

Electrolab D99 Extended Warm-Up Node – Datasheet

Features

Electrolab's radio communication network offers integrated I/O that operates in most environments and eliminates the need for wiring runs. D99 wireless networks operate around a *Gateway*, which acts as the wireless network master device, and one or more *Nodes*.

The Electrolab D99 Extended Warm-Up Node has one analog input that uses an extended warm-up time to accommodate radar, ultrasonic, and other sensors that require an extended warm-up time. Other configurations allow for RTD, discrete, and two analog inputs.

- Default configuration defines one analog input with an extended 29-second warm-up time for compatibility with most 4 to 20mA sensors, including radar, ultrasonic, and other sensors requiring an extended warm-up time.
- Additional configurations allow for one 3-wire 100-Ohm Platinum RTD, one sinking discrete input, two analog inputs, and 19V boost voltage.
- Technology driven by one lithium primary battery integrated into the housing.
- DIP switches for ease of user configuration.
- Frequency Hopping Spread Spectrum (FHSS) technology and Time Division Multiple Access (TDMA) control architecture ensure reliable data delivery within the unlicensed Industrial, Scientific, and Medical (ISM) band.
- Transceivers provide bidirectional communication between the Gateway and Node, including fully acknowledged data transmission.
- Lost RF links are detected and relevant outputs set to user-defined conditions.
- D99 Metal housings are certified for use in Class I, Division 1, Groups A, B, C, D; Class II, Division 1, Groups E, F, G; Class III, Division 1; and Zone 0 (Category 1G) and Zone 20 (Category 1D) when properly installed in accordance with the National Electrical Code, the Canadian Electrical Code, or applicable local codes/regulations.



Electrolab SKU	Frequency	Boost Voltage	I/O
ELD99M3D5	900 MHz ISM Band	19V	Inputs: One analog input with a 29-second warm-up time; one sinking discrete.
Available upon request	2.4 GHz ISM Band		Additional Input Configuration: One 3-wire 100-Ohm Platinum RTD, one sinking discrete, and two analog (0-20mA)

WARNING: Not to Be Used for Personnel Protection



Never use this device as a sensing device for personnel protection.

Doing so could lead to serious injury or death. This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.

User Configuration Tool

The User Configuration Tool (UCT) offers an easy way to link I/O points in your wireless network, view I/O register values graphically, and set system communication parameters when a host system is not part of the wireless network. The User Configuration Tool (UCT) software runs on any computer with the Windows 7, Windows 8, or Windows 10 operating system.

Use a USB to RS-485 adapter cable to connect a standalone Electrolab D80 Performance Gateway to the computer. The USB to RS-485 adapter cable is not required for the D100 IoT Gateway Controller. For standalone D80 Performance Gateway devices, use a USB to RS-485 adapter cable for 1 Watt nodes.

Setting Up Your Wireless Network

To set-up and install your wireless network, disconnect the power from your device(s) and perform the following steps:

1. Configure the DIP switches of all devices.
2. If your device has I/O, connect the sensors to the Electrolab Wireless Communications Network devices. If your device does not have I/O, skip this step.
3. Refer to the wiring diagrams to apply power to all devices.
 - To indicate there is no Node link to the Gateway, the Gateway's LED will be solid green and the Node's LED 2 will flash red.

4. Form the wireless network by binding the Nodes to the Gateway. If the binding instructions are not included in the datasheet, refer to the product manual.
5. Observe the LED behavior to verify the devices are communicating with each other.
 - To indicate the Node is in communication with the Gateway, the Gateway's LED will be solid green and the Node's LED will flash green.
6. Conduct a site survey between the Gateway and Nodes. If the site survey instructions are not included in this datasheet, refer to the product manual.
7. Install your wireless sensor network components. If installation instructions are not included in this datasheet, refer to the product manual.

Configure the DIP Switches

Before making any changes to the DIP switch positions, disconnect the power. DIP switch changes will not be recognized if power isn't cycled to the device. For devices with batteries integrated into the housing, remove the battery for at least 1 minute.

Accessing the DIP Switches of a Single-Chamber Metal Housing

The DIP switches are located behind the rotary dials. To access the DIP switches, perform the following steps:

1. Unscrew and remove the top of the D99 Node's metal housing. The top section is the section with the glass window.
2. Pull the Node cover section off the bracket assembly. Two pins bind the Node cover with the bracket assembly.
3. Gently unplug the ribbon cable from the back of the node cover.
4. Remove the black cover plate from the bottom of the device's cover. The DIP switches are located behind the rotary dials.

