



# **QTM-8524**

**2.4 GHz RF Radio Modem Module**

## **Users Manual**

**WIRELESS MODEM MODULE  
FOR QTM-8000 SERIES SYSTEMS**

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QTM-8524  
User's Manual  
Revision 1.0  
PN

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|-------------------|-------------------------------|
| Date of Purchase: | _____                         |
| Model Number:     | <u>QTM-8524</u>               |
| Product:          | <u>2.4 GHz RF Radio Modem</u> |
| Serial Number:    | _____                         |

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# **Table of Contents**

|                                                              |           |
|--------------------------------------------------------------|-----------|
| <b>1. Introduction</b>                                       | <b>9</b>  |
| 1.1 Available QTM-8000 Series Modules                        | 10        |
| 1.2 QTM-8000 Series Common Features                          | 11        |
| 1.3 QTM-8000 Series Wireless Networks                        | 12        |
| 1.3.1 Disadvantages of Conventional Two-Wire RS-485 Networks | 13        |
| 1.3.2 The QTM-8000 Series Network Advantage                  | 14        |
| 1.3.3 Operation Principle                                    | 15        |
| 1.3.4 Supporting Multiple Baud Rates                         | 16        |
| 1.4 QTM-8000 Series Module dimensions                        | 17        |
| <br>                                                         |           |
| <b>2. QTM-8524 Specifications</b>                            | <b>20</b> |
| 2.1 Pin Assignments                                          | 20        |
| 2.2 QTM-8524 Module Specifications                           | 21        |
| 2.3 QTM-8524 Block Diagram                                   | 22        |
| 2.4 QTM-8524 Disassembly                                     | 22        |
| 2.5 QTM-8524 Jumper Settings                                 | 24        |
| 2.6 QTM-8524 Basic Wire Connections                          | 26        |
| 2.6.1 RS-232 Connection Between PC and QTM-8524              | 26        |
| 2.6.2 Connecting QTM-8000 Modules to the QTM-8524            | 26        |
| <br>                                                         |           |
| <b>3. Antennas</b>                                           | <b>27</b> |
| 3.1 QTM-8524 Antenna Options                                 | 27        |
| 3.1.1 QTM-24ANT-SW Specifications                            | 27        |
| 3.1.2 QTM-24ANT-C Specifications                             | 28        |
| 3.2 Connecting Antennas to QTM-8524 Modules                  | 29        |
| 3.2.1 Site Selection                                         | 29        |
| 3.2.2 Installation                                           | 29        |
| 3.2.3 Connection                                             | 29        |
| 3.3 Mounting External Antennas                               | 30        |
| 3.3.1 Mounting the QTM-24ANT-SW                              | 30        |
| 3.3.2 Mounting the QTM-24ANT-C                               | 32        |
| 3.3.3 RF Safety                                              | 34        |

|                                                |    |
|------------------------------------------------|----|
| 4. Configuration                               | 34 |
| 4.1 RS-232 or RS-485 Configuration             | 34 |
| 4.2 Half-Duplex and Full-Duplex Operation      | 34 |
| 4.3 Synchronous and Asynchronous Communication | 35 |
| 4.4 Configuration Modes                        | 36 |
| 4.4.1 Mode 1: Full-Duplex, Synchronous         | 37 |
| 4.4.2 Mode 2: Half-Duplex, Synchronous         | 38 |
| 4.4.3 Mode 3: Full-Duplex, Asynchronous        | 39 |
| 5. Application Examples                        | 40 |
| 5.1 Peer-to-Peer Communication (Mode 1)        | 40 |
| 5.2 Interfacing with QTM-8000 Modules (Mode 1) | 41 |
| 5.3 Multiple PC Communication (Mode 2)         | 42 |
| 5.4 Asynchronous Communication (Mode 3)        | 43 |
| 6. Approvals                                   | 44 |

# **List of Figures**

|         |                                                                            |    |
|---------|----------------------------------------------------------------------------|----|
| 1.3     | QTM-8000 Series Network with Multiple Baud Rates and Multiple Data Formats | 12 |
| 1.3.2.1 | Single Baud Rate QTM-8000 Wireless Network                                 | 13 |
| 1.3.2.2 | Multi-Baud Rate Wireless QTM-8000 Network                                  | 14 |
| 1.4.1   | QTM-8000 Series Front, Side, Rear and Top Views                            | 17 |
| 1.4.2   | QTM-8000 Series DIN Rail Mounting                                          | 18 |
| 1.4.3   | QTM-8000 Series Panel Mounting                                             | 19 |
| 2.3     | QTM-8524 Block Diagram                                                     | 22 |
| 2.4     | Disassembling the QTM-8524                                                 | 23 |
| 2.5     | QTM-8524 Jumper Settings                                                   | 25 |
| 2.5.1   | Connecting QTM-8524 to DB-9 Serial Cable                                   | 26 |
| 2.5.2   | Connecting QTM-8524 to QTM-8000 I/O Modules                                | 26 |
| 3.1.1   | QTM-24ANT-SW Transmission Pattern                                          | 27 |
| 3.1.2   | QTM-24ANT-C Transmission Pattern                                           | 28 |
| 3.3.1.1 | Mounting the QTM-24ANT-SW Steps 1-6                                        | 30 |
| 3.3.1.2 | Mounting the QTM-24ANT-SW Step 7                                           | 31 |
| 3.3.2.1 | Installing the QTM-24ANT-C Ceiling Mount Bracket                           | 33 |
| 3.3.2.2 | Connecting the QTM-24ANT-C Antenna to the Bracket                          | 33 |
| 5.1     | QTM-8524 Peer-to-Peer Communication                                        | 40 |
| 5.2     | QTM-8524 as part of a QTM-8000 Series I/O Network                          | 41 |
| 5.3     | QTM-8524 Modules Used to Network Multiple PCs                              | 42 |
| 5.4     | QTM-8524 Modules in an Asynchronous Network                                | 43 |

## 1. Introduction

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The QTM-8000 Series of modules is comprised of analog and digital I/O modules designed for a wide variety of data acquisition and signal conditioning functions. These modules are designed for an RS-485 communication network, and require an RS-485 to RS-232 converter in order to be accessed through a standard PC serial port. The QTM-8520/8520R module performs this function. Unlike many other converters, the versatile QTM-8520 contains a unique self-tuner ASIC that allows it to process signals from multiple serial devices operating at different baud rates and using different data formats. This flexibility makes a QTM-8000 Series network an extremely cost effective solution for remote signal monitoring and control.

The QTM-8524 is a radio modem module that can implement QTM-8000 Series modules as a wireless data acquisition and signal conditioning network. The wireless communication modules form RF communication between peer-to-peer or multi-point structures, which eliminates the use of long cables. Like the QTM-8520, the QTM-8524 functions as a RS-485 to RS-232 converter. However, it does not contain the self-tuner ASIC which means that all modules operating in a QTM-8524 wireless network must be functioning at the same baud rate and using the same data format. To implement a wireless network functioning at several different baud rates, a QTM-8520 module must be used in conjunction with multiple pairs of QTM-8524 modules.



## **1.1 Available QTM-8000 Series Modules**

### **Wireless Radio Modem Modules:**

QTM-8524: 2.4 GHz RF to RS-232 or RS-485 converter

### **Bus Conversion and Repeater Modules:**

QTM-8520: RS-232 to RS-485 converter with 3000V isolation

QTM-8520R: RS-232 to RS-485 converter with 3000V isolation

QTM-8510: RS-485 to RS-485 repeater with 3000V isolation

### **Digital I/O Modules:**

QTM-8050: 7 digital input s, 8 TTL compatible digital outputs

QTM-8052: 8 isolated digital input channels

QTM-8060: 4 isolated digital inputs, 4 digital relay outputs

### **Analog Output Modules:**

QTM-8021: Single channel analog (current or voltage) output

### **Analog Input Modules:**

QTM-8013D: Single channel RTD analog input

QTM-8014D: 1 analog input, 1 digital input, 2 digital outputs,  
with LED display.

QTM-8017: 8 channel analog input module

QTM-8018: 8 channel thermocouple input module

### **Timer/Counter Modules:**

QTM-8080D: 2 independent 32-bit counters,  
2 digital output channels  
5 Hz to 50kHz frequency measurement range

## ***1.2 QTM-8000 Series Common Features***

### **Communication :**

- Asynchronous half-duplex 2-wire RS-485 network
- Maximum network distance without repeater=4000 feet (1.2Km)
- Baud Rates: 600,1200,2400,4800,9600,19200,38400,57600 (bps)
- A single network can accommodate multiple devices with different baud rates and data formats
- QTM-8000 series data format=  
1 start + 8 data + 1 stop + no parity = 10-bit
- Two extra checksum bytes can be enabled or disabled
- Built-in transient voltage suppressor and PTC protector
- ASCII command / response protocol
- Plug-in screw terminal block

### **Power :**

- +10V ~ +30V DC
- Power reverse protection, over-voltage brown-out protection

### **System :**

- Internal Dual watchdog, power-on start value and safe value for host failure
- Operating temperature : -10 to 70°C (14 to 185°F)
- Storage temperature : -25 to 80°C (-13 to 185°F)
- Humidity : 5 to 95%, non-condensing
- Isolation voltage : 3000 VDC

