

INTEROPERABILITY NOW

Installation and Operation Manual

QMT-1
IP Backhaul Remote
For
The SNV-12 Voter

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CAUTION

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Glossary

<i>Glossary</i>		
COR	Carrier Operated Relay	A signal from a receiver that gives a positive indication that a carrier or signal is being received and that the receiver is unscelched. It has the same function as Carrier Operated Squelch (COS).
COS	Carrier Operated Squelch	See COR.
DHCP	Dynamic Host Configuration Protocol	A method of automatically assigning an IP address to an Ethernet device at startup time. This method conserves IP addresses in networks where devices do not stay connected permanently.
DSP	Digital Signal Processor	A type of microprocessor, which is optimized for signal processing functions.
IP	Internet Protocol	A protocol designed to allow communications between computers on different networks.
LAN	Local Area Network	A group of computers and associated devices that share a common communications line, typically within a small geographic area.
PTT	Push-to-talk	A signal to a radio transmitter, which controls the actual transmission of radio frequency energy over the air. Also called a keyline.
TCP	Transmission Control Protocol	An additional layer to the Internet Protocol, which ensures delivery of packets, sent across the network. It can handle situations such as lost packets or packets arriving out of order.
UDP	User Datagram Protocol	An additional layer to the Internet Protocol which does not ensure delivery of packets but which offers much lower transmission overhead than TCP.
VoIP	Voice over Internet Protocol	Also called Voice over Packet (VoP), a method of sending voice communications across a digital network.
WAN	Wide Area Network	A network, which is spread out over a wider area, such as around a city or state. It may include other public or shared networks.

1 General Information

1.1 Scope

This instruction manual provides the information necessary to install and operate the QMT-1 IP Backhaul Remote. This manual assumes a basic understanding of the SNV-12 voter, analog voter fundamentals, and the SVM-3 site voter module. See also the manual for the SNV-12 and any manual addenda relative to the SVM-3 module.

1.2 Overview

The SNV-12 Voter has been long established as the leader in the analog receiver voting. Prior to the introduction of the QMT-1, working in concert with the SVM-3 modules, all audio input into the SNV-12 was strictly synchronous, interfaced to the unit's SVM-2 modules. The QMT-1/SVM-3 pair allow the voting receiver audio to be transported to the voter via IP.

To gain a good understanding of the system, it's worth considering some of the technical roadblocks that had to be overcome to make it work:

- An analog voter can function properly only if audio from all unscelched voting receivers is time-synchronized when it reaches the voter. Unfortunately IP data transfer is not concerned with timing.
- Synchronization is needed because analog voters chose the best site by comparing FM noise levels within a standard audio spectrum – at the same frequencies that carry speech. Speech alters the noise measurement, but all balances out if audio is synchronized.
- Also, the voter may need to be able to transfer to a new voted site during a field transmission, and it must be able to do so without the listener experiencing any echoes or missed syllables as the voter transitions from one site to another.
- Most codecs do a poor job of accurately transferring FM noise, simply because they are not optimized to do so. This means that an SNV-12 module would not be able to do as accurate a measurement on digitized RX audio as it does on analog RX audio

The SVM-3/QMT-1 pair resolves these potential problems:

The QMT-1 digitizes the audio for transport to the SVM-3 module, but also performs a pair of other functions – it performs a Signal Quality (FM Noise) measurement on the analog audio before digitization, and adds a time stamp. This information is sent as metadata along with the digital audio packets.

The SVM-3, in concert with the SNV-12 voter, returns the audio to analog, uses the timestamp to resynchronize the audio, and compares Signal Quality measurements to determine (and vote) the best site.

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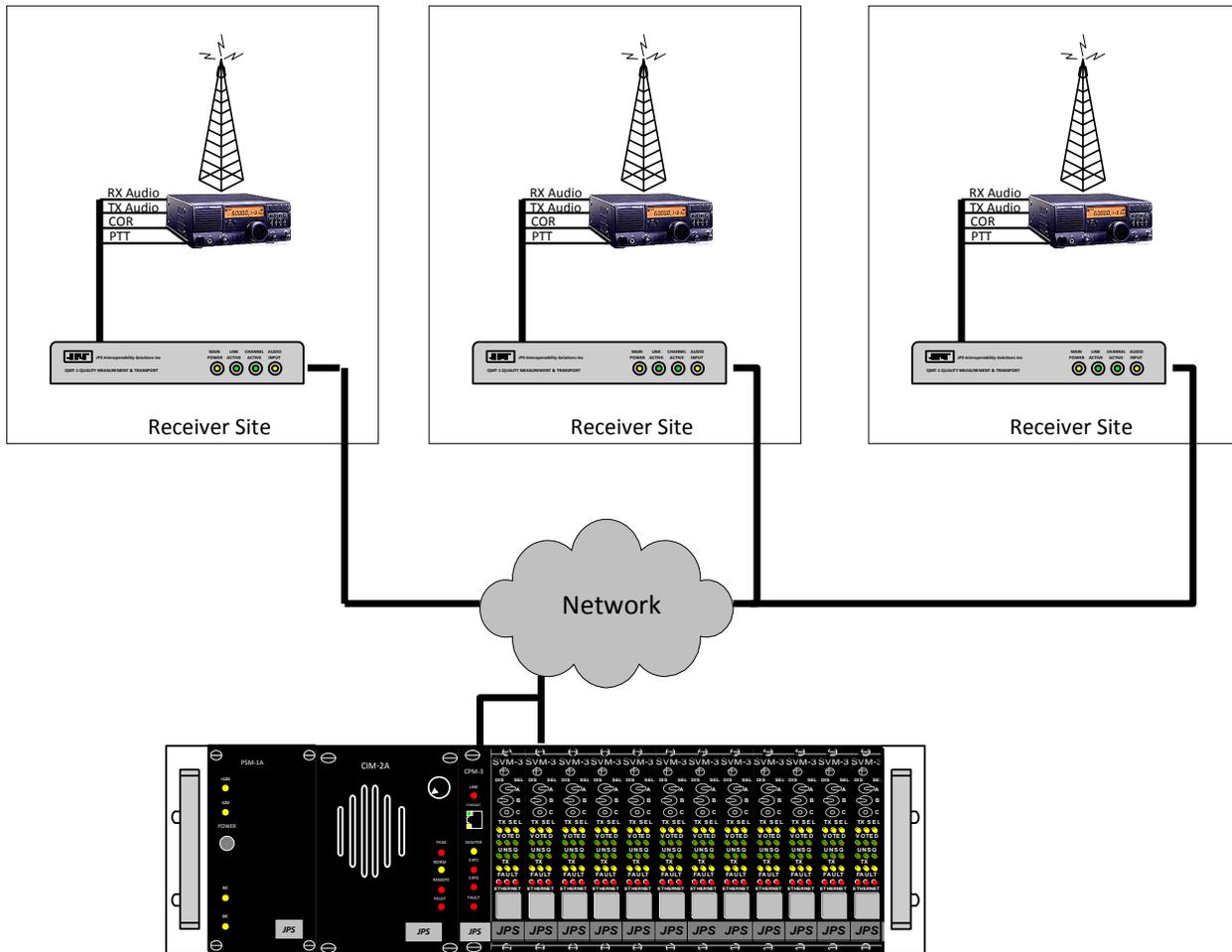


