SureCross® Ethernet Data Radio

Configurable Ethernet radio for creating wireless Ethernet networks

The SureCross Ethernet radio is an industrial grade, long range, 900 MHz radio used to create point to multipoint configurations of wireless Ethernet networks.

- RF transmission rate of 1.536 Mb/s and a throughput of 935 Kb/s
- 128 bit AES encryption for Ethernet data packets
- Sub-block error detection and retransmission
- Automatic scan or manual override for the best of the 12 communication channels
- Indicator LEDs for channel selection and signal strength
- Point to multipoint configurations with up to 16 subscriber units
- User configuration via internal web page
- Built-in spectrum analyzer and firmware upgrading

For additional information and a complete list of accessories, including FCC approved antennas, refer to Banner Engineering's website, www.bannerengineering.com/surecross.

Model	Physical Connection	Frequency
DXER9	Power: 4-pin or 5-pin M12/Euro-style Ethernet: Industrial connection	900 MHz

⚠ WARNING . . . Not To Be Used for Personnel Protection

Never use these products for personnel protection. Doing so could lead to serious injury or death.

These devices do NOT include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A device failure or malfunction can cause either an energized or de-energized output condition. Consult your current Banner Safety Products catalog for safety products that meet OSHA, ANSI, and IEC standards for personnel protection.

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Overview

The SureCross Ethernet radio allows the user to create a long-range, wireless Ethernet network for up to 16 subscriber unit radios for each access point radio. The access points act as the masters for the data radio networks: they keep the timing and control the encryption key exchange.

The access point data radio automatically scans for the best of the 12 available radio channels, encrypts Ethernet data received from the network, and transmits it wirelessly to the correct subscriber unit data radio. The access point also monitors the network performance and automatically changes channels if interference degrades the performance. The user may manually select any of the 12 radio channels by toggling DIP switch settings on the access point radio. It is possible to operate up to 12 access points in the same area with each access point on a different channel, but to avoid interference, position all radios at least 10 feet apart.

Any 10/100 BaseT Ethernet client device (ECD) can be connected to a SureCross Ethernet radio subscriber unit. Each subscriber unit encrypts Ethernet traffic received from the attached ECD and wirelessly transmits the data to its access point. Each subscriber unit can be plugged directly into an ECD without adding drivers or loading software. Crossover cables are never needed. Only one ECD can be directly attached to each subscriber unit, and fixed IP addresses are recommended for the attached ECDs.

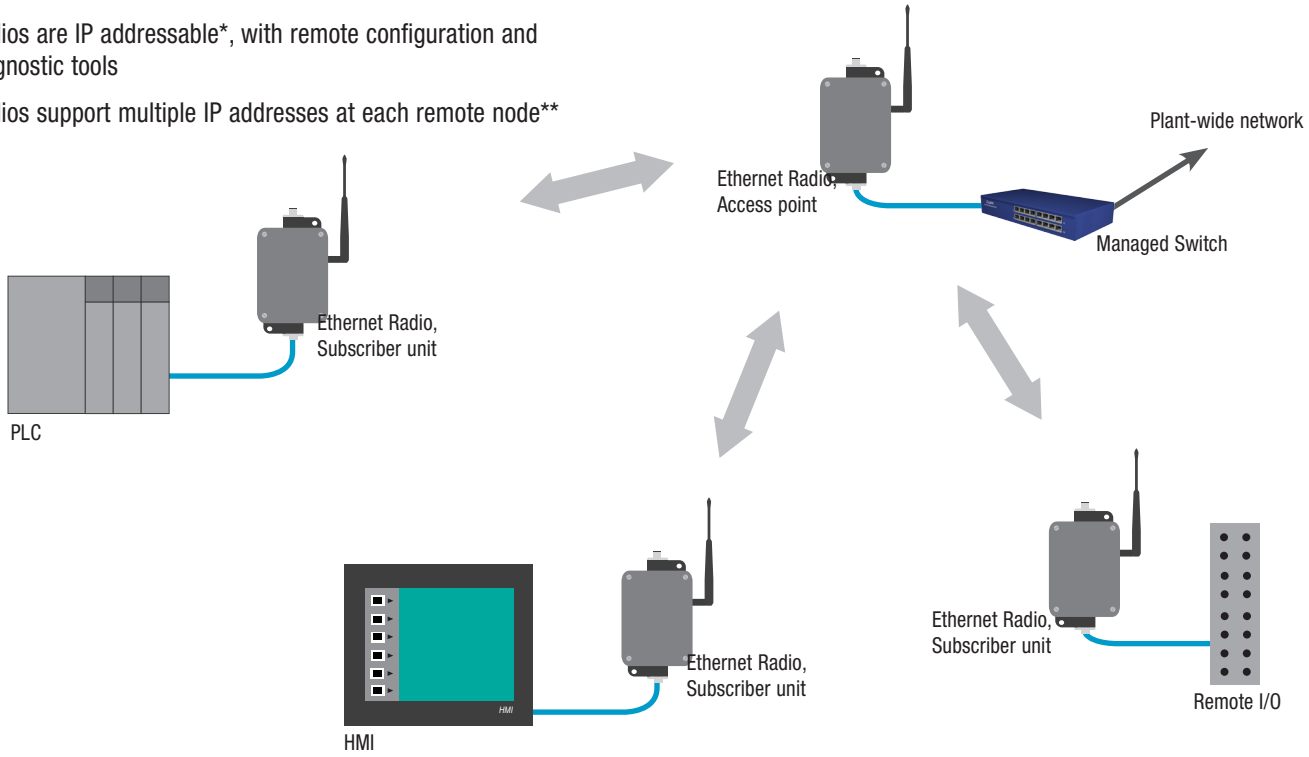
Network Encryption Keys

Banner Ethernet Data Radios use electronic network encryption keys that allow the user to group radios together to form a network. Network keys are shared between radios using the web-based configuration pages described on the following pages.

Network Diagram

Radios are IP addressable*, with remote configuration and diagnostic tools

Radios support multiple IP addresses at each remote node**



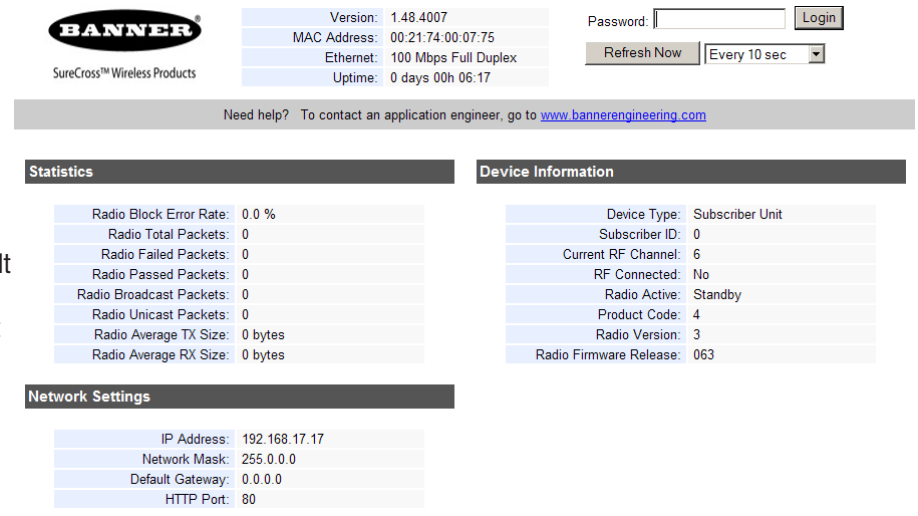
* There is a limit of 64 routable MAC addresses per access point. This allows an Ethernet switch to be attached to subscriber units, but limits to 64 the total number of Ethernet devices to which the access point can connect.

