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Zlinx® Xtreme
IP67 Radio Modem

ZXT9-RM ZXT24-RM

Model Number: ZXT9-RM, ZXT24-RM

B&B ELECTRONICS

Zlinx Xtreme IP67 Radio Modem
ZXTx-RM Series

Documentation Number: ZXTx-RM-2310m

This product was designed and manufactured in Ottawa, Illinois USA

Using domestic and imported parts by

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Revision – Original – June 2010

Table of Contents

Contents

1.0 Overview

1.1 Prerequisites

This manual assumes you have a basic understanding of wireless communications, Serial Protocols (RS-232/422/485), and basic electronics.

1.2 Safety Information

WARNING

Exposure to RF energy is an important safety consideration. The FCC has adopted a safety standard for human exposure to radio frequency electromagnetic energy emitted by FCC regulated equipment as a result of its actions in Docket 93-62 and OET Bulleting 65 Edition 97-01.

DO NOT Operate unless all RF connectors are secure and any open connectors are properly terminated

DO NOT Operate the equipment near electrical blasting caps or in an explosive atmosphere.

All equipment must be properly grounded for safe operations. All equipment should be serviced only by a qualified technician.

A separation distance of 20 cm or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operation at closer than this distance is not recommended. The antenna used for this device must not be co-located in conjunction with any other antenna or transmitter.

1.3 Installation Information

Operating Voltage	10 to 30 VDC
Maximum Surrounding Ambient Air Temp	74°C
Wiring Terminals	Use Copper Wire Only, One Conductor Per Terminal
Wire Range	30 to 12 AWG
Tightening Torque	0.5 to 0.6 Nm
Temperature Rating of Field Installed Conductors	105°C minimum, sized for 60°C ampacity.

Please see the Quick Start Guide for UL Class 1 Division 2 installation instructions.

1.4 About this Manual

This manual has been created to assist you in installing, configuring, operating, and trouble shooting your Zlinx® Xtreme Radio Modem.
It is divided into eleven major sections.

Product Information – covers what is included with your radio modem, operating modes, operating states, and user interface components.

Hardware Installation – covers how to install your radio modem. Additional information is provided about RF considerations, accessory antennas, and cable selection.

Electrical Installation – covers wiring connections and powering your radio modem.

Software Installation – covers installing the manager software and basic software functionality.

Startup and Configuration – contains more detailed information about how to configure your radio modem.

Use Cases – contains information concerning the most widely used configurations.

Testing and Troubleshooting – contains information about trouble shooting aids.

Appendix – has additional information.

1.5 Product Features Summary

Need to extend an RS-232/422/485 signal across a highway or across the building? Your Zlinx ® Xtreme Radio Modem will do the job faster, easier, and less expensively than stringing cable. The Zlinx ® Xtreme Radio Modem connects serial devices which can be set up in point to point or point to multi point networks. Easy plug-and-play set-up saves installation and maintenance time. In addition, Zlinx ® Xtreme Radio Modem meets the IP67 standard and is built to handle the heat, cold, and environments of industrial operations.

- Modbus compatible – no additional converters needed
- RS-232, 422, 485 (2-Wire & 4-Wire) serial communications
- Frequency range: ISM band, 902 to 928 MHz or 2.4 to 2.5 GHz
- Signal strength indicators aids troubleshooting.
- 900 MHz or 2.4 GHz antenna included.
- 256 Bit AES Encryption
- Wide, -40 to 74°C, Operating Temperature
- Rugged Circuitry for Indoor and Outdoor Applications
- IP67 Rated for total protection against dust and water up to 1 meter
- Software support Windows XP, Vista, and 7 (32 / 64 Bit)
- Field Upgradable Firmware

2.0 Product Information

2.1 Zlinx® Xtreme Radio Modem Models

ZXT9-RM - 900 MHz ISM Band Radio Modem
ZXT24-RM – 2.4 GHz ISM Band Radio Modem

2.2 Package Contents

- ✓ Zlinx® Xtreme Radio Modem
- ✓ Software CD
- ✓ Quick Start Guide
- ✓ Antenna
- ✓ Enclosure Mounting Ears and hardware

NOTE: the Cable Glands cannot be used for Class 1 Division 2 applications. Please see the Quick Start Guide for additional information about UL Class 1 Division 2 installation instructions.

2.3 Modes of Operation

2.3.1 Point-to-Point Serial

This configuration is used to wirelessly transmit serial data from one location to another. A Zlinx® Xtreme Radio Modem is configured with another radio modem of same frequency in a master slave relationship to transmit serial data wirelessly. Typical applications include connecting a device such as a pressure/flow transmitter to a PLC or SCADA system.

2.3.2 Point-to-Point Serial to Xtreme I/O

This configuration is employed to connect a PLC/HMI/SCADA system to a remote Xtreme I/O or Zlinx I/O module to monitor or control discrete devices via Modbus. The serial master (PLC/HMI/SCADA) is a Modbus RTU master and must be connected to the serial port of the Radio Modem. Each Xtreme I/O device populates and updates its own Modbus map and support Modbus RTU Slave format. The radio modem is connected to the respective Modbus Master. Typical examples include a Water tank monitoring system where a float sensor level data is transmitted to a HMI through the wireless network.

2.3.3 Point-to-Multi Point (Serial or Xtreme I/O)

A Radio Modem is configured to communicate with multiple other modems or I/O modules. The “master” modem is connected to the Modbus Master and can communicate with Modbus Slaves connected to other radio modems or Xtreme I/O units. An example is a PLC Process control/monitoring application requiring analog, digital and serial data to be brought to a central PLC.

