Specifications

WLS-2614

Document Revision 1.1, November, 2006

Specifications

Typical for 25 °C unless otherwise specified.

Specifications in *italic* text are guaranteed by design.

Analog input

Table 1. Generic analog input specifications

Parameter	Conditions	Specification
A/D converters		Four dual 24-bit, Sigma-Delta type
Number of channels		8 differential
Input isolation		*500 VDC minimum between field wiring and USB interface*
Channel configuration		Thermocouple sensor type
Differential input voltage range	Thermocouple	±0.080 V
Absolute maximum input voltage	*±C0x through ±C7x relative to GND (pins 9, 19, 28, 38)*	±25 V power on, ±40 V power off.
Input impedance		5 Gigohm, min.
Input leakage current	Open thermocouple detect enabled	105 nA max.
Normal mode rejection ratio	*fIN = 60 Hz*	*90 dB min.*
Common mode rejection ratio	*fIN = 50 Hz/60 Hz*	*100 dB min.*
Resolution		24 bits
No missing codes		*24 bits*
Input coupling		DC
Warm-up time		30 minutes min.
Open thermocouple detect		Automatically enabled when the channel pair is configured for thermocouple sensors. The maximum open detection time is 3 seconds.
CJC sensor accuracy	*15 °C to 35 °C*	*±0.25 °C typ.* *±0.5 °C max.*
	0 °C to 70 °C	*-1.0 to +0.5 °C max*

Channel configurations

Table 2. Channel configuration specifications

Sensor Category	Conditions	Specification
Thermocouple	J, K, S, R, B, E, T, or N	8 differential channels

Note 1: Channel configuration information is stored in the EEPROM of the isolated microcontroller by the firmware whenever any item is modified. Modification is performed by commands issued over USB or wireless from an external application, and the configuration is made non-volatile through the use of the EEPROM.

Note 2: The factory default configuration is *Type J.*

Accuracy

Thermocouple measurement accuracy

Table 3. Thermocouple accuracy specifications, including CJC measurement error

Sensor Type	Maximum error	Typical error	Temperature range
J	±1.499 °C	±0.507 °C	-210 to 0 °C
	±0.643 °C	±0.312 °C	0 to 1200 °C
K	±1.761 °C	±0.538 °C	-210 to 0 °C
	±0.691 °C	±0.345 °C	0 to 1372 °C
S	±2.491 °C	±0.648 °C	-50 to 250 °C
	±1.841 °C	±0.399 °C	250 to 1768.1 °C
R	±2.653 °C	±0.650 °C	-50 to 250 °C
	±1.070 °C	±0.358 °C	250 to 1768.1 °C
B	±1.779 °C	±0.581 °C	250 to 700 °C
	±0.912 °C	±0.369 °C	700 to 1820 °C
E	±1.471 °C	±0.462 °C	-200 to 0 °C
	±0.639 °C	±0.245 °C	0 to 1000 °C
T	±1.717 °C	±0.514 °C	-200 to 0 °C
	±0.713 °C	±0.256 °C	0 to 600 °C
N	±1.969 °C	±0.502 °C	-200 to 0 °C
	±0.769 °C	±0.272 °C	0 to 1300 °C

Note 3: Thermocouple specifications include linearization, cold-junction compensation and system noise. These specs are for one year, or 3000 operating hours, whichever comes first and for operation of the device between 15 °C and 35 °C. For measurements outside this range, add ±0.5 degree to the maximum error shown. There are CJC sensors on each side of the module. The accuracy listed above assumes the screw terminals are at the same temperature as the CJC sensor. Errors shown do not include inherent thermocouple error. Please contact your thermocouple supplier for details on the actual thermocouple error.

Note 4: Thermocouples must be connected to the device such that they are floating with respect to GND (pins 9, 19, 28, 38). The device GND pins are isolated from earth ground, so connecting thermocouple sensors to voltages referenced to earth ground is permissible as long as the isolation between the GND pins and earth ground is maintained.

