Electrolab D80 Performance Gateway – Datasheet

Features

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

- Wireless industrial I/O device with four selectable discrete inputs, four sourcing discrete sourcing outputs, two universal analog inputs, and two 0mA to 20mA analog outputs.
- Selectable transmit power levels of 250mW or 1 Watt for 900MHz models.
- 10V to 30V dc power input.
- DIP switches for user configuration.
- Modbus serial interface.
- Site Survey analyzes the network's signal strength and reliability and displays the results on the Gateway's LCD.
- 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.

Additional information, updated documentation, and accessories can be found on the Electrolab website at www.electrolabcontrols.com.

Models	Frequency	Environmental Rating	I/O
ELD99-D80-P2C	900 MHz ISM Band	IP67, NEMA 6	**Inputs**: Four selectable discrete, two 0 to 20mA or 0V to 10V analog **Outputs**: Four sourcing discrete, two 0 to 20mA analog
Also available	2.4 GHz ISM Band		

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.

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CAUTION: Never Operate 1 Watt Nodes without Antennas

To avoid damaging the wireless circuitry, never power up 1 Watt nodes without an antenna.

CAUTION: Electrostatic Discharge (ESD)

ESD Sensitive Device. This product uses semiconductors that can be damaged by electrostatic discharge (ESD). When performing maintenance, care must be taken so the device is not damaged. Disconnect power from the device when accessing the internal DIP switches. Proper handling procedures include wearing anti-static wrist straps. Damage from inappropriate handling is not covered by warranty.

User Configuration Tool

The User Configuration Tool (UCT) offers an easy way to link I/O points in your wireless network, view I/O registers 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 a Windows 7, Windows 8, or Windows 10 operating system.

Use a USB to RS-485 adapter cable to connect a standalone Electrolab D80 Gateway to the computer. For Electrolab D100 IoT Controllers, connect a computer to the D100 IoT Controller using a USB or Ethernet connection.

Download the most recent version of the UCT software from the Electrolab website by visiting the “Tech Docs” tab for the product being configured.

Setting Up Your Wireless Network

To set-up or install your wireless network, disconnect the power from your Electrolab device and follow the steps below.

1. Configure the DIP switches of all devices.
    - Switch “1” of the D80 Gateway must be set to “ON” to make the gateway transmit at 250mW for intrinsically safe environments.
2. If your device has I/O, connect the sensors to the wireless communications network devices. If your device does not have I/O, skip this step and continue to Step #3.
3. Apply power to all devices. Refer to the diagrams listed below.
    - 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 in communication 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 Internal DIP Switches

To access the internal DIP switches, perform the following steps:

1. Unscrew the four screws that mount the cover to the bottom housing.
2. Remove the cover from the housing without damaging the ribbon cable or the pins.
3. Gently unplug the ribbon cable from the board mounted into the bottom housing.
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 into place. Plug in the ribbon cable after verifying that the blocked hole lines up with the missing pin. Mount the cover back onto the bracket assembly.

DIP Switch Settings

Switches						
Device Settings	**1**	**2**	**3**	**4**	**5**	**6**
900 MHz transmit power level: 1 Watt (30 dBm)	OFF*					
900 MHz transmit power level: 250 mW (24 dBm), DX80 compatibility mode (***Must be set to ON for compatability with Electrolab nodes)***	ON					
Modbus or UCT configured (overrides DIP switches 3-8)		OFF*				
DIP switch configured		ON				
Inputs sourcing (PNP)			OFF*			
Inputs sinking (NPN)			ON			
Link loss output: zero				OFF*	OFF*	
Link loss output: one				OFF	ON	
Link loss output: hold last state				ON	OFF	
Link loss output: user configuration				ON	ON	
0 to 20 mA scale						OFF*
4 to 20 mA scale						ON

* Default configuration

Analog Input and Output Scale

Use the DIP switch to select which current scale to use for all the device's analog inputs and outputs: 0mA to 20mA or 4mA to 20mA. When using a 4-20mA sensor with a 0-20mA input, the sensor uses the 4-20mA section of the total range. Using a 4-20mA with a 0-20mA input allows you to determine when you have an error condition with the sensor. A normal input reading between 4mA and 20mA indicates a functioning sensor whereas a value below 4 mA indicates an error condition, such as a broken wire or loose connection. This DIP switch is used only on the 0 to 20 mA models, not the 0V to 10V models.