### 1.3 QTM-8000 Series Wireless Networks

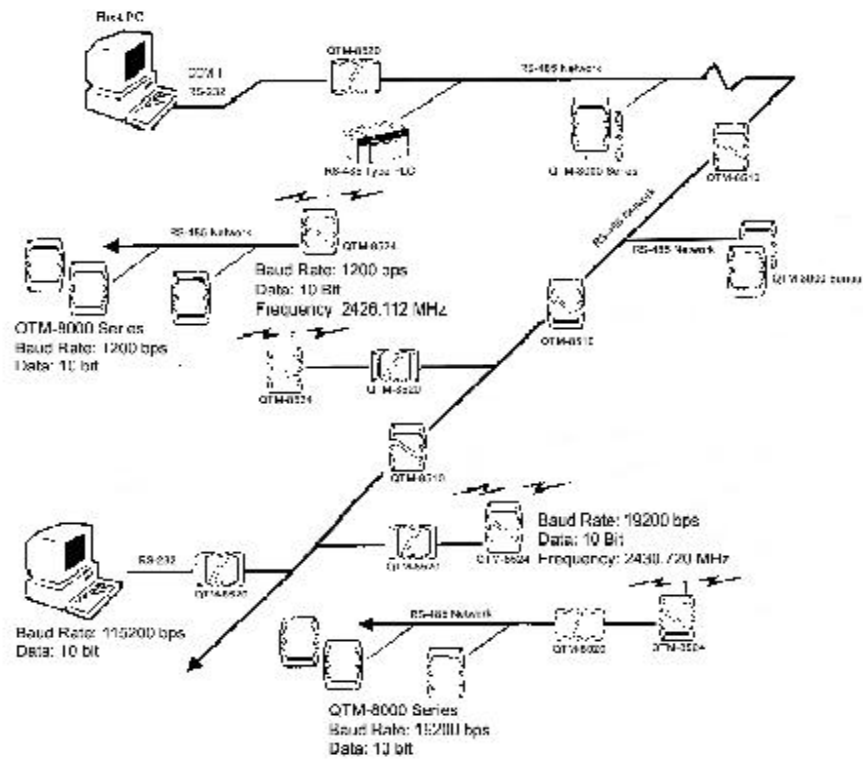


Figure 1.3--QTM-8000 Series Network with multiple baud rates and multiple data formats

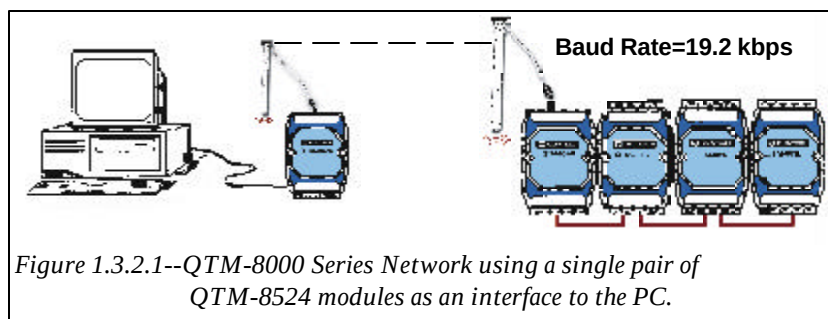
### 1.3.1 Disadvantages of Conventional Two-Wire RS-485 Networks:

In a standard RS-485 network, a converter is used to adapt the host PC's single wire RS-232 signal to the two-wire RS-485 signal required by the network. However, when using a standard converter, not only must the baud rate and data format for all signals remain fixed, but they must be identical for all incoming signals. This can pose a problem if multiple types of devices are to be used in a single system, such as a QTM module operating at 115200 bps with a 10-bit per channel data format, and a standard PLC operating at 9600 bps with an 11-bit data format. One solution to this problem is to use two independent two-wire RS-485 networks to accommodate both devices. However, this can increase overall system cost and decrease system reliability. If devices are capable of operating at different baud rates, but share a single data format, a single standard two-wire RS-485 network can be used, provided that all devices are set to use the lowest common baud rate. While this solution may save on system cost, it is at the expense of performance.

### 1.3.2 The QTM-8000 Series Network Advantage:

The most desirable system is one in which a single RS-485 network can be used to link devices operating at multiple baud rates with different data formats. The QTM-8000 Series can do just that. Using the QTM-8520 converter module to auto-tune the network, up to 256 devices operating between 1200 and 115200 bps can be controlled via a single standard RS-232 serial port. (Using a QTM-8510 repeater expands the network to 2,048 devices.)

For wireless networks, the QTM-8524 can convert and control the RS-485 network. However, a single baud rate, channel, and frequency must be jumper selected for each module pair. This means that if a QTM-8524 is connected directly to the computer's serial port, the network can only function at a single baud rate. To support multiple baud rates in a QTM-8000 wireless network, the QTM-8520 must be used in conjunction with a pair of QTM-8524 RF modules for each desired baud rate. (See figures 1.3.2.1 & 1.3.2.2)



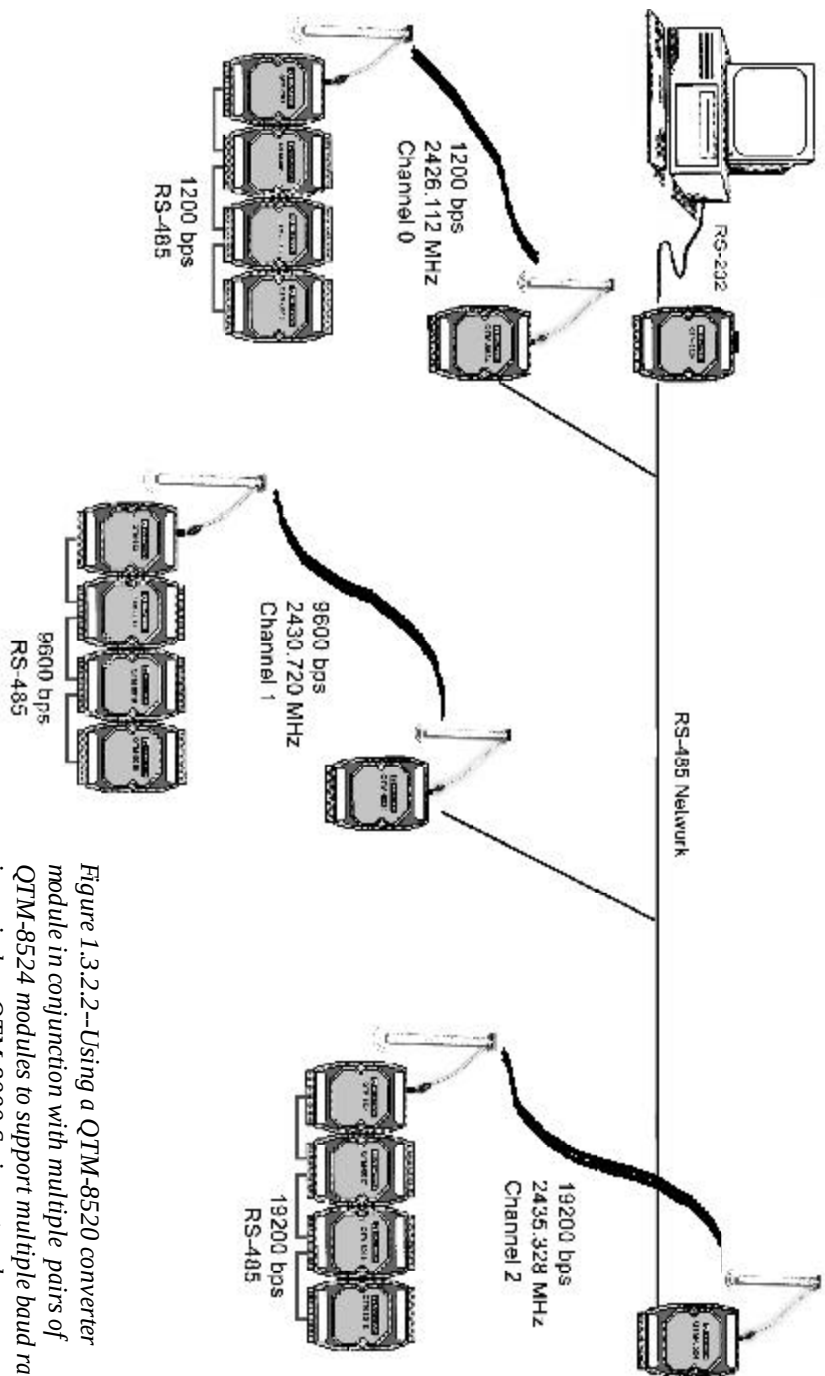


Figure 1.3.2.2--Using a QTM-8520 converter module in conjunction with multiple pairs of QTM-8524 modules to support multiple baud rates in a wireless QTM-8000 Series network

### **1.3.3 Operation Principle (Refer to *Figure 1.3.2.1 & 1.3.2.2*):**

- (1) The Host PC sends out a command via COM1.
- (2) The QTM-8520 or upstream QTM-8524 converts the RS-232 signal into a RS-485 signal or a RF signal respectively.
- (3) All modules connected to the RS-485 network will simultaneously receive this command. Each module in the network will extract the destination address field and compare this value to its local module address. The receiving wireless module first converts the RF signal to RS-485, then sends the command to the downstream modules.
- (4) The module to which the command was addressed will execute it, and the other modules will ignore the command.
- (5) After executing the command, the addressed module sends a response back to the host PC over the RS-485 or RS-485 / RF network.
- (6) The QTM-8520 or upstream QTM-8524 module processes the response and converts it from RF / RS-485 to RS-232 for use by the Host PC
- (7) Host PC will interpret this result and take appropriate action.

### 1.3.4 Supporting Multiple Baud Rates

As noted earlier, QTM-8000 Series networks support devices operating at different baud rates. For example, in *Figure 1.3* the diagram depicts a wireless modem operating at 19200 bps, QTM-8000 Series modules operating at 2400 bps and a PLC operating at 9600 bps. The QTM-8520 converter module can automatically switch to any baud rate in the 1200 bps to 115,200 bps range.

In order to support multiple baud rates in a wireless network, the QTM-8520 must be used to auto tune the network and pairs of QTM-8524 RF modules are jumper configured to match the specific baud rate at which downstream modules are operating. When the host PC sends commands it tailors them to the baud rate at which the target module is operating. The QTM-8520 drives the signal from RS-232 to RS-485 at that given baud rate. The QTM-8524 that is configured for that same baud rate receives the RS-485 commands and converts them to RF. Any other QTM-8524 set for a different baud rate will ignore the command. The RF signal is transmitted along a set channel as selected on the QTM-8524. The downstream QTM-8524 that is configured for that same channel receives the RF signal and converts the commands to RS-485. These commands are then distributed to all the modules downstream from the receiving QTM-8524. Each module at the target baud rate will determine whether the command is addressed to it (see step 3 in section 1.3.3) and react appropriately.

