Features

Sure Cross® Wireless TL70 Tower Lights combine the best of Banner's popular Tower Light family with its reliable, field proven, Sure Cross wireless architecture.

Benefits

- Enables machine monitoring and Overall Equipment Effectiveness by collecting available machine data for analysis and to identify causes of lost production
- Lowers the cost and complexity of line and plant reconfigurations
- Provides an easy way to implement remote monitoring and the Industrial Internet of Things (IIoT)



- **Easy Installation**—Adds wireless communication and networking capabilities to new or existing TL70 Tower Lights
- **Power Options**—Works with either the standard DC-powered or AC-powered TL70 base
- **Input Flexibility**—Accepts PNP or NPN inputs
- **No Constant Power**—Uses machine input power for lights and stores power to keep radio in sync
- **Industrial Design**—Rugged, water-resistant IP65 housing with UV-stabilized material
- **Event Counter**—Configure input wires as auxiliary sourcing inputs from external devices or as a 20 Hz, 32-bit event counter
- **Powerful Radio**—Available in 900 MHz (1 watt) and 2.4 GHz (65 mW) ISM Bands

IMPORTANT: Please download the complete TL70 Wireless Communication Segment technical documentation, available in multiple languages, from www.bannerengineering.com for details on the proper use, applications, Warnings, and installation instructions of this device.

IMPORTANT: Por favor descargue desde www.bannerengineering.com toda la documentación técnica de los TL70 Wireless Communication Segment, disponibles en múltiples idiomas, para detalles del uso adecuado, aplicaciones, advertencias, y las instrucciones de instalación de estos dispositivos.

IMPORTANT: Veuillez télécharger la documentation technique complète des TL70 Wireless Communication Segment sur notre site www.bannerengineering.com pour les détails sur leur utilisation correcte, les applications, les notes de sécurité et les instructions de montage.

Models

Model	Base Color	Frequency	Input	Output
SG-TL70-DXN9	Black	900 MHz ISM Band	Six PNP/NPN discrete, 32-bit Synchronous Event Counter (enabled using DIP switches storing counter value with inputs 5 and 6)	Six Discrete Out
SG-TL70-DXN9C	Gray			
SG-TL70-DXN2	Black	2.4 GHz ISM Band		
SG-TL70-DXN2C	Gray			

Original Instructions
21-Aug-25

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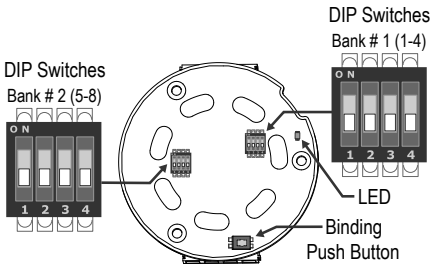
204207
p/n: 204207 Rev. D

ПРОМЭЛЕКТРОНИКА/ sales@prom-elec.com

Configuration Instructions

Set the Radio Module DIP Switches

Before applying power to the device, set the radio module's DIP switches. Default configurations are noted with (*).



DIP Switch 1—The 900 MHz radios transmit at 1 Watt (30 dBm) or 250 mW (24 dBm). Refer to your Gateway's datasheet for more information.

DIP Switch 1: Radio Transmit Power	900 MHz Models	2.4 GHz Models
OFF *	1 Watt (30 dBm) operation	Disabled
ON	250 mW (24 dBm) operation	

DIP Switch 2—Use DIP switch 2 if:

- There are no light segments attached to the tower light base; or
- In conjunction with DIP switch 5 and constant power to read inputs back to the Gateway and control light segments independently from the Gateway using the output registers.

DIP Switch 2: Input Wires	900 MHz Models and 2.4 GHz Models
OFF *	Input wires control light segments
ON	Disables input wire control of light segments; input state is still reported back to the Gateway

DIP Switch 3—In the default position (OFF), inputs 1 through 6 control the tower lights. When DIP switch 3 is ON, the input wire for Module 5 is the counter input and the input wire for Module 6 is disabled. Registers 5 and 6 store the 32- bit synchronous counter count. Inputs 5 and 6 are independent from the lights and will not drive any lights they are wired to. Input wires 1 through 4 function normally. Using the counter input requires a TL70 with an 8-pin base to support the additional counting input.