Figure 1-1 SNV-12 Voting System with SVM-3 Site Voter Modules and QMT-1 Remotes

QMT-1 remotes reside at the receiver site, one QMT-1 per receiver. By being placed at the receiver, the QMT-1 can accurately measure the Signal Quality before the audio is encoded into RoIP. The QMT-1 has an analog interface with the receiver/transceiver and can detect an unsquelch condition by either a hardware COR line or by absence of a Pilot Tone. When the QMT-1 detects an Unsquelch condition, it begins taking signal quality measurements of the receiver audio, adds time stamps, and encodes the audio, sending audio and metadata in a JPS-proprietary format.

The SVM-3 module resides in the SNV-12 chassis. Each SVM-3 can connect to as many as three QMT-1 remote units. The SNV-12 voter chassis can accommodate up to 12 SVM-3 modules providing a total of 36 receiver streams to the chassis.

SVM-3 modules can also coexist with SVM-2 modules in the same chassis, with some sites passing analog RX audio to the voter, and others sending digitized audio via a QMT-1.

When SVM-3 modules are added to an existing SNV-12 voter chassis, no changes are required other than updating the Control Processor Module to the latest firmware and then configuring it.

1.3 System Requirements

The IP network used with the SVM-3 modules must meet certain minimum requirements. While the voter system may continue to work if some of these parameters are not met, the overall system performance may be degraded.

For example, in order to time-synchronize audio signals, the quicker-to-arrive signals must be delayed until the slowest one arrives. If the time variation is too long, normal communications may be difficult to maintain.

For these reasons, the SVM-3 IP Backhaul is not intended to be run on public networks (i.e. the Internet). The performance of these networks often varies considerably.

The network that the SVM-3/QMT pair is used on must to meet the following specifications:

- 100 Kbits/per second throughput per QMT-1 audio channel in each direction. 200 Kbps for a duplex channel.
- Packet loss less than 0.1%.
- Differential latency between RX sites less than 10ms.
- Jitter less than 5ms.

1.4 General Notes

Compatibility with Simulcast Systems

Outgoing QMT-1 audio CAN NOT transport outgoing simulcast audio precisely or consistently timed to support simulcast transmissions. It is suitable for single transmit site operation, TX steering, and multisite (different frequencies at different sites).

Site Totals

- An SNV-12 system can consist of a single chassis, or a *Master Chassis* connected to, and controlling, one or two Expansion Chassis, accommodating up to 36 voting receivers (sites).
- Each SVM-2 module can serve only one remote voting site.
- Each SVM-3 can serve up to three remote voting receiver sites and always counts as three sites towards the system site total of 36 (even if an SVM-3 is interfaced to fewer than three receivers).
- A single chassis SNV-12 system can support any combination of SVM-2 or SVM-3 modules.
- The Master Chassis in a multi-chassis SNV-12 system is also able to support any combination of SVM-2 or SVM-3 modules, however any expansion chassis in that system can support SVM-2 modules only.

The main points to remember are that only SVM-2 modules can be used in an Expansion Chassis and the total site count cannot exceed 36 sites.

1.5 The QMT-1 Radio interface

The QMT-1 employs the radio interface used by JPS Interoperability Solutions and therefore:

- Includes the radio interface DSP algorithms relevant to the IP Voting Backhaul application.
- Can use any of the large number of custom interface cables, designed and optimized by JPS Systems Engineering, covering over 300 different radio makes and models.

See Section 2.7.3 for full information on the radio interface. Be sure to use the adapter plug, shipped with this unit, with any JPS custom radio interface cables.

1.6 Network Interface

The QMT-1 is a 10/100BASE-T Ethernet device and each unit has a unique Ethernet address and an RJ-45 physical interface jack. A 10/100BASE-T device operates at either 10 or 100 Mbps and interconnects to an Ethernet hub or switch using standard CAT 5 twisted pair cable, also known as UTP. The maximum cable length between an QMT-1 and its hub port is 100 meters. The QMT-1's Ethernet port can be linked with virtually any LAN, WAN, or the Internet, no matter which topology or cabling system is in use.