## 1.4 QTM-8000 Series Module Dimensions

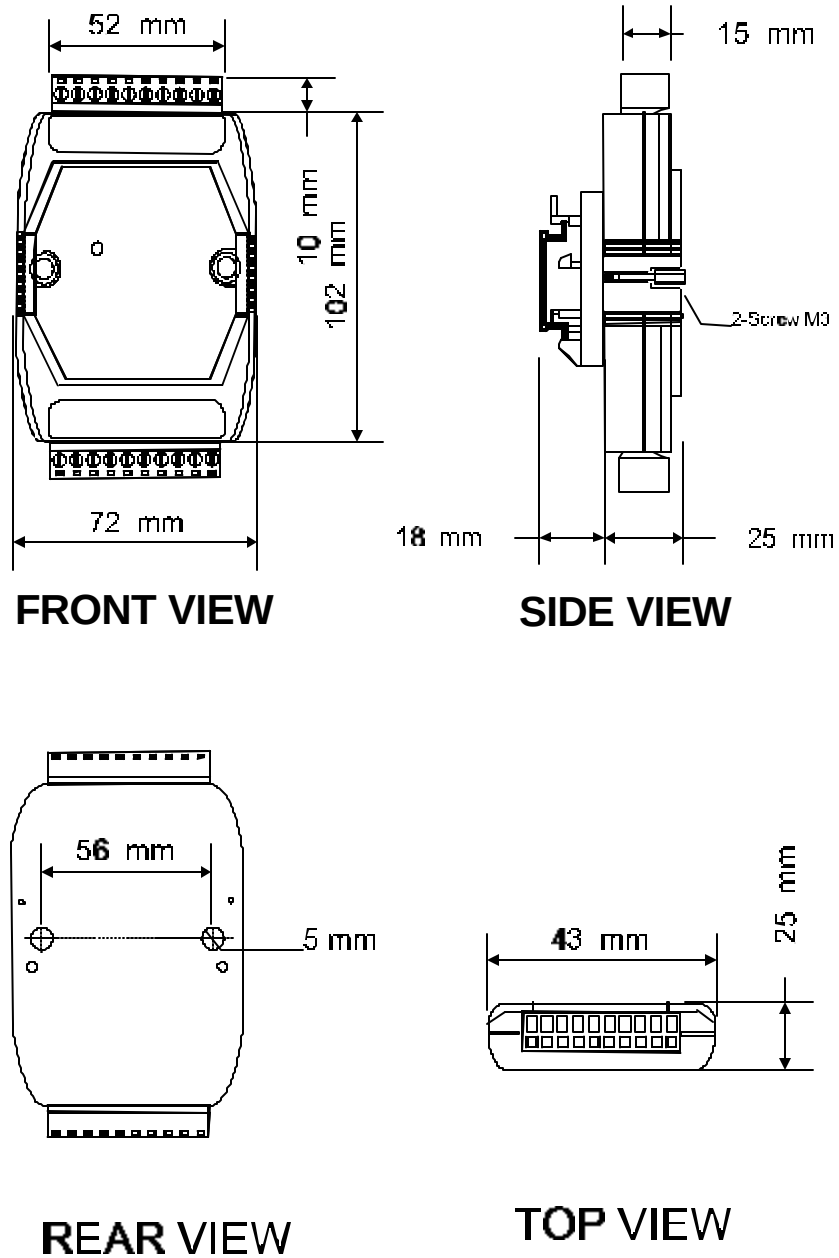
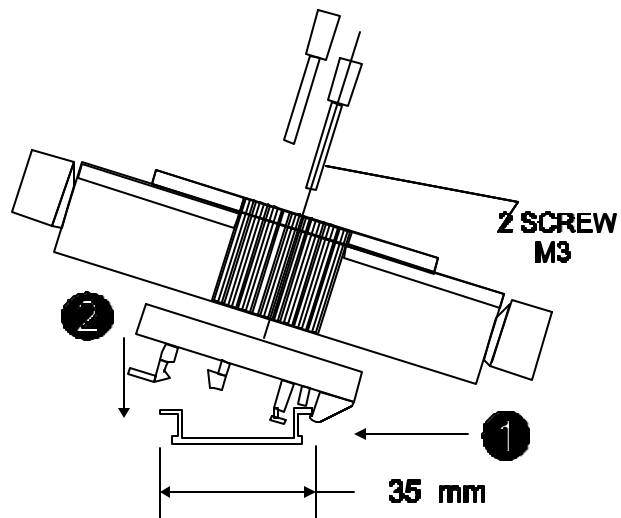


Figure 1.4.1--QTM-8000 Series Front, Side, Rear, and Top Views





## DIN-RAIL Mounting

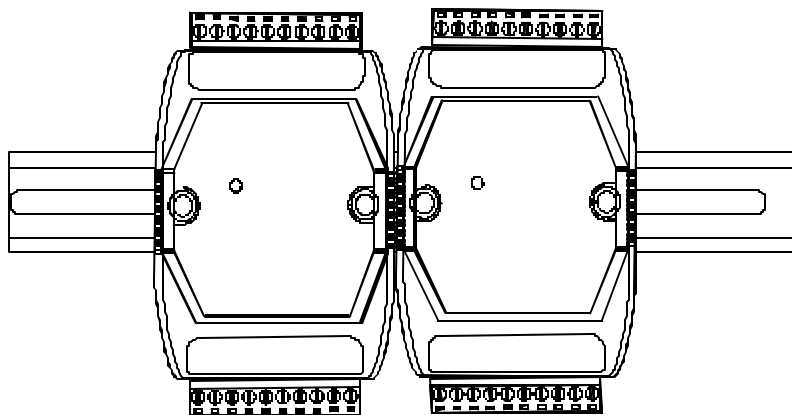
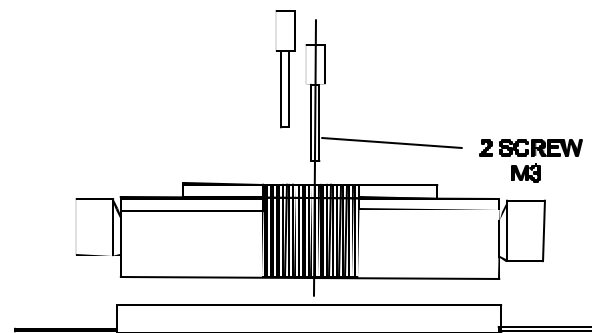
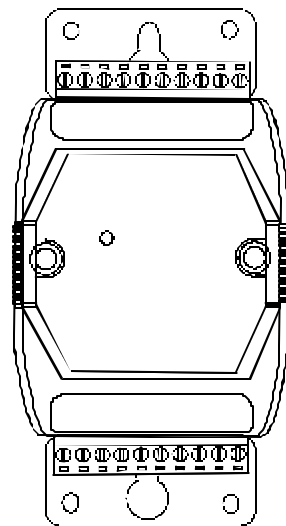


Figure 1.4.2--QTM-8000 Series Din Rail Mounting



### Panel Mounting



### Plastic Part for Panel Mount

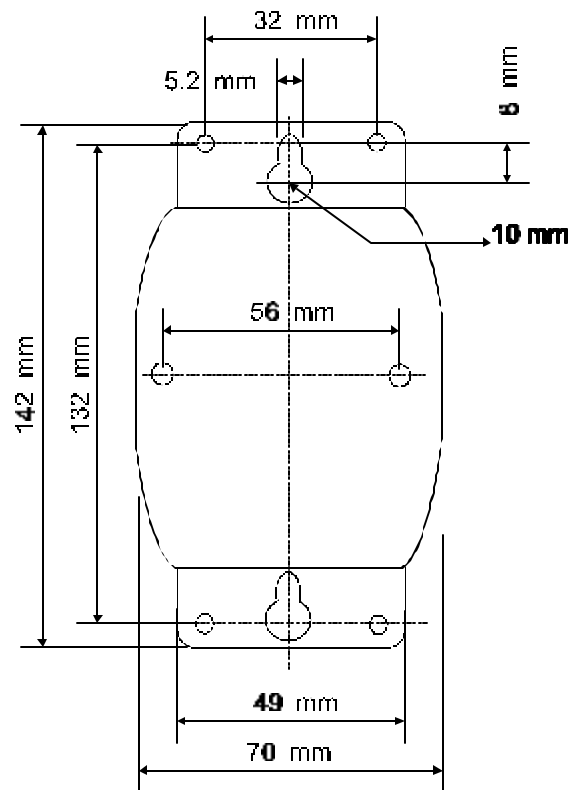
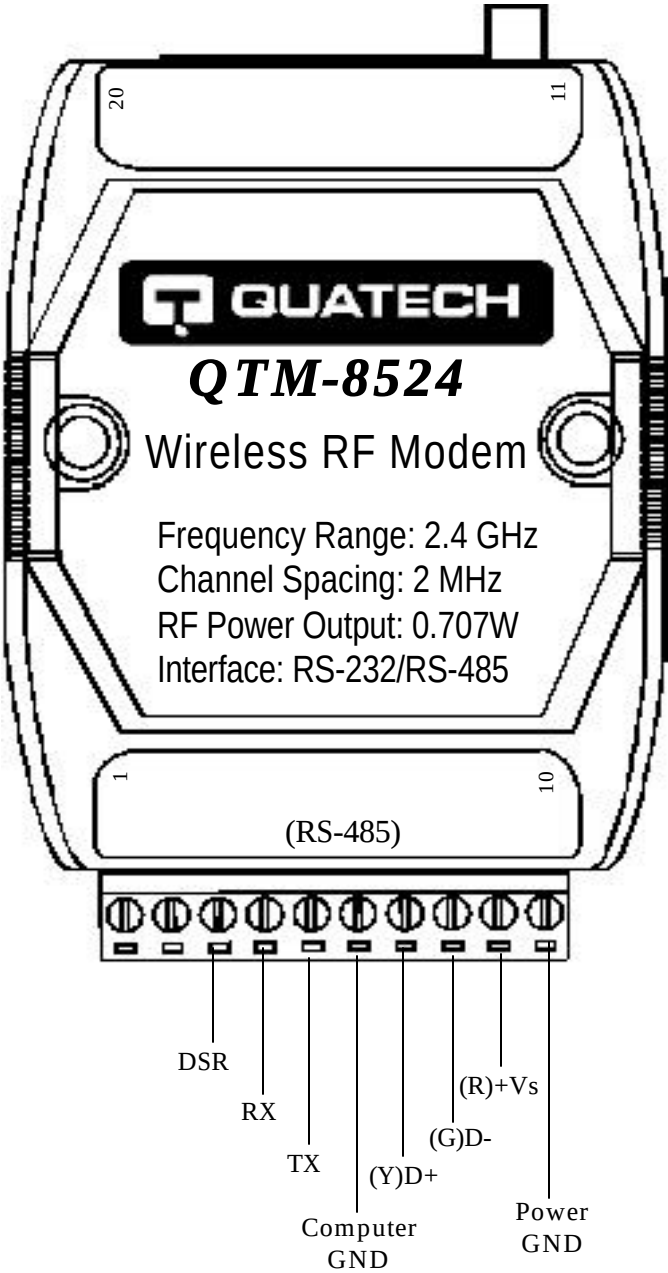