2.4 Operating States

The Zlinx® Radio Modem has six operating states.

2.4.1 Idle State

- Checks for Valid RF Data received and *discards* invalid data
- Checks for serial data to be packaged and RF transmitted
- Received Valid RF data in buffer to be output serially
- Checks if Sleep Mode condition is met
- Checks for Command Mode commands

2.4.2 Transmit State

- Packages serial data (2048 bytes max in RF packet)
    - ZXT9RM – 2048 bytes max
    - ZXT24RM – 202 bytes max
- Returns to Idle State

2.4.3 Receive State

- Switches to Receive State to start receiving RF packets if RF data was detected while in the Idle State
- Returns to Idle State when data is no longer detected or an error is detected

2.4.4 Sleep State

- This allows the radio modem to enter a state of low power consumption when not in use.

2.4.5 Command Mode

- Enters AT Command mode with +++ sent to serial input with Guard Time before and after. Exits after Timeout. The guard times and the entry characters are user configurable.

2.5 User Interface Components

2.5.1 Signal Strength (RSSI) LED's

There are eight green LED's to indicate signal strength (Received Signal Strength Indicator / "RSSI"). They are arranged to indicate RSSI from weakest (bottom LED lighted) to strongest (all eight LED's lighted). See figure 2-1.

Figure 2-1 RSSI Indicator

2.5.2 Transmit LED

The green transmit LED flashes when data is transmitted out the serial port. See figure 2-2 below.

2.5.3 Receive LED

The green receive LED flashes when data is received by the serial port. See figure 2-2 below.

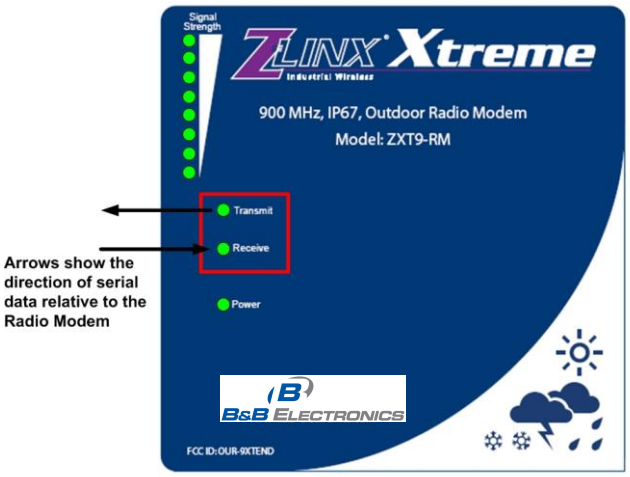


Figure 2-2 Transmit and Receive LED's

2.5.4 Power LED

The green power LED is ON when power is applied.

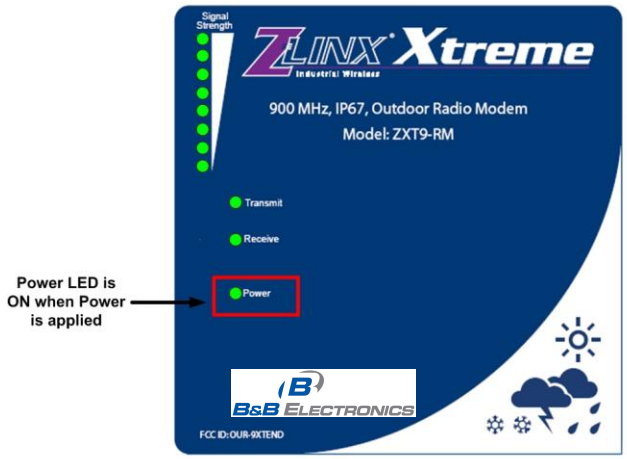


Figure 2-3 Power LED

2.5.5 Internal User Interfaces

The remaining user interfaces are located inside the radio modem enclosure. To access these interfaces, the cover must be removed. The cover is held in place with four plastic Phillips style screws.

2.5.6 Push Button

Push Button PB1 is located on the circuit board behind the radio modem cover. It is used to temporarily set the serial port to a know condition. To do this you must use the 232 port on the modem. Press and hold the button while power cycling the device. Once power comes up release the button and the unit will temporarily be restored to a know condition and in command mode for about 20 seconds. You will then be able to connect to the device using the manger at the settings listed below.

- Baud rate = 9600
- Data bit = 8

- Parity = None
- Stop bit = 1

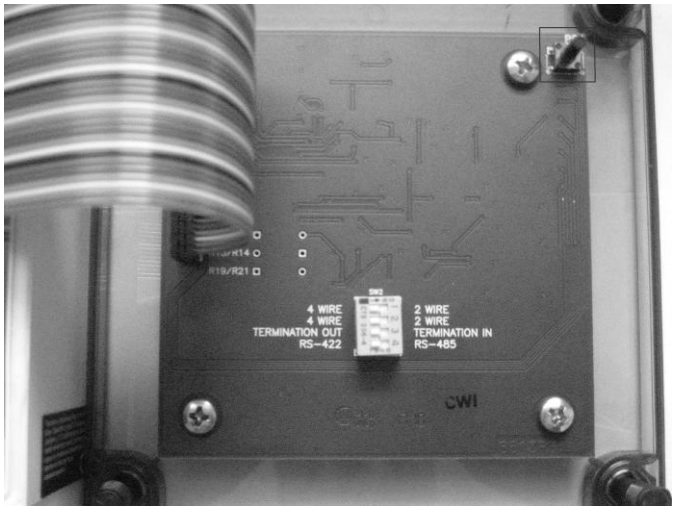


Figure 2-4 Push Button

2.5.7 USB Connector

The USB connector is located on the circuit board inside the radio modem enclosure. It is used to connect a PC to the radio modem to perform configurations and firmware updates. The connector is a type b female. Any commercially available USB cable can be used to connect to the radio modem. Figure 2-5 shows the USB Connector location.