After making the necessary changes to the DIP switches, place the black cover plate back into position and gently push it into place. Confirm that the blocked hole is aligned with the missing pin and plug in the ribbon cable. Finally, mount the cover back onto the bracket assembly.

DIP Switch Settings (RTD Cin)

*Default configuration.

Device Settings	Switches							
	1	2	3	4	5	6	7	8
Rotary dial address mode	OFF*							
Extended address mode	ON							
Modbus or UCT configured (override DIP switches)		OFF*						
DIP switch configured		ON						
Disable RTD (I/O 6)			OFF*					
Enable RTD (I/O 6)			ON					
Temp °Celsius for RTD Input				OFF*				
Temp °Fahrenheit for RTD Input				ON				
One current input (I/O 3)					OFF*			
Two current inputs (I/O 3 and I/O 4)					ON			
10 ms warm-up; 250 ms sample/report rate						OFF*	OFF*	OFF*
10 ms warm-up; 1 second sample/report rate						OFF	OFF	ON
10 ms warm-up; 4 seconds sample/report rate						OFF	ON	OFF
250 ms warm-up; 4 seconds sample/report rate						OFF	ON	ON
10 ms warm-up; 16 seconds sample/report rate						ON	OFF	OFF

The measured temperature = (Modbus register value) ÷ 20.

To use a radar sensor, DIP switch 2 must be OFF. DIP switches 3 through 8 are disabled. The warm-up time defaults to 29 seconds and the sample rate defaults to 20 minutes. This is a good choice providing a reasonable balance between battery life of 6 to 12 months (depends on particular sensor) and a response time of 20 minutes. The loop powered 4 to 20 mA sensor will be powered by SP1 (sensor +) and the loop return will be connected to AI1 (sensor -).

Every 20 minutes SP1 powers up to 19 volts for 29 seconds (warm-up time), then samples the AI input. In rare cases, a particular sensor may require the warm-up time to be increased. The warm-up time can be extended using the User Configuration Tool (UCT). On this model, the warm-up time parameter is set in half-second increments. For example, to extend the warm-up time to 60 seconds, set the warm-up parameter to $60 \times 2 = 120$. Extending the warm-up time increases the current consumption, so you may want to consider slowing the sample rate, which is also configurable using the UCT. The sample rate parameter is set in 1/16-second increments. To set the sample rate to 40 minutes (2,400 seconds) set the sample rate parameter to 2400×16 , or 38400. The maximum setting is 65,535 or about 68-minutes.

To use a pressure sensor, DIP switch 2 must be ON. Use DIP switches 6 through 8 to set the warm-up time and sample/report rate for the analog inputs and their corresponding switch power outputs.

Address Mode

Electrolab wireless devices may use one of two types of addressing modes: *rotary dial addressing* or *extended addressing*. In **rotary dial** address mode, the left rotary dial establishes the network ID and the right rotary dial sets the device ID. The wireless network is restricted to a maximum of 16 devices.

Extended address mode uses a security code to "bind" Nodes to a specific Gateway. Bound Nodes can only send and receive information from the Gateway to which they are bound. In extended address mode, wireless networks may contain up to 48 node devices.

The device ships in rotary dial address mode by default, with the DIP switch in the OFF position. To use extended address mode, change the DIP switch to the ON position.

Modbus/User Configuration Tool (UCT) or DIP Switch Configured

In Modbus/UCT Configured mode, the device parameters are changed using the User Configuration Tool (UCT) or a Modbus command. All DIP switch positions are ignored. In DIP Switch Configured mode, use the DIP switches to configure the parameters listed in the table.