** There is a limit of 16 active subscriber units for each access point. A total of 12 access points (in the 900 MHz band) can be deployed to support up to 192 fixed subscriber units across a given site.

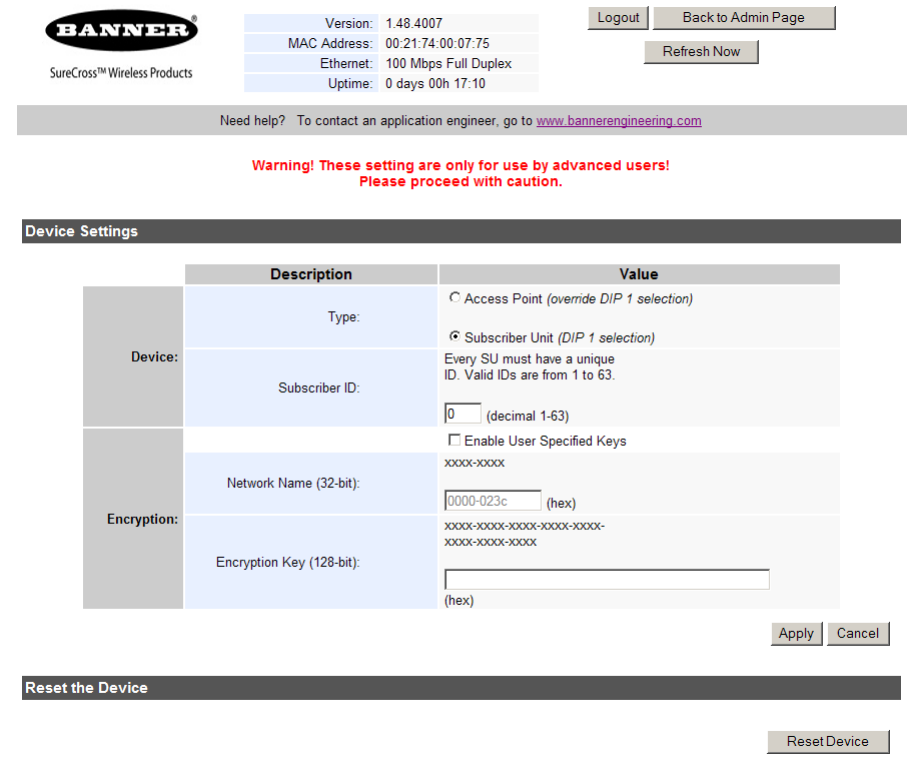
Set-up Procedures

1. Starting with all units powered off, select a radio to operate as the access point data radio and set its DIP switch 1 to the ON position to enable access point operation.
2. Apply power to the units.
3. Using the Ethernet cable, connect the access point radio to your computer. Go to 192.168.17.17 to view the configuration web pages.

   To view the configuration screens, enter the password and click the Login button. The default password is "password." The IP address and default password is printed on a sticker on the radio board instead of the Ethernet radio device. Note that configuration changes made using these web-based screens will override any DIP switch settings.
4. Go to the Advanced Admin screen.
5. Select the Enable User Specified Keys checkbox.
6. For the access point: Enter the number of subscriber devices connected. For the subscriber units: Assign a unique subscriber ID, in numerical order from 1 to 63.
7. Enter an 8-digit hex (0 to 9 and A through F) network name. Use the hyphens as shown on the screen. Use this same network name for the access point (master) and all subscriber units (slaves) in the same network.
8. Enter a 32-digit encryption key. Use the hyphens as shown on the screen. Use this same encryption key for all radios within the same network.
9. Click the Apply button to send the information to the Ethernet data radio.
10. Repeat steps 2 through 8 for all subscriber units.
11. Cycle power to all radios for the new keys to activate.
12. Deploy the radios.



Login Screen



Advanced Admin Screen

To add NEW subscriber units to the Ethernet radio network

1. Apply power to the subscriber unit.
2. Using the Ethernet cable, connect the radio to your computer. Go to 192.168.17.17 to view the configuration web pages.
3. Go to the Advanced Admin screen.
4. Select the Enable User Specified Keys checkbox.
5. Enter the 8-digit hex (0 to 9 and A through F) network name. Use the hyphens as shown on the screen. Use the same network name for the access point (master) and all subscriber units (slaves) in the same network.
6. Enter a 32-digit encryption key. Use the hyphens as shown on the screen. Use this same encryption key for all radios within the same network.
7. Click the Apply button to send the information to the Ethernet data radio.
8. Repeat steps 1 through 7 until all new subscriber units are successfully programmed.
9. Cycle power to the new radios for the new keys to activate.

To re-key a subscriber unit to a NEW access point

1. Apply power to the subscriber unit.
2. Using the Ethernet cable, connect the radio to your computer. Go to 192.168.17.17 to view the configuration web pages.
3. Go to the Advanced Admin screen.
4. Select the Enable User Specified Keys checkbox.
5. Enter the 8-digit hex (0 to 9 and A through F) network name used by the new access point. Use the hyphens as shown on the screen.
6. Enter a 32-digit encryption key used by the new access point. Use the hyphens as shown on the screen.
7. Click the Apply button to send the information to the Ethernet data radio.
8. Cycle power to the new radio for the new keys to activate.

Additional Information

For additional information, including installation and setup, weatherproofing, and a list of accessories, refer to the SureCross™ Wireless I/O Network product manual, Banner p/n 132607.

The radios cannot be damaged by incorrect programming. If DIP 1 is accidentally toggled, DIP 1 can be returned to its previous position and the radio retains all the network associations it had in its previous mode (assuming the radio had not yet successfully key exchanged with a new network). A access point data radio can be reset by programming it as a subscriber unit data radio to a new access point and then turning it back into a access point again.

Subscriber units without a network key boot up in “key exchange mode” and wait to receive a key. Subscriber units with a network key boot up for five seconds in “key exchange mode” and search for the access point. If a new access point is present, the subscriber unit exchanges keys with the access point; otherwise the subscriber unit begins normal operation after the five seconds.

