Welch Allyn®
QTEL RMS

REHABILITATION MANAGEMENT
SYSTEM

SERVICE MANUAL

⚠ *CAUTION:* *Federal law restricts this device to sale by or on the order of a physician*

For patent information, please visit www.welchallyn.com/patents

For information about any Welch Allyn product, visit: https://www.welchallyn.com/en/about-us/locations.html

Customer Service and Technical Support: https://www.welchallyn.com/en/other/contact-us.html 1.888.667.8272,

mor_tech.support@hillrom.com

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901145 REHABILITATION MANAGEMENT SYSTEM

Welch Allyn, Inc.
4341 State Street Road
Skaneateles Falls, NY 13153 USA

www.welchallyn.com

EC **REP** EU IMPORTER

Welch Allyn Limited
Navan Business Park, Dublin Road,
Navan, Co. Meath C15 AW22
Ireland

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1. GENERAL STATEMENTS

Manual Purpose

The purpose of this manual is to supply information to service personnel in order to maintain and service the Q-Tel System. This manual is intended to function primarily as a guide to preventative maintenance and repair.

Disposal

This product and its accessories must be disposed of according to local laws and regulations. Do not dispose of this product as unsorted municipal waste. For more specific disposal information see www.welchallyn.com/weee

2. NOTICES

Manufacturer's Responsibility

Welch Allyn, Inc. is responsible for the effects on safety and performance only if:

• Assembly operations, extensions, readjustments, modifications, or repairs are carried out only by persons authorized by Welch Allyn, Inc.

• The device is used in accordance with the instructions for use.

Responsibility of the Customer

The user of this device is responsible for ensuring the implementation of a satisfactory maintenance schedule. Failure to do so may cause undue failure and possible health hazards.

This manual must be kept in a safe place to prevent its deterioration and/or alteration. The user and Welch Allyn, Inc. authorized personnel must have access to this manual at any time.

The user of this device must periodically check the accessories, their functionality and integrity.

Equipment Identification

Welch Allyn, Inc. equipment is identified by a serial and reference number on the bottom of the device. Care should be taken so that these numbers are not defaced.

Copyright and Trademark Notices

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Notice to EU Users and/or Patients

Any serious incident that has occurred in relation to the device, should be reported to the manufacturer and the competent authority of the Member State in which the user and/or patient is established.

3. WARRANTY INFORMATION

Limited Warranty Statement

Welch Allyn warrants that the Welch Allyn Q-Tel RMS you have purchased meets the labeled specifications of the product and will be free from defects in materials and workmanship that occur within 1 year after the date of purchase. Accessories used with the Product are warranted for 90 days after the date of purchase.

The date of purchase is: 1) the date specified in our records, if you purchased the Product directly from us, 2) the date specified in the warranty registration card that we ask you to send to us, or 3) if you don't return the warranty registration card, 120 days after the date on which the Product was sold to the dealer from whom you bought the Product, as documented in our records.

This warranty does not cover damage caused by: 1) handling during shipping, 2) use or maintenance contrary to labeled instructions, 3) alteration or repair by anyone not authorized by Welch Allyn, and 4) accidents.

You assume all responsibility for the use of the Product with any accessory that does not meet the requirements described in the Product documentation.

If a product or accessory covered by this warranty is determined to be defective because of defective materials, components, or workmanship, and the warranty claim is made within the warranty period described above, Welch Allyn will, at its discretion, repair or replace the defective Product or accessory free of charge.

You must obtain a return authorization from Welch Allyn to return your Product before you send it to Welch Allyn's designated service center for repair.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. WELCH ALLYN'S OBLIGATION UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF PRODUCTS CONTAINING A DEFECT. WELCH ALLYN IS NOT RESPONSIBLE FOR ANY INDIRECT OR CONSEQUENTIAL DAMAGES RESULTING FROM A PRODUCT DEFECT COVERED BY THE WARRANTY.

4. USER SAFETY INFORMATION

⚠️ **WARNING:** This alert identifies hazards that may cause serious personal injury or death.