Temperature Units

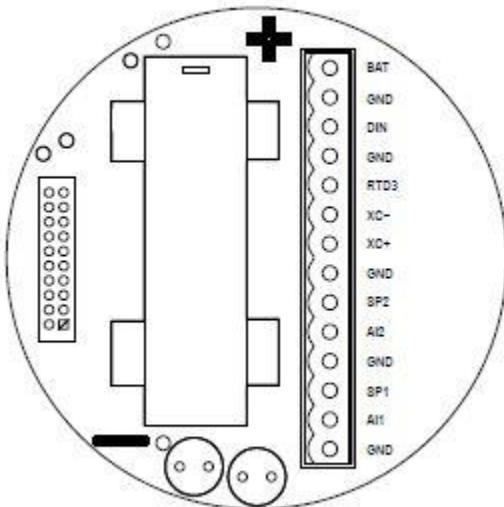
Use the DIP switch to specify if the temperature is stored in degrees Fahrenheit or Celsius. The default position is OFF, setting the temperature to Fahrenheit. For Celsius measurements, set this switch to the ON position.

Warm-Up Time

The warm-up time defines how long the device must power the sensor before a stable sensor reading is taken.

Terminal Blocks and Wiring

The complete control drawing is available upon request. In the control drawings, this device is referred to as the RTS Cin/Vin.



AIx or Ax. Analog IN x

BAT. Internal battery connection

Dix. Discrete IN x

GND. Ground/dc common connection

RTD3. RTD connection. See Control Drawings.

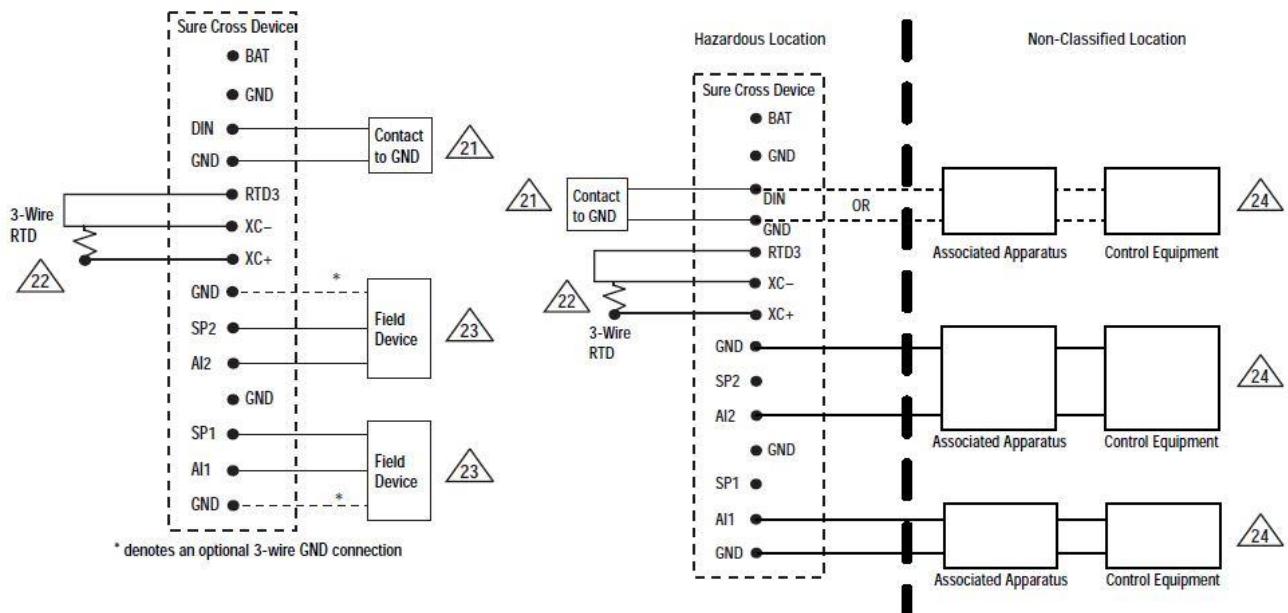
SPx. Switch Power; provides variable power sources for external devices.

XC- and XC+. RTD connection. See Control Drawings.

The GND connection can be considered the same as the housing ground when using a stainless steel antenna feedthrough. When the stainless steel antenna feedthroughs are not used, the GND connection is isolated from the metal housing.