Access point data radios without network keys boot up in “key exchange mode” until they have issued network keys to at least one subscriber unit data radio. Once the access point has issued keys, it only boots up for five seconds in “key exchange mode.” If a subscriber unit is present during the five seconds, the access point issues new keys to the subscriber unit and remains in “key exchange mode,” waiting for more subscriber units to be attached. Once all new subscriber units have been attached, cycle power to the access point. The access point boots up and enters normal operation after five seconds of “key exchange mode.”

Banner Engineering Corp. • Minneapolis, MN U.S.A
www.bannerengineering.com • Tel: 763.544.3164

LED Display

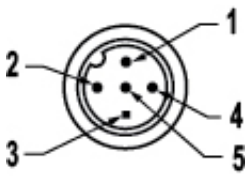
Name	Function	LED Color
Power	Unit has power and has successfully booted	Red
RF Rx	Radio reception is occurring	Green
RF Tx	Radio transmission is occurring	Green
Eth Link	The Ethernet port has a valid Ethernet connection	Green
1 2 4 8 16 32	By adding the numbers that are lit, the user can determine the current radio channel. 1 903.12500 MHz 7 915.62500 MHz 2 905.20833 MHz 8 917.70833 MHz 3 907.29167 MHz 9 919.79167 MHz 4 909.37500 MHz 10 921.87500 MHz 5 911.45833 MHz 11 923.95833 MHz 6 913.54167 MHz 12 926.04167 MHz	Green
Link Quality Meter - The more lighted LEDs, the higher the link quality. OR "Key exchange mode" when blinking sequentially	Excellent link quality - No transmission retries	Green
	Very good link quality - Few transmission retries	Green
	Good link quality - Occasional transmission retried	Amber
	Fair link quality - Some transmission retries	Amber
	Poor link quality - Many transmission retries	Red
	No link quality - No link available	Red

Advanced Operation

Please call Banner technical support at 888.373.6767 if the system topology requires:

- More than 16 subscriber units per access point for roaming/mobility applications
- Multiple access points that use the same network key for roaming/mobility
- Low packet loss rates when using broadcast or multicast Ethernet packets

NOTE: Broadcast and multicast packets (example: DHCP, UDP) are sent once and may experience losses at extended range. Unicast packets (example: HTTP, TCP) are sent using advanced error correction and retransmission techniques to ensure delivery.



4-pin or 5-pin M12 Euro-Style Connection

	Function	Wire color (when using Banner cables)
1	+5 to 48V dc	brown
2		
3	dc common (GND)	blue
4		
5		

Industrial Ethernet Hookup

	Wire Color	Description
1	White/Orange	+Tx
2	White/Blue	+Rx
3	Orange	–Tx
4	Blue	–Rx

DIP Switches

DIP Switch 1

Access point data radio or subscriber unit data radio:

- DIP 1 ON - The radio operates as a access point
- DIP 1 OFF - The radio operates as a subscriber unit. When defines as a subscriber unit, DIP switches 3 through 8 are not used.

DIP Switches 3 through 8

Automatic Frequency Selection Mode (DIP switches — DIP 3-8 OFF for automatic mode)

The SureCross Ethernet radio is designed to automatically select and continuously optimize the performance of its radio channel. The radio channel is monitored to ensure it is providing low error rates necessary for successful data transmission. If the error rate rises, the access point data radio autonomously changes to a new channel. There are 12 non-overlapping channels.

Manual Frequency Selection Mode

The operation of the SureCross Ethernet radio can be restricted to a specific channel within the 900 MHz band by setting DIP switches 3-8 on the access point data radio as shown in the DIP switch table. The subscriber unit data radio responds to the access point's choice of channel.

	Switches							
Device Settings	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Subscriber unit	OFF*							
Access point	ON							
Channel Center Frequency								
Automatic Channel Selection			OFF*	OFF*	OFF*	OFF*		
903.12500 MHz			ON	OFF	OFF	OFF		
905.20833 MHz			OFF	ON	OFF	OFF		
907.29167 MHz			ON	ON	OFF	OFF		
909.37500 MHz			OFF	OFF	ON	OFF		
911.45833 MHz			ON	OFF	ON	OFF		
913.54167 MHz			OFF	ON	ON	OFF		
915.62500 MHz			ON	ON	ON	OFF		
917.70833 MHz			OFF	OFF	OFF	ON		
919.79167 MHz			ON	OFF	OFF	ON		
921.87500 MHz			OFF	ON	OFF	ON		
923.95833 MHz			ON	ON	OFF	ON		
926.04167 MHz			OFF	OFF	ON	ON		

* Default configuration

IP Address Changer

IP Discovery Changer Utility

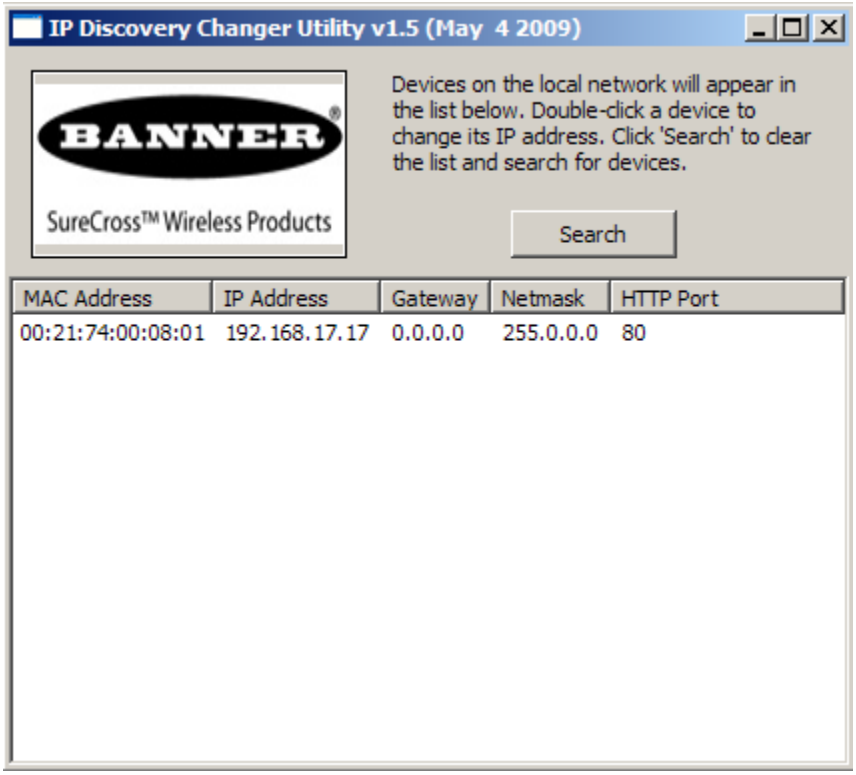
The IP Discovery Changer Utility reads the IP addresses of the devices connected to the local network when the program is launched.

