

## DX85-P7 Features

The Sure Cross® wireless system is a radio frequency network with integrated I/O that operates in most environments to eliminate 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. A remote I/O device with a Modbus interface expands the I/O of the Gateway or the Modbus host.



- Wireless industrial I/O device with up to 12 NPN inputs or NMOS outputs
- 10 V DC to 30 V DC power input
- Selectable Modbus slave address
- Modbus RTU protocol using RS-485

For additional information, updated documentation, and a list of accessories, refer to Banner Engineering's website, [www.bannerengineering.com](http://www.bannerengineering.com).

### WARNING:



- **Do not use this device for personnel protection**
- Using this device for personnel protection could result in serious injury or death.
- This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A device failure or malfunction can cause either an energized (on) or de-energized (off) output condition.

### IMPORTANT:

- **Electrostatic discharge (ESD) sensitive device**
- ESD can damage the device. Damage from inappropriate handling is not covered by warranty.
- Use proper handling procedures to prevent ESD damage. Proper handling procedures include leaving devices in their anti-static packaging until ready for use; wearing anti-static wrist straps; and assembling units on a grounded, static-dissipative surface.

## DX85-P7 Models

Model	I/O
DX85M-P7	Discrete I/O: Up to 12 NPN inputs or up to 12 NMOS outputs (for a total of 12 I/O)



DX80...C (IP20; NEMA 1) models are also available. To order this model with an IP20 housing, add a C to the end of the model number: DX85M-P7C.

## DX85 Modbus RTU I/O Slaves Overview

Use the DX85 Modbus RTU I/O devices to expand the I/O of a Modbus master device. DX85s are hardwired to Modbus master devices using RS-485 and use Modbus RTU to exchange data. DX85s are available with discrete, analog, or a mix of discrete and analog I/O.

## Setting Up Your DX85 Modbus Remote IO Devices

To set up and install your DX85 Modbus Remote I/O devices, follow these steps:

1. Configure the DIP switches.
2. Set the Slave ID on the DX85 Modbus Remote I/O devices.
3. Connect the sensors to the DX85 devices.
4. Connect the DX85 to your Gateway, data radio, PLC, or other Modbus host device.
5. Apply power.



6. Observe the LED behavior to verify the devices are communicating with each other.

For additional information, including installation and setup, weatherproofing, device menu maps, troubleshooting, and a list of accessories, refer to one of the following product manuals.

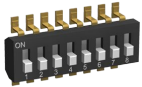
- Sure Cross® Quick Start Guide (p/n [128185](#))
- Sure Cross® Wireless I/O Network Manual (p/n [132607](#))
- Host Configuration Manual (p/n [132114](#))

## Configure the DIP Switches

Before changing DIP switch positions, disconnect the power<sup>(1)</sup>. Any changes made to the DIP switches are not recognized until after power is cycled to the device. For parameters not set using the DIP switches, use the configuration software to make configuration changes. For parameters set using the DIP switches, the DIP switch positions override any changes made using the configuration software.

### Access the Internal DIP Switches

Follow these steps to access the internal DIP switches.



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 the cable plugs into.
3. Gently unplug the ribbon cable from the board mounted into the bottom housing. Skip this step if there is no ribbon cable (integrated battery models) or the ribbon cable is glued down (for C housing models or for Class I, Division 2 certified devices).
4. Remove the black cover plate from the bottom of the device's cover.  
The DIP switches are located behind the rotary dials.
5. Make the necessary changes to the DIP switches.
6. Place the black cover plate back into position and gently push into place.
7. If necessary, plug the ribbon cable in after verifying that the blocked hole lines up with the missing pin.
8. Mount the cover back onto the housing.

### DIP Switch Settings for a DX85 with 12 I/O

Use the DIP switches 1 through 4 on the board to set the baud rate and parity and DIP switch 5 to set the rotary dial mode.