Discrete Input Type

Select the type of discrete input sensors to use with this device: sourcing (PNP) sensors or sinking (NPN) sensors.

Link Loss Outputs

The DX80 wireless devices use a deterministic node link time-out method to address RF link interruption or failure. When a radio link fails, all pertinent wired outputs are sent to defined states until the link is recovered, ensuring that disruptions in the communications link result in predictable system behavior.

Following a node link time-out, all outputs linked to the Node in question are set to de-energize (discrete outputs to 0, analog outputs to 0 mA or 4 mA), energize (discrete outputs to 1, analog outputs to 20 mA), or to hold the last stable state/value. Use the DIP switches to select the link loss output state.

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

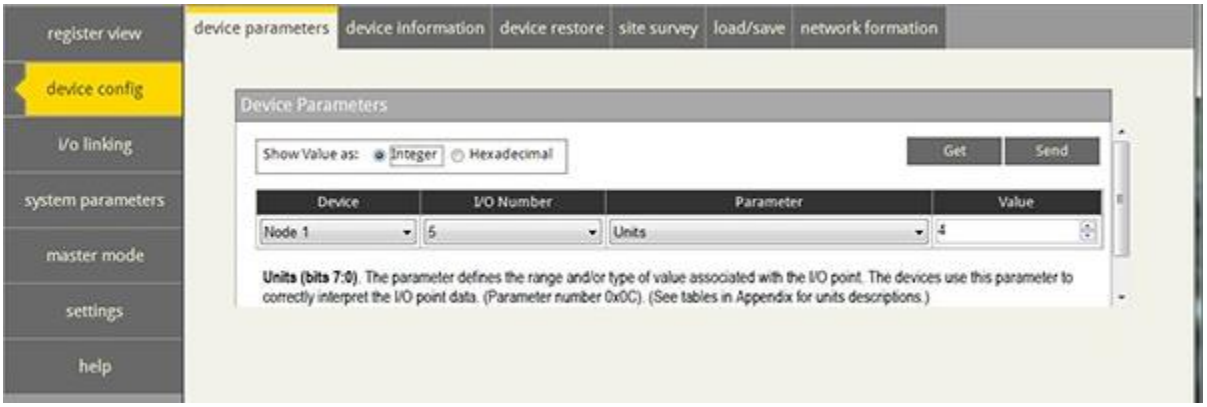
In Modbus/UCT Configured mode, the device parameters are changed using the User Configuration Tool (UCT) or a Modbus command. All DIP switch positions are ignored. In DIP Switch Configured mode, use the DIP switches to configure the parameters listed in the table.

The 900 MHz nodes can operate at 1 watt (30 dBm) or 250 mW (24 dBm). To work with the Electrolab nodes in intrinsically safe environments, the nodes must be set to 250 mW (24 dBm).

Configuring Universal Analog Inputs for mA or V

To configure inputs to use 0V to 10V instead of 0mA to 20mA, remove the installed resistors (AI and/or A2) from the marked locations on the wiring board. For reference, see the steps below in which an example configuration makes Analog Input 1 a 0V to 10V input.

1. Launch the *User Configuration Tool* software.
2. On the device (Gateway or Node), Change the ***Units parameter*** for the particular input to use **voltage** instead of **milliamps**. See the Modbus Register table for the I/O number of each analog input. Writing a four (4) to the *Units parameter* defines the units as 0V to 10V. Writing a two (2) to the *Units parameter* defines the units as 0mA to 20mA.



Note that a 220 ohm 0.1% resistor must be installed for a 0mA to 20mA input. The resistor must be removed for an input defined as a 0V to 10V input.

Wiring Your Wireless Communications Network Device

Use the following diagrams when wiring the sensors and applying power to the Wireless Communications Network device.

Terminal Blocks

Refer to Class I Division 2/Zone 2 control drawing for wiring specifications or limitations.