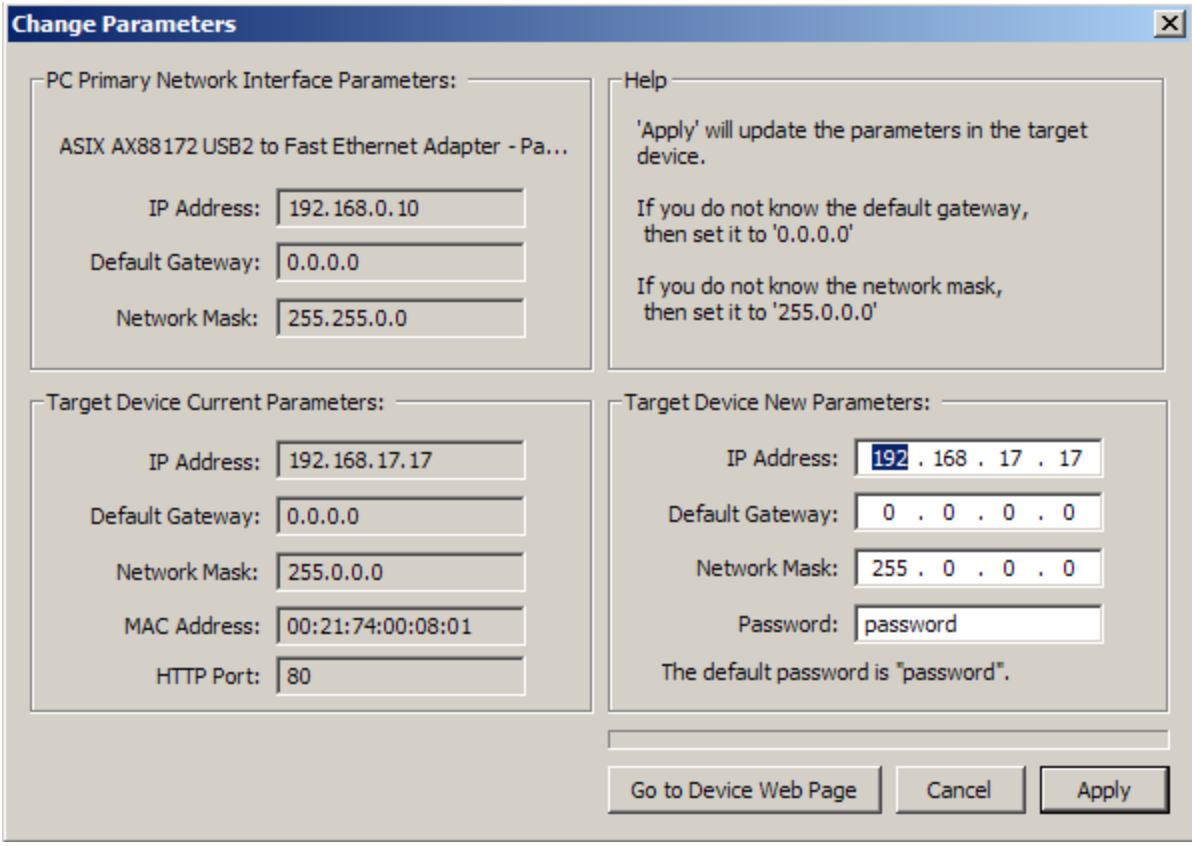
To download this IP Address Utility, go to www.bannerengineering.com/surecross and access either the Software page or the Data Radio page.

The sample screen shown illustrates the default IP address of the Ethernet Data Radio.

To change the IP address, Network Mask, or password settings, double click on the device in the list.

After making changes on the Change Parameters screen, click the Apply button, then click on the Go to Device Web Page button to launch the Web Configuration page.

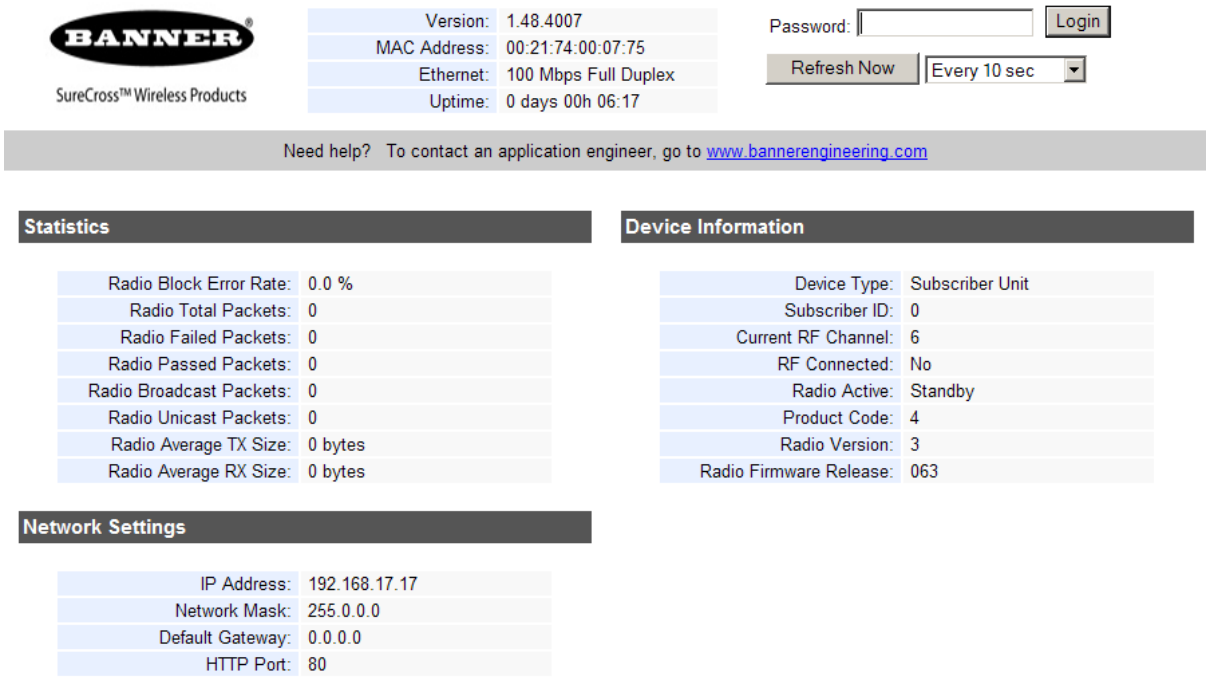




Configuration Web Pages

With the Ethernet Radio plugged into your computer via the Ethernet cable, go to 192.168.17.17 to view the configuration web pages. This initial screen displays the performance statistics, network settings, and device information for your Ethernet radio device.