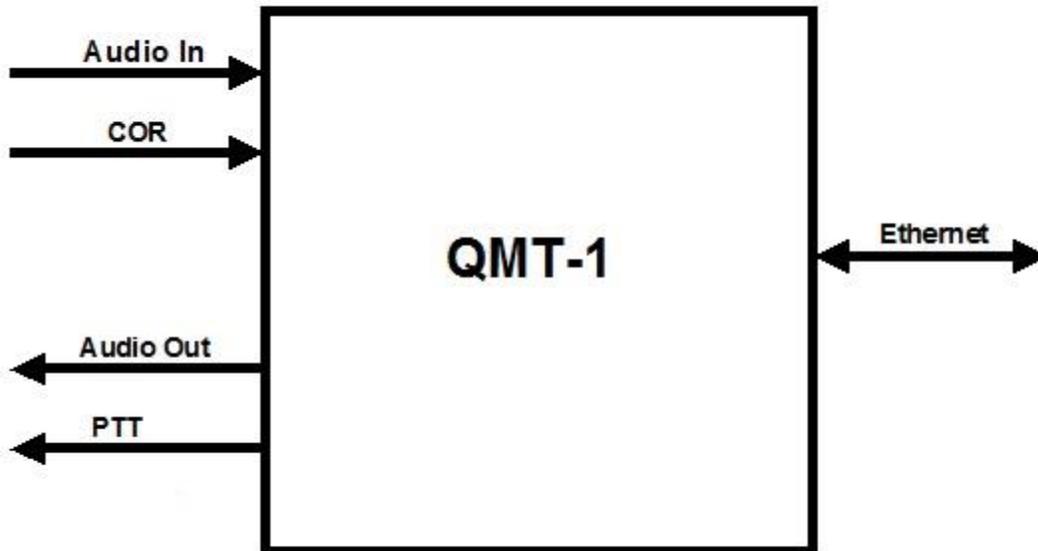


Figure 1-2 QMT-1 Basic Block Diagram

1.7 Specifications

<i>Table 1-1 Specifications</i>	
RX Audio Input	
Input impedance	Balanced 47k ohms, transformer coupled.
Input Level	Incoming signals adjustable from -30 to +11 dBm to set 0 dBm nominal input; +15 dBm clipping. +20 dB boost configurable
Frequency Response	10 Hz to 3600 Hz +/- 2dB.
Digitized Audio to SVM-3	uLaw Vocoder, 64 Kbps data rate (with metadata overhead, throughput as high as 100Kbps per channel)
COR Input	
Input impedance	47k ohm pull-up to +5V.
Polarity	COR: Selectable active low or active high;
Threshold	+2.5V nominal.
Protection	Up To + 100 VDC.
<i>Note: Above for Hardwired COR Output signal from receiver. Pilot Tone COR also available; 1950 or 2175 Hz.</i>	
TX Audio Output	
Output Impedance	Unbalanced 10 ohms, AC Coupled.
Output Level	Adjustable from -30 to +11 dBm, 0 dBm nominal factory default; +15 dBm clipping into a 600-ohm load.
Network & Device Throughput Timing Variability	+/- 100 microseconds (not suitable for Simulcast transmissions)
Frequency Response	10 Hz to 3350 Hz +/- 2dBm.
Distortion	0.5% or less (excepting Vocoder).
PTT Output	
Output Type	Open drain, 47k ohm pull-up to +5V.
Maximum Sink Current	100 mA.
Max Open Circuit Voltage	+60 VDC.
Network Interface	
Interface Type	10/100BASE-T Ethernet, 10 or 100 Mbps; RJ-45 Connector.
Protocols	TCP; UDP for Audio and Status.
General/Environmental	
Programming/Configuration	Web-based
Front Panel	Power, Link Active, Channel Active, and Audio Level LEDs.
Rear Panel	Audio/Data (DB15 Female), Serial, Network, and Power Connectors.
Input Power (12 VDC Nom)	+11 to +15 VDC @ 0.5A max. Wall cube supplied operates on 100-240 VAC.
Power Connector	Coaxial Jack, 2.5 mm ID, 5 to 5.5 mm OD; Center Pin Positive; Reverse Polarity Protected.
Size and Weight	1.4" H x 8"W x 6.8"D (3.55 x 20.3 x 17.3 cm). 1.1 lbs. (0.5kg).
Temperature	Operating: -20 to +60 degrees C. Storage: -40 to +85 degrees C.
Humidity	Up to 95% @ 55 degrees C.
Regulatory Compliance	
FCC part 15 Class A	RFI Emissions, USA

1.8 Equipment and Accessories Supplied

<i>Table 1-2 Equipment and Accessories Supplied</i>		
QMT-1 Shipping Level - JPS P/N 5170-200000		
Quantity	Item	JPS P/N
1	QMT-1 Final Assembly	5170-201000
1	12V DC Power Supply [100 to 240 VAC, 47-63 Hz]	1620-240061
1	Operation & Maintenance Manual	5170-200200
1	Accessory Kit	50170-200150
	Consisting of:	
	<i>Qty</i>	<i>Part Number</i> <i>Description</i>
	1	0313-080515 Audio Crossover Adapter

<i>Table 1-3 Equipment and Accessories Supplied - European Version</i>		
QMT-1 Shipping Level - JPS P/N 5170-210000		
Quantity	Item	JPS P/N
1	QMT-1 Final Assembly	5170-201000
1	12V DC Power Supply [100 to 240 VAC, 47-63 Hz] with European adapters	1620-120600
	Or: DC Power Supply with European adapters	1620-120600
1	Operation & Maintenance Manual	5170-200200
1	Accessory Kit	50170-200150
	Consisting of:	
	<i>Qty</i>	<i>Part Number</i> <i>Description</i>
	1	0313-080515 Audio Crossover Adapter

End of Section One

2 Installation

2.1 General

This section provides the instructions for unpacking, inspection, installation and set-up. Also included are directions for reshipment of damaged parts or equipment.

2.2 Unpacking and Inspection

After unpacking the unit, retain the carton and packing materials until the contents have been inspected and checked against the packing list. If there is a shortage or any evidence of damage, do not attempt to use the equipment. Contact the carrier and file a shipment damage claim. A full report of the damage should also be reported to the JPS Customer Service Department. The following information should be included in the report:

- Order Number
- Equipment Model and Serial Numbers
- Shipping Agency
- Date(s) of Shipment

The JPS Customer Service Department can be reached by phone at (919) 790-1011, by fax at (919) 790-1456. Upon receipt of this information, JPS will arrange for repair or replacement of the equipment.

2.3 Reshipment of Equipment

If it is necessary to return the equipment to the manufacturer, a Returned Material Authorization (RMA) number must first be obtained from JPS. This number must be noted on the outside of the packing carton and on all accompanying documents. When packing the unit for reshipment, it is best to use the original packaging for the unit; if this is not possible, make sure that adequate packing material is used to prevent excessive shocks during transport and handling.

Shipment should be made prepaid consigned to:

JPS Interoperability Solutions
Customer Service Department
5800 Departure Drive
Raleigh, North Carolina 27616
USA

Plainly, mark with indelible ink all mailing documents as follows:

GOODS RETURNED FOR REPAIR

Mark all sides of the package:

FRAGILE - ELECTRONIC EQUIPMENT

Inspect the package prior to shipment to be sure it is properly marked and securely wrapped.

2.4 Installation Overview

NOTE: QMT-1 installation requires knowledge of Ethernet network fundamentals as well as a basic understanding of Internet Protocol (IP). As with any network-connected device, improperly configuring and installing the QMT-1 could disrupt proper network operation. Please seek the assistance of your network administrator or other knowledgeable person if you are unsure about how your network is configured.

Six steps are needed to properly install the QMT-1. These steps are:

1. Determine the IP address, subnet mask, and (if applicable) the gateway address for the unit. You may have to contact the network administrator for your organization to obtain this information.

NOTE: Operation of the QMT-1 is not possible without the information requested above.

