

## Specifications

Typical for 25 °C unless otherwise specified.

Specifications in *italic text* are guaranteed by design.

### Analog Input

Parameter	Conditions	Specification
A/D converter type		Successive approximation type
Input voltage range for linear operation, single-ended mode	CHx to GND	±10 V max
Input voltage range for linear operation, differential mode	CHx to GND	-10 V min, +20V max
<i>Absolute maximum input voltage</i>	<i>CHx to GND</i>	<i>±40 V max</i>
Input current (Note 1)	V <sub>in</sub> = +10 V	70 μA typ
	V <sub>in</sub> = 0 V	-12 μA typ
	V <sub>in</sub> = -10 V	-94 μA typ
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 ±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	Software paced	50 S/s
	Continuous scan	1.2 kS/s
	Burst scan to 4K sample FIFO	8 kS/s
Channel gain queue	Up to 8 elements	Software configurable channel, range, and gain.
Resolution (Note 2)	Differential	12 bits, no missing codes
	Single-ended	11 bits
CAL accuracy	CAL = 2.5 V	±0.05% typ, ±0.25% max
Integral linearity error		±1 LSB typ
Differential linearity error		±0.5 LSB typ
Repeatability		±1 LSB typ
CAL current	Source	5 mA max
	Sink	20 μA min, 200 nA typ
Trigger source	Software selectable	External digital: DIO0-DIO3

**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:** The AD7870 converter only returns 11-bits (0-2047 codes) in single-ended mode.

Table 6. 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 7. Accuracy, single-ended mode

Range	Accuracy (LSB)
±10 V	4.0

Table 8. Accuracy components, differential mode - all values are (±)

Range	% of Reading	Gain Error at FS (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 9. Accuracy components, single-ended mode

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

## Analog output

Parameter	Conditions	Specification
D/A converter type		PWM
Resolution		10-bits, 1 in 1024
Maximum output range		0 -5 Volts
Number of channels		2 voltage output
Throughput	Software paced	100 S/s single channel mode 50 S/s dual channel mode
Power on and reset voltage		Initializes to 000h code
Maximum voltage (Note 3)	No load	V <sub>s</sub>
	1 mA load	0.99 * V <sub>s</sub>
	5 mA load	0.98 * V <sub>s</sub>
Output drive	Each D/A OUT	30 mA
Slew rate		0.14 V/mS typ

**Note 3:** V<sub>s</sub> is the USB bus +5V power. The maximum analog output voltage is equal to V<sub>s</sub> at no-load. V is system dependent and may be less than 5 volts.

## Digital input / output (screw terminal DIO3:0)

Parameter	Conditions	Specification
Digital type		Discrete, 5V/TTL compatible
Number of I/O		4
Configuration		4 bits, independently programmable for input or output.
Input high voltage		3.0 V min, 15.0 V absolute max
Input low voltage		0.8 V max
Output voltage (Note 4)	No load	$V_s - 0.4$ V min, $V_s$ typ
	1 mA load	$V_s - 1.5$ V
<i>Input leakage current</i>		$\pm 1.0$ $\mu A$
Output short-circuit current (Note 4)	Output high	3.3 mA
Power-up / reset state		Input mode (high impedance)

**Note 4:** The DIO[3:0] lines available at the screw terminals are protected with 1.5 KOhm series resistors.

## Digital input / output (DB37)

Digital type	82C55
Number of I/O	24 (Port A0 through Port C7)
Configuration	2 banks of 8 and 2 banks of 4, or 3 banks of 8
Pull up/pull-down configuration	All pins pulled up to $V_s$ via 47K resistors (default). Positions available for pull down to ground. Hardware selectable via zero ohm resistor.
Input high voltage	2.0 V min, 5.5 V absolute max
Input low voltage	0.8 V max, -0.5 V absolute min
Output high voltage ( $I_{OH} = -2.5$ mA)	3.0 V min
Output low voltage ( $I_{OL} = 2.5$ mA)	0.4 V max

## External trigger

Parameter	Conditions	Specification
Trigger source	External digital	DIO[3:0], only DIO may be selected as a trigger input
Trigger mode	Software selectable	Level sensitive: user configurable for TTL level high or low input.
Trigger latency	Burst	25 $\mu s$ min, 50 $\mu s$ max
Trigger pulse width	Burst	40 $\mu s$ min
Input high voltage		3.0 V min, 15.0 V absolute max
Input low voltage		0.8 V max
<i>Input leakage current</i>		$\pm 1.0$ $\mu A$