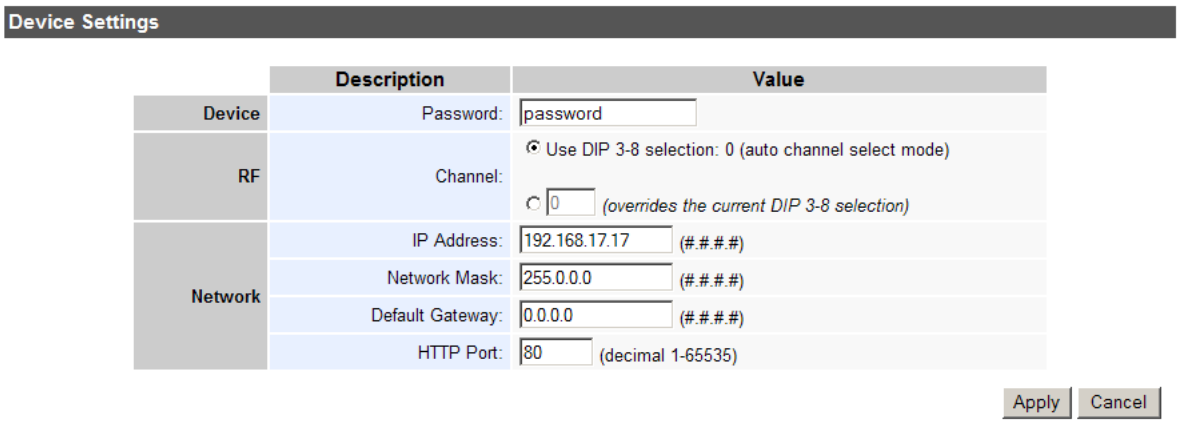
To view the configuration screens, enter the password and click the Login button. The default password is “password.” The IP address and default password is printed on a sticker on the radio board instead of the Ethernet radio device. Note that configuration changes made using these web-based screens will override any DIP switch settings.



Device Settings Screen

After the password is entered and the Login button clicked, additional information is added to the bottom of the screen. The first section, *Device Settings*, displays the specific radio and network settings for the Ethernet radio. Use this screen to change the password, select the radio operation, or change the IP address, network mask, or http port. After making changes, click the Apply button to activate these changes.

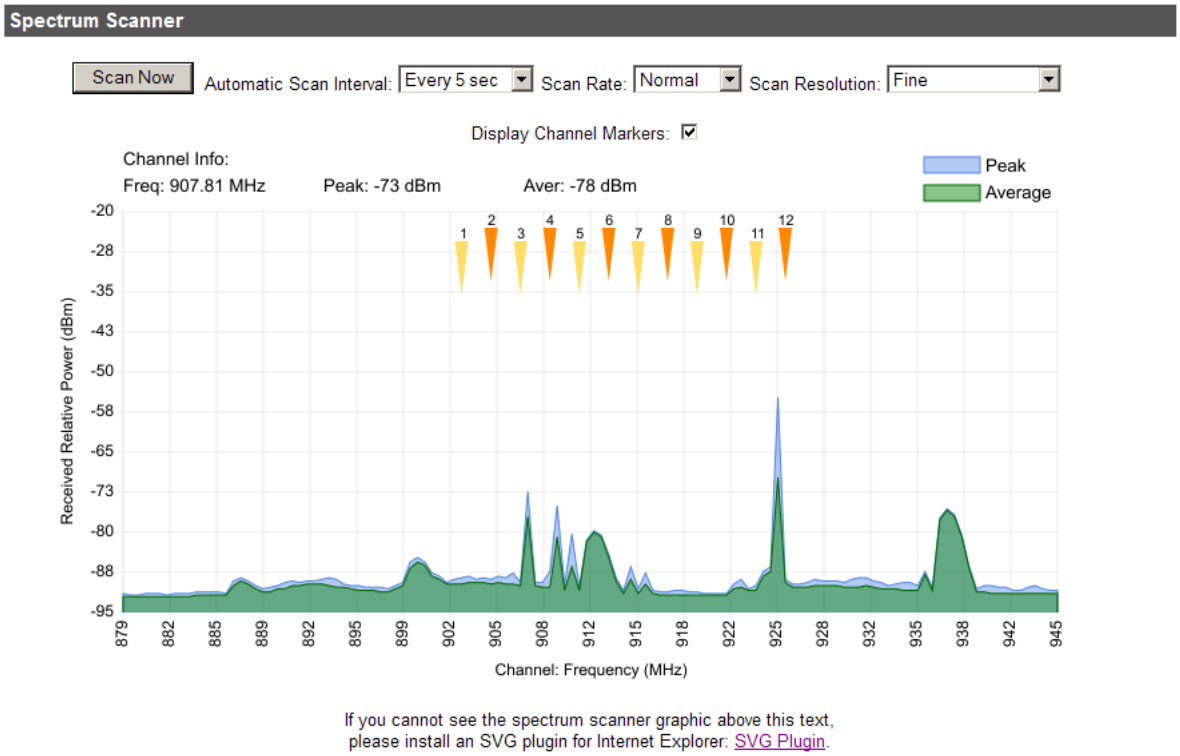
By default, the radio chooses its frequency to minimize interference. If you set a fixed channel, verify that the access point and all subscriber units use the same channel.



Spectrum Scanner Screen

The *Spectrum Scanner* analyzes the radio traffic in your area and displays the results graphically. Spikes in the readings indicate radio traffic. To see an accurate display, set the Automatic Scan Interval to every 3 to 10 seconds. Note that when you leave this screen, the Automatic Scan Interval is reset to none. Use this display to help select an available radio channel when you are setting the channel manually. The first time you access this web page, this graphic may not be visible. If there is no graphic images displayed, click on the link at the bottom of the display area to download the SVG plugin and follow your browser's instructions.