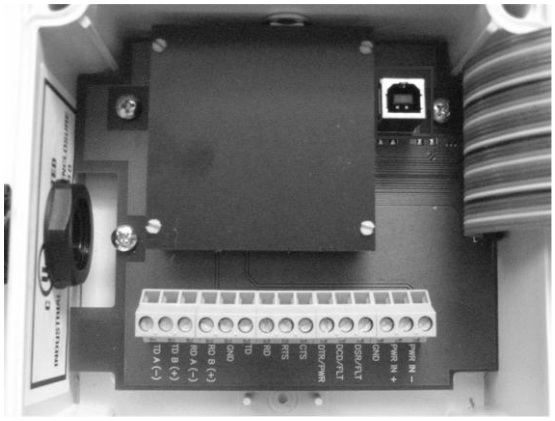


Figure 2-5 USB Connector

2.5.8 Terminal Block

The terminal block is used to connect serial signals and power. Figure 2-6 shows the location.

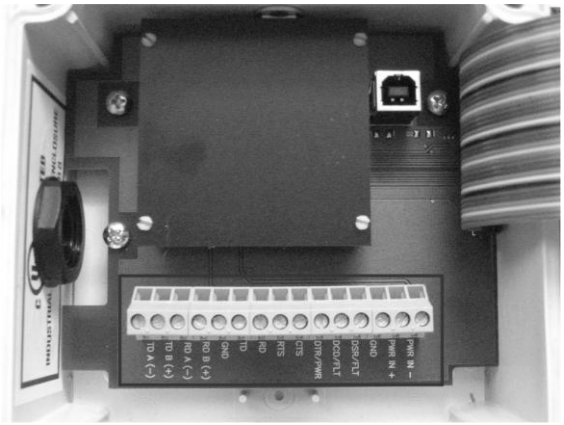


Figure 2-6 Terminal Block

2.5.9 DIP Switch

OFF		ON	Switch	RS-232	RS-422	RS-485 4-Wire	RS-485 2-Wire
4 Wire		2 Wire	1	OFF	OFF	OFF	ON
4 Wire		2 Wire	2	OFF	OFF	OFF	ON
Termination Out		Termination In	3	OFF	OFF*	OFF*	OFF*
RS-422		RS-485	4	OFF	OFF	ON	ON

Note: The use of built in termination is optional and depends on your application
Note: For RS-232 operation, set all switches OFF

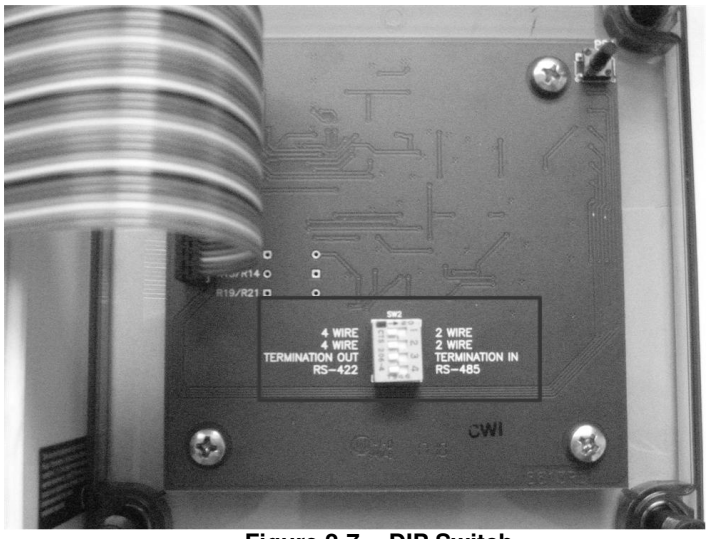


Figure 2-7 DIP Switch

3.0 Hardware Installation

3.1 Mechanical Diagram

The mechanical diagram in Appendix C contains information for mounting your radio modem.

NOTE: the Cable Glands cannot be used for Class 1 Division 2 applications. Please see the Quick Start Guide for UL Class 1 Division 2 installation instructions.

3.2 IP67 Cable Gland Installation

3.2.1 Cable Gland Description

The Cable Gland is used to maintain the water tight rating while allowing a cable to enter the enclosure. The assembly consists of black molded nylon body, hex nut, cable nut and a rubber gasket and cable seal.