2. Provide the proper primary power for the unit.
3. Interconnect the unit with the communications system via the QMT-1's rear panel connectors. J7 provides the audio and control lines necessary to interface the QMT-1 to your voting receiver and any system transmitter.
4. Configure the unit's operational parameters per the Configuration section of this manual.
5. Connect the unit to your Ethernet network using the supplied Ethernet cable per Section 2.7.4 Network Connection, J3
6. Set the input and output audio levels per Section 4.4.2 Input/Output Level Adjustments.

The QMT-1 is then ready to use.

2.5 Installation Considerations

Careful attention to the following installation suggestions should result in the best unit/system performance. Figure 2-1 provides overall unit dimensions.

The QMT-1 must be installed in a structure that provides both protection from the weather and assurance of ambient temperatures between -20 and +60 degrees C. When the unit is mounted in a cabinet with other heat-generating equipment, the use of a rack blower is suggested to keep the cabinet interior temperature rise to a minimum.

NOTE: If the QMT-1 is installed in a high RF environment such as repeater system or other transmitter site, it is recommended that all cable assemblies be individually shielded, with the shield grounded to the ground pin on the terminal block for that module. For all D-subminiature connector cable assemblies, cable shields should be connected to connector shells so that they make contact with the grounded D-subminiature connector shells on the QMT-1.

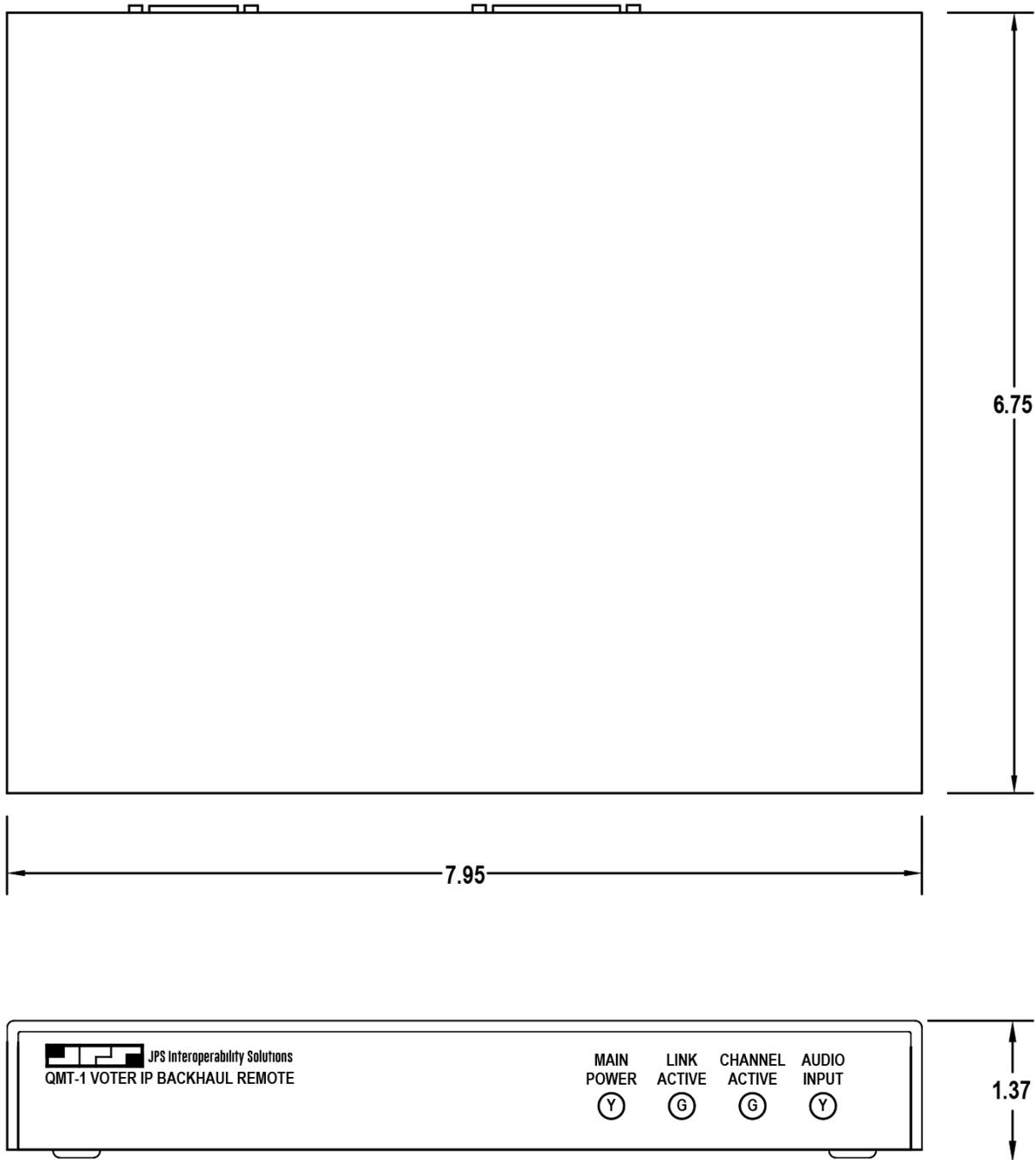


Figure 2-1 Outline Dimensions

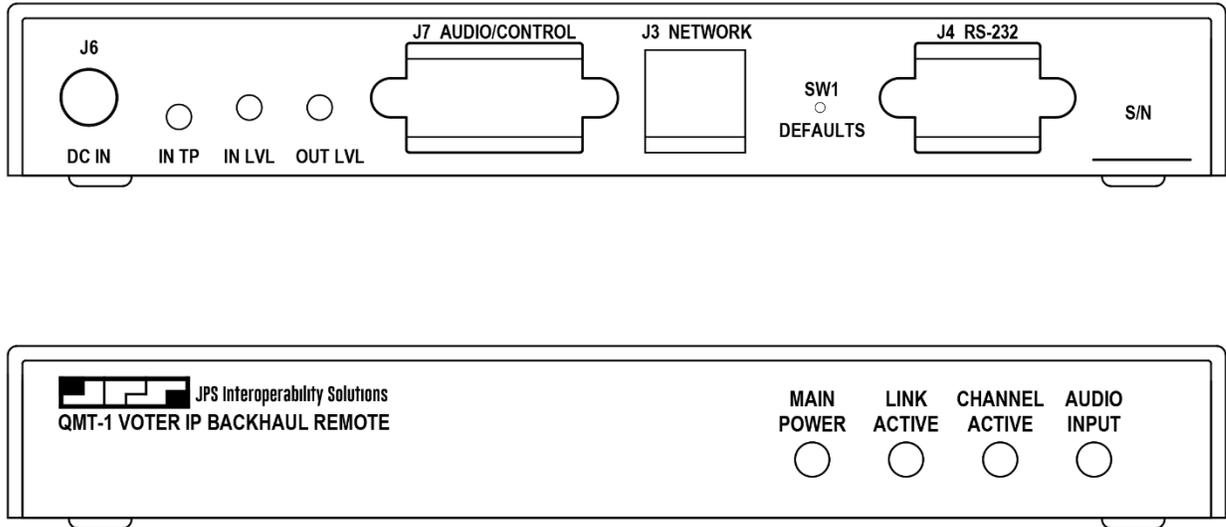


Figure 2-2 Control and Connector Locations

2.5.1 Power Requirements

The QMT-1 is designed to operate from a nominal +12V DC supply. The unit will meet all of its specifications over a voltage range of +11 to +15 VDC and will be damaged by a DC source that delivers a constant (non-transient) DC voltage above this range. The DC power consumption is 500 mA maximum. The AC adapter provided with the unit meets these specifications.