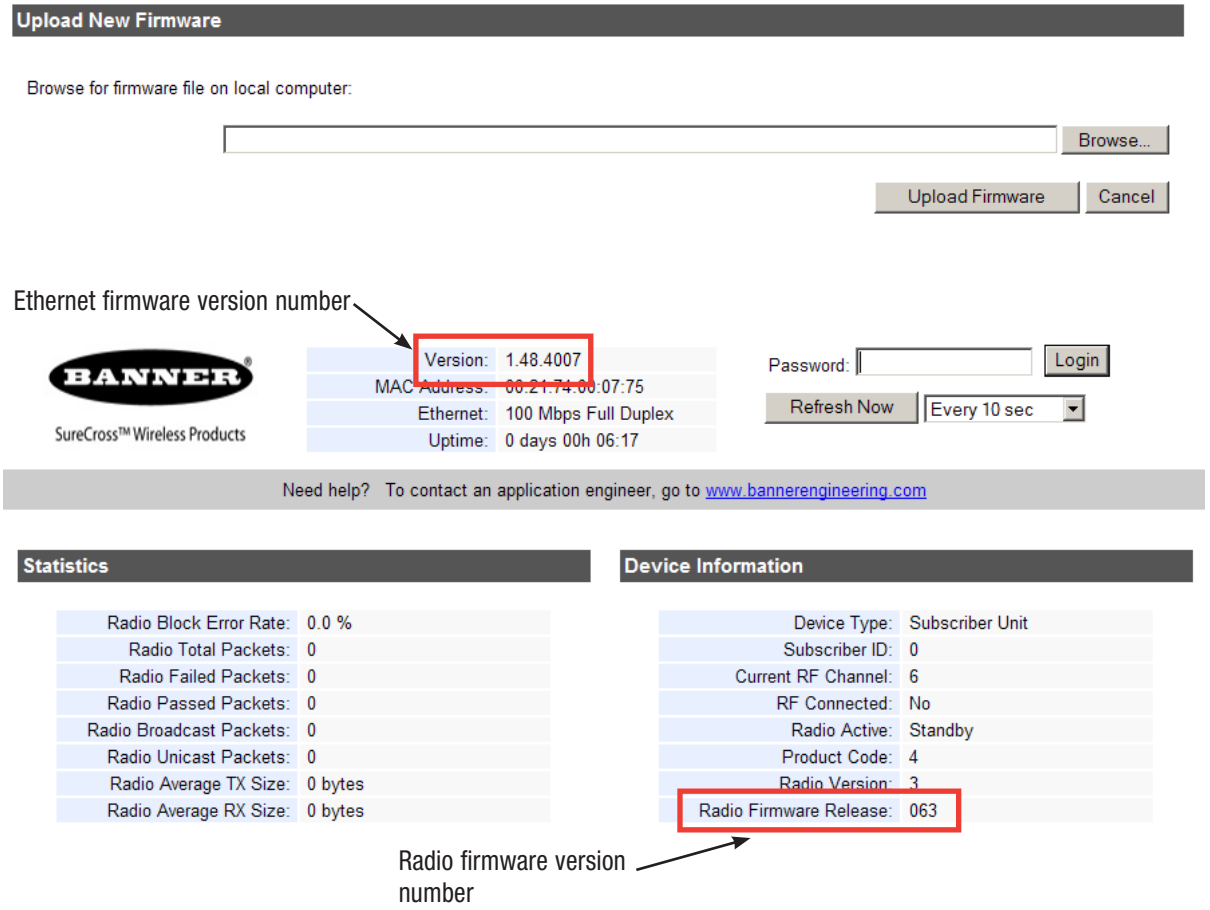
This graphic may not display properly in all browsers. If the graphic does not display as part of the Admin screen, click on the Fast Spectrum Scanner button at the bottom of the screen to load the image on its own web page. If the graphic does not display by either method, load these configuration pages using another browser. Internet Explorer and Mozilla's Firefox should display the graphic in both locations. Apple Safari and Google Chrome may not display the graphic as part of the Admin screen, but do display this graphic from the Fast Spectrum Scanner button.



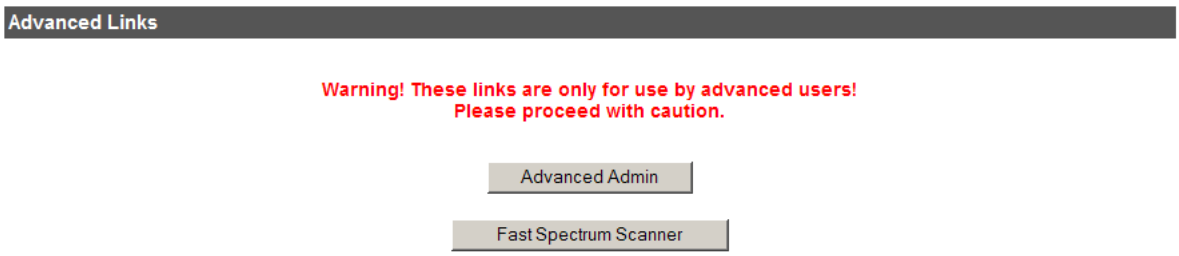
Updating Firmware Screen

To update the Ethernet or radio firmware, follow these instructions.

1. Download the firmware updates from either the data radio or software pages on the Wireless Sensor Network section of Banner Engineering's website.
2. Using the radio's web browser interface, enter the password and click the Login button. (If you don't know the password, use the IP Address Changer utility to read or reset it. This file is also downloadable from Banner Engineering's website.)
3. Near the bottom of the *Admin* page is a section titled *Upload New Firmware*. Enter the path to the Radio firmware update file (file extension .BIN) or click the **Browse** button to find it.
4. Click **Upload Firmware** and **OK** to confirm. After a few seconds, the radio should reset and return to the *Login* page.
5. Repeat steps 3 and 4 to update the Ethernet firmware update file (file extension .WEBBIN).
6. Look at the version numbers listed on the top of the Login page to verify the update was successful.



The bottom of the web page contains a link to the *Advanced Admin* page. Use the *Advanced Admin* page only for advanced configuration of networks with more than 16 subscriber units. Click the Advanced Admin button to access this configuration page.