Figure 3-3 IP67 Cable Gland

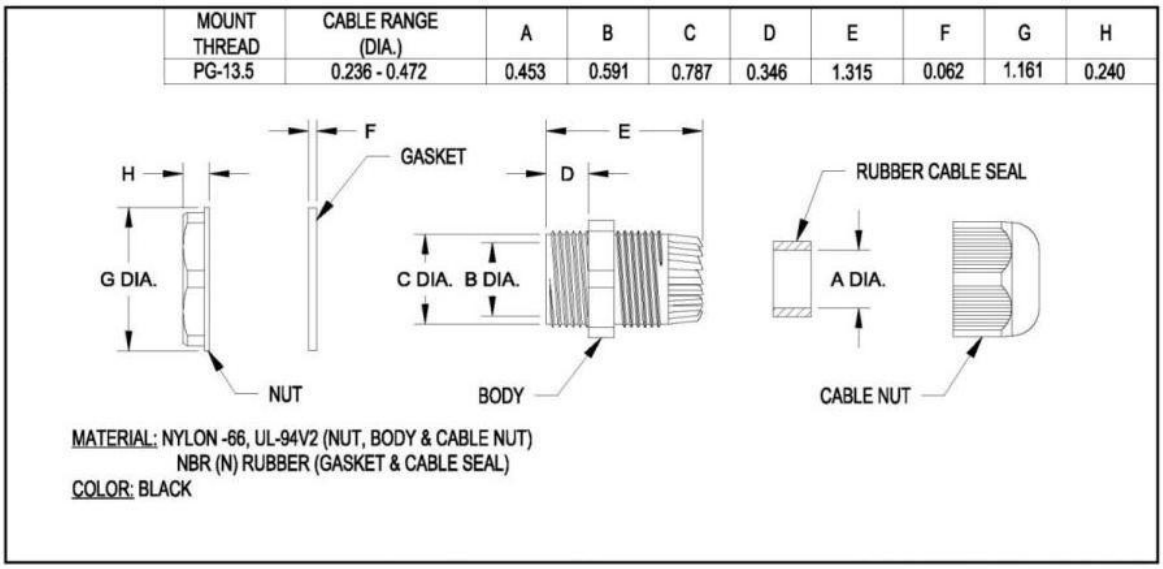


Figure 3-4 IP67 Cable Gland

3.2.2 Cable Gland Installation

1. The cable gland will accept cable diameters from 0.236 to 0.472 inches (5.99 to 11.99 mm).
2. Insert the Non-tapered end of the Body (D) through the conduit knock-out on the radio modem enclosure.
3. Place the Gasket around the body on the outside of the enclosure.
4. Thread the Hex Nut onto the Body from the inside of the enclosure.
5. Place the Cable Nut onto the cable being careful to position the threaded side so that it can be attached to the Cable Body.
6. Tighten the Cable Nut. This will cause the tapered end of the Cable Body to compress, ensuring a water-tight seal.

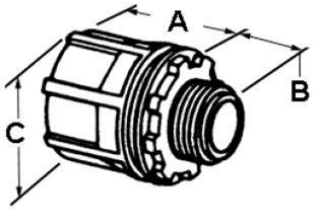
3.3 Watertight Threaded Conduit Hub

Unused conduit openings: Class 1 Division 2 installation requires a UL Recognized conduit plug (UL Category Code QCRV2) be used when a conduit opening is not being used.

3.3.1 Description

Another method to bring a cable into the enclosure is to use the water tight threaded conduit hub. It is used to secure threaded half inch rigid service entrance conduit. It consists of a Body, Nut, and Gasket.

Figure 3-5 ½ Inch Threaded Conduit Hub



A	3/16 in
B	9/16 in
C	1 1/8 in

Figure 3-6 ½ Inch Threaded Conduit Hub

3.3.2 Water Tight Threaded Conduit Installation

1. Insert the treaded end of the body into the conduit knock-out from the outside of the enclosure. The rubber gasket should be on the outside of the enclosure.
2. Thread the Nut onto the conduit body from inside the enclosure.
3. 1/2 and 3/8 inch conduit fittings as well as 1/2 Inch, rigid, threaded conduit can be attached to the threaded hub.

3.4 IP67 Membrane Cable Gland

NOTE: the Cable Glands cannot be used for Class 1 Division 2 applications. Please see the Quick Start Guide for UL Class 1 Division 2 installation instructions.

3.4.1 Description

The membrane cable gland is used to plug an unused hole in the enclosure.

Figure 3-7 IP67 Membrane Cable Gland

3.4.2 IP67 Membrane Cable Gland Installation

1. Stuff the cable gland into the knock-out hole with the narrow end toward the inside of the radio modem enclosure. The enclosure wall will fit into the indentation between the inside and outside portions of the gland.

3.5 Supplied Antenna

3.5.1 ZXT9-RM Supplied Antenna

Your Zlinx Xtreme 900 MHz product comes supplied with a “rubber duck” style antenna which can be articulated up to 90 degrees. Then antenna is a ¼ wave dipole with an omni directional pattern and vertical polarization. It is recommended that your Zlinx Xtreme product be mounted vertically.

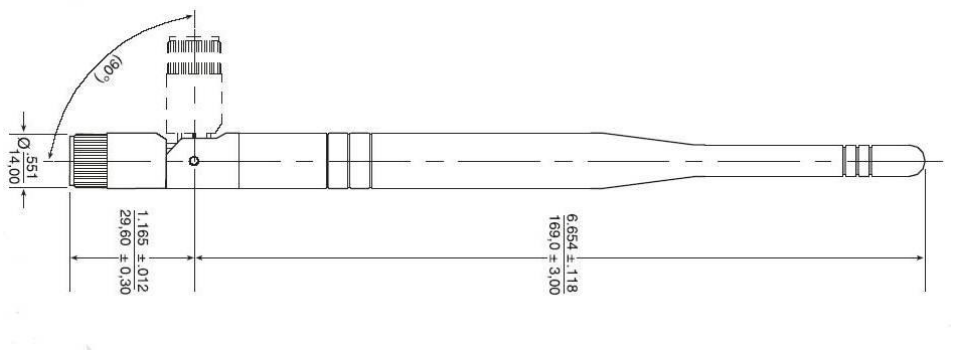


Figure 3-8 ZXT9-RM Supplied Antenna

Impedance	50Ω
Connector	RPSMA Female
VSWR	2.0 Max (in-band)
Gain	3.0 dBi
Polarization	Vertical
Replacement Part Number	ZXT9-ANT1

3.5.2 ZXT24-RM Supplied Antenna

Your Zlinx Xtreme 2.4 GHz product comes supplied with a “rubber duck” style antenna which can be articulated up to 90 degrees. Then antenna is a ¼ wave dipole with an omni directional pattern and vertical polarization.