The QMT-1 is a microprocessor-controlled device. As with any such equipment, a very short loss of power can cause operational problems and/or cause the unit to reset. The communications link will be inoperable during the reset period. JPS recommends the QMT-1 and associated equipment be connected to an AC power source that utilizes an uninterruptible power system (UPS). If the overall site does not have UPS capability, the QMT-1 should be plugged into a smaller UPS, such as those used for personal computer systems

2.6 Installation Checklist

<i>Table 2-1 Basic Installation Checklist</i>	
Determine QMT-1 network parameters such as IP address, subnet mask, and gateway address.	You must assign these values. If you are not sure how to determine these values, see the network administrator for your organization.
Provide suitable power for the device.	See section 2.5.1 Power Requirements.
Make interconnections.	See Section 2.7.2 Audio Level Adjustment Potentiometers and Input Test Point for External Interconnect Information.
Configure QMT-1 parameters.	See Section 3 Configuration.
Adjust audio levels.	See Section 4.4.2.

2.7 Rear Panel Adjustments and Connectors

Refer to Figure 2-2 for a view of the QMT-1 Rear Panel. All rear panel connectors and adjustment potentiometers are explained in the section below, starting at the left side of the panel.

2.7.1 DC Input Connector, J6

The QMT-1 operates on a nominal +12 VDC. The power is applied through J6 via the “Wall Cube” AC adapter provided with the unit.

2.7.2 Audio Level Adjustment Potentiometers and Input Test Point

A test probe may be inserted into the test point to measure the level of the incoming audio. See Section 4.4.2 for input and output audio level setting instructions.

2.7.3 Connection to Radio (J7)

The interface between the QMT-1 and associated radio is made via rear panel J7 (Audio/Control). J7 is a female DB-15 connector. A mating male connector is included in the accessory kit.

Note: An *Audio Crossover Adapter*, part number **0313 080515** is included with the QMT-1. It provides a crossover of transmit and receive audio as well as COR and PTT control signals. *You need this adapter only if you use one of the JPS custom radio interface cables*

<i>Table 2-2 QMT-1 Pinout (J7)</i>		
PIN	Signal	Description
1	Ground	Ground connection.
2		Not used.
3		Leave Unconnected
4		Leave Unconnected
5	Ground	Ground connection.
6	Audio Input +	Balanced audio input.
7	Analog Ground	Analog ground.
8	Audio Output	Unbalanced Audio output.
9		Not used.
10		Leave Unconnected
11		Leave Unconnected
12	COR Input	Input from radio COR, programmable active high or low.
13	PTT Out	Output to radio PTT, active low, open drain.
14	Audio Input -	Balanced audio input.
15	Analog Ground	Analog ground.

2.7.4 Network Connection, J3

The QMT-1 is connected to the Ethernet network via rear panel connector J3 using a standard RJ-45 Ethernet Patch Cable (non-crossover). A six-foot long cable is included with the unit.

3 Configuration

3.1 General

This section explains all settings and level adjustments that configure the QMT-1. It is not necessary to remove the QMT-1 cover to configure the unit.

Like the CPM-3 and SVM-3, the QMT-1 is configured by browsing to the unit. There are two pages, the first page provides configuration and status information.

The screenshot shows the QMT-1 Configuration page with the following settings:

- Unit Name: Conference Room
- Firmware version: QMT-1 V0.35
- MAC address: 00:0e:1a:00:5f:02
- Operating Mode: Normal
- IP address: 192.168.16.23
- Subnet mask: 255.255.255.0
- Gateway: 0.0.0.0
- QMT-1 Cmd port: 23
- QMT-1 RoIP port: 1221
- QMT-1 Sync Port: 319
- SVM-3 IP: 192.168.16.123
- SVM-3 RoIP Port: 1221
- SVM-3 Sync Port: 3000
- Vocoder: 6. SNV-12 IP
- Squelch Type: High active COR (H/W)
- COR inhibit time: 0
- COR hang time: 0
- Duplex mode: Half
- ECHO enabled: YES
- TX Delay (ms): 0
- Input Boost: No boost
- Security level: 0

UDP Link Status		Time Statistics		Audio Packet Count			Test Tone
RoIP Link	Time Sync	QMT-1 Up Time	Connect Time	Sent	Received	Missed	Generator
Up	Up	1 days, 11 hours, 31 minutes, 38 seconds	1 days, 11 hours, 31 minutes, 35 seconds	217	0	0	<input type="button" value="Start"/>

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Figure 3-1 QMT-1 Information Page

On the QMT-1 *Information* page there is a button that enables/disables a 1000 Hz Test Tone. If the QMT-1 is connected to an SVM-3 (RoIP Link Up), then pressing “Start” will cause the QMT-1 to begin sending RoIP packets to the SVM-3 that contain a 1000 Hz Test Tone. The tone level is set to correspond with what a properly adjusted input level to the QMT-1 should be. If the voter at the SVM-3 site is operating the test tone can be heard on the CIM-2A front panel speaker. After the “Start” button is pressed, it will become a “Stop” button. Pressing “Stop” turns off the Test Tone.

All QMT-1 configuration items are found on the *Configuration* page.