Figure 1.4.3--QTM-8000 Series Panel Mounting

## 2. QTM-8524 Specifications

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### 2.1 Pin Assignments



## 2.2 QTM-8524 Module Specifications

### QTM-8524: 2.4 GHz RS-232/RS-485 to RF Converter

#### ***RF Communication Transceiver***

**Frequency Band:** 2426 to 2458 MHz

**Channel Spacing:** 2.048 MHz (8 Channels jumper select)

**Peak Output Power:** 28.5 dBm  $\pm$  2 dB (.707 watts)

**Modulation:** Gaussian Minimum Shift Keying (GMSK)

#### ***Time Division Duplexing***

**Transmission Range:** RS-232

Line of Sight: .35 miles

Semi-Open: 150 ft.

#### ***Direct Sequence Spread Spectrum***

**Non-Overlapping Channels:** 8 Channels, Jumper selectable  
(Full-Duplex Mode Only)

**Modes of Operation:** Full Duplex or Half Duplex, Jumper selectable

**Communication:** Asynchronous or Synchronous, Jumper selectable

#### ***Serial Communication Interface***

RS-232 (TxD, RxD, GND) or RS-485 (D+, D-), Jumper selectable

**Baud Rate:** 600 bps to 57.6 kbps, Jumper selectable

#### ***Environments***

**Operating Temperature:** 0 °C to 50 °C

**Storage Temperature:** -30 °C to 70 °C

#### ***Power Supply***

**Vs:** +10V to +30V DC Unregulated

**Power Consumption:** 1.5W

**Note:** The QTM-8524 must operate in full-duplex, synchronous mode in order to be used with QTM-8000 Series data acquisition and signal conditioning modules.

## 2.3 QTM-8524 Block Diagram

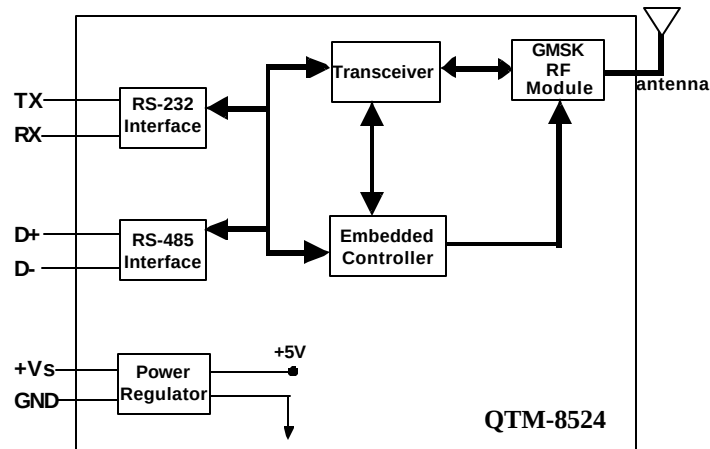


Figure 2.3--QTM-8524 Block Diagram

## 2.4 QTM-8524 Disassembly

Disassembly of the QTM-8524 is required to change the jumper settings. Please refer to figure 2.4 and follow the steps below to disassemble the module:

1. Remove the DIN rail mounting bracket by loosening the screws on the front of the unit.
2. Remove the two (2) small screws that were under the DIN rail mounting bracket.
3. Using a small flat bladed screwdriver, gently pry at the corners to separate the plastic case.
4. Set the jumpers as desired and replace the radio assembly in the case. Use care not to flex the cable too much while setting the jumpers.

5. Snap the case back together firmly.
6. Insert the two (2) small screws in the back of the unit.
7. Place the DIN rail bracket back (notice locating pins on the bottom of the bracket) and secure tightly.

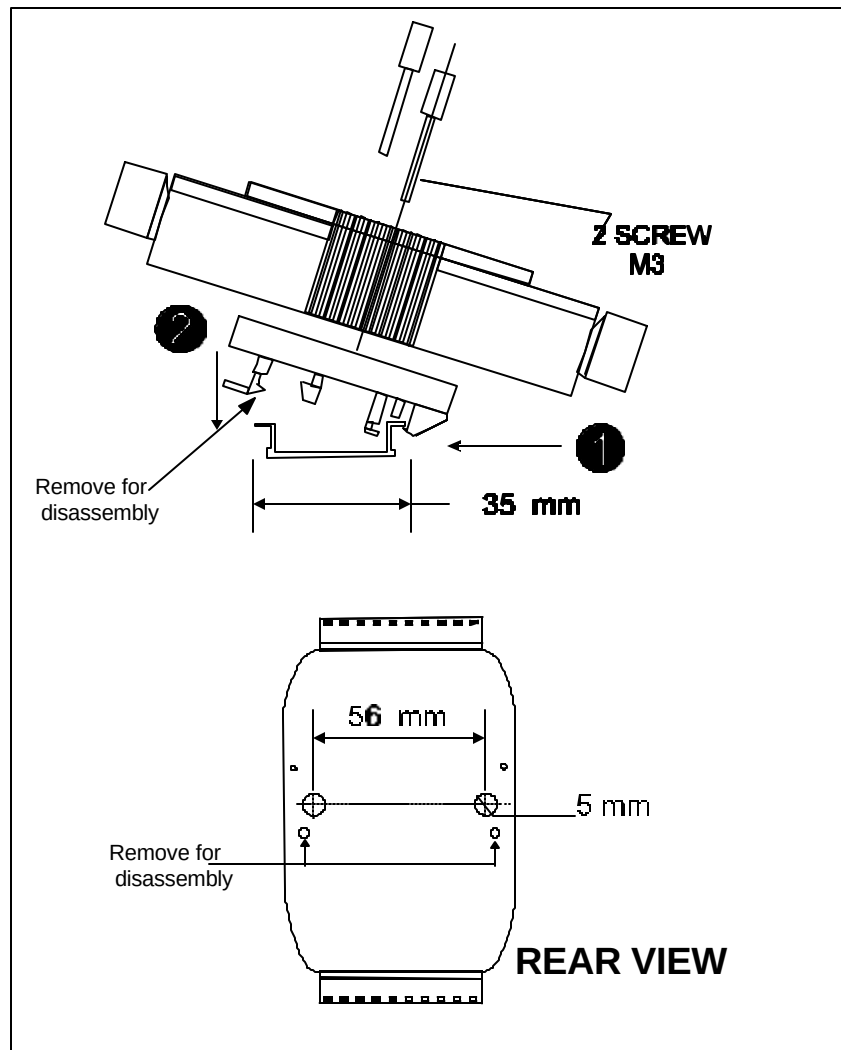


Figure 2.4--Disassembling the QTM-8524

## 2.5 *QTM-8524 Jumper Settings*

Factory default jumper settings are indicated below.

- Channel 3
- Baudrate (bps) = 9600 bps
- Slave Mode
- RS-232 Interface
- Frequency Channel = 2439.936 MHz
- Full Duplex Mode
- Synchronous Communication

Figure 2.5 on the following page diagrams the other possible jumper settings. See section 4 for more information about how QTM-8524 modules should be configured for different types of QTM-8000 wireless networks.