Control Drawings

RTD Cin/Vin – Single Chamber Metal Housing (D99...D)



Entity Parameters - 21	
Uo/Voc	5.88 V
Io/Isc	1.80 mA
Po	2.65 mW
Co/Ca	43 μ F
Lo/La	12.3 H

Entity Parameters - 22	
Uo/Voc	5.88 V
Io/Isc	77.2 mA
Po	113.5 mW
Co/Ca	43 μ F
Lo/La	6.7 mH

Entity Parameters - 24	
Ui/VMax	30V
Ii/Imax	120mA
Pi	840mW
Ci	0
Li	0

NOTES:

1. The total capacitance of all field devices/cables that may be connected to terminals of Group 23 must not exceed the Co/Ca value shown in the table.
2. The total inductance of all field devices/cables that may be connected to terminals of Group 23 must not exceed the Lo/La values shown in the table.

Entity Parameters - 23				
	10 V	13 V	18 V	19 V
Uo/Voc	12.6 V	15.75 V	21 V	23.1 V
Io/Isc	34.89 mA	78.22 mA	94.75 mA	114.56 mA
Po	110 mW	308 mW	498 mW	662 mW
Co/Ca	1104 nF	432 nF	142 nF	94 nF
Lo/La	32.8 mH	6.5 mH	4.4 mH	3.0 mH

Metal Enclosure	
CSA C/US	Class I, Division I, Groups A, B, C, D Class II, Division I, Groups E, F, G Class III, Division I Class I, Zone 0, Group IIC
LCIE/ATEX	Group IIC, Zone 0 Dust, Zone 20

LED Behavior for the Nodes

Nodes do not sample inputs until they are communicating with the Gateway. The Nodes and antennas must be a minimum distance apart to function properly. Recommended minimum distances are the following:

- 2.4GHz 65mW Nodes: 1 foot
- 900 MHz 1 Watt Nodes: 15 feet

LED 1	LED 2	Node Status
Flashing GREEN		Node Link OK
Flashing RED	Flashing RED	Device Error
	Flashing RED, 1 per 3 sec.	No Radio Link

Modbus Register Table (D99 RTD Cin)

I/O	Modbus Holding Register		I/O Type	Units	I/O Range		Holding Register Representation		Terminal Block Labels
	Gateway	Any Node			Min.	Max.	Min. (Dec.)	Max (Dec.)	
1	1	1 + (Node# × 16)	Discrete IN 1	-	0	1	0	1	DIN
2	2	2 + (Node# × 16)							
3	3	3 + (Node# × 16)	Analog IN 1	mA	0	20.0	0	65535	AI1
4	4	4 + (Node# × 16)	Analog IN 2	mA	0	20.0	0	65535	AI2
5	5	5 + (Node# × 16)							
6	6	6 + (Node# × 16)	RTD IN	°F/°C	-1638.3	1638.4	-32768	32767	RTDx
7	7	7 + (Node# × 16)	Reserved						
8	8	8 + (Node# × 16)	Device Message						
15	15	15 + (Node# × 16)	Control Message						
16	16	16 + (Node# × 16)	Reserved						

The temperature = (Modbus register value) ÷ 20

Temperature values are stored as signed values in the Modbus register. A 0 in the register is interpreted as 0° and 65535 in the register (0xFFFF) is interpreted as $-1 \div 20 = -0.05^\circ$ in High Resolution mode and $-1 \div 2 = -0.5^\circ$ in Low Resolution mode.

Storage and Sleep Modes

Storage Mode (applies to battery-powered models only)—while in storage mode, the Node does *not* operate. All Nodes powered from an integrated battery ship from the factory in Storage Mode to conserve the battery. To wake the device, press and hold **Button 1** for five seconds. To put any integrated battery Node into Storage Mode, press and hold **Button 1** for five seconds. The radio is in Storage Mode when the LEDs stop blinking, but in some models, the LCD display remains on for an additional minute after the radio enters Storage Mode. Wait at least one minute before waking a device that has entered Storage Mode.

Sleep Mode (applies to both battery and 10-30 VDC powered models)—during normal operation, Electrolab Nodes enter Sleep Mode after fifteen minutes of operation. The radio continues to function, but the LCD display goes blank. To wake the device, press any button.

Assembly

Follow these steps to assemble your Electrolab D99 Extended Warm-Up Node. The D99 unit ships as a complete unit, including the radio core, housing, and integrated battery. One terminal header is also included in the shipment. To unpack and wire the unit, perform the steps below.