	DIP Switches							
	1	2	3	4	5	6	7	8
Baud Rate: 19200	OFF *	OFF *						
Baud Rate: 38400	OFF	ON						
Baud Rate: 9600	ON	OFF						
Baud Rate: 19200	ON	ON						
Parity: None			OFF *	OFF *				
Parity: Even			OFF	ON				
Parity: Odd			ON	OFF				
Parity: None			ON	ON				
Rotary Dial Decimal Mode					OFF *			
Rotary Dial Hex Mode					ON			
6 Inputs, 6 Outputs (non bit-packed)						OFF *	OFF *	OFF *
12 Inputs, 0 Outputs						OFF	OFF	ON
10 Inputs, 2 Outputs						OFF	ON	OFF
8 Inputs, 4 Outputs						OFF	ON	ON
6 Inputs, 6 Outputs						ON	OFF	OFF
4 Inputs, 8 Outputs						ON	OFF	ON
2 Inputs, 10 Outputs						ON	ON	OFF

Continued on page 3

<sup>(1)</sup> For devices powered by batteries integrated into the housing, triple-click button 2, then double-click button 2 to reset the device without removing the battery.

Continued from page 2

	DIP Switches							
	1	2	3	4	5	6	7	8
0 Inputs, 12 Outputs						ON	ON	ON

\* Default configuration

For the 6 IN/6 OUT non bit-packed configuration, the discrete INs use I/O points 1 through 6 and the discrete OUTs use I/O points 9 through 14.

### Baud Rate and Parity

The baud rate (bits per second) is the data transmission rate between the device and whatever it is physically wired to. Set the parity to match the parity of the device you are wired to.

## Setting the Slave ID on a DX85 Remote I/O Device

On a DX85 Modbus RTU Remote I/O device, use the rotary dials to set the device's Slave ID.

In Rotary Dial Decimal Mode, the left dial acts as the left digit and the right dial acts as the right digit, allowing the Slave ID to be set from 01 through 99.

In Rotary Dial Hex Mode, the left dial acts as the left digit and the right dial acts as the right digit, allowing the Slave ID to be set from 01 through F7 for a total of 247 slaves. The 12 I/O DX85 models use Rotary Dial Decimal Mode and do not have a DIP switch selection for this option.

To configure the DX85 using the Key definition for "{keyrefName}" not found in the DITA map., set the DX85's Slave ID to 01.

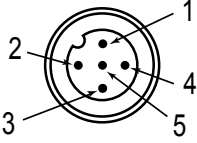
## Wire Your Sure Cross® Device

Use the following wiring diagrams to first wire the sensors and then apply power to the Sure Cross devices.

### 5-pin M12 Wiring

Wiring the 5-pin M12 connector depends on the model and power requirements of the device. Connecting power to the communication pins will cause permanent damage.

*5-pin M12 male connector wiring*

5-pin M12 Male Connector	Pin	Wire Color	Description
	1	Brown (bn)	10 to 30 V DC
	2	White (wh)	RS485 / D1 / B / +
	3	Blue (bu)	DC common (GND)
	4	Black (bk)	RS485 / D0 / A / -
	5	Gray (gy)	Comms Ground

### DX80...C Wiring

Wiring power to the DX80...C models varies depending the power requirements of the model. Connecting DC power to the communication pins (Tx/Rx) causes permanent damage. For *FlexPower* devices, do not apply more than 5.5 V to the B+ terminal.

*Wiring for the C housing models*

Terminal Label	Gateway and DX85	10 V DC to 30 V DC Powered Nodes	Battery-Powered Nodes
V+	10 V DC to 30 V DC	10 V DC to 30 V DC	
Tx/+	RS485 / D1 / B / +		
V-	DC common (GND)	DC common (GND)	DC common (GND)
Rx/-	RS485 / D0 / A / -		

Continued on page 4

Continued from page 3

Terminal Label	Gateway and DX85	10 V DC to 30 V DC Powered Nodes	Battery-Powered Nodes
B+			3.6 V DC to 5.5 V DC

### Terminal Blocks and Wiring (P7 12 Sinking I/O Models)

<p><i>P7 model wiring board</i></p>	<p><i>P7C model wiring board</i></p>
<p>B+. 3.6 V DC to 5.5 V DC (use for battery powered models only)                  IOx. Input or output (depending on configuration)                  GND. Ground/DC common connection                  PWR. 10 V DC to 30 V DC power connection</p>	<p>RX/-. Serial communication line for the Gateway. No connection for Nodes (Gateway and DX85 models)                  TX/+. Serial communication line for the Gateway; no connection for Nodes (Gateway and DX85 models)                  V+. 10 V DC to 30 V DC power connection                  V-. Ground/DC common connection</p>

For the default configuration of 6 IN and 6 OUT, use IO1 through IO6 to wire the inputs and IO7 through IO12 to wire the outputs.