It is recommended that your Zlinx Xtreme product be mounted with the antenna on the top, perpendicular with the horizon

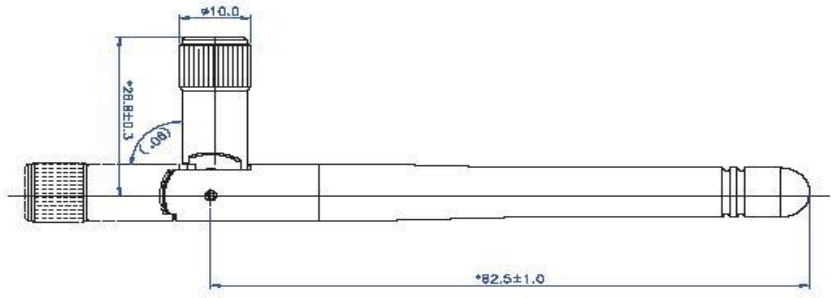


Figure 3-9 ZXT24-RM Supplied Antenna

Impedance	50Ω
Connector	RPSMA Female
VSWR	2.0 Max (in-band)
Gain	2.1 dBi
Polarization	Vertical
Replacement Part Number	ZZ24D-ANT1

3.6 Optional Antennas

3.6.1 Omni Antenna Description

In some applications, a higher gain Omni directional antenna may be required. An Omni-directional antenna is an antenna system which radiates power uniformly in one plane with a directive pattern shape in a perpendicular plane. This pattern is often described as "donut shaped". Omni-directional antenna can be used to link multiple directional antennas in outdoor point-to-multipoint communication.

Omni Directional antennas are a good choice if you need to mount your antenna on a mast to increase its elevation. Please note that mounting brackets must also be purchased. Also note that these antennas have an N style connector. Refer to section 3.9 to select the correct cable.

Figure 3-10 Representative Photograph of Optional Omni Antenna

FG9023 – High Gain Omni Directional (900 MHz)

Use With	ZXT9-RM (900 MHz)
Impedance	50Ω
Connector	N Female
VSWR	2:1 Max (In Band)
Gain	3 dBi
Polarization	Vertical
Length	25 inches (63.5 cm)
Mounting Brackets (Not Included)	FM2

FG9026 – High Gain Omni Directional (900 MHz)

Use With	ZXT9-RM (900 MHz)
Impedance	50Ω
Connector	N Female
VSWR	2:1 Max (In Band)
Gain	6 dBi
Polarization	Vertical
Length	65 inches (165.1 cm)
Mounting Brackets (Not Included)	FM2

FG24008 – High Gain Omni Directional (2.4 GHz)

Use With	ZXT24-RM (2.4 GHz)
Impedance	50Ω
Connector	N Female
VSWR	1.5:1 Max (In Band)
Gain	8 dBi
Polarization	Vertical
Length	24.5 inches (62.2 cm)
Mounting Brackets (Not Included)	FM2

3.6.2 Yagi Antenna Description

A Yagi-Uda Antenna, commonly known simply as a Yagi antenna or Yagi, is a *directional antenna* system consisting of an array of a dipole and additional closely coupled parasitic elements (usually a reflector and one or more directors). The dipole in the array is driven, and another element, typically 5% longer, effectively operates as a reflector. Other parasitic elements shorter than the dipole may be added in front of the dipole and are referred to as directors. This arrangement increases antenna directionality and gain in the preferred direction over a single dipole.

Since Yagi Antennas are directional, they must point directly at the other antenna through a clear line of sight.

Figure 3-11 Enclosed Yagi – Model YE240015 for 2.4 GHz Models

Figure 3-12 Representative Yagi Antenna Photograph

YS8963 – High Gain Yagi (900 MHz)

Use With	ZXT9-RM (900 MHz)
Impedance	50Ω
Connector	N Female
VSWR	1.5:1 Max (In Band)
Gain	6 dBi
Polarization	Vertical
Length	16.8 inches (42.7 cm)
Mounting Brackets	Included

YS8966 – High Gain Yagi (900 MHz)

Use With	ZXT9-RM (900 MHz)
Impedance	50Ω
Connector	N Female
VSWR	1.5:1 Max (In Band)
Gain	9 dBi
Polarization	Vertical
Length	27.8 inches (70.6 cm)
Mounting Brackets	Included

YS89612 – High Gain Yagi (900 MHz)

Use With	ZXT9-RM (900 MHz)
Impedance	50Ω
Connector	N Female
VSWR	1.5:1 Max (In Band)
Gain	11 dBi
Polarization	Vertical
Length	49 inches (124.5cm)
Mounting Brackets	Included

YS24008 – High Gain Yagi (2.4 GHz)

Use With	ZXT24-RM (2.4 GHz)
Impedance	50Ω
Connector	N Female
VSWR	1.5:1 Max (In Band)
Gain	12.5 dBi
Polarization	Vertical
Length	18 inches (45.7 cm)
Mounting Brackets	Included

3.7 Antenna Cables

If you decide to use one of the optional antennas, you will need to select the appropriate cable and connector. It is important to select a cable that matches the radio's impedance. An impedance mismatch will cause the radio link to become inefficient and could damage the radio. Selecting the incorrect cable could also cause significant signal loss. A rule of thumb is for every 3 dB of loss, your system will lose one half the output power emitted from the radio.