NOTE: The QMT-1 comes from the factory configured with the following default settings:

IP Address: 192.168.1.200
 Subnet Mask 255.255.255.0
 Gateway IP 0.0.0.0

The screenshot shows the 'Configuration' page for a QMT-1 device. The page has a blue header with 'QMT-1' repeated. Below the header, there are two tabs: 'Information' and 'Configuration'. The 'Configuration' tab is active. The settings are organized into two columns:

- Left Column:**
 - QMT-1 Name: Conference Room
 - IP Address: 192 . 168 . 16 . 23
 - Gateway: 0 . 0 . 0 . 0
 - QMT-1 Sync Port: 319
 - SVM-3 IP: 192 . 168 . 16 . 123
 - SVM-3 Sync Port: 3000
 - Vocoder: 6. SNV-12 IP
 - COR Inhibit (ms): 0
 - Duplex: Half
 - TX Delay (ms): 0
- Right Column:**
 - Operating Mode: Normal
 - Subnet Mask: 255 . 255 . 255 . 0
 - QMT-1 RoIP Port: 1221
 - QMT-1 Cmd Port: 23
 - SVM-3 RoIP Port: 1221
 - Squelch Type: High active COR (H/W)
 - COR Hangtime (ms): 0
 - RX Boost Mode: No boost

At the bottom of the configuration area, there are two buttons: 'Save Changes' and 'Clear Changes'. Below the buttons is the copyright notice: 'Copyright © 2018 JPS Interoperability Solutions Inc. All Rights Reserved'.

Figure 3-2 Configuration Page

3.2 QMT-1 Configuration Selections

3.2.1 QMT-1 Name:

This entry allows the operator to give the QMT-1 a unique name. Not required.

3.2.2 Operating Mode:

The QMT-1 Operating Mode selection is used by the factory to put the unit into test mode. This selection should be left on *Normal*.

3.2.3 IP Address:

This is the IP Address assigned to the QMT-1. Setting this address to 0.0.0.0 will cause the QMT-1 to attempt to use DHCP to automatically obtain an IP address. Whenever this address is changed the QMT-1 will reboot.

3.2.4 Subnet Mask:

The Subnet Mask is used to configure the IP Subnet the QMT-1 operates in. This is generally assigned by IT personnel. Changing the Subnet Mask will cause the QMT-1 to reboot.

3.2.5 Gateway:

This is usually the address of the router the QMT-1 is connected to. The *Gateway* is the IP address the QMT-1 will go to whenever it attempts to send a packet out of its own Subnet. Changing the Gateway setting will cause the QMT-1 to reboot.

NOTE: To restore the factory default conditions (including network parameters, and therefore helpful if the current IP address is forgotten), remove and reapply power to the unit while rear panel switch “SW1” (*DEFAULTS*) is depressed. When the front panel LED’s have blinked, release the switch, and the unit will be operational using the JPS factory default parameters.

Any previously assigned user parameters will be lost during this process.

3.2.6 QMT-1 RoIP Port:

This is the UDP port that the QMT-1 will use to send and receive RoIP audio packets.

3.2.7 QMT-1 Sync Port:

This is the UDP port that the QMT-1 will use to send and receive TimeSync packets.

3.2.8 QMT-1 Cmd Port:

This is the port which the QMT-1 uses for Telnet activity.

3.2.9 SVM-3 IP:

This is the IP address of the SVM-3 which the QMT-1 is to connect to. The SVM-3 IP address is usually static and assigned by IT personnel. Setting this address to 0.0.0.0 will put the QMT-1 in idle operation and will prevent it from attempting to contact and link with the SVM-3.

3.2.10 SVM-3 RoIP Port:

This is the UDP RoIP port of the SVM-3 where the QMT-1 will attempt to create an audio link.

3.2.11 SVM-3 Sync Port:

This is the UDP Time Synchronization (TimeSync) port of the SVM-3. The QMT-1 will send a TimeSync query packet to this port after it has established a RoIP audio link.

3.2.12 Vocoder:

This is the audio compression encoder/decoder that the QMT-1 is set to use. It must be set to the same Vocoder as the SVM-3. Currently only Vocoder #6 (64Kbps uLaw) is used.

3.2.13 Squelch Type:

This is set to the type of squelch the receiver provides. Options are Hardware COR (active low or active high, configurable), 1950 Hz Pilot Tone and 2175 Hz Pilot Tone.

3.2.14 COR Hangtime:

This is the period of time the QMT-1 will continue to assume COR is present after the receiver has stopped reporting COR. This is typically set to 0 unless the audio is delayed by the receiver and would be otherwise cut off. The allowable range for COR Hangtime is 0-1000ms. Typically left at 0ms.

3.2.15 Duplex:

If the remote site has a voting receiver only, set to Half Duplex. If there is also a transmitter at the site that will use TX audio and PTT Active from the SNV-12 via the QMT-1, set to Full Duplex.

3.2.16 RX Boost Mode:

The QMT-1 has a receive audio dynamic range of -30 to +10 dBm and is adjusted by a potentiometer accessed through the QMT-1 rear panel. The RX Boost mode is normally left OFF, however if the receiver audio level is low enough to require it, the RX Boost mode can be enabled to bring the RX audio up to an acceptable level.

3.2.17 TX Delay:

This is the number of ms the QMT-1 will delay transmitting audio to the radio after it has initiated PTT. Add TX delay if a slow-to-key transmitter cause clipping of initial syllables of transmissions. Most modern transmitters do not require much if any TX Audio Delay.

3.2.18 Restoring Factory Defaults

The QMT-1 allows the user to restore the original factory default operating conditions. This may be useful if the unit has been incorrectly configured, and it is necessary to return to a well-defined state. To restore the factory default conditions, the power to the unit needs to be removed and restored while rear panel switch “SW1” (*DEFAULTS*) is depressed. When the front panel LED’s have blinked, the switch may be released, and the unit will be operational using the JPS factory default parameters. The IP address will return to “**192.168.1.200**”, which will allow web configuration. All other previously assigned user parameters will be lost during this process.

3.2.19 Store Setup Changes with SAVE Command

If any configuration changes have been made, click on the “SAVE CHANGES” button to store these new settings in memory. Depending on the changes made, the QMT-1 may automatically restart.

3.3 I/O DESCRIPTIONS

This section provides detailed explanations of the QMT-1's audio interfaces and its parallel control inputs and outputs.

3.3.1 Audio Input

The QMT-1 audio input is 47K ohm, balanced. It can be used as an unbalanced input by grounding one half of the balanced pair and connecting the single-ended input to the remaining half. The use of balanced inputs and shielded cables is recommended for superior immunity to noise.

The audio input will accept signal levels from -30 to $+11$ dBm. Internal circuitry is used to amplify or attenuate this input as necessary to optimize the level to the DSP. The signal level is adjusted by the IN LVL potentiometer accessible from the rear panel. The input is set to -10 dBm when shipped. This means the IN LVL potentiometer is adjusted so that an audio input of -10 dBm provides the correct level to the DSP circuitry.