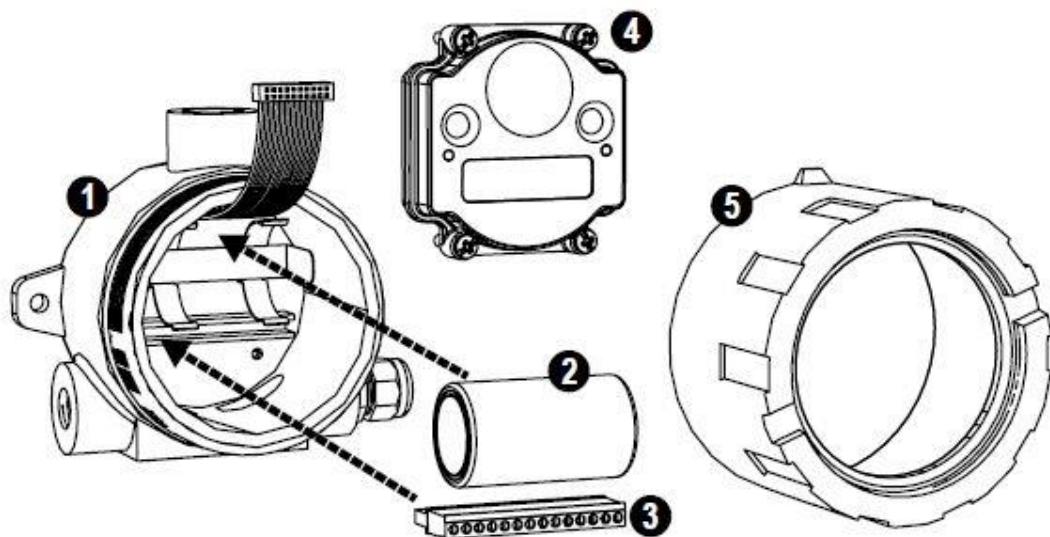


Figure 1 Installing the Battery and Terminal Header

1. Open the end with the glass window (5) and gently lift the radio core unit (4) and the space frame (not pictured) it sits on. The core unit connects to the space frame using two pins; the radio core is connected to the wiring board with a ribbon cable.
2. Disconnect the ribbon cable from the radio.
3. Insert the battery (2) into the battery holder. Ensure the battery is placed in accordance with the markings on the board.
4. Install the terminal header (3) onto the terminal pins.
5. Insert your sensor wires through a cable gland and one of the two $\frac{1}{2}$ -inch NPT ports. Wire the sensor wires into the terminal header (3) according to the control drawings. Use a cable gland certified for your region and environment.
6. Gently install the ribbon cable (4) into the ribbon cable pins (6), confirming that the ribbon cable is seated on both rows of pins.
7. Reconnect the space frame to the node core unit.
8. Place the node unit into the housing and gently push down until the spacer frame pin holes rest on the edge of the metal housing.
9. Close the metal cover firmly and lock it closed using the set screw.