When using the DIP switches to configure the input and output selection, wire the inputs beginning with IO1. After all inputs are wired, begin using the remaining IOx as outputs. For example, if you are using 10 inputs and 2 outputs, use terminals IO1 through IO10 for the inputs and terminals IO11 and IO12 for the outputs.

<p><i>Discrete input wiring for NPN sensors</i></p>	<p><i>Discrete output wiring for NPN or NMOS sensors</i></p>	<p>The DIx and DOx of these wiring diagrams correspond to the IOx on the terminal block.</p>
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### LED Behavior of the DX85 Modbus RTU Remote I/O

After powering up, verify the DX85 is communicating properly. LED 1 should be on and green. The Modbus communication LEDs refer to the communication between the DX85 and what it is connected to (host system, Gateway, Data Radio, etc).

LED 1	LED 2	Status
Green	-	Power on
Flashing red	Flashing red	Device error, contact factory
-	Flashing amber	Modbus communication active
-	Flashing red	Modbus communication error

### Configuring the Discrete I/O of the 12 I/O Device

The 12 I/O device can be configured into any combination of 12 discrete inputs or outputs. Inputs are stored in a bit packed form in I/O point 1, device register 1. Outputs are stored in a bit packed form in I/O point 9, device register 9.

To define which of the 12 I/O points are inputs, adjust the bit field stored as I/O 1's threshold parameter [15:0]. Set bit 0 of the 16-bit parameter data word to define I/O 1 as an input, set bit 1 to define I/O 2 as an input, et cetera. Each bit position of the parameter is associated to a I/O point. In the example below, the first five I/O points are defined as inputs.

Input Parameter	Bit 15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Input Point #					12	11	10	9	8	7	6	5	4	3	2	1
Parameter Data					0	0	0	0	0	0	0	1	1	1	1	1

Define outputs the same way by adjusting the bit field stored in I/O 9's threshold parameter [15:0]. Verify the bit pattern for outputs does not overlap the input pattern. In the example below, I/O points 6-12 are set as outputs.

Input Parameter	Bit 15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Input Point #					12	11	10	9	8	7	6	5	4	3	2	1
Parameter Data					1	1	1	1	1	1	1	0	0	0	0	0

For inputs, the first I/O point selected as an input is placed in bit position 0 in register 1. The second input point is in bit position 1, et cetera. Likewise, for outputs, the first I/O point selected as an output is placed in bit position 0 in register 9, the second input point is in bit position 2. The bit-packed values are stored in right-justified format.

Input Parameter	Bit 15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Input Point #					0	0	0	0	0	0	0	IN 5	IN 4	IN 3	IN 2	IN 1
Parameter Data					0	0	0	0	0	OUT 7	OUT 6	OUT 5	OUT 4	OUT 3	OUT 2	OUT 1

