channel, continuous scan, simultaneous update	5 kS/s
Power on and reset voltage		Initializes to 000h code
Output drive	Each D/A OUT	15 mA
Slew rate		0.8V/microsecond (µs) typical

**Note 5:** Maximum throughput scanning to PC memory is machine dependent. The rates specified are for Windows XP only. Maximum rates on operating systems that predate XP may be less and must be determined through testing on your machine.

Table 9. Analog output accuracy, all values are (±)

Range	Accuracy (LSB)
0-4.096 V	4.0 typical, 45.0 maximum

Table 10. Analog output accuracy components, all values are (±)

Range	% of FSR	Gain Error at FS (mV)	Offset (mV) (Note 6)	Accuracy at FS (mV)
0-4.096 V	0.1 typical, 0.9 max	4.0 typical, 36.0 max	1.0 typical, 9.0 max	4.0 typical, 45.0 max

**Note 6:** Negative offsets will result in a fixed zero-scale error or "dead band." At the maximum offset of 9 mV, any input code of less than 0x009 will not produce a response in the output.

## Digital input/output

Table 11. Digital I/O specifications

Parameter	Specification
Digital type	CMOS
Number of I/O	16 (Port 0 bit 0 through bit 7, Port 1 bit 0 through bit 7)
Configuration	2 banks of 8
Pull up/pull-down configuration	All pins configurable via jumpers (JP1 and JP2) to Vs or Ground via 47 K resistors. JP1 configures Port 1, and JP2 configures Port 0.
Input high voltage	2.0 V minimum, 5.5 V absolute maximum
Input low voltage	0.8 V maximum, -0.5 V absolute minimum
Output high voltage (IOH = -2.5 mA)	3.8 V minimum
Output low voltage (IOL = 2.5 mA)	0.7 V maximum
Power on and reset state	Input

## External trigger

Table 12. Digital trigger specifications

Parameter	Conditions	Specification
Trigger source (Note 7)	External Digital	TRIG_IN
Trigger mode	Software selectable	Edge sensitive: user configurable for CMOS compatible rising or falling edge.
Trigger latency		10 $\mu$ s maximum
Trigger pulse width		1 $\mu$ s minimum
Input high voltage		4.0 V minimum, 5.5 V absolute maximum
Input low voltage		1.0 V maximum, -0.5 V absolute minimum
Input leakage current		$\pm 1.0 \mu$ A

**Note 7:** TRIG\_IN is a Schmitt trigger input protected with a 1.5 kilohm ( $k\Omega$ ) series resistor.

## External clock input/output

Table 13. External clock I/O specifications

Parameter	Conditions	Specification
Pin name		SYNC
Pin type		Bidirectional
Software selectable direction	Output (default)	Outputs internal A/D pacer clock.
	Input	Receives A/D pacer clock from external source.
Input clock rate		50 KHz, maximum
Clock pulse width	Input mode	1 $\mu$ s minimum
	Output mode	5 $\mu$ s minimum
Input leakage current	Input mode	$\pm 1.0 \mu$ A
Input high voltage		4.0 V minimum, 5.5 V absolute maximum
Input low voltage		1.0 V maximum, -0.5 V absolute minimum
Output high voltage (Note 8)	IOH = -2.5 mA	3.3 V minimum
	No load	3.8 V minimum
Output low voltage (Note 8)	IOL = 2.5 mA	1.1 V maximum
	No load	0.6 V maximum

**Note 8:** SYNC is a Schmitt trigger input and is over-current protected with a 1.5  $k\Omega$  series resistor.

## Counter

Table 14. Counter specifications

Parameter	Specification
Pin name (Note 9)	CTR
Counter type	Event counter
Number of channels	1
Input type	TTL, rising edge triggered
Input source	CTR screw terminal
Resolution	32 bits
Schmitt trigger hysteresis	20 mV to 100 mV
Input leakage current	$\pm 1 \mu\text{A}$
Maximum input frequency	1 MHz
High pulse width	500 ns minimum
Low pulse width	500 ns minimum
Input high voltage	4.0 V minimum, 5.5 V absolute maximum
Input low voltage	1.0 V maximum, -0.5 V absolute minimum

**Note 9:** CTR is a Schmitt trigger input protected with a 1.5K  $\Omega$  series resistor.

## Non-volatile memory

Table 15. Non-volatile memory specifications

Parameter	Specification		
EEPROM	1,024 bytes		
EEPROM Configuration	Address Range	Access	Description
	0x000-0x1FF	Reserved	512 bytes system and cal data
	0x200-0x3FF	Read/write	512 bytes user area

## Microcontroller

Table 16. Microcontroller specifications

Parameter	Specification
Type	High performance 8-bit RISC microcontroller
Program Memory	32,768 words
Data Memory	3,936 bytes