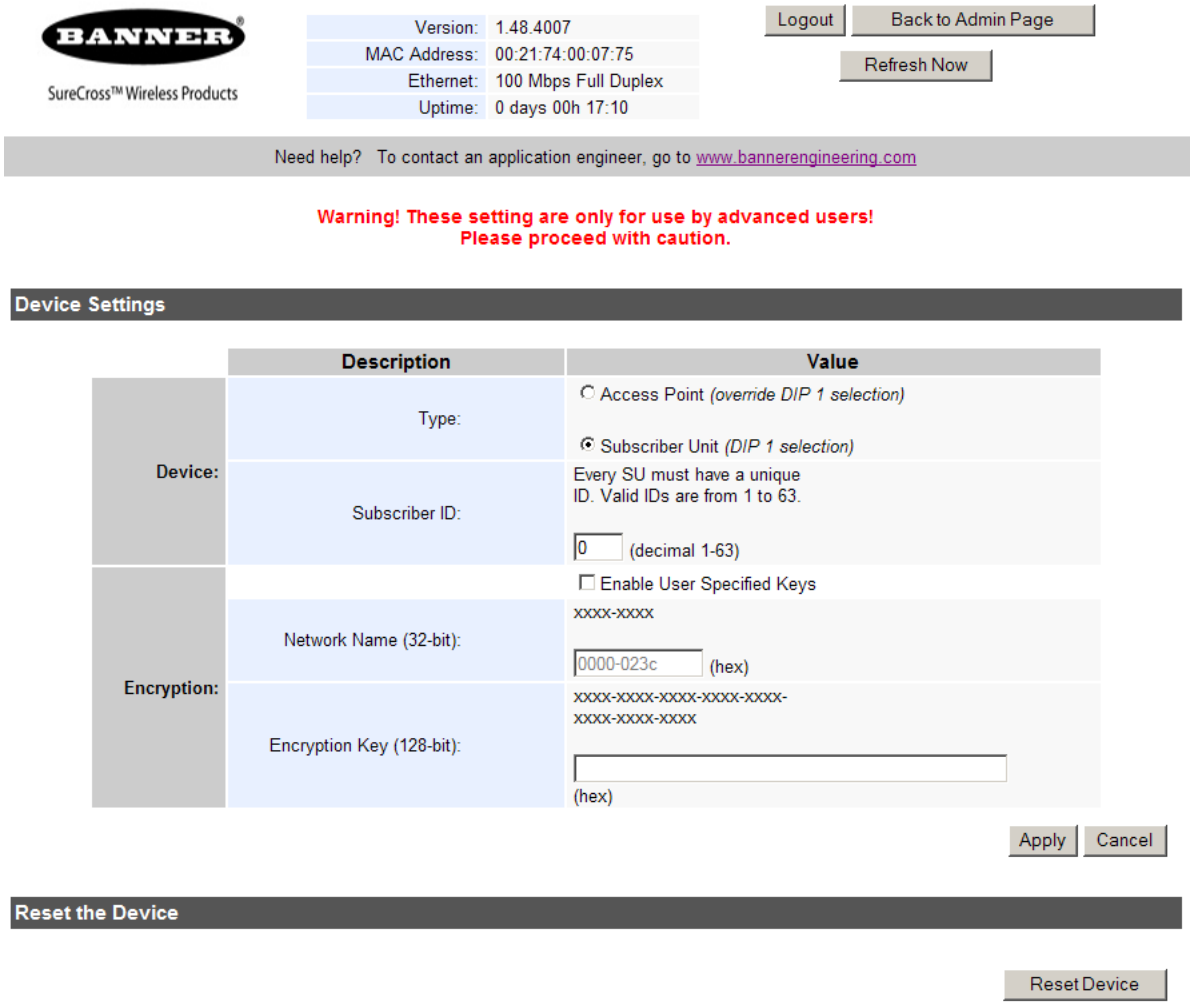
Advanced Admin Screen

When using more than 16 subscriber units within a network or when using the web pages instead of the DIP switches to configure your devices, use the *Advanced Admin* page to set the following parameters:

- **Device type**. Choose the device type, either an Access Point or Subscriber Unit. For Subscriber Units, assign unique ID numbers in numeric order from 1 to 63. For an Access Point, enter the number of Subscriber Units that will be communicating with it.
- **Keys**. Click the box labeled "Enable User Specified Keys" and select and enter an 8-digit hex (0-9 and A-F) Network name that will be common among the Access Point and its Subscriber Units. The hyphen is required.
- **Encryption key**. Choose and enter a 32-digit hex encryption key, including the hyphens. Use the same key for the AP and the SU.

After entering the parameters, click the Apply button to save them to the radio.

When all the radios are keyed and operating, connect them to your network and Ethernet devices as desired and cycle the radio's power to begin normal operation. Browser management of the subscriber units can now be performed over the wireless network. Avoid plugging actively linked radios into the same switch because this will corrupt the routing tables and may cause network problems just as if you had plugged a CAT5 cable directly between two ports of a switch.



Technical specifications

RF transmission rate. 1.536 Mb/s

Ethernet throughput. 935 Kb/s

Output power. +21 dBm (4 Watts EIRP used with 15 dBi antenna)

Receive sensitivity. –97 dBm at 10e-4 BER (–112 dBm with 15 dBi antenna)

Radio link budget. 148 dB with 15 dBi antenna

Range. 40 miles LOS with 15 dBi antenna

Radio channels/bandwidth. 12 non-overlapping with 2.0833 MHz spacing and 1.75 MHz occupied bandwidth

Spread Spectrum Technology. Direct Sequence Spread Spectrum

Manual frequency select. Channel selected with DIP switch or via Web browser interface

Connector types. Ext. Reverse Polarity SMA / 10-100 baseT Industrial Ethernet / 5-pin or 4-pin M12/Euro-style power connection

Status LEDs. Power, Ethernet Link, RF RX, RF TX, 4/Channel, and 6/Link Quality

Error correction technique. Sub-block error detection and retransmission

Adjacent-band rejection. SAW receiver filter attenuates cellular and pager interference

UL Certifications

c UL us LISTED IND. CONT. EQ. 447Y

Maximum ambient temperature. 70 °C

Mounting instructions. See document 132607

Power rating. UL Class 2

Enclosure environmental rating. UL Type 1

Regulator type. Switching regulator

Browser management tools. QoS Statistics, Network Settings, Spectrum Analyzer, and Firmware Upgrading

Power consumption.
Transmit: 1.7 Watts
Receive: 0.8 Watts

Voltage
Apply power using one of the following connections:
Euro-style connector: 5 to 48 V dc with pin 1 positive and pin 3 ground

Temperature range. –40 °C to 70 °C

Mounting. #10 or M5 (M5 hardware included)

M5 Fasteners Max Tightening Torque. 0.56 N·m (5 in·lbf)

Case Material. PBT

Environmental Rating.
IEC IP65; NEMA 4X
(For UL rating, refer to the UL section below)

Compliance Statement (Part 15.9)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: this device may not cause harmful interference, and this device must accept any interference received, including interference that may cause undesired operation.

This device contains FCC ID:R4N-AW900MR and IC: 5305A-AW900MR

Warning (Part 15.21)

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

RF Exposure (OET Bulletin 65)