Note 5: When thermocouples are attached to conductive surfaces, the voltage differential between multiple thermocouples must remain within ±1.4 V. For best results we recommend the use of ungrounded or insulated thermocouples when possible.

Throughput rate to PC (USB or wireless)

Table 4. Throughput rate specifications

Number of input channels	Maximum throughput
1	2 Samples/second
2	2 S/s on each channel, 4 S/s total
3	2 S/s on each channel, 6 S/s total
4	2 S/s on each channel, 8 S/s total
5	2 S/s on each channel, 10 S/s total
6	2 S/s on each channel, 12 S/s total
7	2 S/s on each channel, 14 S/s total
8	2 S/s on each channel, 16 S/s total

Note 6: The analog inputs are configured to run continuously. Each channel is sampled twice per second. The maximum latency between when a sample is acquired and the temperature data is provided by the device is approximately 0.5 seconds.

Digital input/output

Table 5. Digital input/output specifications

Digital type	CMOS
Number of I/O	8 (DIO0 through DIO7)
Configuration	Independently configured for input or output. Power on reset is input mode unless bit is configured for alarm.
Pull up/pull-down configuration	All pins pulled up to +5 V via 47 K kΩ resistors (default). Pull down to ground (GND) also available.
Digital I/O transfer rate (software paced)	▪ Digital input – 50 port reads or single bit reads per second typ. ▪ Digital output – 100 port writes or single bit writes per second typ.
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 low voltage (IOL = 2.5 mA)	0.7 V max
Output high voltage (IOH = -2.5 mA)	3.8 V min.

Note 7: All ground pins on the device (pins 9, 19, 28, 38) are isolated from earth ground. If a connection is made to earth ground when using digital I/O and conductive thermocouples, the thermocouples are no longer isolated. In this case, thermocouples must not be connected to any conductive surfaces that may be referenced to earth ground.

Temperature alarms

Table 6. Temperature alarm specifications

Number of alarms	8 (one per digital I/O line)
Alarm functionality	Each alarm controls its associated digital I/O line as an alarm output. The input to each alarm may be any of the analog temperature input channels. When an alarm is enabled, its associated I/O line is set to output (after the device is reset) and driven to the appropriate state determined by the alarm options and input temperature. The alarm configurations are stored in non-volatile memory and are loaded at power on. Alarms will function both in wireless mode and while attached to USB.
Alarm input modes	▪ Alarm when input temperature > T1 ▪ Alarm when input temperature > T1, reset alarm when input temperature goes below T2 ▪ Alarm when input temperature < T1 ▪ Alarm when input temperature < T1, reset alarm when input temperature goes above T2 ▪ Alarm when input temperature is < T1 or > T2 **Note:** T1 and T2 may be independently set for each alarm.
Alarm output modes	▪ Disabled, digital I/O line may be used for normal operation ▪ Enabled, active high output (digital I/O line goes high when alarm conditions met) ▪ Enabled, active low output (digital I/O line goes low when alarm conditions met)
Alarm update rate	1 second

Memory

Table 7. Memory specifications

EEPROM	1,024 bytes isolated micro reserved for sensor configuration 256 bytes USB micro for external application use

Microcontroller

Table 8. Microcontroller specifications

Type	Three high performance 8-bit RISC microcontrollers

Wireless communications

Table 9. Wireless Communications specifications

Communication standard	*IEEE 802.15.4, ISM 2.4GHz frequency band, non-beacon, point-to-point*
Range	Indoor/urban: Up to 150' (50 m) Outdoor RF line-of-sight: Up to 1/2 mile (750 m)
Transmit power output	10 mW (10 dBm)
Receiver sensitivity	*-100 dBm (1% packet error rate)*
RF channels	*12 direct sequence channels available, channels 12 – 23 (2.410 – 2.465 GHz) (software selectable)*
Addressing	16-bit PAN (personal area network) IDs per channel (software selectable) 64-bit device address
Encryption	*128-bit AES (software selectable)*

Note 8: Contains FCC ID: OUR-XBEEPRO. The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (i.) this device may not cause harmful interference and (ii.) this device must accept any interference received, including interference that may cause undesired operation.