Note that the QTM-8524 must be disassembled before jumper settings can be changed. See section 2.4 for disassembly instructions.

| (1) Channel Select | (2) Frequency Select | (3) Baud Rate Select |
|--------------------|----------------------|----------------------|
| Channel0           | 2426.112 MHz         | 600 bps              |
| Channel1           | 2430.720 MHz         | 1200 bps             |
| Channel2           | 2435.328 MHz         | 2400 bps             |
| Channel3           | 2439.936 MHz         | 4800 bps             |
| Channel4           | 2444.544 MHz         | 9600 bps             |
| Channel5           | 2449.152 MHz         | 19200 bps            |
| Channel6           | 2453.760 MHz         | 38400 bps            |
| Channel7           | 2458.368MHz          | 57600 bps            |

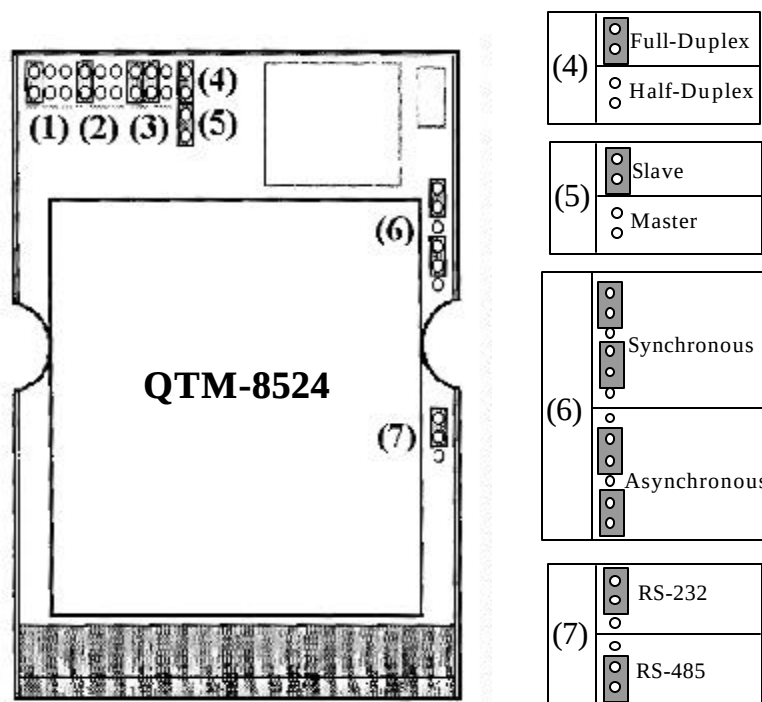


Figure 2.5.--QTM-8524 Jumper Settings

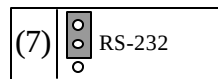


## 2.6 QTM-8524 Basic Wire Connections

### 2.6.1 RS-232 connection between PC and QTM-8524

The QTM-8524 includes a cable that will allow you to connect your wireless module directly to a PC. One end of the cable provides a standard D-9 connector that plugs into a computer's standard serial port. The other end has exposed wires used for connecting with the QTM-8524. Follow the instructions below to wire the module to the cable.

- (1) Position Jumper 7 to RS-232 as shown



- (2) Connect QTM-8524 GND, TX and RX to CA-0910's corresponding RS-232 GND, TX and RX
- (3) Connect CA-9010's DB-9 female connector to the PC's RS-232 DB-9 male connector

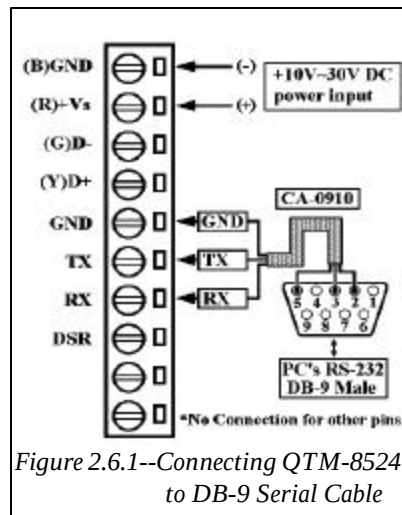
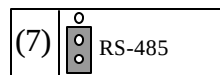


Figure 2.6.1--Connecting QTM-8524 to DB-9 Serial Cable

### 2.5.2 Connecting QTM-8000 modules to the QTM-8524

- (1) Position Jumper 7 to RS-485 as shown



- (2) Connect QTM-8524 D+ to D+ of QTM-8000 RS-485 network
- (3) Connect QTM-8524 D- to D- of QTM-8000 RS-485 network

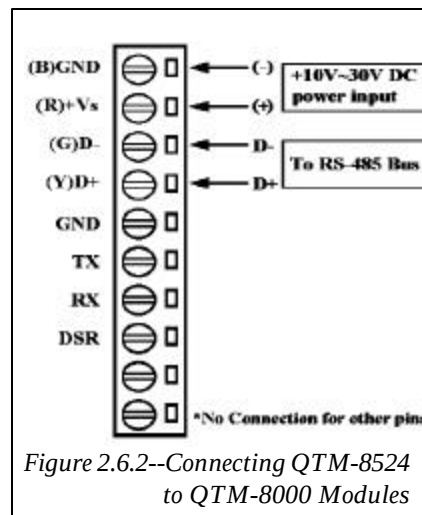


Figure 2.6.2--Connecting QTM-8524 to QTM-8000 Modules

## 3. Antennas

---

### 3.1 QTM-8524 Antenna Options

Two antennas are available for use with the QTM-8524. The standard antenna, QTM-24ANT-SW, is for general purpose indoor/outdoor applications, and can be conveniently wall-mounted on a swivel bracket. The optional monopole antenna, QTM-24ANT-C is ideal for office/lab applications and can be easily mounted on the ceiling.

#### 3.1.1 QTM-24ANT-SW Specifications

##### Standard Wall-Mount Antenna

**Type:** Patch

**Mount:** Swivel bracket

**Application:** General Purpose

**Gain:** 7.5dBi

**Frequency:** 2.4 GHz

**Transmission Range:** 500 Meters, open line-of-sight (50M with barriers)

**Included Accessories:** cable, hardware and connector

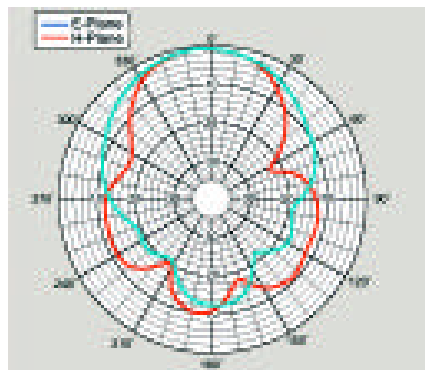


Figure 3.1.1--QTM-24ANT-SW Transmission Pattern

### 3.1.2 QTM-24ANT-C Specifications

#### Ceiling-Mount Antenna

**Type:** Monopole

**Mount:** Ceiling

**Frequency:** 2.4 GHz

**Gain:** 3dBd

**Weight:** 0.29lb ( 0.64 kg)

**Height:** 9 in (22.9 cm)

**Nominal Impedance:** 50 Ohms

**VSWR:** 1.5:1 nominal

**Transmission Range:** 500 Meters, open line-of-sight (50M with barriers)

**Radiating Element:** Plated copper laminate

**Enclosure:** Polycarbonate

**Application:** Office/lab, drop ceiling, transmission

**Included Accessories:** cable, hardware and connector

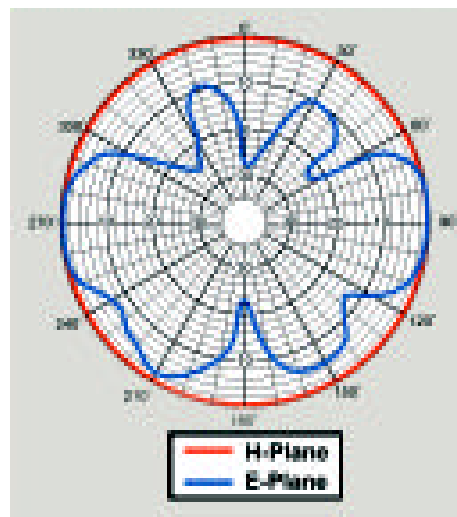


Figure 3.1.2--QTM-24ANT-C Transmission Pattern

## 3.2 *Connecting Antennas to QTM-8524 Modules*

Your QTM-8524 is issued with a high quality communication antenna. To get the maximum performance from your wireless system, please follow the directions and suggestions that follow.

### 3.2.1 Site Selection

Antenna location is extremely important when installing your system. If possible, try to keep the antenna away from any obstructions. Objects and structures made of metal will reduce the efficiency of the antenna. Also, keep in mind that systems like cellular phone repeaters, other wireless LANs, and microwave ovens may interfere with the QTM-8524. If you encounter problems with one frequency, try changing the frequency at which your QTM-8524 modules are operating. Eight (8) different frequencies can be selected using jumper 2 on the module (see Figure 2.4 for a diagram of QTM-8524 jumper settings.).

### 3.2.2 Installation

Install the antenna and module as per the directions. See section 3.3.1 for detailed QTM-24ANT-SW installation instructions and section 3.3.2 for detailed QTM-24ANT-C installation instructions. Be sure to mount the antenna **BEFORE** connecting it to the QTM-8524 module. The QTM wireless system should be professionally installed.

### 3.2.3 Connection

Both antennas are supplied with SMA connectors attached to the antenna cable. These connectors are designed for optimum use at high frequencies.

To connect the antenna to the module, carefully press the connectors together and use your fingers to rotate the coupling nut clockwise to tighten. **DO NOT** over-tighten the connection. A 5/16" open ended wrench can be used to secure the connection just a little past "finger-tight," but no more. Over-tightening the connection may damage the mating surfaces of the connector, and reduce the performance of your wireless system. Use care not to cross-thread the connector. If you feel resistance when tightening, back the coupling nut off and try again.

If the connectors need to be cleaned, use a clean cotton swab and a little pure alcohol. Let the alcohol dry before reconnecting. **DO NOT** saturate the connector with any liquid. **DO NOT** use any lubricants on the connector.

