Electrolab D100 IoT Gateway Controller – Quick Start Guide

Features

The D100 IoT Gateway Controller provides wireless communications to a maximum of 47 Nodes. This Quick Start Guide will discuss a communications network with a maximum of 15 Nodes plus 1 Gateway.

> **NOTE:** The D100 IoT Gateway Controller is a 1-watt radio that must match the wattage of the Nodes it communicates with. The D99 series Nodes offered by Electrolab are intrinsically safe and therefore 250mW. Electrolab sets the D100 IoT Gateway Controller to 250mW at the factory by switching **Switch 1** of the ISM radio board to the *ON* position. If you discover that you cannot establish communications between a Node and a Gateway, confirm that **Switch 1** remains in the *ON* position.

For easy navigation and control, there are four **hard keys** and four LED indicator lights on the face of the Gateway. Use the ↑ and ↓ arrows to navigate settings, press **Enter** to select an option, and press **Back** to exit a menu.

Understanding D100 IoT Gateway and D99 Node Connections

Connect power to the D100 IoT Gateway Controller using PW and GD (12-30vdc).

- Use a USB A to USB B cable for the UCT connection (used for both UCT programs, D100, and D80).
- M+ and M- are Modbus Master Communications via RS485 (the Gateway is Master).
- S+ and S- are Modbus Slave RS485 communications via RS485 (the Gateway is Slave, set the address via the front panel pushbuttons and the LCD display).
- Tx and Rx are for RS232 communications (seldom used).
- All other connections are for the Gateway I/O.

Establishing Communications Between a Node and a Gateway

Electrolab D99 Nodes power and interrogate the connected end devices only after establishing communications with a Gateway. A Gateway must be "bound" to a Node for it to effectively communicate. Follow the steps below to successfully bind a Node to a Gateway.

> **NOTE:** Bind only one Node at a time to avoid communications conflicts.

1. To begin binding, power the Node for binding. *LED 2* on the face of the Gateway will flash red.

2. Press **Push Button 2** on the Node three times. The Node will display "*BINDING*" and the LEDs will begin to flash red.

3. Prepare the Gateway by applying power and using the ↑ and ↓ arrows to highlight the *ISM Radio* option. Press **Enter** to select.

4. Use the ↓ arrow on the Gateway to highlight the *Binding* option. Press **Enter** to select the function.

5. Use the ↑ and ↓ arrows on the Gateway to change the Node number for binding and press **Enter**.

6. Select the Node number using the rotary switches on the front of the Node. The Gateway will display "*BINDING*" and its LEDs will begin flashing. When the Node is bound, the Gateway will briefly display "*BOUND*" and its LEDs will stop flashing.

7. After binding is completed, stop the binding process on the Gateway by pressing **Back**.

8. Use the ↑ and ↓ arrows to select a new Node address for binding and repeat Steps 1-6. Once all Nodes are bound, press **Back** to exit binding.

Conducting a Site Survey Using Push Buttons

During installation, it is good practice to conduct a site survey to ensure the proposed locations of each device (Nodes and Gateway) will provide satisfactory signal.

Due to the communication retries, the quality of the communications will directly affect battery life. To conduct a site survey using push buttons, follow the steps below.

> **NOTE:** Only the Gateway can initiate a Site Survey. Initiate a Site Survey using the User Configuration Tool (UCT) software or the push buttons on the Gateway.

1. Place the Node at the location where the Gateway will be installed. Use the Gateway to assess signal strength (RSSI) at the proposed location for Node installation.

2. Enter *Site Survey* mode on the Gateway using the pushbuttons and the LCD display. From the *Main Menu* on the LCD display, select *Site Survey* and press **Enter**.

3. Use the ↑ and ↓ arrows to change the Node/Modbus address number.

4. Press **Enter** to select and display the *Survey Data* menu.

5. Use the rotary switches on the Node to select the Node address to communicate with.

6. When the survey is complete, exit by pressing **Back.**

7. Colored text will appear on the Gateway display. Observe the text color to determine signal strength. See the note below to better understand the display text legend.