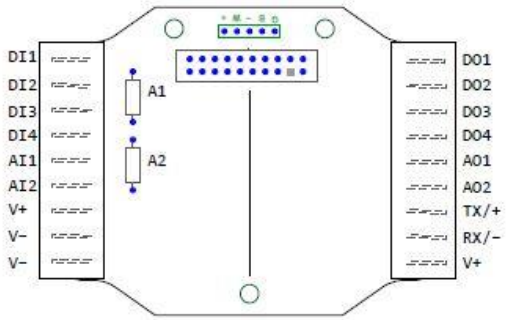


Figure 1IP20 Housing (2PC Models)

- *RX/-* is the serial communication line for the Gateway. No connection for the Nodes.
- *TX/+* is the serial communication line for the Gateway. No connection for the Nodes.
- *V+* is the 10V to 30V dc power connection.
- *V-* is the Ground/dc common connection.

Electrolab D80 Performance Gateway Wiring

The process of wiring power to your Electrolab D80 Performance Gateway can vary depending on the power requirements for the model. Connecting dc power to the communication pins (Tx/Rx) causes permanent damage. See the table below for reference.

Terminal Label	Gateway	10 to 30 V dc Powered Nodes	Battery Powered Nodes
V+	10 to 30 V dc	10 to 30 V dc	
Tx/+	RS485 / D1 / B / +		
V–	dc common (GND)	dc common (GND)	dc common (GND)
Rx/–	RS485 / D0 / A / -		
B+			3.6 to 5.5 V dc

Wiring Diagrams for Discrete Inputs

Connecting dc power to the communication pins will cause permanent damage. For the Electrolab D80 Performance Gateway, *PWR* in the wiring diagram refers to V+ on the wiring board and *GND* in the wiring diagram refers to V- on the wiring board. To power the sensor using the switch power output (SPx), replace the PWR with SPx in these wiring diagrams.

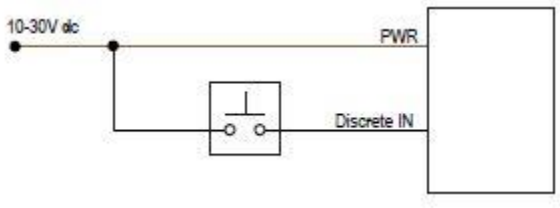


Figure 2 Discrete Input Wiring for PNP Sensors

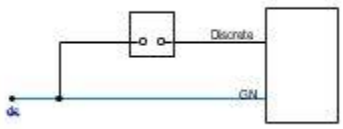


Figure 3 Discrete Input Wiring for NPN Sensors

Wiring Diagrams for Discrete Outputs

Connecting dc power to the communication pins will cause permanent damage. For the D80 Performance Gateway, PWR in the wiring diagram refers to V+ on the wiring board and GND in the wiring diagram refers to V- on the wiring board. To power the sensor using the switch power output (SPx), replace the PWR with SPx in these wiring diagrams.

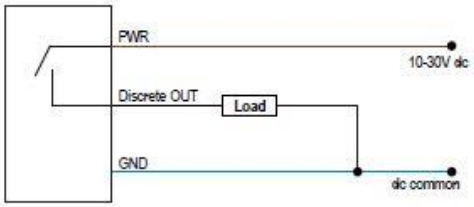


Figure 4 Discrete Output Wiring (PNP)

Wiring Diagrams for Analog Inputs

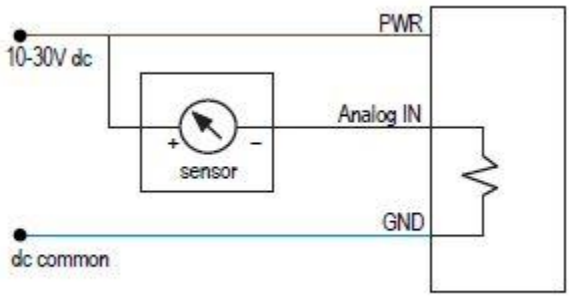


Figure 5 Analog Input Wiring (10-30V dc Power)