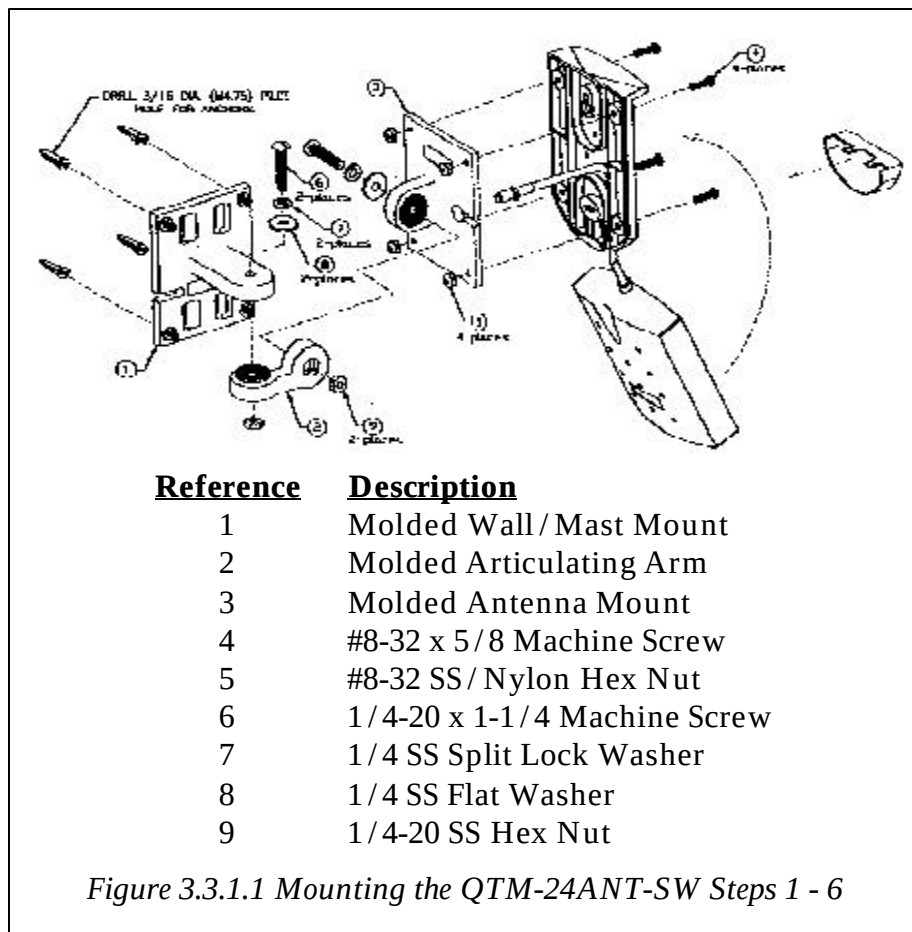
**Warning:** The FCC strictly prohibits connecting any other antenna to the QTM-8524. Only Quatech supplied antennas are approved by the FCC for use with this module. Use of any other antenna will void your warranty.

### 3.3 Mounting External Antennas

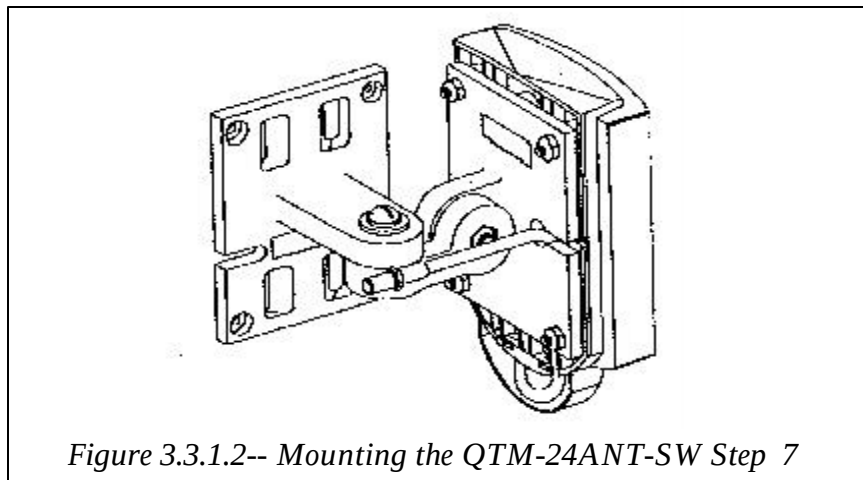
To reduce potential radio interference to other users, the antenna type and its gain should be chosen so that the equivalent isotropically radiated power (EIRP) is not more than that required for successful communication.

#### 3.3.1 Mounting the QTM-24ANT-SW

Please refer to Figures 3.3.1.1 - 3.3.1.3 and follow the instructions below to mount your QTM-24ANT-SW antenna. Be sure to mount the antenna BEFORE connecting it to the QTM-8524 module. The QTM-24ANT-SW should be professionally installed.



- (1) Route the antenna cable through the mounting plate as shown in Figure 3.3.1. DO NOT snap the antenna to the mounting plate yet.
- (2) Secure the molded antenna mount to the mounting plate as shown in Figure 3.3.1. 1 Use the #8-32 x 5/8" machine screws and the #8-32 SS/ Nylon hex nut as shown.
- (3) Snap the antenna into the mounting plate (dashed lines) as shown in Figure 3.3.1.1
- (4) Secure the articulated arm to the molded antenna mount using a 1/4-20 x 1-1/4" machine screw, a 1/4" flat washer, a 1/4" lock washer, and a 1/4-20 SS hex nut as shown in Figure 3.3.1.1.
- (5) Secure the molded wall/ mast mount to the articulating arm using a 1/4-20 x 1-1/4" machine screw, a 1/4" flat washer, a 1/4" lock washer, and a 1/4-20 SS hex nut as shown in Figure 3.3.1.1.
- (6) Adjust the length of the cable to minimize the exposed cable loop.
- (7) Place the cable guard over the exposed cable and snap it in place, as shown in Figure 3.3.1.2.
- (8) To mount the assembly, drill four (4) 3/16" diameter (M4.75) pilot holes for the wall anchors. Use the molded wall/ mast mount as a template to drill your holes. Or, cut out the hole template provided on page 45.
- (9) Loosen the screws in the boom arm to adjust the antenna position. Tighten the screws when the optimum position is determined.



### **3.3.2 Mounting the QTM-24ANT-C**

#### **Safety**

The QTM-24ANT-C antenna has been designed to attach to and hang from standard ceiling panel runners. To prevent personal injury or equipment damage, the antenna must be securely mounted per the following instructions. The QTM-24ANT-C should be professionally installed.

#### **Location**

The location at which the QTM-24ANT-C is mounted is very important. Objects such as metal columns, walls, etc. will reduce efficiency. Best performance is achieved when transmit and receive antennas are mounted at the same height, and in a direct line of sight with no obstructions. If this is not possible, and reception is poor, it is a good idea to try a few different mounting positions to optimize reception.

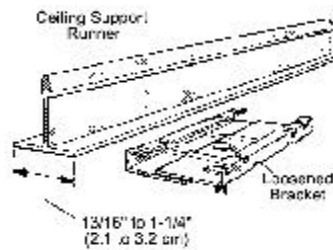
#### **Mounting**

The QTM-24ANT-C is suitable for use indoors or outside. The antenna bracket fits ceiling support runners 13/15" to 1-1/4" (2.1 to 3.2 cm) wide.

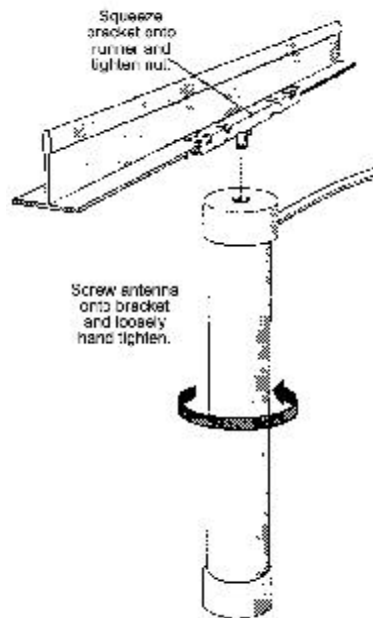
To install the antenna, follow the steps below:

- (1) Loosen the 1/4-20 hex nut and position the antenna mount over the support runner. (See Figure 3.3.2.1).
- (2) Squeeze the bracket firmly onto the runner (hand-pressure is adequate) and tighten the hex nut securely as shown in Figure 3.3.2.2
- (3) Carefully screw the antenna onto the 1/4-20 screw (lightly hand-tighten) as shown in Figure 3.3.2.2
- (4) Secure coaxial cable along the support runner using tape or cable ties.

If a different mount is used, limit the depth it is threaded into the mounting hole to .35 inches (.9 cm). For outdoor mounting, install the antenna with the threaded hole down.



*Figure 3.3.2.1-- Installing the QTM-24ANT-C Ceiling Mount Bracket*



*Figure 3.3.2.2-- Connecting the QTM-24ANT-C Antenna to the Ceiling Mount Bracket*



### 3.3.3 RF Safety

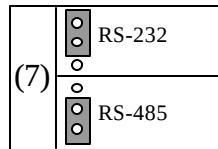
The QTM-8524 has been classified by the FCC as a §15.247 Spread Spectrum Mobile Transmitter. The antennas selected for use with this transmitter were chosen to provide optimum safety when installed properly. Please reference Sections 3.3.3 and 3.3.2 of this manual before installing the antennas. Keep in mind that mounting the antennas higher yields a twofold benefit: better reception and less RF exposure to people in the general vicinity. According to FCC requirements for MPE compliance, the antennas must be installed to provide a minimum distance of 20cm from all persons under normal use.

## 4. Configuration

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### 4.1 RS-232 or RS-485 Configuration

QTM-8524 modules can be configured for either RS-232 or RS-485 serial communication. This setting is selected using jumper seven on the module as shown:



When connecting the QTM-8524 directly to a PC, RS-232 mode must be used. (See section 2.5.1 for instructions on how to wire the QTM-8524 for connection to a PC.). To implement a QTM-8000 Series network using a single pair of QTM-8524 modules, the upstream module must be configured as RS-232 and connected to the PC's serial port. The downstream modules should be configured for RS-485 in order to communicate with the QTM-8000 Series data acquisition and signal conditioning modules. When using multiple pairs of QTM-8524 modules in conjunction with the QTM-8520 converter module, both QTM-8524s should be configured for RS-485. (See section 2.5.2.1 for instructions on how to wire the QTM-8524 for connection to a QTM-8000 Series network.)

### 4.2 Half-Duplex and Full-Duplex Operation

QTM-8524 modules can operate in both *Full-Duplex* and *Half-Duplex* modes. In *Half Duplex* mode communication can take place in only one direction at a time. Each device can communicate information in a single direction only - transmit or receive. If more than one module transmits data at the same instant, then the data on the bus will be corrupted and therefore invalid. In

*Half duplex* mode, all modules must have the same baudrate and frequency configuration and all modules must be jumper configured for slave. (See Figure 2.4 for a diagram of QTM-8524 jumper settings.)