NOTE: The colored text on the Gateway display indicates signal strength for *% of packets received* and *% of retries*. The color legend is as follows: Green (G), Yellow (Y), Red (R), and Missed (M). Note that M = *% of retries* and not missed communications. For the Missed (M) category, look for numbers as close to 0 as possible. For categories Green (G) and Yellow (Y), look for higher numbers. The number scale will range 0-100. Please note that large numbers may still appear in the Missed (M) category and not be indicative of bad communications; large numbers in the Missed (M) category simply indicate a presence of retries that will affect battery life.

Conducting a Site Survey Using the User Configuration Tool (UCT)

Use the User Configuration Tool (UCT) software (DXM Configuration Tool v3) to connect and configure the D100 IoT Gateway Controller.

NOTE: Users can download the most recent version of the User Configuration Tool (UCT) software by visiting the "Tech Library" tab for their product on the Electrolab website at www.electrolabcontrols.com.

Use the D80 UCT software (DX80 User Configuration Tool v2) to read and configure the bound D99 Nodes.

Use the D80 User Configuration Tool (UCT) software and the matching USB cable to enter or read the Node I/O programming parameters. Select *Serial DXM* while configuring the comm. port. There are some parameters that are set by default via dip switch settings behind the display; however, the programing tool provides diagnostic data and more flexibility. The UCT software and Gateway communicate Modbus RTU at 19200N81 via USB. The Gateway is Modbus ID 0 and the Nodes begin with ID 1 through 47. The Node address is set via the rotary switches on the front of the Node.

To conduct a site survey using the User Configuration Tool, follow the steps below. Note that the figures shown will provide a general point of reference for navigating the software, but information presented on the screen will vary depending on the user's device settings.

1. Connect a USB cable (USB A to USB B) to program and/or view the Gateway configuration parameters.
2. Launch the User Configuration Tool (UCT) software.

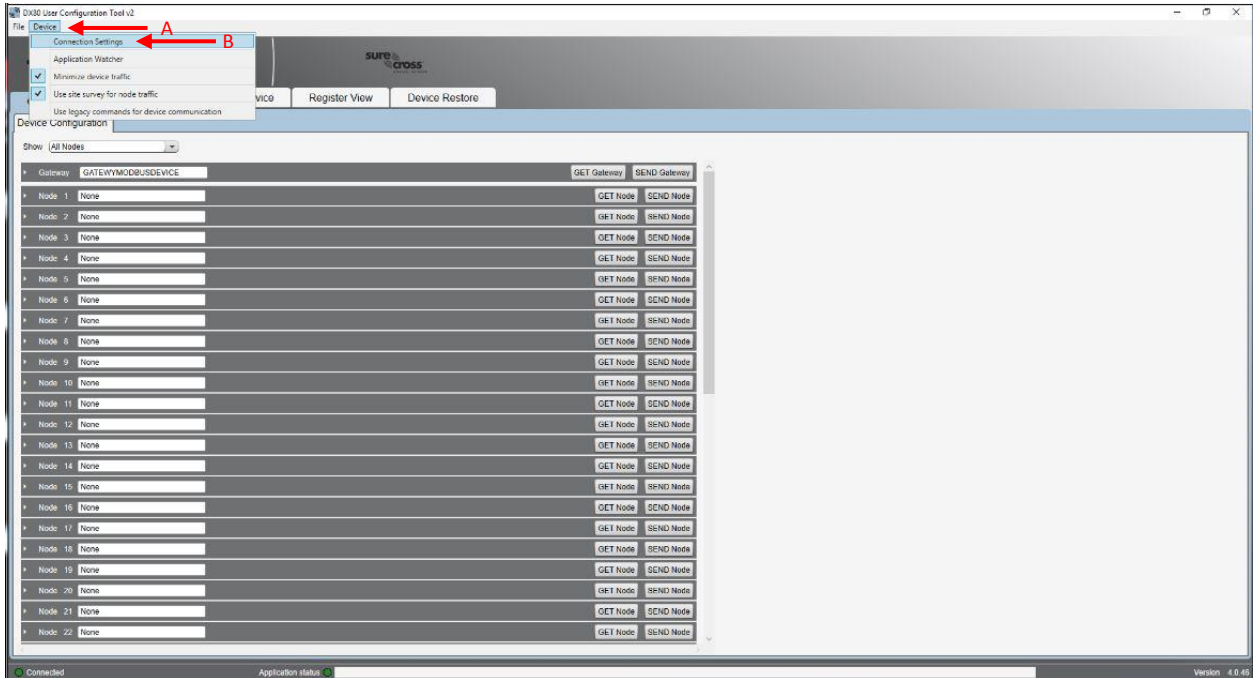3. Select *Device* from the menu bar (A). A drop-down menu will open. Select *Connect Settings* (B).