⚠️ **Caution:** This alert identifies hazards that may cause minor personal injury, product or property damage.

NOTE: This manual may contain screen shots and pictures. Any screen shots and pictures are provided for reference only and are not intended to convey actual operating techniques. Consult the actual screen in the host language for specific wording.

⚠️ **WARNING(S)**

- **WARNING! Restricted use.** The Q-Tel RMS System is intended for use in a hospital or clinical setting by trained and authorized personnel who are acting on the orders or under the supervision of a physician. The system is intended as a complement to, not a substitute for, patient observation by health care professionals. Q-Tel RMS should not be used for unintended activities.

- **WARNING! Use only Welch Allyn approved equipment.** Use of accessories or cables other than those specified, with the exception of accessories or cables sold by Welch Allyn as replacement parts for internal components, may result in increased emissions or decreased immunity of the system. Use only Welch Allyn-approved and specified parts and accessories. Use of other parts can degrade performance and/or safety and may void warranty or contract coverage.

- **WARNING! Restricted use.** The Q-Tel RMS system needs special precautions regarding EMC and needs to be installed and put into service according to the guidelines of the EMC declaration tables.

- **WARNING! Audible alarms.** Do not connect any devices to the Aux input on the speakers as this may mask an audible alarm.

- **WARNING! Audible alarms are not available during a power failure.** During a power outage, the audible alarms may not function; discharge all patients.

- **WARNING! The *Lead Off* condition disrupts the alarm function.** The arrhythmia alarm detection system must have all leads properly connected to the patient in order to function correctly. If a lead-off condition occurs and the *Lead Off* alarm displays, reattach the lead as soon as possible.

- **WARNING! RF Interference.** Portable and mobile RF communications equipment may affect the Q-Tel RMS system. Observe the recommended separation distances in the EMC declaration tables.

- **WARNING! Improper system performance.** The Q-Tel RMS system should not be used adjacent to or stacked with other equipment. If adjacent or stacked use is necessary, observe the Q-Tel RMS system to verify normal operation in the configuration in which it will be used.

- **WARNING! Review default settings.** For optimal patient safety, all operators and clinicians using the system must review the system default settings periodically.

- **WARNING! Explosion hazard.** This instrument is not approved for use and must not be operated in the presence of flammable anesthetics.

- **WARNING! Shock hazard.** Do not place fluids on top of the system. Never spill liquid of any kind on this product. Connectors are not fluid proof. Fluid spilled onto the internal parts of the system can create an electrical hazard. If fluid enters the system, turn off the power immediately and call Technical Support. Do not use until the interior has been cleaned and tested. Water tight boots are commercially available, if needed, for your facility's environment.

- **WARNING! Shock hazard.** Do not use spray on liquid cleaners/aerosol cleaners. Only use damp cloth for cleaning.

- **WARNING! Shock hazard.** Do not use this product near water.

- **WARNING! Possible injury or system damage.** Do not place this product on an unstable cart, stand, or table. This product may fall, causing serious damage to the product or to a person nearby.

- **WARNING! Visual inspection required.** Visually inspect the system periodically to verify functionality. Be aware of and correct any system issues that can affect correct operation and full functionality, such as inoperable hardware, out of adjustment hardware, powered off hardware, or system error messages. Before each use of the equipment, visually check all connector cables and the power receptacle. Make sure all power cables are plugged in securely. Check for worn or damaged plastic coverings, frayed or broken wires, cracked connections, and other signs of damage. Do not operate the equipment if the integrity of these items is in question.

- **WARNING! Monitor system data.** Q-Tel RMS provides ECG monitoring data. The operator must be aware of the meanings of this data and the patient's condition to ensure that the patient is not over-exerted during the rehab session.