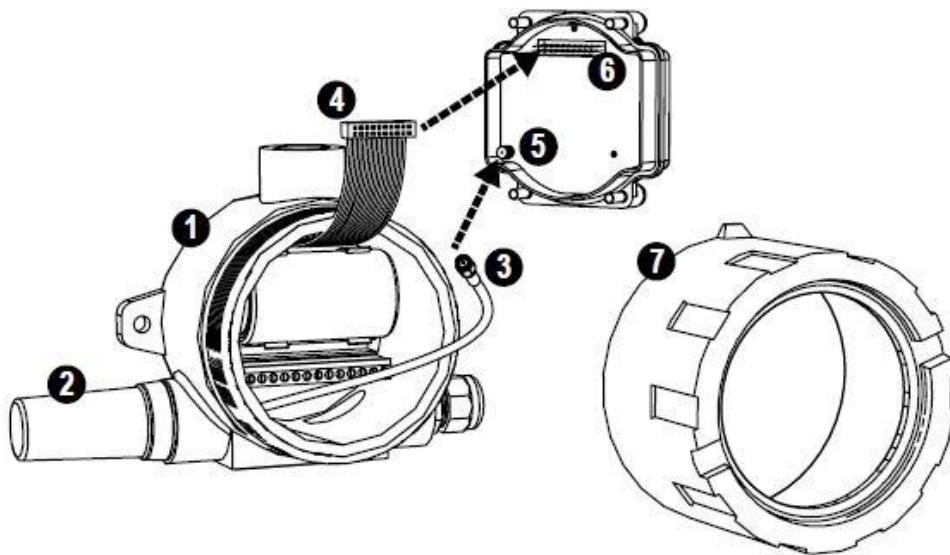


Figure 2 Installing and Connecting the Antenna

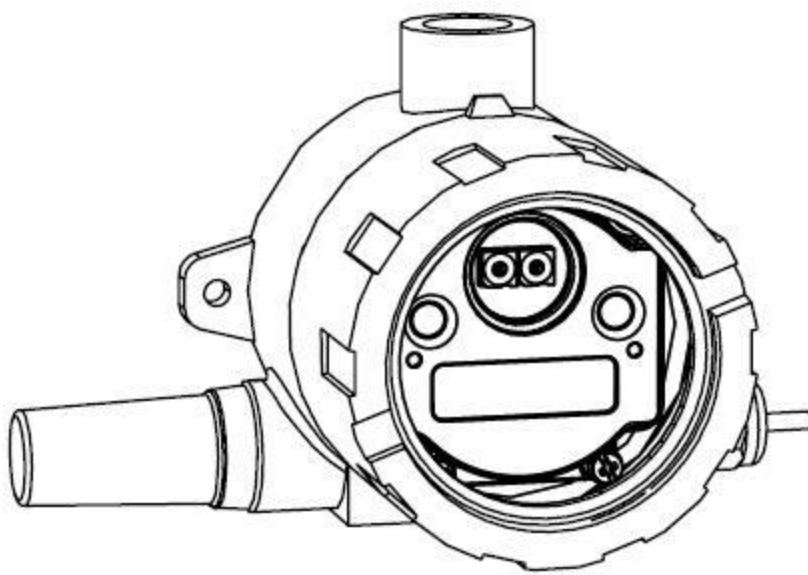


Figure 3 Final Assembly

Replacing the Battery (D99 Node Models)

To replace the lithium “D” cell battery in the metal housings, perform the following steps.

1. Unscrew the lid of the metal enclosure.
2. Lift the node out of the metal enclosure and pull the spacer frame off the back side of the node.
3. Disconnect the node by unplugging the ribbon cable from the node board and set aside the node and spacer frame.
4. Remove the discharged battery.
5. Replace with a new battery. Only use a 3.6V lithium battery from Xeno, model number XL-205F.
6. Confirm that the battery’s positive and negative terminals align to the positive and negative terminals of the battery holder mounted within the case. **CAUTION:** There is a risk of explosion if the battery is replaced incorrectly.
7. Wait two minutes.
8. Insert the ribbon cable through the center of the spacer frame. Plug the ribbon cable back into the node board.
9. Insert the node back onto the spacer frame pins. Push the node and spacer frame assembly back into the enclosure until it is seated.
10. Screw on the lid and tighten.
11. After replacing the battery, allow up to 60-seconds for the device to power up.
12. Properly dispose of the used battery according to local regulations by taking it to a hazardous waste collection site, an e-waste disposal center, or other facility qualified to accept lithium batteries.