3.3.2 Audio Input Test Point

Access to an audio test point, TP1, is provided via the rear panel so the actual audio signal voltage applied to the A/D converter can be measured with an AC voltmeter. The correct level for best operation as measured at TP1 is about 0.2V or -12dBm (600-ohm reference.)

3.3.3 Audio Output

The audio output from the QMT-1 is a low impedance (10 ohm) unbalanced AC coupled output. The output level is adjusted by the OUT LVL potentiometer accessible from the rear panel. This output provides a -10 dBm nominal level; $+15$ dBm clipping into a 600-ohm load. The audio output will supply signal levels from -30 to $+11$ dBm.

3.3.4 COR Input

The COR input to the QMT-1 is a high impedance input and can be programmed to be active high or active low. In the active low configuration, the input is pulled up to $+5\text{V}$ DC internally through a 47K ohm resistor. In the active high configuration, the input is pulled down to ground through a 22K ohm resistor. The logic threshold is 2.5V DC nominal, and the input is protected from momentary surges up to $+100\text{V}$ DC.

3.3.5 PTT Output

The PTT output from the QMT-1 is an open drain type. It can sink up to 100 mA of current, and can withstand open-circuit voltages up to $+60\text{V}$ DC. In order to avoid conflicts with internal pull-up resistors on the PTT lines of some radio equipment, there is no internal pull-up resistor on the QMT-1 PTT output.

End of Section Three

4 Operation

4.1 General

This Section contains information and instructions required for proper operation of the QMT-1. Refer to Figure 2-2 Control and Connector Locations for views of controls and connectors.

4.2 Front Panel Indicators

All front panel indicator LEDs are explained below, starting at the left side of the unit.

4.2.1 Power LED

This yellow LED is lit whenever DC power is applied to the unit.

4.2.2 Link Active LED

The green Link Active LED is illuminated whenever the QMT-1 has an IP connection open to a companion SVM-3 module. If this indicator is not lit, either the QMT-1 does not have an active VoIP connection or the connection has been lost.

4.2.3 Channel Active LED

This green LED is lit whenever COR is active. This also indicates that the QMT-1 is sending audio data across the IP link.

4.2.4 Audio Input LED

This yellow LED is provided as a visual aid in setting the proper input audio level for optimal operation. See Section 4.4.2 Input/Output Level Adjustments for instructions.

4.3 Rear Panel Connectors, Adjustments and Level Potentiometers

Section 2.7 Rear Panel Adjustments and Connectors contains full explanations and pin-outs for all rear panel connectors. Figure 2-2 displays connector locations.

4.4 QMT-1 Operation

Basic operation and control of the QMT-1 is discussed in the following paragraphs. These instructions assume the QMT-1 has already been correctly set up per Section 3 Configuration.

4.4.1 Operation at Power-Up

When the units have been connected and configured and are attached to the network the client will automatically connect to the SVM-3 when power is applied.

4.4.2 Input/Output Level Adjustments

At this point, the audio input level to the QMT-1 may be set by adjusting the IN LVL control on the rear panel. With normal audio input applied at J7, adjust the IN LVL control until the AUDIO INPUT indicator flashes on voice peaks. The OUT LVL control sets the audio output level from the QMT-1 and may be adjusted to the level suitable for the equipment connected to the unit. Input level adjustments should first be made with the “Audio Boost” selection OFF. If more input gain is needed, set “Audio Boost” to ON and re-adjust the input level.

The proper audio input level may also be set by connecting an AC voltmeter to the test point TP1 on the rear panel and adjusting the IN LVL control for an average audio level of about 0.2V or –12dBm.

4.4.3 COR Input Description

The COR input on J7 controls the flow of data across the network. When COR is not active the units will send a keep-alive packet every 4 seconds just to keep the connection from timing out. If a unit has an active COR input, that unit’s audio input will be transferred across the network to the SVM-3.

End of Section Four

5 QMT-1 Troubleshooting

Table 5-1 Troubleshooting Table

<u>Symptom:</u>	<u>Possible Causes:</u>
Main Power LED is not illuminated	Check that AC adapter is operational and firmly plugged in.
SVM-3 and QMT-1 units are properly configured and online but LINK ACTIVE is not on.	<p>Verify that both the SVM-3 and QMT-1 units are “visible” on the network by “pinging” their IP addresses from a network-connected computer.</p> <p>Verify that the SVM-3’s IP address, RoIP Port, and Sync Port have been programmed into the QMT-1 via the QMT-1 web configuration page.</p> <p>Verify that the RoIP PORT has not been changed from the default value of 1221, or if it has, make sure the PORT value is the same on both QMT-1 and SVM-3.</p> <p>Verify that the SVM-3 Sync PORT has not been changed from the default value of 3000, or if it has, make sure the Sync PORT value is the same on both QMT-1 and SVM-3.</p> <p>Verify that any network firewalls in place allow traffic on UDP ports 1221 and 3000.</p> <p>Verify that another QMT-1 client is not already connected to the SVM-3.</p>
LINK ACTIVE is on, but no audio is transmitted.	Verify that the COR line is active. Audio is only transmitted when COR is active.
CHANNEL ACTIVE indicator is on continuously.	<p>Verify that the COR polarity is programmed properly. See section 3.3.8.</p> <p>If QMT-1 is attached to a radio COR line, make sure the radio squelch is set properly.</p>
Audio has pauses and/or gaps in it.	Check for low bandwidth or excessive latency on the network by running a trace route from a network-connected PC to the QMT-1 at the other end of the link.

End of Section Five

6 QMT-1 FAQ (Frequently Asked Questions)

6.1 General

This section provides answers to some frequently asked questions about the installation and operation of the QMT-1.

How much network bandwidth does the QMT-1 consume?

The QMT-1 bandwidth usage varies depending on the application. When COR is inactive and no audio is being transmitted across the link, the bandwidth usage is essentially zero, since a small “keep-alive” packet is only sent every 4 seconds. When COR is activated and the default voice compression method is used, audio will be sent across the link at approximately 70Kbps, with metadata overhead bringing throughput up to as high as 100Kbps. If a full-duplex connection is active (transmitter as well as voting receiver at the remote site) then the total bandwidth usage will be approximately 200Kbps.

Can I use the QMT-1 on a dialup connection?

No. The QMT-1’s network connection is via Ethernet. Most dialup (telephone line) modems only provide RS-232 connections, but even if an Ethernet connection to a dialup is available, the QMT-1 may not operate properly since the connection speed is not guaranteed on a dialup connection. Poor telephone lines or varying line conditions may cause a dialup modem to reduce its connection speed without the user being aware of this condition. For this and other reasons, dialup connections are not supported by the QMT-1.