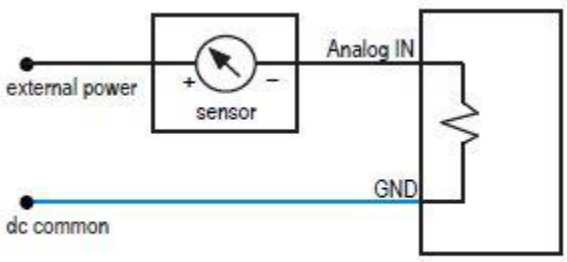


Figure 6 Analog Input Wiring (4-20mA, 2-wire, Externally-Powered Sensors)

Wiring Diagrams for Analog Outputs

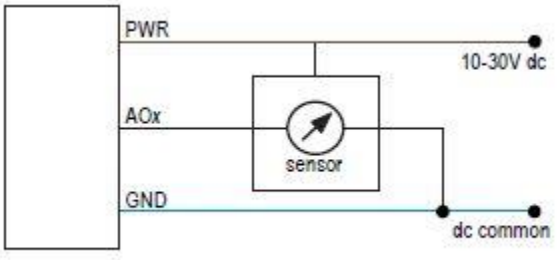


Figure 7 Analog Output Wiring

LED Behavior for the Gateways

Verify all devices are communicating properly. The nodes and antennas must be a minimum distance apart to function properly. Recommended minimum distances are the following:

- 900 MHz 1 Watt nodes: 15 feet

LED 1	LED 2	Gateway Status
Solid green		Power ON
Flashing red	Flashing red	Device Error
	Flashing amber	Modbus Communication Active
	Flashing red	Modbus Communication Error

For Gateway-only systems, the Modbus communication LEDs refer to the communication between the Gateway and its host system (if applicable).

Modbus Registers

I/O	Modbus Holding Register		I/O Type	Units	I/O Range		Holding Register Representation	
	Gateway	Any Node			Min. Value	Max. Value	Min. (Dec.)	Max. (Dec.)
1	1	1 + (Node# × 16)	Discrete IN 1	-	0	1	0	1
2	2	2 + (Node# × 16)	Discrete IN 2	-	0	1	0	1
3	3	3 + (Node# × 16)	Discrete IN 3	-	0	1	0	1
4	4	4 + (Node# × 16)	Discrete IN 4	-	0	1	0	1
5	5	5 + (Node# × 16)	Analog IN 1	mA V	0.0 0.0	20.0 10.0	0	65535
6	6	6 + (Node# × 16)	Analog IN 2	mA V	0.0 0.0	20.0 10.0	0	65535
7	7	7 + (Node# × 16)	Reserved					
8	8	8 + (Node# × 16)	Device Message					
9	9	9 + (Node# × 16)	Discrete OUT 1	-	0	1	0	1
10	10	10 + (Node# × 16)	Discrete OUT 2	-	0	1	0	1
11	11	11 + (Node# × 16)	Discrete OUT 3	-	0	1	0	1
12	12	12 + (Node# × 16)	Discrete OUT 4	-	0	1	0	1
13	13	13 + (Node# × 16)	Analog OUT 1	mA	0.0	20.0	0	65535
14	14	14 + (Node# × 16)	Analog OUT 2	mA	0.0	20.0	0	65535
15	15	15 + (Node# × 16)	Control Message					
16	16	16 + (Node# × 16)	Reserved					

Included with Model

The following items ship with the D80 Performance Gateways:

- D80 Access Hardware Kit, containing four PG-7 plastic threaded plugs, four PG-7 nylon gland fittings, four PG-7 hex nuts, one 1/2-inch NPT plug, and one 1/2-inch nylon gland fitting.
- Mounting Hardware Kit, containing four M5-0.8 x 25mm SS screws, four M5-0.8 x 16mm SS screws, four M5-0.8mm SS hex nuts, and four #8-32 x 3/4" SS bolts
- PTFE tape
- 900 MHz Antenna, 2 dBd Omni, Rubber Swivel RP-SMA Male.
- Electrolab D80 Performance Gateway, Quick Start Guide (EL# 29165)