- **WARNING! Monitor system data.** Network slowdowns and system failures may delay or disable the display of ECG waveforms and visual alarms on network-connected Q-Tel RMS Workstations. Alarm volumes should be set sufficiently loud on the Q-Tel RMS Tower to be heard adequately over the entire rehab facility. The towers are the primary source of alarm notification. ECG waveforms displayed on the Workstation that are not being updated should not be relied upon for current patient status.

⚠ Caution(s)

- **Caution: UPS software is not compatible with Q-Tel RMS.** Do not install the UPS software that comes with the UPS device.

- **Caution: Connect only the computer, monitor, and HUB to the UPS.** Do not connect any components, other than the computer, monitor, and HUB into the UPS. See the Q-Tel RMS Main Tower block diagram.

- **Caution: System damage.** Do not obstruct the air holes on the unit. Improper ventilation and air flow could cause the unit to overheat, resulting in automatic shutdown. Slots and openings in the cabinet and the back or bottom are provided for ventilation. To ensure reliable operation of the product and to protect it from overheating, do not block or cover these openings. Do not place the product on a rug or similar surface that may block ventilation openings. Never place this product near or over a radiator or heat register. Do not place this product in a built-in installation unless proper ventilation is provided.

- **Caution: Possible interference.** Other electrical devices used on or near patients connected to this device can cause arrhythmia-like artifact on ECG recordings or displays. Those devices, that induce or pass current through the body, can be checked as a possible source of artifact by turning them off while obtaining the diagnostic ECG waveforms on this device.

- **Caution: Network failure.** The Q-Tel RMS system monitors network connections and notifies the user via a message window if a network failure is detected. If a network issue causes a Q-Tel RMS Workstation to be disconnected from the Q-Tel RMS Towers, the Workstation will cease to be functional. Immediately check the system network, and correct any dislodged network plugs, power-down conditions or other failures. Re-establishing the network connection and any needed link within a few minutes of the failure will allow activities in Patient Information and Charting and Editing to continue without shutting down and restarting the Q-Tel RMS Workstation application.

- **Caution: Session storage at capacity.** Sessions that are stored to the hard drive will cause the device to fill over time. Each hour-long exam session with full disclosure data will use approximately 12 MB of storage. Over time the Q-Tel RMS database will fill with patient data. See the Purge and Archive section for instructions on maintaining system performance and allowing for continued storage of new session data.

Electrical Safety

The electrical safety of this product has been considered in its design and production. Welch Allyn medical products are designed to comply with applicable national and international electrical codes.

- **WARNING! Shock hazard.** Do not use spray on liquid cleaners/aerosol cleaners. Only use damp cloth for cleaning.

- **WARNING! Possible injury or system damage.** The product should be operated from the type of power source indicated on the marking label. If you are not sure of the type of power available, consult your dealer or local power company.

- **WARNING! Shock hazard.** Never push objects of any kind into this product through cabinet slots as they may touch dangerous voltage points or short out parts that could result in a risk of fire or electric shock.

- **WARNING! Electrical hazard.** Do not connect additional multiple portable socket outlets (outlet strips) or extension cords to the Q-Tel RMS system.

- **WARNING! Electrical hazard.** Use only the medical grade power cords supplied with your system. Plug the system only into a grounded power outlet.

- **WARNING! Power cords and system cables.** Do not allow anything to rest on the power cord or cables. Do not locate this product where persons will or can walk or trip on the cord or cables.

- **WARNING! Power cords and system cables.** Do not let the cables get caught in the treadmill or other exercise device mechanism.

- **WARNING! Patient protection.** The Q-Tel RMS equipment was not designed to be used in the environment where the patient is undergoing a medical procedure as defined in IEC 60601-1-1 (1.5 m from the patient). The use of an isolation transformer between mains and Q-Tel RMS is required but is not a sufficient safety measure for use in the patient environment because of data connections (antenna network, data network) that might cause excessive leakage currents in some conditions. Additional separation devices may be required. Any equipment that has a physical connection between Q-Tel RMS and that is in the patient environment (e.g. laser printer and any powered components) must have additional protection against electrical shock (e.g., an Isolation Transformer and/or a separation device between the equipment and Q-Tel RMS) in order to be in compliance with IEC 60601-1 or equivalent safety standards.