Figure 1 - Navigating "Device" options

4. After you select *Connection Settings*, a window for connection settings will open. Navigate to the "Comm Port" option and use the drop-down menu to select the communication port for use (A). After selecting a communications port, select *Connect* (B).
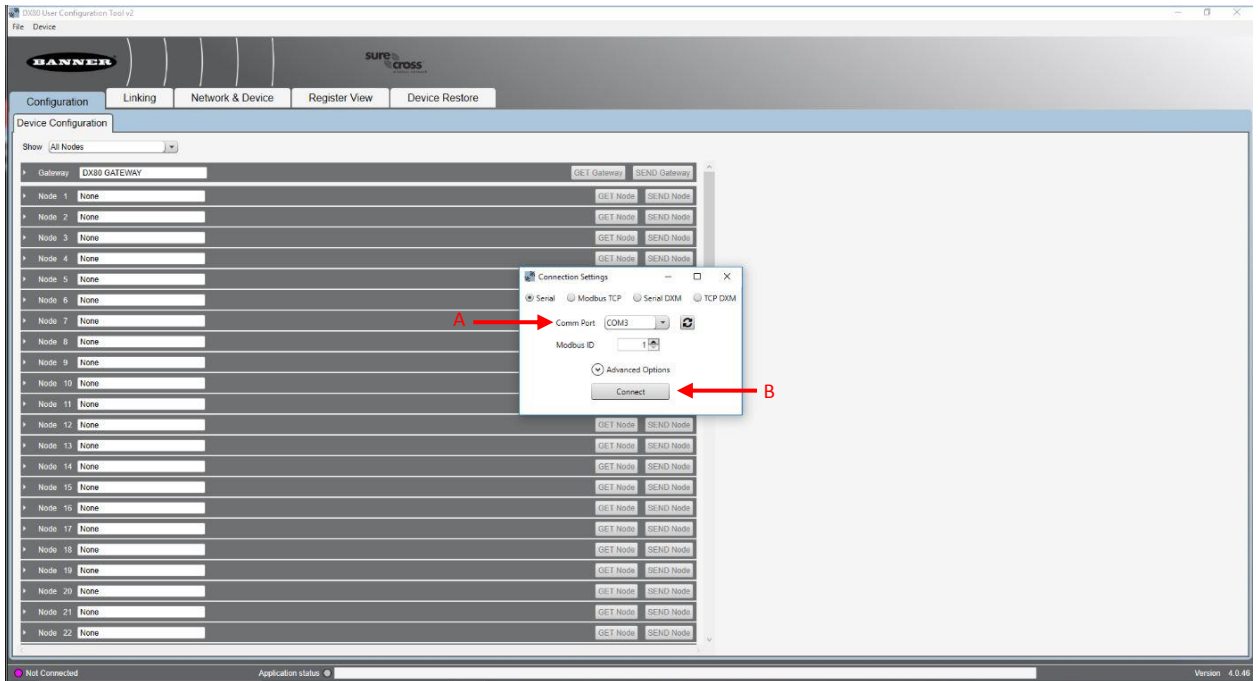

Figure 2 - Navigating "Connection Settings" options

5. On the Gateway, navigate to *Settings > General* to read/write the Gateway port configurations and to view stored *Device Information*.

6. On the Gateway, navigate to *I/O Board* menu and select the *Get All Parameters and I/O* option to retrieve all I/O Parameters and device configuration for the Gateway's I/O board.

7. On the UCT software, select the arrow to the left of the Input or Outputs to reveal a drop-down window. The Gateway's I/O configurations are now available for editing if necessary.

8. On the UCT software, select *GET* to read the configuration and *SEND* to write any changes to the configuration.

9. The Gateway interrogates all the configured Nodes in its programmed Max Node Count. This is the number of radios in the communication rotation (not including the Gateway) in increments of 8, 16, 24, 32, 40 and 48. The larger the number, the longer it will take to search for all possible Node connections in the communications cycle (see: Table 1). The default number is 16.