In *Full Duplex* systems, transmission and reception can occur simultaneously. For example, device A can send information to device B while at the same time receiving data from device C. In order for the QTM-8524 modules to function in *Full Duplex* mode, the module connected to the PC or to the QTM-8520 must be jumper configured for master, and the downstream QTM-8524 must be jumper configured for slave mode. Both modules must be set to the same baudrate, frequency and channel. When using QTM-8524 modules with QTM-8000 Series I/O modules, Full Duplex mode must be used.

**Note 1:** In *Half Duplex* operation, the channel selection jumper setting need not be used.

**Note 2:** For a multi-point application, the network must be configured for *Half Duplex* operation. Thus, QTM-8000 Series data acquisition and signal conditioning modules can not be used in this network type.

### **4.3 Synchronous & Asynchronous Communication**

The QTM-8524 can be jumper configured for two modes of data communication-- synchronous and asynchronous. (This selection is made using jumper 6, see Figure 2.4 for a diagram of QTM-8524 jumper settings.) In synchronous mode, the QTM-8524 uses an internal system clock to synchronize the data bits. When the QTM-8524 is configured for synchronous communication, the PC or serial communication device to which it is attached must send data in the format specified below:

#### **1 START BIT, 8 DATA BITS, NO PARITY, 1 STOP BIT**

Whether receiving or transmitting, all QTM-8524 modules configured for synchronous communication can only process data in the above format.

When configured for asynchronous mode, QTM-8524 modules can process signals in any data format. To prevent data distortion, the sampling rate and data rate in asynchronous networks should be limited to 32 kS/s and 14.4 kbps respectively.

**Note:** QTM-8524 modules configured for asynchronous mode must also be configured for RS-232 communication. Thus, asynchronous mode can not be used when the QTM-8524 is integrated into a QTM-8000 Series data acquisition and signal conditioning network.

## **4.4 Configuration Modes**

### **Mode 1 : FULL DUPLEX, SYNCHRONOUS**

Peer-to-peer communication  
One QTM-8524 configured for MASTER  
One QTM-8524 configured for SLAVE.  
Maximum Baudrate: 19200 bps  
Fixed Data Format: 1 Start Bit, 8 Data Bits, No Parity, 1 Stop Bit  
Compatible with QTM-8000 Series I/O Networks

### **Mode 2 : HALF DUPLEX, SYNCHRONOUS**

Multiple Node Communication  
All Slave Configuration  
Maximum Baudrate: 57600 bps  
Fixed Data Format: 1 Start Bit, 8 Data Bits, No Parity, 1 Stop Bit  
Time Delay between transmit and receive  
Channel Selection: Disabled  
Not Compatible with QTM-8000 Series I/O Networks

### **Mode 3 : FULL DUPLEX, ASYNCHRONOUS**

Peer to Peer Communication  
One QTM-8524 configured for MASTER  
One QTM-8524 configured for SLAVE  
Maximum Baudrate: 14400 bps  
Variable Data Format  
Interface: RS-232 ONLY  
Not compatible with QTM-8000 Series I/O Networks

#### 4.4.1 Mode 1: Full Duplex, Synchronous

Mode 1 is the most common form of peer-to-peer communication. In this mode, a module first encodes the input data streams. Then, it transmits the data to the downstream QTM-8524 module. The receiving module decodes the data stream and drives the data onto the serial communication lines.

In Mode 1, the QTM-8524 modules are configured for full duplex mode and synchronous communication. As mentioned in the previous section, both modules must be configured for the same baud rate, frequency and channel. Note also that the data must be transmitted using the predefined synchronous data format (see section 4.3).

##### **Jumper Configuration:**

1. Select Channel from C0 - C7 (Jumper 1)
2. Select Frequency from 2426.112 - 2458.26 MHz (Jumper 2)
3. Select Baud Rate from 600 bps to 19200 bps (Jumper 3)
4. Select Full Duplex Mode (Jumper 4)
5. Select Master or Slave (Jumper 5)
6. Select Synchronous Communication (Jumper 6)
7. Select RS-232 or RS-485 (Jumper 7)

(See Figure 2.4 for a diagram of QTM-8524 jumper settings.)

##### **Advantages:**

1. Decreases communication error rate
2. Increases communication stability
3. Can be used with QTM-8000 Series I/O modules

##### **Limitations:**

1. Fixed data format
2. Peer-to-peer communication
3. Maximum baudrate: 19200 bps

**Note:** When QTM-8524 modules are used in Mode 1 with QTM-8000 Series I/O modules, the upstream QTM-8524 connected to the PC should be configured for RS-232 communication and set to Master mode, the downstream QTM-8524 should be configured for RS-485 communication and set to Slave mode.

#### **4.4.2 Mode 2: Half-Duplex, Synchronous**

Mode 2 enables communication between two or more QTM-8524 modules. This allows a single QTM-8524 connected to a PC to communicate with multiple other remote QTM-8524 modules also connected to PCs or PLCs. In mode 2, a single QTM-8524 module broadcasts signals to every other QTM-8524 module in the network. These modules receive the information, interpret the data, and respond accordingly.

Mode 2 requires all modules to be configured for half-duplex synchronous communication. In a half-duplex system all QTM-8524 modules are jumper configured for Slave State, and all must be configured for the same frequency and baud rate. As in Mode 1, the synchronous network requires that data be configured using the predefined data format noted in section 3.2.

##### **Jumper Configuration:**

1. No Channel Selection
2. Select Frequency from 2426.112 - 2458.26 MHz (Jumper 2)
3. Select Baud Rate from 600 bps to 57600 bps (Jumper 3)
4. Select Half Duplex Mode (Jumper 4)
5. Select Slave State (Jumper 5)
6. Select Synchronous Communication (Jumper 6)
7. Select RS-232 or RS-485 (Jumper 7)

(See Figure 2.4 for a diagram of QTM-8524 jumper settings.)

##### **Advantages:**

1. Decreases communication error rate
2. Increases communication stability

##### **Limitations:**

1. Fixed data format
2. Half-Duplex Only
3. Cannot be used with QTM-8000 Series I/O Modules

### 4.4.3 Mode 3: Full Duplex, Asynchronous

Using Mode 3, QTM-8524 modules can be used to transmit data in any format. In Mode 3, only point-to-point communication is permitted. Both QTM-8524 modules must be configured for full-duplex mode and RS-232 communication, and must share the same frequency. In this mode channel selection is ignored and baud rate need not be synchronized. However, baud rate must be kept under 14.4 kbps. This is because data waveforms may be distorted using data rates greater than 14.4 kbps. The controlling application must handle all desired synchronizing and error correction duties.

#### **Jumper Configuration:**

1. No Channel Selection
2. Select Frequency from 2426.112 - 2458.26 MHz (Jumper 2)
3. No baud rate selection
4. Select Full Duplex Mode (Jumper 4)
5. Set one QTM-8524 to Master and one to Slave (Jumper 5)
6. Select Asynchronous Communication (Jumper 6)
7. Select RS-232 (Jumper 7)

(See Figure 2.5 for a diagram of QTM-8524 jumper settings.)

#### **Advantages:**

1. Full duplex communication
2. Variable data formats

#### **Limitations:**

1. Peer-to-peer communication
2. Maximum Baud Rate: 14.4 kbps
3. RS-232 Communication only
4. Cannot be used with QTM-8000 Series I/O Modules

## 5. Application Examples

### 5.1 Peer-to-Peer Communication (Mode 1)

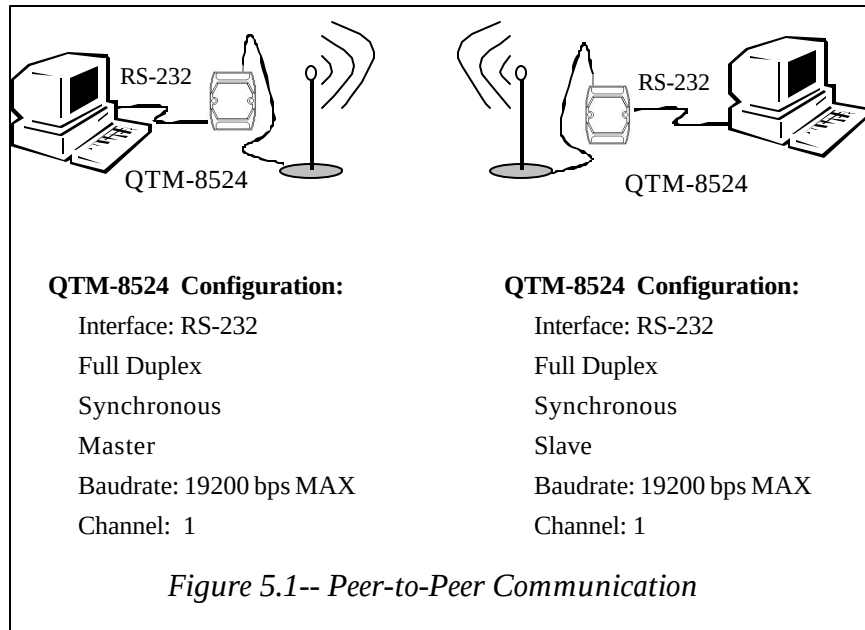


Figure 5.1 above depicts a basic serial full-duplex communication application. In this type of application, both QTM-8524 modules are configured for the same baud rate, frequency and channel.