## Indicator LEDs

Table 17. Indicator LED specifications

Parameter	Specification
Power LED (top)	Indicates that the device's microcontroller has power and is configured.
Status LED	Blinks to indicate USB communications.
OEM power	OEM Connector; LED sink current up to 5 mA per LED @ 5 V <sub>max</sub>

## Power

Table 18. Power specifications

Parameter	Conditions	Specification
Supply current (Note 10)		80 mA
+5V <sub>USER</sub> power available (Note 11)	<ul style="list-style-type: none"> <li>▪ Connected to self-powered hub</li> <li>▪ Connected to externally-powered root port hub</li> </ul>	4.5 V minimum, 5.25 V maximum
	Connected to bus-powered hub	4.1 V minimum, 5.25 V maximum
Output current (Note 12)	Connected to self-powered hub	420 mA maximum
	Connected to externally-powered root port hub	
	Connected to bus-powered hub	20 mA maximum
Fuse F1, (F4 spare)	<a href="#">0452.500</a> - Littelfuse 0.5A NANO <sup>2</sup> ® Slo-Blo <sup>®</sup> Subminiature Surface Mount Fuse	
Fuse F2, (F3 spare)	<a href="#">0452.375</a> - Littelfuse 0.375A NANO <sup>2</sup> ® Slo-Blo <sup>®</sup> Subminiature Surface Mount Fuse	

**Note 10:** This is the total current requirement for the USB-7204 which includes up to 10 mA for the status LED.

**Note 11:** *Self-powered hub* refers to a USB hub with an external power supply. Self-powered hubs allow a connected USB device to draw up to 500 mA.

*Root port hubs* reside in the PC's USB host controller. The USB port(s) on your PC are root port hubs. All externally powered root port hubs (desktop PCs) provide up to 500 mA of current for a USB device. Battery-powered root port hubs provide 100 mA or 500 mA, depending upon the manufacturer. A laptop PC that is not connected to an external power adapter is an example of a battery-powered root port hub.

*Bus powered hubs* receive power from a self-powered or root port hub. In this case the maximum current available from the USB +5 V is 100 mA. The minimum USB +5 V voltage level can be as low as 4.1 V.

Protected by fuse F2 at 375 mA.

**Note 12:** This refers to the total amount of current that can be sourced from the USB +5 V, analog outputs and digital outputs.

## General

Table 19. General specifications

Parameter	Specification
Device type	USB 2.0 (full-speed)
Device compatibility	USB 1.1, USB 2.0
DEFAULTS for programmable options and "DEV:RESET/DEFAULT" message	AI Channel Mode = Differential Range = $\pm 10$ V
	AInScan Low Channel = 0 High Channel = 0 Samples = 1000 Rate = 1000 Range = $\pm 10$ V Pacer = Master Transfer Mode = BlockIO Trigger = Disabled Queue = Disabled Status = Idle
	AITrig Trigger Polarity = Rising Rearm = Disabled
	AOutScan Low Channel = 0 High Channel = 0 Samples = 1000 Rate = 1000 Trigger = Disabled Status = Idle
	CTR Value = 0

## Environmental

Table 20. Environmental specifications

Parameter	Specification
Operating temperature range	0 to 70 °C
Storage temperature range	-40 to 70 °C
Humidity	0 to 90% non-condensing

## Mechanical

Table 21. Mechanical specifications

Parameter	Specification
Dimensions	3.55" (L) x 3.75" (W) x 0.5" (H) 4.40" (L) with detachable screw terminals connected
USB cable length	3 meters maximum
User connection length	3 meters maximum