To Change the Max Node Count with the LCD Display and Pushbuttons

1. From the main menu of the Gateway, navigate to *System Config > ISM Radio > Max Node Count*.

2. Use the ↑ and ↓ arrows to change the count and press **Enter** to select the count and exit the menu. It will be necessary to change the Max Node Count when the address number of the bound Nodes exceeds the maximum Node count.

To Change the Max Node Count with the User Configuration Tool (UCT)

1. Use the D80 User Configuration Tool (DX80 User Configuration Tool v2) to read the Gateway parameters.

2. On the UCT software, select *Get Gateway* to read the configuration and change the Max Node Count. From the drop-down menu, select *Devices in System* and select *SEND Parameters*.

3. Select *YES* when prompted to restart the device.

Register Display

Each Gateway and Node has 16 Modbus registers that display.

- Registers 1 through 6 display data from the end devices in decimal form (0, 1, 0-65535). In Discrete mode, 0 = Off and 1 = On (the user can invert this programming, if necessary). The values of 0-65535 represent 0 to full scale. For example, the software interprets a raw value of 32756 as full scale (*in Volts* or *mA/65535*32756* or

*10v/65535*32765 = 4.999v*). Coincidentally, the system considers this a full-scale raw data reading for a 0-5v or 1-5v signal. The first eight registers are for I/O Data.

- Register 7 is reserved.
- Register 8 is a status register.
    - A value in Register 8 or 128 represents good Node communications.
    - A value of 0 represents loss of communications.
    - A value of 13569 represents communications without valid/updated data (usually seen when a battery is dying).
- The format of Modbus registers is consistent across all Gateway and Nodes (see: "Table 1"). More information on the individual Node offering Modbus Register Tables is found in their respective manuals. Interpreted data will appear on the display of the Node (i.e., *ON, OFF*, *14.32mA*, *3.65v*, etc. as opposed to raw data).

The *Register View* tab is used to read and display the data in the registers pertaining to each Node. The location of the Node-specific data registers is specified in Table 1. Enter the starting register for the Node specific register you want to view and the number of registers to read.

Select the *Read Registers* option for an instantaneous read or select *Enable Polling* to poll the registers continuously. The table will fill with the registers related to the selected Node address, which directly relates to the registers in Table 1. The data present is the data in the Gateway only and remains on a radio schedule to receive data from the Nodes (see table on next page).

Refer to the "D80 Performance Gateway and D99 Series Node—Quick Start Guide" for more information on configuring the Nodes. Refer to specific D99 Series Node datasheets for specific information about each Node.

TABLE 1

Modbus Registers from Slave ID 1 – D100 IoT Gateway Controller

MAXN (Maximum Node Number)

Cycle	48 = 500 ms															
Cycle	32 = 250 ms															
Cycle	16 = 125 ms															
Cycle	8 = 62.5ms															
	GATEWAY							**Node**								
Device #	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
In 1	1	17	33	49	65	81	97	113	129	145	161	177	193	209	225	241
In 2	2	18	34	50	66	82	98	114	130	146	162	178	194	210	226	242
In 3	3	19	35	51	67	83	99	115	131	147	163	179	195	211	227	243
In 4	4	20	36	52	68	84	100	116	132	148	164	180	196	212	228	244
In 5	5	21	37	53	69	85	101	117	133	149	165	181	197	213	229	245
In 6	6	22	38	54	70	86	102	118	134	150	166	182	198	214	230	246
In 7	7	23	39	55	71	87	103	119	135	151	167	183	199	215	231	247
In 8	8	24	40	56	72	88	104	120	136	152	168	184	200	216	232	248
Out 1	9	25	41	57	73	89	105	121	137	153	169	185	201	217	233	249
Out 2	10	26	42	58	74	90	106	122	138	154	170	186	202	218	234	250
Out 3	11	27	43	59	75	91	107	123	139	155	171	187	203	219	235	251
Out 4	12	28	44	60	76	92	108	124	140	156	172	188	204	220	236	252
Out 5	13	29	45	61	77	93	109	125	141	157	173	189	205	221	237	253
Out 6	14	30	46	62	78	94	110	126	142	158	174	190	206	222	238	254
Out 7	15	31	47	63	79	95	111	127	143	159	175	191	207	223	239	255
Out 8	16	32	48	64	80	96	112	128	144	160	176	192	208	224	240	256