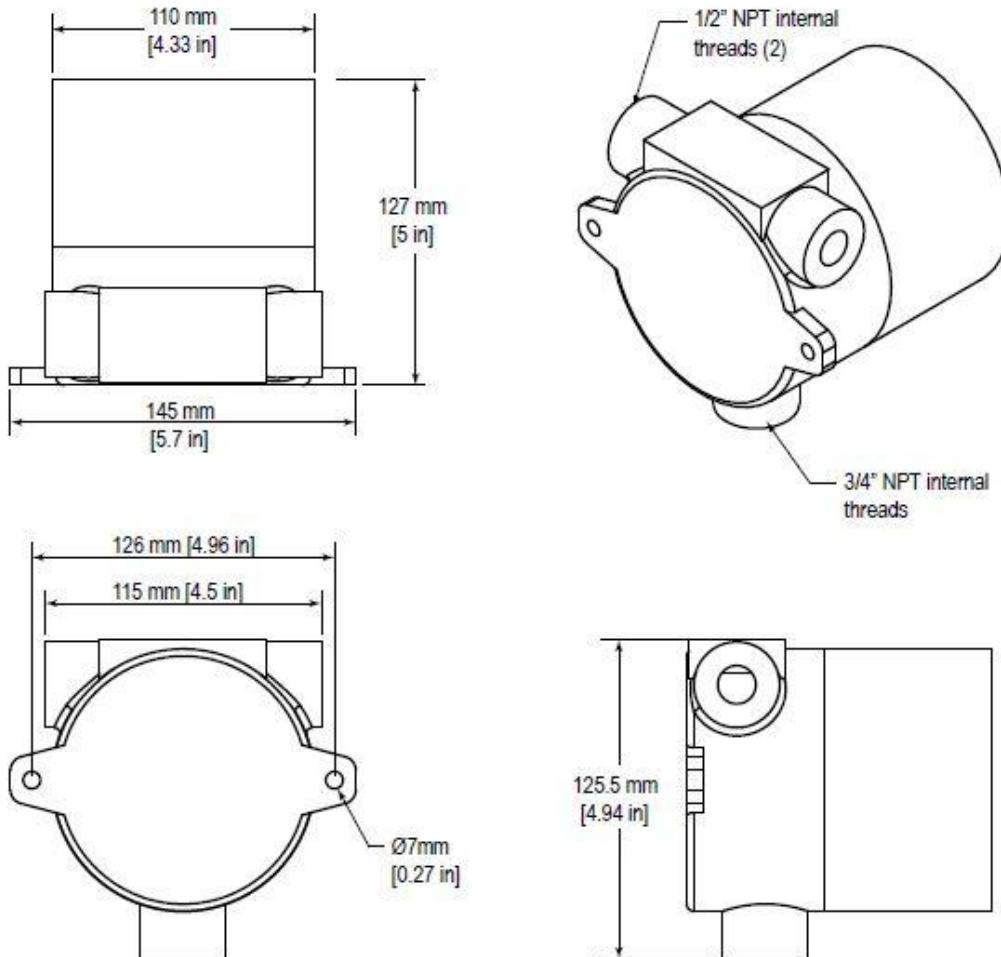
As with all batteries, there is a fire, explosion, and severe hazard. Do not burn the batteries or expose them to high temperatures. Do not recharge, crush, disassemble, or expose contents to water. The battery may be replaced in explosive gas atmospheres. For pricing and availability, contact Electrolab, Inc.



WARNING:

- Do not replace the battery when an explosive dust atmosphere may be present.
- The replacement battery MUST be an Electrolab, Inc. approved battery. Use of a different battery will VOID the intrinsic safety rating of this device and may result in an explosion.
- When replacing the battery, the negative end of the battery holder is the side by the large capacitors. This side is marked with a minus (-) sign.
- Do not attempt to recharge the battery. These batteries are not rechargeable. Recharging may cause serious injury to personnel or damage equipment. Replace only with factory recommended batteries.

Metal Housing Dimensions



Included with Device (Metal Housing with Dome Antenna)

	Qty.	Item
Dome Antenna	1	Dome Antenna, 902-928 MHz, 2 dBd Omni, 1/2-inch NPT, 18" cable, or Dome Antenna, 2.4 GHz, 2 dBd Omni, 1/2-inch NPT, 18" cable
	1	Terminal strip header, 14 position

Specifications

Radio Range¹

900 MHz, 150 mW: Up to 4.8 km (3 miles)
2.4 GHz, 65 mW: Up to 3.2 km (2 miles)

Minimum Separation Distance

900 MHz, 150 mW: 2 m (6ft)
2.4 GHz, 65 mW: 0.3 m (1ft)

Radio Transmit Power

900 MHz, 150 mW: 21 dBm (150 mW) conducted
2.4 GHz, 65 mW: 18 dBm (65 mW) conducted, less than or equal to 20 dBm (100 mW) EIRP

900 MHz Compliance

FCC ID TGUDX80 - This device complies with FCC Part 15, Subpart C, 15.247
IC: 7044A-DX8009

2.4 GHz Compliance

FCC ID UE300DX80-2400 - This device complies with FCC Part 15, Subpart C, 15.247
ETSI EN 300 328 V1.8.1 (2012-06) IC: 7044A-DX8024

Analog Input 1

Rating: 24 mA
Sample Rate: 20 minutes (DIP switch configurable) Report Rate: 20 minutes (DIP switch configurable) Accuracy: 0.1% of full scale +0.01% per °C Resolution: 15-bit
Switch Power 1 (SP1) Warm-up: 29 seconds