DIP Switch 3: Event Counter	900 MHz Models and 2.4 GHz Models
OFF *	Default I/O operation
ON	Configure input 5 as a 32-bit synchronous counter at a maximum frequency of 20 Hz; disable input 6 (the counter requires two registers)

DIP Switch 4—Bit packing uses a single register, or range of contiguous registers, to represent I/O values. This allows you to read or write multiple I/O values with a single Modbus message. Input 1 is stored in the least significant bit of register 1. Output 1 is stored in the least significant bit of register 9. DIP switch 4 in the ON position does not work with DIP switch 6 for flashing recognition.

DIP Switch 4: Bit Packing I/O	900 MHz Models and 2.4 GHz Models
OFF *	Default I/O operation
ON	Bit-packed I/O with all inputs in Modbus register 1 and all outputs in Modbus register 9. All other Modbus registers are disabled.

DIP Switch 5—Enabling dc-powered mode with DIP switch 5 configures the input wire for Module 6 to accept a constant 24 V dc input. The TL70 can still accept inputs for up to 5 tower light segments and remotely control light segments from the Gateway.

DIP Switch 5: Configure DC Power Mode	900 MHz Models and 2.4 GHz Models
OFF *	Default I/O operation
ON	Enable dc-powered mode and remote light segment control

DIP Switch 6—Enables the TL70 Wireless Node Segment to recognize a 0.8 Hz to 6 Hz flashing state produced on the input. This feature allows each light segment attached to have two separate states that can be recognized and tracked for reporting or triggering rules/functions when paired with the DXM100 Wireless Controller. The input register will alternate between a value of 2 and 3 when the flashing state is active. DIP switch 6 in the ON position cannot be used in conjunction with DIP switch 4 (ON position).

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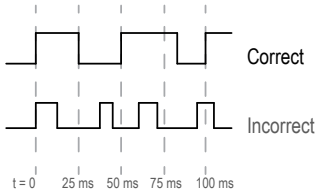
DIP Switch 6: Enable Flash Recognition	900 MHz Models and 2.4 GHz Models
OFF *	Default I/O operation (Input register values: 0 = OFF, 1 = ON)
ON	Enables flash recognition (Input register values: 0 = OFF, 1 = ON, 2 = Flashing OFF, 3 = Flashing ON)

DIP Switch 7—Allows the user to trigger the output of a light in a specific flash pattern. To use this feature constant power is required and DIP switch 5 must be turned ON. See "Creating Host Controlled Flash Patterns" on page 5 for more information.

DIP Switch 7: Enable Host Controlled Flash Patterns	900 MHz Models and 2.4 GHz Models
OFF *	Default I/O operation
ON	Enables host controlled flash patterns

Event Counter

To use the event counter, the measured (logic high) signal must be greater than or equal to 25 ms. The 32-bit count is stored in I/O registers 5 and 6.



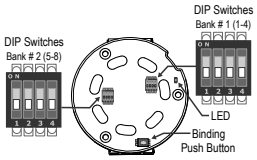
To zero out (clear) the event counter,

- Map an input/button on a Gateway to Node register 14 to clear the counter when the input/button is activated; or
- From a host system, write a 1 (the output must transition from a zero to a one to reset the counter) to Node register 14 or write a 5424 (0x1530) to Node control register 15.

RF firmware revision 5.3 or higher (on all products released after 3/20/2015) is required to use this feature.

Bind the TL70 to the Gateway and Assign the Node Address

Before beginning the binding procedure, apply power to all the devices.



1. Enter binding mode.
   - For housed Gateways, triple-click button 2.
   - For board-level Gateway modules, triple-click the button.
   - For DXMs, under the **ISM Radio** menu, use the down arrow button to highlight the **Binding** menu. Click **ENTER**.

   On the board modules, the green/red LED flashes. On the housed models, both LEDs flash red.
2. Assign the TL70 a Node address using the Gateway's rotary dials or the DXM's arrow keys.
   - On a Gateway: Use the left rotary dial for the left digit and the right rotary dial for the right digit. For example, to assign your TL70 to Node 01, set the left dial to 0 and the right dial to 1.
   - On the DXM: Use the arrow keys to select the Node ID, then press **ENTER**. The display shows **Binding**.