Note 9: Canada: Contains Model XBee Radio, IC: 4214A-XBEEPRO

Caution! To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operations at closer than this distance is not recommended. The antenna used for this transmitter must not be co-located in conjunction with any other antenna or transmitter.

USB +5V voltage

Table 10. USB +5V voltage specifications

Parameter	Conditions	Specification
USB +5V (VBUS) input voltage range		4.75 V min. to 5.25 V max.

Power

Table 11. Power specifications

Parameter	Conditions	Specification
Connected to USB		
Supply current		500 mA max.
User +5V output voltage range (terminal block pin 21 and 47)	Connected to a self-powered hub. (Note 10)	4.75 V min. to 5.25 V max.
User +5V output current (terminal block pin 21 and pin 47)	Connected to a self-powered hub. (Note 10)	10 mA max.
Isolation	*Measurement system to PC*	*500 VDC min.*
Wireless Communications operation		
Supply current		500 mA max.
AC Adapter power supply (used for remote wireless communications operation)		
Standalone power supply		USB power adapter 2.5 Watt USB adapter with interchangeable plugs (Includes plug for USA)
Output voltage		5V ±5%
Output wattage		2.5 W
Input voltage		100 – 240 VAC 50 – 60 Hz
Input current		0.2 A

Note 10: 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. This device may not be used with bus-powered hubs due to the power supply requirements.

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 PC's) 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.

USB specifications

Table 12. USB specifications

USB device type	USB 2.0 (full-speed)
Device compatibility	USB 1.1, USB 2.0
	Bus powered, 500 mA consumption max
USB cable type	*A-B cable, UL type AWM 2725 or equivalent. (min 24 AWG VBUS/GND, min 28 AWG D+/D-)*
USB cable length	3 meters max.

Environmental

Table 13. Environmental specifications

Operating temperature range	0 to 70 ° C
Storage temperature range	-40 to 85 ° C
Humidity	0 to 90% non-condensing