## Configure the Discrete I/O on the 12 I/O Devices

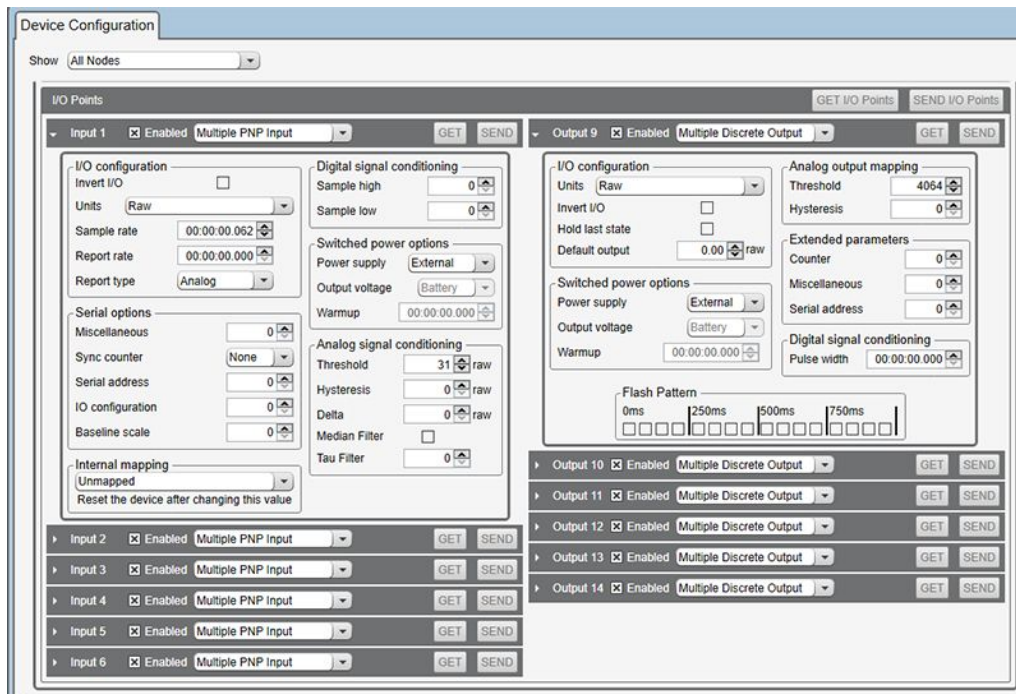
When using the User Configuration Software to configure either a Gateway or Node, select the Gateway or specific Node from the software's drop-down list. To configure a DX85 Remote I/O model, set the DX85's Slave ID to 01 and select the Gateway from the drop-down list.

To define which of the 12 I/O points are inputs for the selected device, adjust the threshold parameter for I/O point 1:

1. Go to the **Configuration > Device Configuration** screen.
2. On the **I/O Points** heading, click **GET I/O Points**. This downloads all existing I/O parameter settings from your device and loads the settings into the User Configuration Software.
3. Click the arrow to display Input 1's parameters.
4. Enter a value into the Threshold parameter field. Use the bit mask as defined in "[Configuring the Discrete I/O of the 12 I/O Device](#)" on page 4.

For example, set bit 0 of the 16-bit parameter data word to define I/O 1 as an input, set bit 1 to define I/O 2 as an input, et cetera. Each bit position of the parameter is associated to a I/O point. In the example, the first five I/O points are defined as inputs (0000 0001 1111 = 0x001F = 0031).

To define which of the 12 I/O points are outputs for the selected device, adjust the threshold parameter for I/O point 9. In the example, bits 11 through 5 are used to set seven outputs (1111 1110 0000 = 0x0FE0 = 4064).



5. Click **Send** or **Send I/O Points** to upload the settings to the wireless network.

## Holding Registers

Modbus Registers	I/O Type		Holding Register Representation (Dec.)	
	Bit-Packed	Non Bit-Packed (default configuration)	Min.	Max.
1	Bit-Packed Discrete IN (IO1–IO12)	Discrete IN 1 (IO1)	0	4095
2		Discrete IN 2 (IO2)	0	1
3		Discrete IN 3 (IO3)	0	1
4		Discrete IN 4 (IO4)	0	1
5		Discrete IN 5 (IO5)	0	1
6		Discrete IN 6 (IO6)	0	1
7	Reserved			
8	Device Message			
9	Bit-Packed Discrete OUT (IO1–IO12)	Discrete OUT 1 (IO7)	0	4095
10		Discrete OUT 2 (IO8)	0	1
11		Discrete OUT 3 (IO9)	0	1
12		Discrete OUT 4 (IO10)	0	1
13		Discrete OUT 5 (IO11)	0	1
14		Discrete OUT 6 (IO12)	0	1
15	Control Message			
16	Reserved			

For other non bit-packed configurations, the inputs begin at I/O point 1 and the outputs begin after the last input.