   Valid Node addresses are 01 through 47.
3. Access the circuit board in the radio module of the TL70.
4. Enter binding mode on the TL70 by triple-clicking the binding button.
   The bicolor LED flashes alternately while it searches for a Gateway in binding mode. After the TL70 is bound, the LED is red and green for four seconds (looks amber), then it flashes four times (looks amber). The TL70 automatically exits binding mode, cycles power, and enters Run mode.
5. For DXMs, click **BACK** to exit binding for that specific Node address.
6. Label the Node with the assigned address for future references.
   This makes it easier to identify the physical Node location within a multi-Node network.
7. Reassemble the components back onto the base.
8. Repeat steps 2 through 5 for as many TL70 Wireless Communication Segments as are needed for your network.
9. After binding all TL70s, exit binding mode on the Gateway.
   - For housed Gateways, double-click button 2.
   - For board-level Gateway modules, double-click the button.
   - For DXM models, click **BACK** until you return to the main menu.

LED Behavior for the Nodes

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

Recommended minimum distances are:

900 MHz radio transmitting at ≤ 250 mW: 6 feet
900 MHz radios transmitting at ≥ 500 mW: 15 feet
2.4 GHz radios transmitting at 65 mW: 1 foot

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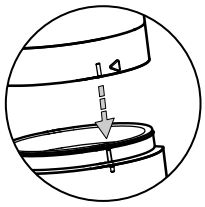
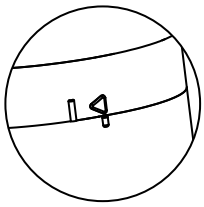
LED (Bi-color)	Node Status
Flashing green	Radio link okay
Green and red flashing alternately	In Binding mode
Both colors are solid for 4 seconds, then flash 4 times; looks amber	Binding mode is complete
Flashing red, once every 3 seconds	Radio link error
Flashing red, once every second	Device error

Assemble the TL70 Wireless Communication Segment



Align the notches



Notches shown in locked position

To assemble the modules:

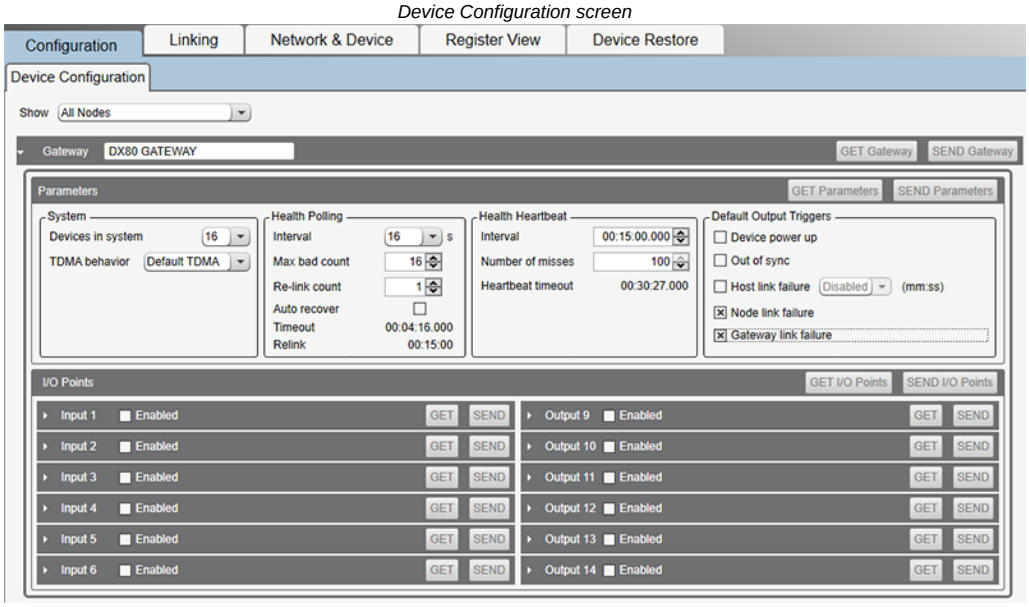
1. Position the TL70 Wireless Communication Segment on the base. The communication segment must mount directly to the TL70 base.
2. Align the notches on each module and press together.
3. Rotate the top module clockwise to lock into place (notches shown in the locked position).
4. Assemble the remaining modules in the desired order.

Follow the instructions and wiring diagrams on the TL70 Modular Tower Light datasheet, using either the standard or AC voltage base for triggering appropriate inputs.