- **WARNING! Possible improper system performance.** Do not connect items that are not specified as part of the Q-Tel RMS system to a Q-Tel RMS Tower or Workstation. Set up the Q-Tel RMS Tower or Workstation as described in the installation instructions and maintain that configuration.

- **Caution: Electrical hazard.** The maximum permitted load for the optional isolation transformer used with the system is 900VA.

- **Caution: Electrical hazard.** The Main Power Source / Isolation Transformer should be plugged into a dedicated power line to ensure that the primary power to the Q-Tel RMS computer is not subject to power sags induced by other devices.

⚠ Improper Software Use

The system must be dedicated to the task of monitoring and recording parameters during rehabilitative sessions. You can compromise the ability of the machine to perform its job by running improper software (for example, games, screensavers, etc.) that is not qualified and tested to run with the Q-Tel RMS software and that uses resources needed for the monitoring and session entry process.

- **WARNING! Requires computer knowledge.** Users must be trained in the use of a PC and capable of recognizing abnormal PC behavior.

- **WARNING! Audible alarms.** Do not use the system to play CDs or DVDs as the sound may mask an audible alarm.

- **WARNING! Patient safety.** Do not alter the software. Do not add or run other software programs on the Q-Tel RMS Tower or Workstation computer (except anti-virus software), especially while monitoring patients. Any unauthorized change or addition may affect patient safety or efficacy. Other software can reduce disk space and available memory; it also can change configuration files. Quinton supports the operation of Q-Tel RMS in its software-only released configuration.

- **WARNING! Possible improper system performance.** Do not load unqualified software on the machine. Unqualified software can compromise the safety of your patient and the accuracy of the tests.

- **Caution: Safeguards for patient information.** The facility is responsible for ensuring appropriate safeguards are put in place to protect patient health information (PHI). This includes a mixture of physical and IT-based mechanisms to secure PHI from unauthorized access. Examples include:
  - Physically securing computers or securing access to them.
  - Ensuring strong passwords are used, especially on mobile equipment.

- **Caution: Computer virus protection.** Do not use removable media that have been used on other PCs. They can introduce computer viruses with destructive effects on the software and data.

⚠ Operator Notes

All screen shots are for reference only. The screen displays differently depending on the system configuration.

At the end of each day, close the Q-Tel RMS application. If you do not close the application at the end of the day, you cannot admit patients to sessions the following day until you close and re-open the Q-Tel RMS application. It is also recommended to turn off the computer, particularly in areas or times of unstable AC power.

- **WARNING! Read this manual carefully.** The operator must be thoroughly familiar with the information in this manual before using the equipment.

- **WARNING! Review system findings.** Any notification or abnormal indication displayed by this system should be reviewed by skilled staff.

- **WARNING! Audible alarms.** The speakers must remain connected to the system at all times. Disconnecting the speakers can cause a system fault and can prevent you from hearing audible alarms.

- **WARNING! Remote usage.** When working on a Q-Tel RMS system located remotely away from the patient, do not use (exercise related) session management features or discharge a patient.

- **Caution: Powering off.** You must perform standard Windows shutdown procedures when you turn off the computer or the Q-Tel RMS software can become inoperable. See Powering Off the Computer.

    NOTE: The Q-Tel RMS application requires the user to be a member of the local Power Users or Administrators group to run. Other components of the Q-Tel RMS, including the Backup/Restore, Configuration, Session Recovery, Import/Export and Purge/ Archive utilities, can be used only by users that are members of the local Administrators group.

S2 Transmitter Restrictions

Some countries regulate the use of transmitter channel frequencies. These restrictions are outlined below for the United States with declared channels for 802.11a/b/g/n wireless protocols by the Federal Communications Commission (FCC).