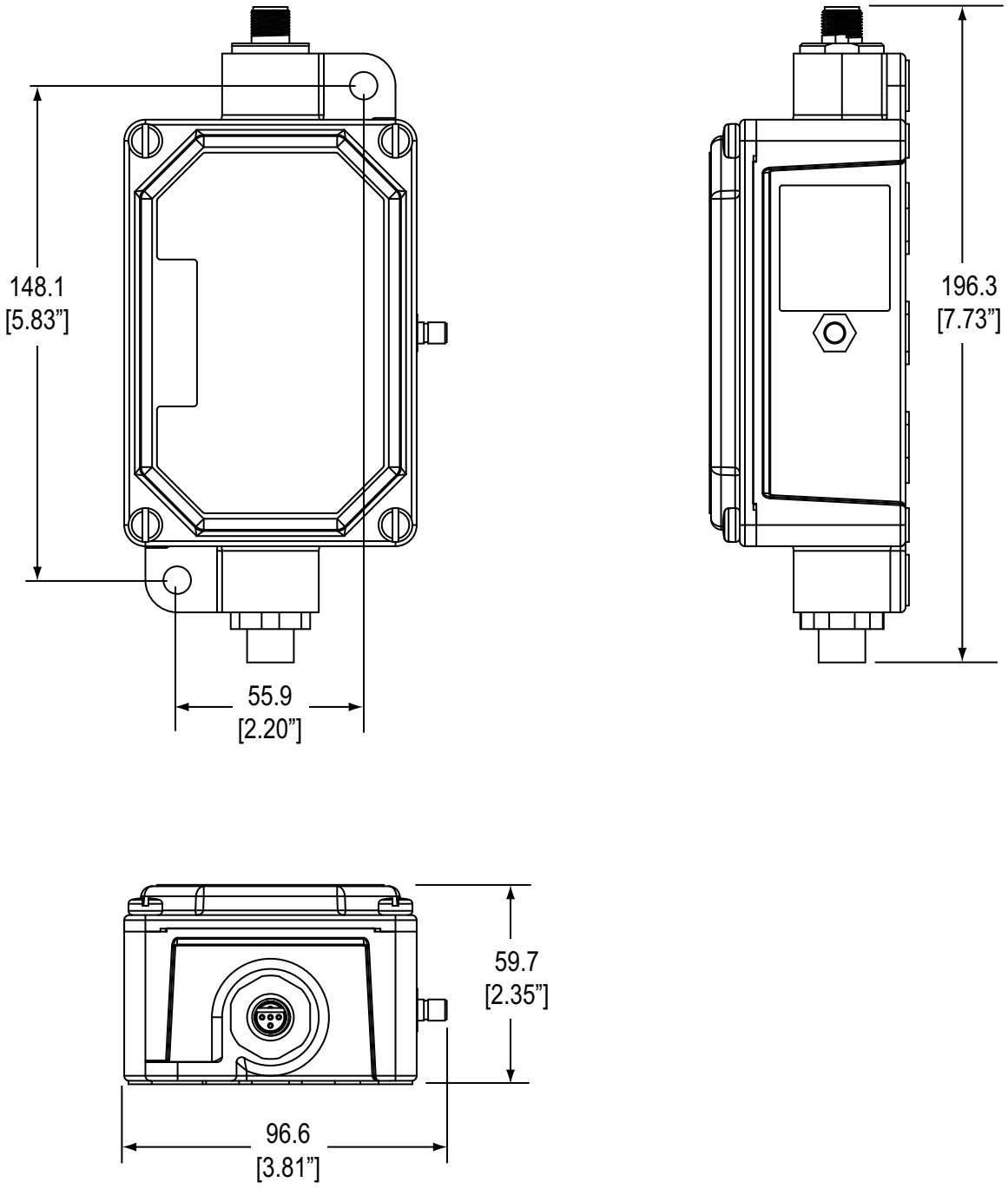
To comply with FCC RF exposure requirements for mobile transmitting devices, this transmitter should only be used or installed at locations where there is at least 20 cm separation distance between the antenna and all persons.

Information to the User - Part 15.105(b)

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Dimensions



It is Banner Engineering's 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 that the device is approved in the destination country. A list of approved countries appears in the SureCross DX80 Wireless Product Manual, in the *Agency Certifications* section. The SureCross wireless products were certified for use in these countries using the standard 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 Banner Engineering if the destination country is not on this list.

Included with Ethernet Data Radio

Included with Device	Model	Qty	Item
Mounting Hardware Kit	BWA-HW-001	4	Screw, M5-0.8 x 25mm, SS
		4	Screw, M5-0.8 x 16mm, SS
		4	Hex nut, M5-0.8mm, SS
		4	Bolt, #8-32 x 3/4", SS
Antenna	BWA-902-C	1	Antenna, 902-928 MHz, 2 dBd Omni, Rubber Swivel RP-SMA Male
SureCross Literature CD	79685	1	SureCross Literature CD
Cables	MQDC1-506	1	Cable, 5-pin Euro (female, single ended), Straight, 2 m, black
	BWA-EX2M	1	Ethernet Cable, M12 Industrial/RJ45, Crossover, 2 meter
Data sheet		1	

Accessories

Antennas

Model Number	Description
BWA-9Y6-A	Antenna, Yagi, 900 MHz, 6.5 dBd, N Female
BWA-9Y10-A	Antenna, Yagi, 900 MHz, 10 dBd, N Female
BWA-902-C	Antenna, Omni, 900 MHz, 2 dBi, Rubber Swivel, RSMA Male
BWA-906-A	Antenna, Omni, 900 MHz, 6 dBd, Fiberglass, N Female
BWA-905-B	Antenna, Omni, 900 MHz, 5 dBd/7.2 dBi, With ground plane, N Female
Banner offers a range of omni-directional and directional (Yagi) antennas for use with the SureCross DX80 wireless network. For more information on antenna specifications and the options available for your system, please contact the applications engineers at Banner Engineering Corp and Banner document p/n 132113, *Antenna Basics*.	

Surge Suppressors

Model Number	Description
BWC-LFNMN	Surge Suppressor, N-Type, 900 MHz/2.4 GHz
BWC-LFNBMN	Surge Suppressor, Bulkhead, N-Type, 900 MHz/2.4 GHz
BWC-LMRSFRPB	Surge Suppressor, Bulkhead, RP-SMA Type, 900 MHz/2.4 GHz

Cables

Model Number	Description
MQDC1-506	Cordset, Quick Disconnect, 5-pin Euro, Straight, 2 m
MQDC1-501.5	Cordset, Quick Disconnect, 5-pin Euro, Straight, 0.5 m
MQDC1-515	Cordset, Quick Disconnect, 5-pin Euro, Straight, 5 m
MQDC1-530	Cordset, Quick Disconnect, 5-pin Euro, Straight, 9 m
CSB-RND-M125.47M125.73	Splitter Cable, 5-pin Euro QD, No trunk male, two female branches, black
BWA-E2M	Ethernet Cable, M12 Industrial / RJ45, Straight, 2 m
BWA-EX2M	Ethernet Cable, M12 Industrial / RJ45, Crossover, 2 m
BWA-E8M	Ethernet Cable, M12 Industrial / RJ45, Straight, 8 m

Antenna Cables

Model Number	Description
BWC-1MRSMN05	LMR200, RP-SMA to N-Type Male, 0.5 m
BWC-1MRSMN2	LMR200, RR-SMA to N-Type Male, 2 m
BWC-1MRSFRSB4	RG58, RP-SMA to RP-SMA Female Bulkhead, 4 m
BWC-1MRSFRSB1	RG58, RP-SMA to RP-SMA Female Bulkhead, 1 m
BWC-1MRSFRSB2	RG58, RP-SMA to RP-SMA Female Bulkhead, 2 m
BWC-1MRSFRSB0.2	RG58, RP-SMA to RP-SMA Female Bulkhead, 0.2 m
BWC-4MNFN3	LMR400, N-Type Male to N-Type Female, 3 m
BWC-4MNFN6	LMR400, N-Type Male to N-Type Female, 6 m
BWC-4MNFN15	LMR400, N-Type Male to N-Type Female, 15 m
BWC-4MNFN30	LMR400, N-Type Male to N-Type Female, 30 m
There is a wide range of antenna cabling available. Please contact Banner Engineering Corp. for more information or for specific cable lengths and connectors.	

more sensors, more solutions

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Lightning Arrestors/Surge Protection. Always use lightning arrestors/surge protection with all remote antenna systems to avoid invalidating the Banner Engineering Corp. warranty. No surge protector can absorb all lightning strikes. Do not touch the SureCross device or any equipment connected to the SureCross device during a thunderstorm.

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