Sure Cross® DX80 Performance Configuration Software

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

Device Configuration screen



Use a USB to RS-485 adapter cable to connect a standalone DX80 Gateway to the computer. For DXM Controllers with an internal DX80 radio, connect a computer to the DXM Controller using the supplied USB or Ethernet connection. Download the most recent revisions of the configuration software from Banner Engineering's website: https://www.bannerengineering.com/us/en/products/wireless-sensor-networks/reference-library/software.html.

The USB to RS-485 adapter cable is not required for the DXM Controller. For standalone DX80 Gateway devices use:

- USB to RS-485 adapter cable model **BWA-UCT-900** for 1 Watt radios
- USB to RS-485 adapter cable model **BWA-HW-006** for all other radios

Modbus Registers

Modbus holding registers for the 8-pin models. On 5-pin models, the M5 and M6 modules are not available. When DIP Switch 7 and 5 are enabled, the I/O range for all outputs is up to 0xFFFF, based on which flash pattern message is being created. Input register values: 0 = OFF, 1 = ON and if DIP Switch 6 is enabled then 2 = Flashing OFF, 3 = Flashing ON is added.

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I/O	Modbus Holding Register		I/O Type	I/O Range		Holding Register Representation (Dec.)		Module #
	Gateway	Any Node		Min.	Max.	Min.	Max.	
1	1	1 + (Node# × 16)	Discrete IN 1 / Bit-packed inputs [1]	0	3 / 63	0	3 / 63	M1
2	2	2 + (Node# × 16)	Discrete IN 2	0	3	0	3	M2
3	3	3 + (Node# × 16)	Discrete IN 3	0	3	0	3	M3
4	4	4 + (Node# × 16)	Discrete IN 4	0	3	0	3	M4
5	5	5 + (Node# × 16)	Discrete IN 5 / 32-bit event counter high word [2]	0	3 / 65535	0	3 / 65535	M5
6	6	6 + (Node# × 16)	Discrete IN 6 / 32-bit event counter low word [2]	0	3 / 65535	0	3 / 65535	M6
7	7	7 + (Node# × 16)	Reserved					
8	8	8 + (Node# × 16)	Device Message					
9	9	9 + (Node# × 16)	Discrete OUT 9 / Bit-picked outputs [1]	0	1 / 63	0	1 / 63	M1
10	10	10 + (Node# × 16)	Discrete OUT 10	0	1	0	1	M2
11	11	11 + (Node# × 16)	Discrete OUT 11	0	1	0	1	M3
12	12	12 + (Node# × 16)	Discrete OUT 12	0	1	0	1	M4
13	13	13 + (Node# × 16)	Discrete OUT 13	0	1	0	1	M5
14	14	14 + (Node# × 16)	Discrete OUT 14 / Zero out (clear) the counter [2]	0	1	0	1	M6
15	15	15 + (Node# × 16)	Control Message					
16	16	16 + (Node# × 16)	Reserved					

[1]Active when DIP Switch 4 is enabled

[2]Active when DIP Switch 3 is enabled

Creating Host Controlled Flash Patterns

When DIP switch 7 is enabled, a host controlled system can write a value of 0x0000 to 0xFFFF to an output register to enable that light segment in that specific flash pattern.

Flash a TL70 light by entering a time-based bit mask into the output register. Bit 0 represents the first 62.5 ms time window, bit 1 represents the second 62.5 ms window, etc.

For example, turn ON the output from 0 to 250 ms, OFF from 250 to 500 ms, ON from 500 to 750 ms, then OFF again from 750 ms to 1 second by writing 0x0F0F to the appropriate output.

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Bin	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
Hex	0				F				0				F			
Light	Turned off from 750 ms to 1 s				Turned on from 500 to 750 ms				Turned off from 250 to 500 ms				Turned on from 0 to 250 ms			

Specifications

Performance Radio with Internal Antenna Specifications

Radio Transmit Power (900 MHz, 500 mW radios)

Conducted: 27 dBm (500 mW)

EIRP with the supplied antenna: < 36 dBm

Radio Transmit Power (2.4 GHz radios)

Conducted: < 18 dBm (65 mW)

EIRP with the supplied antenna: < 20 dBm (100 mW)

Antenna Minimum Separation Distance

900 MHz radios transmitting at ≥ 500 mW: 4.57 m (15 ft) with the supplied antenna

2.4 GHz radios transmitting at 65 mW: 0.3 m (1 ft) with the supplied antenna

Radio Range

A 2 dB antenna ships with this device.