## 5.2 Interfacing with QTM-8000 Modules (Mode 1)

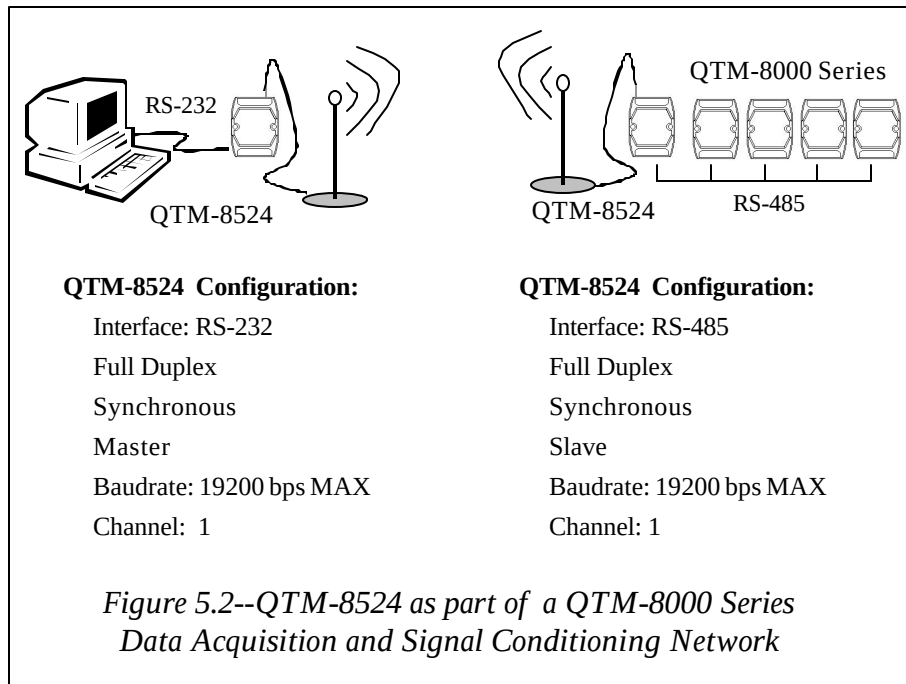


Figure 5.2 above depicts QTM-8000 Series data acquisition and signal conditioning modules integrated into a wireless network. The upstream QTM-8524 connected to the PC should be set for RS-232 communication, the downstream QTM-8524 connected to the module network should be set for RS-485. Both QTM-8524 modules must be configured for the same frequency, channel and baud rate. The attached QTM-8000 Series I/O modules must also be configured at that same baud rate. (Note that because of the speed limitation imposed by the QTM-8524, communication over this network can not exceed 19.2 kbps, even though QTM-8000 Series I/O Modules are themselves capable of speeds up to 115.2 kbps.) Up to 256 QTM-8000 I/O modules can be configured in a network using one pair of QTM-8524 modules.



### 5.3 Multiple PC Communication (Mode 2)

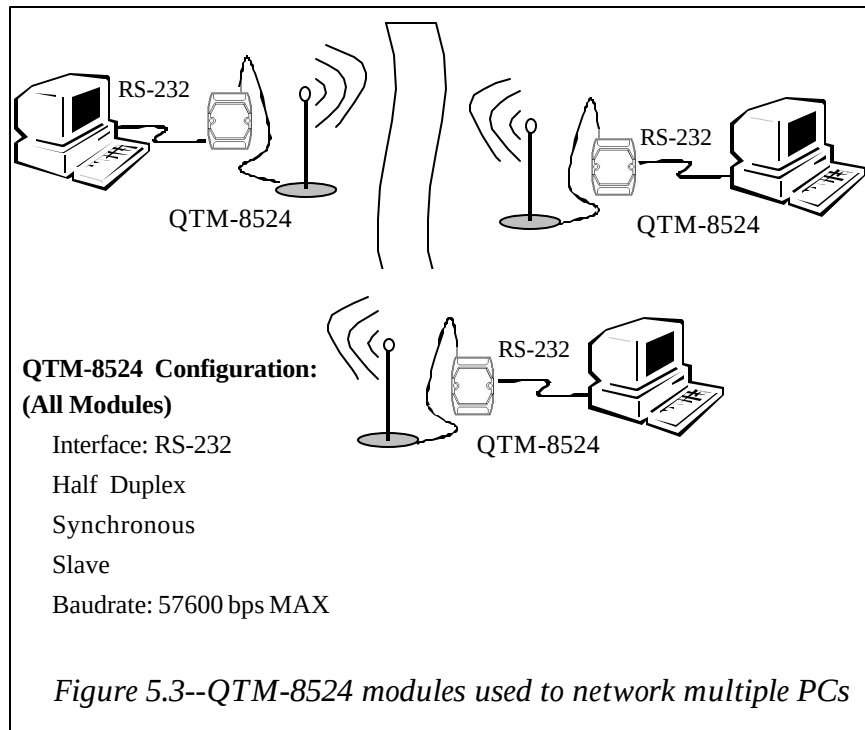


Figure 5.3 above depicts a basic multi-point application. In this type of application, multiple QTM-8524 modules can operate in a single wireless network. All modules must be configured to Half-Duplex communication and must be set in Slave State. Either RS-232 or RS-485 must be selected for the entire network. All modules must also be configured to operate at the same baud rate, channel and frequency. Note that this mode cannot be used with QTM-8000 Series data acquisition and signal conditioning modules.

## 5.4 Asynchronous Communication (Mode 3)

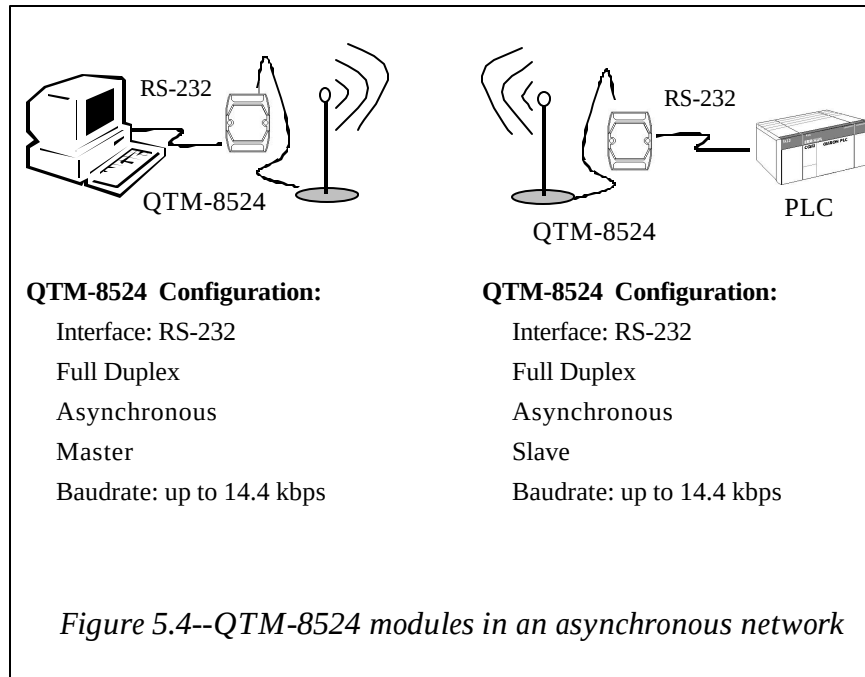


Figure 5.4 above depicts a basic asynchronous communication application. In this type of application, both QTM-8524 modules must be configured for Full-Duplex RS-232 communication, and they must operate at the same frequency. Baud rate need not be the same for both modules, however it must be less than 14.4 kbps. Note that asynchronous mode can not be used with QTM-8000 Series I/O Modules.

## 6. Approvals

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### FCC Approvals

The QTM-8524 is approved pursuant to FCC Part 15.247 for intentional spread spectrum radiators (47CFR15.247) while being used with the Quatech supplied antennas (QTM-24ANT-SW and the QTM-24ANT-C). This certification is applicable in the United States and all of its territories (Guam, Samoa America, US Virgin Islands and Puerto Rico).

FCC ID: F4AQTM85242000

The QTM-8524 is approved pursuant to FCC Part 15 Subpart B limits for unintentional radiators. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

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.

### Additional Antennas

Operation of this device with antennas that are not supplied by Quatech is strictly prohibited under FCC regulations. Operation with antennas that are non-compliant will void any warrantee whether explicit or implied.

**DOC Approvals (Canada)**

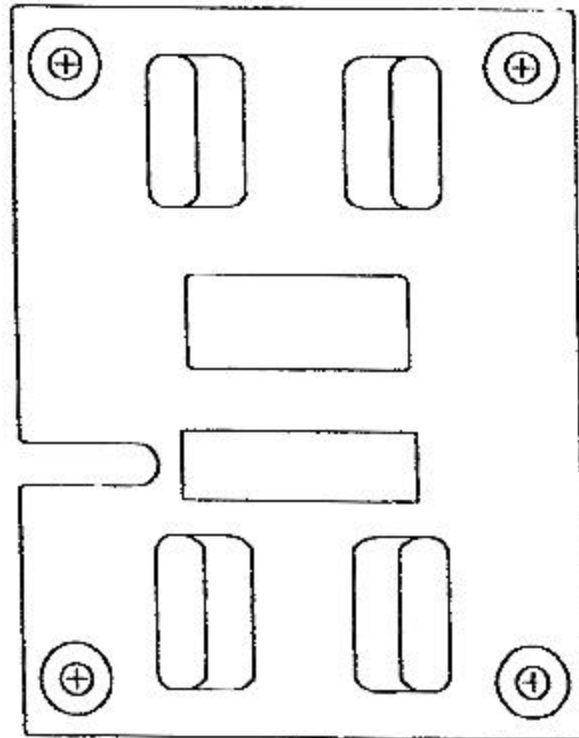
The QTM-8524 is approved for use in accordance with RSS-210 and RSS-139. To prevent radio interference to the licensed service, this device is intended to be operated indoors and away from windows to provide maximum shielding. Equipment (or its transmit antenna) that is installed outdoors is subject to licensing.

CANXXXXXXXXXX

**Additional Antennas**

This device has been designed for use with an antenna having a maximum gain of 7.5dB. Antennas having higher gain is strictly prohibited per regulations of Industry Canada. The required antenna impedance is 50 ohms. Quatech Inc. will not be responsible or liable for systems or damage caused by systems operated with unapproved antennas, and such operation will void all warranties whether explicit or implied.

### ***QTM-24ANT-SW Hole Template***



Cut this template out of the manual and use it as a guide for drilling the holes needed to install your QTM-24ANT-SW wall-mount antenna.