Analog Input 2

Rating: 24 mA
Sample Rate: 16 seconds (DIP switch configurable) Report Rate: 16 seconds (DIP switch configurable) Accuracy: 0.1% of full scale +0.01% per °C Resolution: 15-bit
Switch Power 2 (SP2)

Supply Voltage

3.6 V dc low power option from an internal battery

Power Consumption

Consumption: Application dependent

Housing

Glass and cast aluminum w/ chromatin and chemically resistant paint (outside only)

Antenna Connection

Ext. Reverse Polarity SMA, 50 Ohms
Max Tightening Torque: 0.45 N·m (4 lbf·in)

Interface

Indicators: Two bi-color LEDs Buttons: Two
Display: Six character LCD

Wiring Access

Two 1/2-inch NPT ports, one 3/4-inch NPT port (internal threads)

¹ Radio range is with the 2dB antenna that ships with the product. High-gain antennas are available, but the range depends on the environment and line of sight. Always verify your wireless network's range by performing a Site Survey.

Spread Spectrum Technology

FHSS (Frequency Hopping Spread Spectrum)

RTD Input

Type: Platinum, 100 ohm (European, DIN 43760) Sample Rate: 16 seconds
Report Rate: 16 seconds Accuracy: 0.1% of fullscale Resolution: 0.1 °C, 15-bit

Discrete Input

Input Rating: See control drawing Sample Rate: 62.5 milliseconds Report Rate: On change of state
ON Condition (NPN): Less than 0.7 V
OFF Condition (DX99 NPN): Greater than 2.2 V or open

Environmental Rating

IEC IP68²

Operating Conditions³

-40 °C to +65 °C (-40 °F to +149 °F) (Electronics); -20 °C to +80 °C
(-4 °F to +176 °F) (LCD)
95% maximum relative humidity (non-condensing) Radiated Immunity: 10 V/m (EN 61000-4-3)

Shock and Vibration

IEC 68-2-6 and IEC 68-2-27
Shock: 30g, 11 millisecond half sine wave, 18 shocks
Vibration: 0.5 mm p-p, 10 to 60 Hz



CSA: Class I, Division 1, Groups A, B, C, D;
Class II, Division 1, Groups E, F, G; Class III,
Division 1 (Ex ia IIC T4 / AEx ia IIC T4)
Certificate: 2008243



LCIE/ATEX: Zone 0 (Category 1G) and 20
(Category 1D), Temperature Class T4 (II 1 GD /
Ex ia IIC T4 Ga / Ex ia IIIC T82°C Da IP68)
Certificate: LCIE 08 ATEX 6098 X



Special Conditions for Safe Use imposed by Intrinsic Safety Certificate
LCIE 08 ATEX 6098 X: Ambient temperature range is -40 to 70 °C.
D99 devices can only be connected to Intrinsically Safe certified
equipment or simple apparatus as defined by EN 60079-11. All
connected equipment must comply with the Entity Parameters
(Safety Parameters) listed in the *Control Drawings*. The device must
only use a lithium battery manufactured by XENO, type XL-205F.

² Refer to the *Electrolab D80 Performance Gateway Wireless Setup Manual Cross* (EL# 29166) for installation and waterproofing instructions.

³ Operating the devices at the maximum operating conditions for extended periods can shorten the life of the device.



Warning

Install and properly ground a qualified surge suppressor when installing a remote antenna system. Remote antenna configurations installed without surge suppressors invalidate the manufacturer's warranty. Keep the ground wire as short as possible and make all ground connections to a single-point ground system to ensure no ground loops are created. No surge suppressor can absorb all lightning strikes; do not touch the Electrolab Wireless Communications Network device or any equipment during a thunderstorm.

Exporting Electrolab Wireless Communications Network Nodes. It is our intent to fully comply with all national and regional regulations regarding radio frequency emissions. **Customers who want to re-export this product to a country other than that to which it was sold must ensure the device is approved in the destination country.** A list of approved countries appears in the *Node Certifications* section of the product manual. The Electrolab Wireless Communications Network products were certified for use in these countries using the antenna that ships with the product. When using other antennas, verify you are not exceeding the transmit power levels allowed by local governing agencies. Consult with Electrolab, Inc. if the destination country is not on this list.

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