Transmit power and range are subject to many factors, including antenna gain, installation methods, characteristics of the application, and environmental conditions.

Please refer to the following documents for installation instructions and high-gain antenna options.

Installing Your Sure Cross® Radios (151514)
Conducting a Site Survey (133602)
Sure Cross® Antenna Basics (132113)

Link Timeout (Performance)

Gateway: Configurable via User Configuration Software

Node: Defined by Gateway

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Spread Spectrum Technology

FHSS (Frequency Hopping Spread Spectrum)

900 MHz Compliance (SX7023EXT Radio Module)

Radio module is indicated by the product label marking

Contains FCC ID: UE3SX7023EXT

Contains IC: 7044A-SX7023EXT

2.4 GHz Compliance (SX243 Radio Module)

Radio module is indicated by the product label marking

Contains FCC ID: UE3SX243

Radio Equipment Directive (RED) 2014/53/EU

Contains IC: 7044A-SX243

Tower Light Specifications

Supply Voltage and Current

12 V DC to 30 V DC (Outside the USA: 12 V DC to 24 V DC, ± 10%) [1]

900 MHz Consumption: Maximum current draw is < 40 mA and typical current draw is < 30 mA at 24 V DC. (2.4 GHz consumption is less.)

Indicator Color or Audible Model	Maximum Current (mA)	
	at 12 V DC	at 30 V DC
Blue, Green, White	420	150
Red, Yellow, Orange	285	120
Standard Audible	30	30
Loud Audible (Intensity 1)	18	14
Loud Audible (Intensity 2)	40	28
Loud Audible (Intensity 3)	160	70
Loud Audible (Intensity 4)	350	110

Supply Protection Circuitry

Protected against transient voltages

Audible Alarm

Standard Audible: 2.6 KHz ± 250 Hz oscillation frequency; maximum intensity (typical) 92 dB at 1 m (3.3 ft)

Loud Audible: 2.6 KHz ± 250 Hz oscillation frequency; maximum intensity (typical) at 1 m (3.3 ft)

DIP Switches		Maximum Intensity (typical) at 1 meter dB
9	10	
ON	ON	Intensity 4: 109 dB
OFF	ON	Intensity 3: 106 dB
ON	OFF	Intensity 2: 101 dB
OFF	OFF	Intensity 1: 94 dB

Audible Adjustment

Standard Audible: Rotate the cover until the desired volume is reached

Loud Audible Adjustment: Select the desired volume using DIP switches 9 and 10

Typical Reduction in Sound Intensity with Audible Adjustment (maximum to minimum):

- **Standard Audible:** 8 dB
- **Loud Audible:** 16 dB

Indicators

1 to 6 colors depending on model (Green, Red, Yellow, Blue, White, and Orange)

LEDs are independently selected

Flash Rates: 1.5 Hz ±10% and 3 Hz ±10%

Indicator Response Time

Off Response: 150 µs (maximum) at 12 V DC to 30 V DC

On Response: 180 ms (maximum) at 12 V DC; 50 ms (maximum) at 30 V DC

[1] For European applications, power this device from a Limited Power Source as defined in EN 60950-1.

Connections

5-pin M12 quick disconnect, 8-pin M12 quick disconnect, 150 mm (5.9 in) PVC cable with an M12 quick disconnect, or 2 m (6.5 ft) unterminated cable, depending on model

Construction

Bases, Segments, Covers: Polycarbonate

Vibration and Mechanical Shock

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

Shock: 15G 11 ms duration, half sine wave per IEC 60068-2-27

Indicator Characteristics

Color	Dominant Wavelength (nm) or Color Temperature (CCT)	Color Coordinates[2]		Lumen Output (Typical at 25 °C)
		x	y	
Green	525 nm	–	–	92
Red	625 nm	–	–	40
Yellow	590 nm	–	–	22
Blue	470 nm	–	–	32
White	5000 K	–	–	125
Orange	–	0.66	0.33	33

Operating Conditions

–40 °C to +50 °C (–40 °F to +122 °F)

95% at +50 °C maximum relative humidity (non-condensing)

Environmental Rating

IP65

Radiated Immunity HF

10 V/m (EN 61000-4-3)

Certifications

CE/UKCA approval only applies to 2.4 GHz models

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Blenheim Court
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GREAT BRITAIN

c UL us LISTED

ANATEL
Agência Nacional de Telecomunicações
03737-22-04042

[2] Refer to CIE 1931 chromaticity diagram or color chart, to show equivalent color with indicated color coordinates.