Mechanical

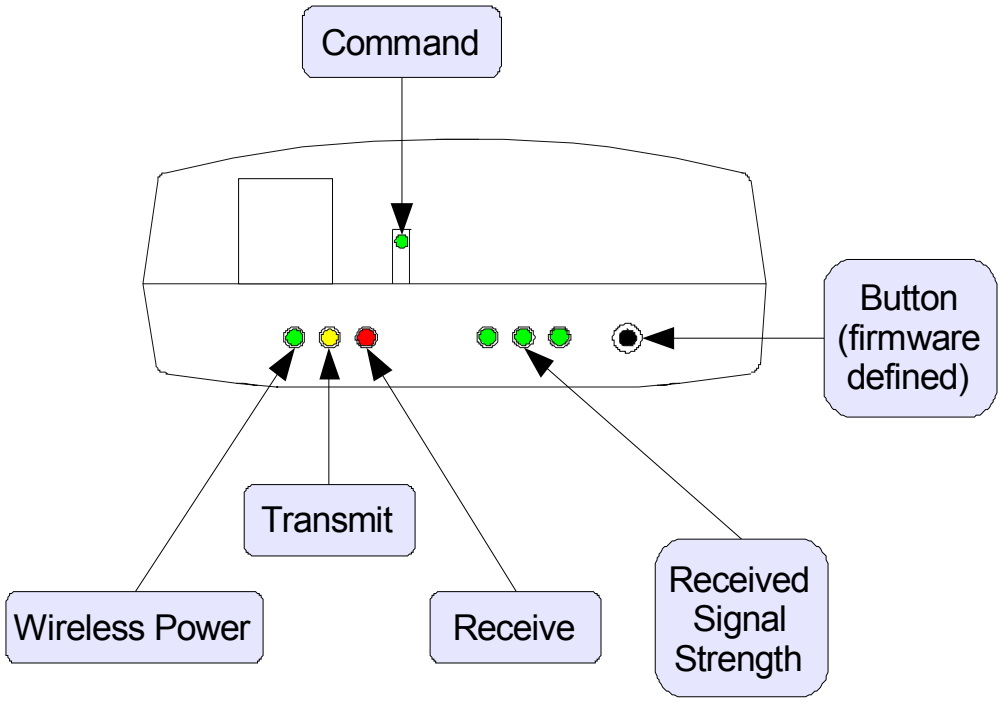
Table 14. Mechanical specifications

Dimensions	127 mm (L) x 88.9 mm (W) x 35.56 (H)
User connection length	3 meters max.

LED / button configuration

Table 15. LED configuration

Command LED	Green LED – indicates a command was received by the device (either USB or wireless)
Received Signal Strength Indicator (RSSI) LEDs	Three green LED bar graph. The LEDs will turn on when receiving a wireless message, and stay on for approximately 1 second after the end of the message. These LEDs indicate the amount of fade margin present in an active wireless link. Fade margin is defined as the difference between the incoming signal strength and the device's receiver sensitivity. ▪ 3 LEDs on: Very strong signal (> 30 dB fade margin) ▪ 2 LEDs on: Strong signal (> 20 dB fade margin) ▪ 1 LED on: Moderate signal (> 10 dB fade margin) ▪ 0 LEDs on: Weak signal (< 10 dB fade margin)
Wireless Power LED	Green LED - indicates that the internal RF module is powered.
Transmit LED	Yellow LED - indicates transmitting data over the wireless link.
Receive LED	Red LED - indicates receiving data over the wireless link.
Button	Firmware defined; this revision executes an LED test.



Screw terminal connector type and pin out

Table 16. Screw terminal connector specifications

Connector type	**Screw terminal**
Wire gauge range	16 AWG to 30 AWG

Table 17. Screw terminal pin out

Pin	**Signal Name**	**Pin Description**	**Pin**	**Signal Name**	**Pin Description**
1	RSVD	Reserved, Do Not Use	27	RSVD	Reserved, Do Not Use
2	NC		28	GND	
3	C0H	CH0 sensor input (+)	29	C7L	CH7 sensor input (-)
4	C0L	CH0 sensor input (-)	30	C7H	CH7 sensor input (+)
5	NC		31	RSVD	Reserved, Do Not Use
6	RSVD	Reserved, Do Not Use	32	NC	
7	C1H	CH1 sensor input (+)	33	C6L	CH6 sensor input (-)
8	C1L	CH1 sensor input (-)	34	C6H	CH6 sensor input (+)
9	GND		35	NC	
10	RSVD	Reserved, Do Not Use	36	RSVD	Reserved, Do Not Use
	CJC sensor			CJC sensor	
11	RSVD	Reserved, Do Not Use	37	RSVD	Reserved, Do Not Use
12	NC		38	GND	
13	C2H	CH2 sensor input (+)	39	C5L	CH5 sensor input (-)
14	C2L	CH2 sensor input (-)	40	C5H	CH5 sensor input (+)
15	NC		41	RSVD	Reserved, Do Not Use
16	RSVD	Reserved, Do Not Use	42	NC	
17	C3H	CH3 sensor input (+)	43	C4L	CH4 sensor input (-)
18	C3L	CH3 sensor input (-)	44	C4H	CH4 sensor input (+)
19	GND		45	NC	
20	RSVD	Reserved, Do Not Use	46	RSVD	Reserved, Do Not Use
21	+5V	+5V output	47	+5V	+5V output
22	GND		48	GND	
23	DIO0	Digital Input/Output	49	DIO7	Digital Input/Output
24	DIO1	Digital Input/Output	50	DIO6	Digital Input/Output
25	DIO2	Digital Input/Output	51	DIO5	Digital Input/Output
26	DIO3	Digital Input/Output	52	DIO4	Digital Input/Output

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