We offer three basic cable types. LMR100, LMR195, and LMR400. LMR400 cable offers lower loss but is thicker and more difficult to work with. LMR100 is thin and easy to work with, but has a larger loss. It is recommended that you use the shortest possible cable run in your application.

Cable Type	900 MHz Loss Per 100 ft	2.4 GHz Loss Per 100 ft	Diameter
LMR-100	22.8 dB	38.9 dB	0.110 in
LMR-195	11.5 dB	19.0 dB	0.195 in
LMR-400	3.9 dB	6.8 dB	0.405 in

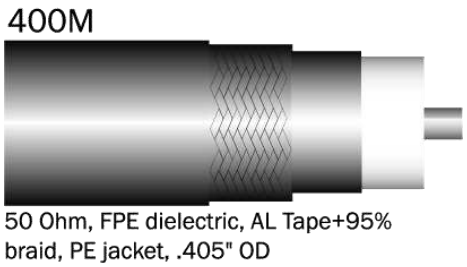


Figure 3-13 LMR400 Cable Cross Section

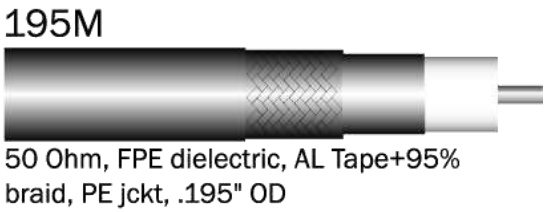


Figure 3-14 LMR195 Cable Cross Section

Figure 3-15 LMR100 Cable Cross Section

Along with the type of cable, you need to select the correct connector. Our product uses an RPSMA Male (plug) connector. Therefore, you will need a cable that has a RPSMA Female (jack) on one end. If you are using one of the optional antennas, you will need an N type Male connector, since these antennas have an N type Female on them. If you are extending the included antenna, you will need an RPSMA Male (plug) since the supplied antenna has an RPSMA female (jack).

Antenna Cable Part Numbers

We have a variety of standard cables available for purchase. The cable part number is relatively easy to interpret.

TTTT-AABB-LLLL

TTTT = Cable Type (400M = LMR400, 195M = LMR195, 100M = LMR195)

AA = Connector A (NM = N-Male, SL = RPSMA Male (Plug)
BB = Connector B (NM = N-Male, SL = RPSMA Male (Plug)
In most cases, this portion of the part number will be NMSL for Zlinx Xtreme products.

LLLL = Length in inches (ex: 6 = six inches, leading zeros are not necessary)

So, 400M-NMSL-24 is an LMR400 cable with a N Male on one end and a RPSMA plug on the other, 24 inches in length.

3.8 Lightening Arrestors

When installed properly, a lightning arrestor can prevent damage to your radio due to high energy transients during lightning strikes. Our arrestors limit surges to less than 45 volts in approximately 100 nanoseconds. A gas discharge tube changes from an open circuit to a short circuit in the presence of energy and voltage surges giving those surges a direct path to ground, thus protecting equipment. They are designed with a rugged housing and high quality plated brass "N" connectors. It also features a user replaceable gas discharge tube (LA350GT). They are available in three models: the LABH350NN and the LABH2400N both allow bulkhead mounting and connector pass-through and the LAIL350NN allows inline placement only.

4.0 Electrical Installation

Please see the Quick Start Guide for UL Class 1 Division 2 installation instructions.

4.1 Wiring

4.1.1 Terminal Block

Both power and data signals are connected to the terminal block. Figure 4-1 shows the layout.

Operating Voltage	10 to 20 VDC
Maximum Surrounding Ambient Air Temp	74°C
Wiring Terminals	Use Copper Wire Only, One Conductor Per Terminal
Wire Range	30 to 12 AWG
Tightening Torque	0.5 to 0.6 Nm
Temperature Rating of Field Installed Conductors	105°C minimum, sized for 60°C ampacity.

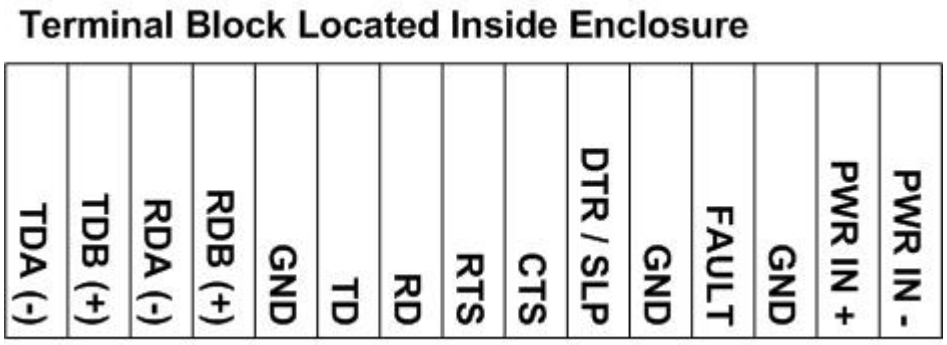


Figure 4-1 Terminal Block

4.1.2 Power Supply Connections

The radio modem requires power from an external source. The radio modem requires 10 to 30 VDC. Power use depends on the model:

ZXT9RM – 1.7 Watts typical, 5.8 Watts maximum.
ZXT24RM – 1.2 Watts typical, 3.5 Watts maximum.