Specifications

Node Range
900 MHz, 1 Watt: Up to 9.6 km (6 miles)
2.4 GHz, 65 mW: Up to 3.2 km (2 miles)

Minimum Separation Distance
900 MHz, 1 Watt: 4.57 m (15 ft)
2.4 GHz, 65 mW: 0.3 m (1 ft)

Node Transmit Power
900 MHz, 1 Watt: 30 dBm (1 W) conducted (up to 36 dBm EIRP)
2.4 GHz, 65 mW: 18 dBm (65 mW) conducted, less than or equal to 20 dBm (100 mW) EIRP

900 MHz Compliance (1 Watt)
FCC ID UE3RM1809: This device complies with FCC Part 15, Subpart C, 15.247
IC: 7044A-RM1809

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

Spread Spectrum Technology
FHSS (Frequency Hopping Spread Spectrum)

Communication Hardware (RS-485)
Interface: 2-wire half-duplex RS-485
Baud rates: 9.6k, 19.2k (default), or 38.4k Data format: 8 data bits, no parity, 1 stop bit

Communication Protocol
Modbus RTU

Supply Voltage
10 to 30 V dc (Outside the USA: 12 to 24 V dc, ±10%).

Power Consumption
900 MHz Consumption: Maximum current draw is < 100 mA and typical current draw is < 50 mA at 24 V dc. (2.4 GHz consumption is less.)

Housing
Polycarbonate housing and rotary dial cover; polyester labels; EDPM rubber cover gasket; nitrile rubber, non-sulphur cured button covers Weight: 0.26 kg (0.57 lbs)
Mounting: #10 or M5 (SS M5 hardware included) Max. Tightening Torque: 0.56 N·m (5 lbf·in)

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

DX80 models: Four PG-7, One 1/2-inch NPT, One 5-pin threaded M12/ Euro-style male quick disconnect
DX80...C models: External terminals

Link Timeout

Gateway: Configurable via User Configuration Tool (UCT) software Node: Defined by Gateway

Environmental Ratings

DX80 models: IEC IP67; NEMA 6
"C" Housing Models/External wiring terminals: IEC IP20; NEMA 1

Operating Conditions

–40 °C to +85 °C (–40 °F to +185 °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

Discrete Inputs

Four, DIP switch selectable between sourcing/PNP and sinking/NPN Rating: 3 mA max current at 30 V dc
Sample Rate: 62.5 milliseconds Report Rate: On change of state

Discrete Input ON Condition

PNP: Greater than 8 V NPN: Less than 0.7 V

Discrete Input OFF Condition

PNP: Less than 5 V
NPN: Greater than 2 V or open

Analog Inputs

Two, 0 to 20 mA (default) or 0 to 10 V (user configurable) Rating (mA): 24 mA
Rating (V): 10 V
Impedance: Approximately 220 Ohms Sample Rate: 62.5 milliseconds
Report Rate: 1 second or On Change of State (1% change in value) Accuracy: 0.2% of full scale +0.01% per °C
Resolution: 12-bit

Discrete Outputs

Four sourcing/PNP
Update Rate: 125 milliseconds ON Condition: Supply minus 2 V OFF Condition: Less than 2 V
Output State Following Timeout: OFF

Discrete Output Rating (PNP)

100 mA max current at 30 V dc
ON-State Saturation: Less than 3 V at 100 mA OFF-state Leakage: Less than 10 µA

Analog Outputs

Two, 0 to 20 mA
Update Rate: 125 milliseconds
Accuracy: 0.1% of full scale +0.01% per °C Resolution: 12-bit

Certifications for DX8x...C (External Wiring Terminal) and DX8x...E Models

CSA: Class I Division 2 Groups ABCD, Class I Zone 2 AEx/Ex nA II T4
Certificate: 1921239
ATEX: II 3 G Ex nA IIC T4 Gc (Group IIC Zone 2) – Certificate LCIE 10 ATEX 1012 X
Refer to the Class I Division 2/Zone 2 control drawings for wiring specifications or limitations. All battery-powered devices must only use the lithium battery manufactured by Xeno, model XL-205F

Warnings

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 any 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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