I have a 100 Mbps (or gigabit) Ethernet. Can I connect the 10 Mbps port on the QMT-1 to my network?

Most network equipment (hubs, switches, routers) will work with either 10Mbps or 100Mbps connection, so it should work without any problems. Check with your network administrator if you’re unsure about your network equipment capabilities.

Where can I find a description of the VoIP protocol used by the QMT-1?

The QMT-1 protocol is proprietary and not available to end-users.

My system uses pilot tones. Does the QMT-1 support them?

Yes. Pilot are supported. You must select 1950 Hz Pilot Tone or 2175 Hz Pilot Tone in the Squelch Type menu on the QMT-1 web configuration page.

After losing power on one end of an QMT-1 link, it takes a while for the units to re-establish communications. Why is this?

The QMT-1 will wait up to 20 seconds before determining that the link has been disconnected. After that, it will attempt to close the IP connection, which may take several seconds. Then it has to open a new connection. This process may take 30 to 45 seconds, depending on your network.

What is the difference between a static IP address and a dynamic IP address?

On an IP network such as the Internet, the IP address is like a phone number. It is a unique number that identifies the network device, and it allows connections to be made between network devices. There are two kinds of IP addresses, those that are permanently assigned and those that are assigned temporarily. Permanently assigned IP addresses are called static IP addresses, while temporary IP addresses are called dynamic IP addresses. Static and dynamic IP addresses work the same way, but a dynamic IP address is like having a telephone number that nobody else knows; it effectively limits you to making outgoing calls only.

Why do we need static and dynamic IP addresses? Why not just assign addresses permanently like phone numbers?

One problem with IP addresses is there are not enough to go around. There are "only" about 4 billion IP addresses available. On the surface that would appear to be enough, but some companies use a lot of them, the military uses a lot of them, and all the millions and millions of people using the Internet use a lot of them. To ease this problem, many Internet providers only assign an IP address to a computer when someone actually dials in to connect to the Internet. When they disconnect, the IP address goes back into the pool of addresses so someone else can use it. This makes sense in cases where computers might sit for a long time without needing to access the Internet, as there is no point in tying up an IP address when it's not being used. There are plans for an upgraded IP addressing system that will fix the problem of too few IP addresses, but for now it is a limitation we must live with.

What kind of IP address does the QMT-1 need?

The QMT-1 can have either a static or dynamic IP address. Only the SVM-3 requires a static IP address.

Who assigns IP addresses?

For Internet access, your Internet Service Provider (ISP) will assign IP addresses to you. If you are on a private network, (like a WAN or LAN) then your network administrator will assign IP addresses. You should never program an IP address into an QMT-1 without checking with the ISP or network administrator first.

What happens if two QMT-1s have the same IP address (or an QMT-1 has the same address as some other device)?

Bad things will happen. Well, that's a bit of an exaggeration, but obviously it will not work properly. Both units will respond at the same time, causing network errors. The extreme case would be if an QMT-1 is programmed to have the same IP address as an existing computer on the same network. This would likely render that computer unusable for network functions, and could cause other users to have problems as well. The bottom line is that two devices on the same network cannot share the same IP address.

What is a firewall?

A firewall is a device that prevents people outside of a network from accessing computers of devices inside the network. It's a security device. For example, a company firewall prevents incoming network connections, so no one outside the company can access the company's computers via the Internet.

How does a firewall affect the QMT-1?

Since the QMT-1 initiates the link to the SVM-3, a firewall typically does not interfere with it.

Should I use a firewall with the QMT-1?

Strictly speaking from the standpoint of the QMT-1, there is no reason to use a firewall with the QMT-1. The QMT-1 is a stand-alone network device which poses minimal security risks. However, if the network the QMT-1 is on is shared with computers, servers, or other network devices, then a firewall may be advisable. Talk to your network administrator about such situations.

What do I do if my network has a firewall?

If the SVM-3 is behind a firewall, then the SVM-3's RoIP port needs to be opened on the firewall for UDP. This is called "opening a hole in the firewall" and should only be done by (or with the cooperation of) the network administrator. This will allow UDP packets through the firewall so they can be received by the server unit. There is no security risk in doing this since the QMT-1 cannot be made to access files or forward information to or from other systems. Likewise, the QMT-1 "Sync" port should be opened on the firewall for UDP. This allows the QMT-1 to establish and maintain a TimeSync with the SVM-3.

The QMT-1 does offer some limited Telnet configuration support. The QMT-1 Telnet port is called the "Cmd" port. If this port is to be used, then the port needs to be opened in the firewall for TCP.

If the QMT-1 is behind a firewall, then nothing needs to be configured on the firewall. Most firewalls will allow traffic back through them that is related to a connection that was initiated by a computer on its network.

What is NAT?

NAT (Network Address Translation) is a scheme by which many network devices can share one IP address. The NAT router translates packets passed through it between the single public IP address it holds and the private IP addresses used by devices on its network. This means that no computers behind the NAT router are directly accessible from outside the network since none of them have public (or routable) IP addresses.

How does NAT affect the QMT-1?

Using NAT does not directly affect the operation of the QMT-1. Special considerations should be made only in the event that multiple server units will be located behind a NAT router. In that case, each unit will need to be assigned a different VoIP port and the NAT router configured to allow both TCP and UDP traffic for the VoIP ports of all the units behind it. Client units are not affected by NAT and no special considerations need be made.

Should I use NAT with the QMT-1?

The only time it is advisable to use NAT with the QMT-1 is when you wish to have multiple units on a network, but have only one public IP address. An example of this would be a bank of QMT-1s sharing a broadband type connection such as DSL or cable modem where only one IP address is allocated by your ISP.

I've connected my radio to the QMT-1, I have the levels turned all the way up, and can still barely hear the audio. What's wrong?

The QMT-1 uses balanced audio on the input. If, instead of connecting to both balanced input lines, you connect your audio to one audio input and ground, you'll get the effect described above. There is enough leakage in the transformer to get some audio through, but it won't work properly. The solution is to ground one side of the QMT-1 balanced input.

I've connected my radio to the QMT-1 and it works, but the audio sounds very "tinny" and doesn't have much bass.

Make sure you haven't used the discriminator output, which is sometimes available on FM receivers and transceivers. Discriminator audio is pre-emphasized, and there is no de-emphasis circuitry in the QMT-1. You'll need to use your regular audio output instead.

End of Document