For DIP switches 5 through 8 to be recognized, DIP switch 2 must be in the ON position. For the 8 bit-packed IN/4 non bit-packed OUT configuration, all discrete INs use I/O point 1 and the discrete OUTs use I/O points 9 through 12. For the 4 non bit-packed IN/8 bit-packed output configuration, the discrete INs use I/O points 1 through 4 and all bit-packed outputs use I/O point 9.

## Specifications

### DX85-P7 Specifications

#### Supply Voltage

10 V DC to 30 V DC (Outside the USA: 12 V DC to 24 V DC,  $\pm 10\%$ )<sup>(1)</sup>

Consumption: Less than 1.4 W (60 mA) at 24 V DC

#### 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)

#### Discrete Inputs

Rating: 3 mA max current at 30 V DC

Sample Rate: Up to 62.5 milliseconds

Report Rate: On change of state

ON Condition (NPN): Less than 0.7 V

OFF Condition (NPN): Greater than 2 V or open

#### Interface

Two bi-color LED indicators

<sup>(1)</sup> For European applications, power this device from a Limited Power Source as defined in EN 60950-1.

#### Discrete Outputs

Update Rate: Up to 62.5 milliseconds

ON Condition (NMOS): Less than 0.7 V

OFF Condition (NMOS): Open

Output State Following Timeout: OFF

#### Discrete Output Rating (12 I/O NMOS)

Less than 100 mA max current at 30 V DC

ON-State Saturation: Less than 0.7 V at 20 mA

#### Wiring Access

P8 models: Four PG-7, one 1/2-inch NPT, one 5-pin M12 male quick-disconnect connector

P8C models: External terminals

#### Certifications



Banner Engineering BV  
Park Lane, Culliganlaan 2F bus 3  
1831 Diegem, BELGIUM



Turck Banner LTD Blenheim House  
Blenheim Court  
Wickford, Essex SS11 8YT  
GREAT BRITAIN

### RS-485 Communication Specifications

#### 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

### Environmental Specifications (IP67 Housing Models)

#### 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

All models meet IEC 60068-2-6 and IEC 60068-2-27 testing criteria

Shock: 30G 11 ms duration, half sine wave per IEC 60068-2-27

Vibration: 10 Hz to 55 Hz, 0.5 mm peak-to-peak amplitude per IEC 60068-2-6

#### Environmental Ratings

IEC IP67; NEMA 6

For installation and waterproofing instructions, go to [www.bannerengineering.com](http://www.bannerengineering.com) and search for the complete instruction manual (p/n Key definition for "{keyrefName}" not found in the DITA map.)

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

### Environmental Specifications for the C Housings

#### 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

All models meet IEC 60068-2-6 and IEC 60068-2-27 testing criteria

Shock: 30G 11 ms duration, half sine wave per IEC 60068-2-27

Vibration: 10 Hz to 55 Hz, 0.5 mm peak-to-peak amplitude per IEC 60068-2-6

#### Environmental Ratings

"C" Housing Models/External wiring terminals: IEC IP20; NEMA 1

Refer to the Sure Cross® DX80 Performance (p/n [132607](#)) or the Sure Cross® MultiHop (p/n [151317](#)) instruction manual for installation and waterproofing instructions.

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

## Included with Device (DX85 and DX85...C Models)

The following items ship with the DX85 models.

- BWA-HW-002: DX80 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
- BWA-HW-001: 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
- BWA-HW-003: PTFE tape
- Quick Start Guide (128185 for DX80 Gateways or 152653 for MultiHop models)
- MQDC1-506: 5-Euro (single ended) straight cable, 2m
- BWA-HW-011: IP20 Screw Terminal Headers (2 pack), not included with the IP67 DX80 models; ships with the IP20 DX80...C models only

\* Not included with DX85...C models.

## Banner Engineering Corp Limited Warranty

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For patent information, see [www.bannerengineering.com/patents](http://www.bannerengineering.com/patents).

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