## Main connector and pin out

Table 22. Main connector specifications

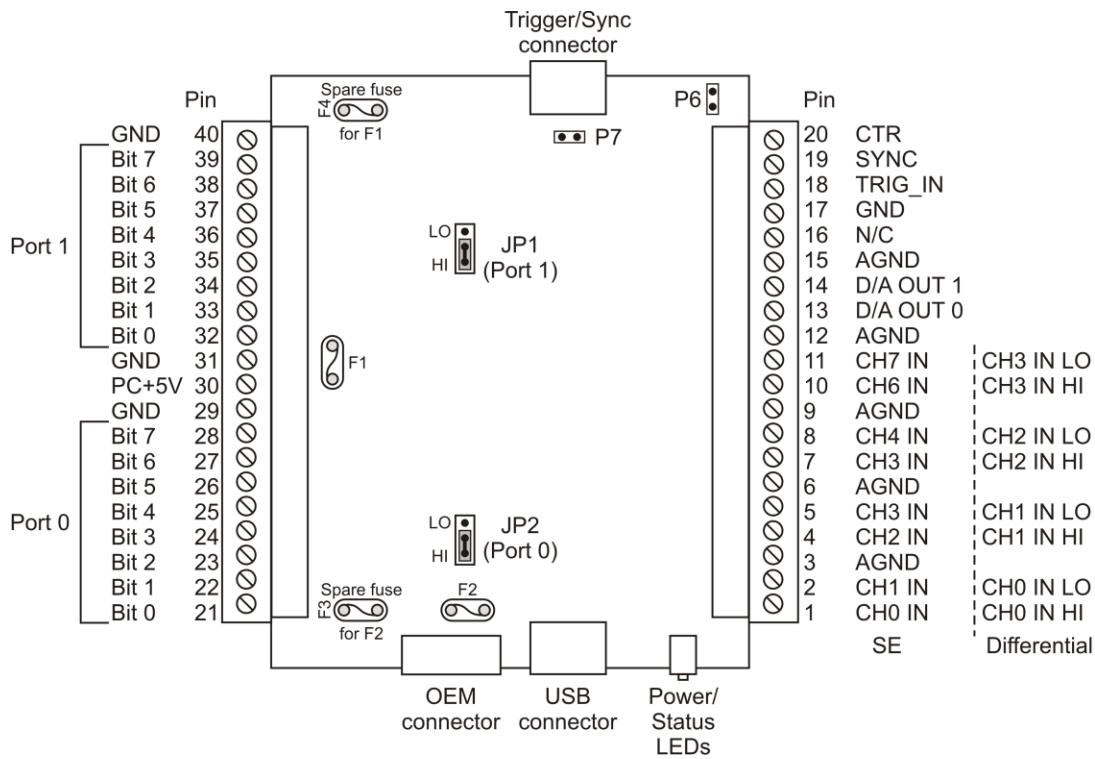
Parameter	Specification
Connector type	Screw terminal
Wire gauge range	16 AWG to 30 AWG

### 4-channel differential mode

Pin	Signal Name	Pin	Signal Name
1	CH0 IN HI	21	Port 0 Bit 0
2	CH0 IN LO	22	Port 0 Bit 1
3	AGND	23	Port 0 Bit 2
4	CH1 IN HI	24	Port 0 Bit 3
5	CH1 IN LO	25	Port 0 Bit 4
6	AGND	26	Port 0 Bit 5
7	CH2 IN HI	27	Port 0 Bit 6
8	CH2 IN LO	28	Port 0 Bit 7
9	AGND	29	GND
10	CH3 IN HI	30	+5V <sub>USER</sub> output
11	CH3 IN LO	31	GND
12	AGND	32	Port 1 Bit 0
13	D/A OUT 0	33	Port 1 Bit 1
14	D/A OUT 1	34	Port 1 Bit 2
15	AGND	35	Port 1 Bit 3
16	N/C (do not connect anything to this pin)	36	Port 1 Bit 4
17	GND	37	Port 1 Bit 5
18	TRIG IN	38	Port 1 Bit 6
19	SYNC	39	Port 1 Bit 7
20	CTR	40	GND

### 8-channel single-ended mode

Pin	Signal Name	Pin	Signal Name
1	CH0 IN	21	Port 0 Bit 0
2	CH1 IN	22	Port 0 Bit 1
3	AGND	23	Port 0 Bit 2
4	CH2 IN	24	Port 0 Bit 3
5	CH3 IN	25	Port 0 Bit 4
6	AGND	26	Port 0 Bit 5
7	CH4 IN	27	Port 0 Bit 6
8	CH5 IN	28	Port 0 Bit 7
9	AGND	29	GND
10	CH6 IN	30	+5V <sub>USER</sub> output
11	CH7 IN	31	GND
12	AGND	32	Port 1 Bit 0
13	D/A OUT 0	33	Port 1 Bit 1
14	D/A OUT 1	34	Port 1 Bit 2
15	AGND	35	Port 1 Bit 3
16	N/C (do not connect anything to this pin)	36	Port 1 Bit 4
17	GND	37	Port 1 Bit 5
18	TRIG IN	38	Port 1 Bit 6
19	SYNC	39	Port 1 Bit 7
20	CTR	40	GND



### OEM connector and pin out (P4)

Table 23. OEM connector specifications

Parameter	Specification
Connector type	10 position 0.1" box header

Table 24. OEM connector pin out

Pin	Signal Name	Pin	Signal Name
1	N/C	2	V <sub>BUS</sub> (fuse protected)
3	N/C	4	D-
5	N/C (do not connect anything to this pin)	6	D+
7	N/C (do not connect anything to this pin)	8	GND
9	N/C (do not connect anything to this pin)	10	SHIELD

### Trigger/Sync connector and pin out (P5)

Table 25. Trigger/Sync connector specifications

Parameter	Specification
Connector type	10 position 0.1" box header

Table 26. Trigger/Sync connector pin out

Pin	Signal Name	Pin	Signal Name
1	TRIG_IN	2	GND
3	N/C	4	GND
5	SYNC	6	GND
7	N/C	8	GND
9	N/C	10	N/C

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