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Required Overcurrent Protection

WARNING: Electrical connections must be made by qualified personnel in accordance with local and national electrical codes and regulations.

Overcurrent protection is required to be provided by end product application per the supplied table.

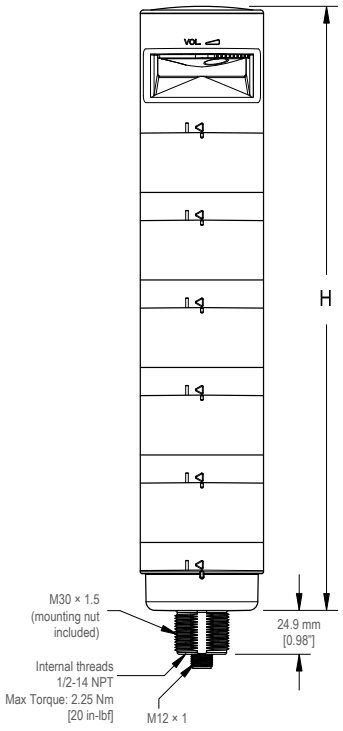
Overcurrent protection may be provided with external fusing or via Current Limiting, Class 2 Power Supply.

Supply wiring leads < 24 AWG shall not be spliced.

For additional product support, go to www.bannerengineering.com.

Supply Wiring (AWG)	Required Overcurrent Protection (A)	Supply Wiring (AWG)	Required Overcurrent Protection (A)
20	5.0	26	1.0
22	3.0	28	0.8
24	2.0	30	0.5

Dimensions



Model	Height (H)
1 light module	87.6 mm (3.45 in)
1 light module, 1 audible module	144.3 mm (5.68 in)
2 light modules	137.3 mm (5.41 in)
2 light modules, 1 audible module	194 mm (7.64 in)
3 light modules	187 mm (7.36 in)
3 light modules, 1 audible module	243.7 mm (9.59 in)
4 light modules	236.7 mm (9.32 in)
4 light modules, 1 audible module	293.4 mm (11.55 in)
5 light modules	286.4 mm (11.28 in)
5 light modules, 1 audible module	343.1 mm (13.5 in)
6 light modules	336.1 mm (13.23 in)

Banner Engineering Corp Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

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For patent information, see www.bannerengineering.com/patents.

Notas Adicionales (con Antena)

Información México: La operación de este equipo está sujeta a las siguientes dos condiciones: 1) es posible que este equipo o dispositivo no cause interferencia perjudicial y 2) este equipo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operación no deseada.

Banner es una marca registrada de Banner Engineering Corp. y podrán ser utilizadas de manera indistinta para referirse al fabricante. "Este equipo ha sido diseñado para operar con las antenas tipo Omnidireccional para una ganancia máxima de antena de 6 dBd y Yagi para una ganancia máxima de antena 10 dBd que en seguida se enlistan. También se incluyen

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aquellas con aprobación ATEX tipo Omnidireccional siempre que no excedan una ganancia máxima de antena de 6dBd. El uso con este equipo de antenas no incluidas en esta lista o que tengan una ganancia mayor que 6 dBd en tipo omnidireccional y 10 dBd en tipo Yagi, quedan prohibidas. La impedancia requerida de la antena es de 50 ohms."

Approved Antennas

BWA-9O2-C--Antena, Omni 902-928 MHz, 2 dBd, junta de caucho, RP-SMA Macho
BWA-9O5-C--Antena, Omni 902-928 MHz, 5 dBd, junta de caucho, RP-SMA Macho
BWA-9O6-A--Antena, Omni 902-928 MHz, 6 dBd, fibra de vidrio, 1800mm, N Hembra
BWA-9Y10-A--Antena, Yagi, 900 MHz, 10 dBd, N Hembra

Mexican Importer

Banner Engineering de Mèxico, S. de R.L. de C.V. | David Alfaro Siqueiros 103 Piso 2 Valle oriente | San Pedro Garza Garcia Nuevo Leòn, C. P. 66269

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