Connect the positive and negative power leads to the Power In(+) and Power In (-) terminals on the terminal block.

.

4.1.3 RS-232 Connections

4.1.3.1 RS-232 Signal Convention (DTE / DCE)

There are two types of RS-232 ports, DTE (Data Terminal Equipment) and DCE (Data Communications Equipment). The signal names and pin numbers are the same, but signal flow is opposite. The pin labeled TD can be input, and RD the output.

The two ports types are complementary, the **Output** signals on a DTE port are ***Inputs*** to a DCE port, and ***Output*** signals on a DCE port are **Inputs** to a DTE port. The signal names match each other and connect pin for pin. Signal flow is in the direction of the arrows.

The Radio Modem is a DCE device.

Figure 4-2 shows RS-232 DTE to RS-232 DCE connections with associated DB9 Pin Numbers and the signal direction.

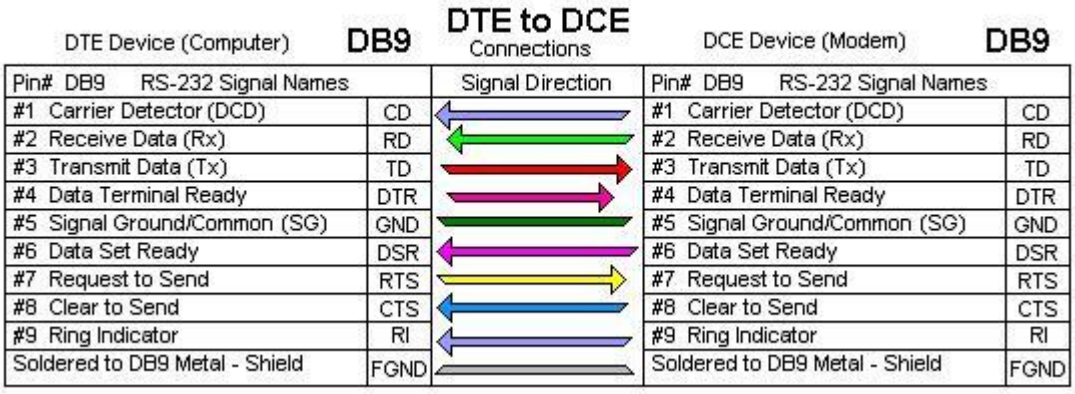


Figure 4-2 Terminal Block

4.1.3.2 Wiring an RS-232 Device to the Radio Modem

The Radio Modem supports TD, RD, RTS, and CTS. Please note that if Sleep Mode is enabled, the DTR signal is used to “wake up” the device. Figure 4-3 is a wiring diagram for connecting a DTE device such as a computer or PLC.