## Counters

Counter type	Event counter
Number of channels	1
Input source	CTR screw terminal
Input type	TTL, rising edge triggered
Resolution	32 bits
Schmitt trigger hysteresis	20 mV to 100 mV
Input leakage current	$\pm 1 \mu A$
Maximum input frequency	1 MHz
High pulse width	500 ns min
Low pulse width	500 ns min
Input low voltage	0V min, 1.0 V max
Input high voltage	4.0 V min, 15.0 V max

## Non-volatile memory

Memory size	8192 bytes		
Memory configuration	Address Range	Access	Description
	0x0000 – 0x17FF	Read/Write	A/D Data (4k samples)
	0x1800 – 0x1EFF	Read/Write	User data area
	0x1F00 – 0x1FEF	Read/Write	Calibration Data
	0x1FF0 – 0x1FFF	Read/Write	System Data

## Power

Parameter	Conditions	Specification
Supply Current (Note 5)		20 mA
+5V USB power available (Note 6)	Connected to Self-Powered Hub	4.5 V min, 5.25 V max
	Connected to Bus-Powered Hub	4.1 V min, 5.25 V max
Output Current (Note 7)	Connected to Self-Powered Hub	450 mA min, 500 mA max
	Connected to Bus-Powered Hub	50 mA min, 100 mA max

**Note 5:** This is the total current requirement for the RedLab-1008 which includes up to 5mA for the status LED.

**Note 6:** Self-powered refers to USB hubs and hosts with a power supply. Bus-powered refers to USB hubs and hosts without their own power supply.

**Note 7:** This refers to the total amount of current that can be sourced from the USB +5V, analog outputs and digital outputs.

## General

Parameter	Conditions	Specification
USB controller clock error	25 °C	±30 ppm max
	0 to 70 °C	±50 ppm max
	-40 to 85 °C	±100 ppm max
Device type		USB 1.1 low-speed
Device compatibility		USB 1.1, USB 2.0

## Environmental

Operating temperature range	-40 to 85 °C
Storage temperature range	-40 to 85 °C
Humidity	0 to 90% non-condensing

## Mechanical

Case dimensions	157 mm (L) x 102 mm (W) x40 mm (H) , including connectors
USB cable length	3 meters max
User connection length	3 meters max

## Main connector and pin out

Connector type	Screw terminal
Wire gauge range	12 AWG to 22 AWG

### 4-channel differential mode

Pin	Signal Name	Pin	Signal Name
1	CH0 IN HI	16	DIO0
2	CH0 IN LO	17	DIO1
3	GND	18	GND
4	CH1 IN HI	19	DIO2
5	CH1 IN LO	20	DIO3
6	GND	21	GND
7	CH2 IN HI	22	D/A OUT 0
8	CH2 IN LO	23	D/A OUT 1
9	GND	24	GND
10	CH3 IN HI	25	CTR
11	CH3 IN LO	26	GND
12	GND	27	GND
13	PC +5V	28	PC +5V
14	PC +5V	29	PC +5V
15	CAL	30	TST

### 8-channel single-ended mode

Pin	Signal Name	Pin	Signal Name
1	CH0 IN	16	DIO0
2	CH1 IN	17	DIO1
3	GND	18	GND
4	CH2 IN	19	DIO2
5	CH3 IN	20	DIO3

Pin	Signal Name	Pin	Signal Name
6	GND	21	GND
7	CH4 IN	22	D/A OUT 0
8	CH5 IN	23	D/A OUT 1
9	GND	24	GND
10	CH6 IN	25	CTR
11	CH7 IN	26	GND
12	GND	27	GND
13	PC +5V	28	PC +5V
14	PC +5V	29	PC +5V
15	CAL	30	TST

## DB37 connector and pin out

Connector type	37 D-Type, shielded
Compatible Cables	C37FF-x
	C37FFS-x
	C37FM-x
Compatible accessory products	CIO-MINI37 SSR-RACK24 SSR-RACK08 CIO-ERB24 CIO-ERB08

Pin	Signal Name	Pin	Signal Name
1	n/c	20	USB +5V Out
2	n/c	21	GND
3	Port B7	22	Port C7
4	Port B6	23	Port C6
5	Port B5	24	Port C5
6	Port B4	25	Port C4
7	Port B3	26	Port C3
8	Port B2	27	Port C2
9	Port B1	28	Port C1
10	Port B0	29	Port C0
11	GND	30	Port A7
12	n/c	31	Port A6
13	GND	32	Port A5
14	n/c	33	Port A4
15	GND	34	Port A3
16	n/c	35	Port A2
17	GND	36	Port A1
18	USB +5V Out	37	Port A0
19	GND		

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