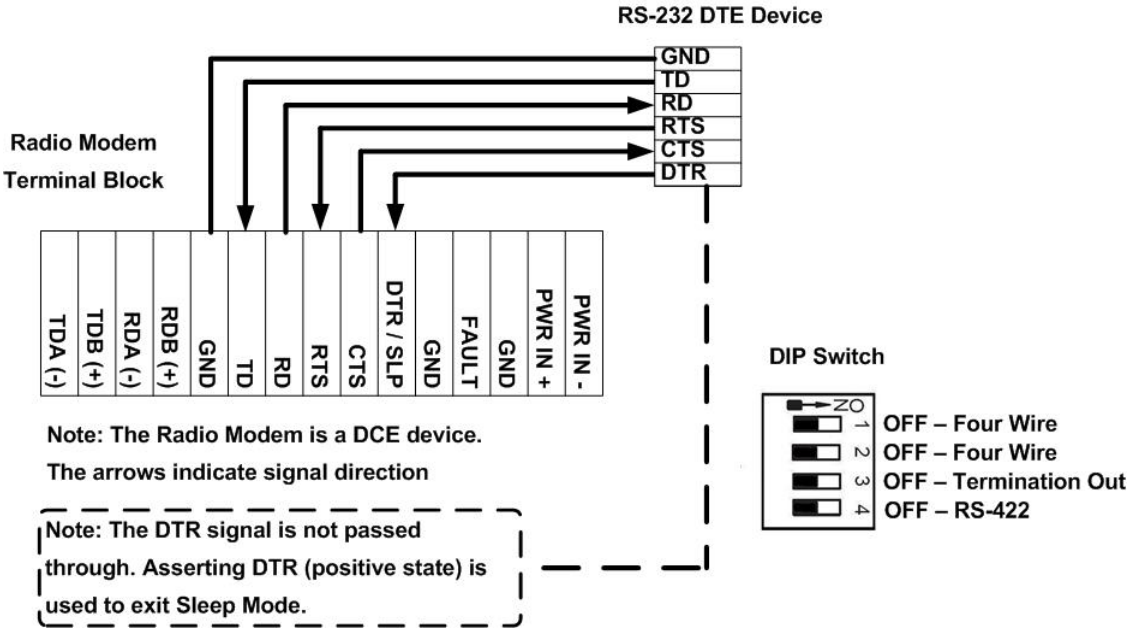


Figure 4-3 RS-232 Wiring

4.1.4 RS-485 Two Wire Connections

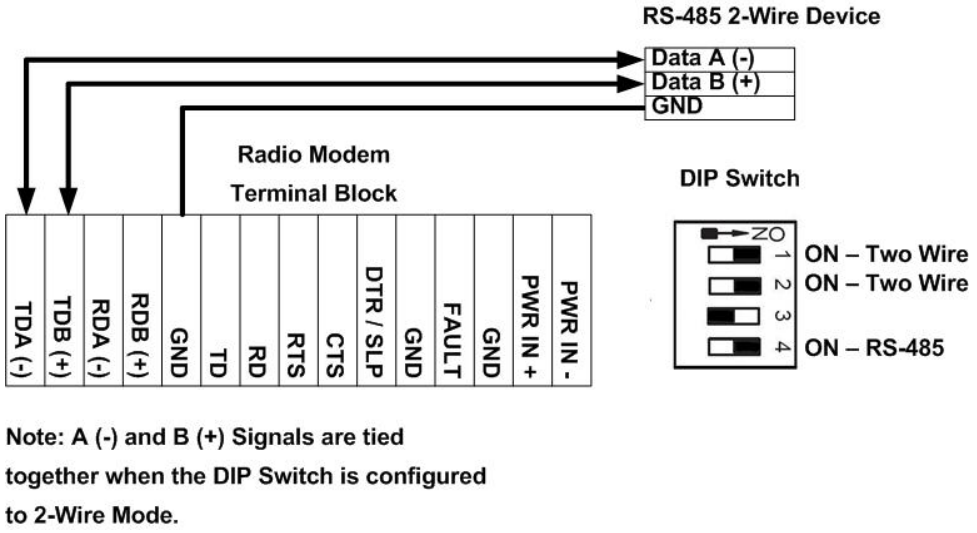


Figure 4-4 RS-232 Wiring

4.1.5 RS-422/485 Four Wire Connections

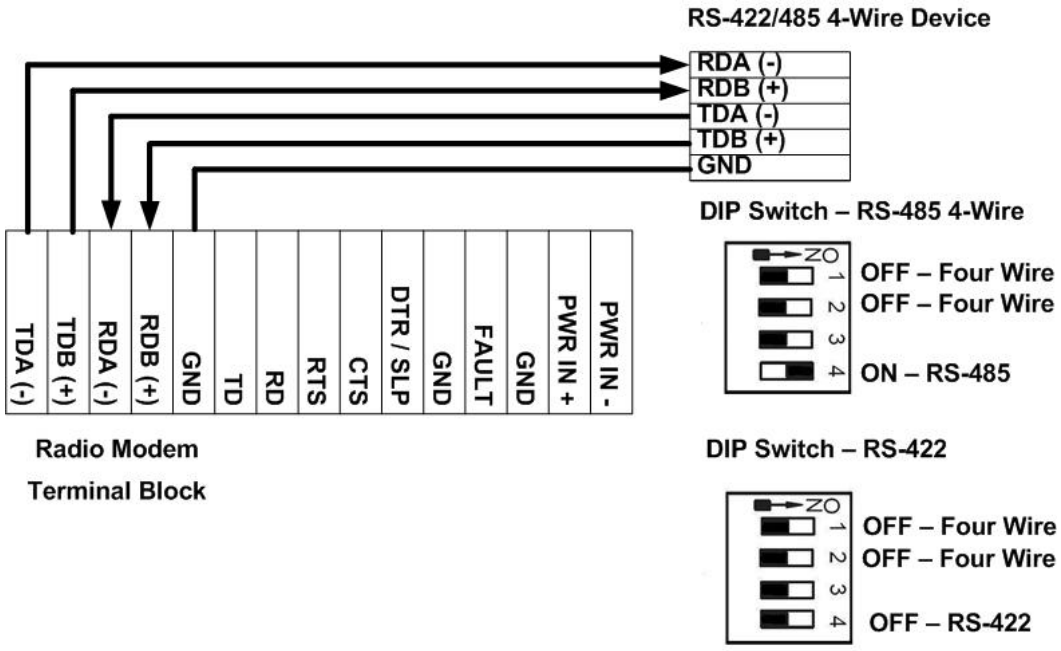


Figure 4-5 RS-422 / 485 4-Wire Wiring

4.1.6 Termination and Biasing

The radio modem has built in 1.2 kΩ pull-up and pull-down resistors R17 and R14). There is also a built in 120 Ω termination resistor (R21). These resistors are located on the PCB behind the cover. Termination is switchable using DIP Switch Position 3. To enable the termination, set switch 3 to ON “Termination IN”. To disable the termination, set switch 3 to OFF “Termination OUT”.

It is possible to use different value resistors by removing the surface mount components and placing through-hole resistors (R16, R13, and R19) in the space provided. The surface mount components are located directly opposite of the through-hole pads that are visible.

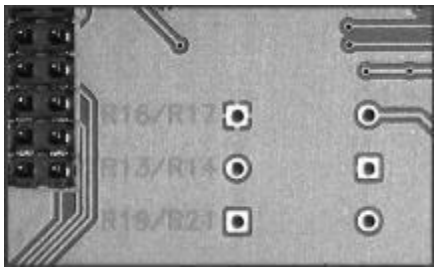


Figure 4-6 Through-hole Resistor Pads