- 2.4 GHz: Channels 1 - 11

- 5 GHz U-NII-1: Channels 36, 40, 44, and 48

- 5 GHz U-NII-2: Channels 52, 56, 60, 64, 100, 104, 108, 112, 116, 120, 124, 18, 132, 136, and 140

- 5 GHz U-NII-3: Channels 149, 153, 157, 161, and 165

Optimal channels for the particular facility are identified during a site survey.

Indications for Use

The indications for use of the Q-Tel RMS system is the acquisition and transmission of ECG data by means of a radio-frequency transmitter worn by individual patients in a hospital or clinical setting, to a central monitor where it is received, displayed, stored, and analyzed. The system alerts the user to heart rate and arrhythmia in the patient. The intended populations are ambulatory adults where cardiac monitoring is prescribed while undergoing exercise rehabilitation. Patient demographics, exercise prescription, and collected data can be exported to an outcomes management program.

Intended Use

- The device is intended to acquire and transmit electrocardiograph (ECG) data by means of a radio-frequency transmitter worn by individual patients in a hospital or clinical setting to a central monitor where it is received, displayed, stored, and analyzed, with alarms for heart rate, arrhythmia, and ST change.

- The device is to be used on ambulatory adult populations where monitoring is prescribed while undergoing exercise rehabilitation.

- Multiple central receivers may be used and connected to a local area network.

- Specified wireless data entry devices may be connected to the system via a wireless access point and be used as a station for entry of patient session data.

- Optional workstation(s) may be connected to the system via a network for entering and viewing patient demographic and rehab session data. The workstation may also be used for tracking patient progress and displaying non-real-time waveforms and alarms.

- Patient demographics, exercise prescription, scheduling information, and collected data can be ported to an outcomes management program.

5. EQUIPMENT SYMBOLS AND MARKINGS

The following symbols may be used in this manual, related documentation, or appear on system components or packaging.

⚠️	WARNING The warning statements in this manual identify conditions or practices that could lead to illness, injury, or death. In addition, when used on a patient applied part, this symbol indicates defibrillation protection is in the cables. Warning symbols will appear with a grey background in a black and white document.		
⚠️	CAUTION The caution statements in this manual identify conditions or practices that could result in damage to the equipment or other property, or loss of data.		
(welchallyn.com 7d)	Follow instructions/directions for use (DFU) -- mandatory action. A copy of the DFU is available on this website. A printed copy of the DFU can be ordered from Welch Allyn for delivery within 7 calendar days.		Replace fuse only as marked
(earth ground symbol)	Earth ground (protective)	(fuse symbol)	Fuse
(off symbol)	Off (power disconnected from mains)	(mains power symbol)	Mains power
(on symbol)	On (power connected to mains)	(equipotentiality symbol)	Equipotentiality
(Type B symbol)	Type B equipment – provides adequate protection against electric shock, particularly regarding allowable leakage current; reliability of the protective earth connection (when present)	(Type BF symbol)	Type BF equipment – contains an F- type isolated patient applied part providing a high degree of protection against electric shock
(Type BF defib symbol)	Type BF equipment with defibrillation protection	(input/output symbol)	Input/output
(WEEE symbol)	Do not dispose as unsorted municipal waste. Requires separate handling for waste disposal according to local requirements	**Hz**	Hertz
(Type CF symbol)	Type CF equipment – contains an F type isolated patient applied part and provides a degree of protection against electric shock higher than that for type BF equipment regarding allowable leakage currents	(Type CF defib symbol)	Type CF equipment with defibrillation protection
(alternating current symbol)	Alternating current	**A**	Amperes

T	Timed fuse (slo-blo)		High voltage
V	Volts		Earth ground (functional)
VA	Volt Amperes	MD	Medical Device
REF	Reorder Number	#	Model Identifier

6. SYSTEM INTRODUCTION

User Profile

The Q-Tel RMS system is intended for use in a clinical setting by trained personnel who are acting on the orders of a physician. See *User Safety Information* for important safety information. The final decision regarding the treatment of patients is the responsibility of the physician.

⚠ **Caution: Restricted use.**
Nurses, clinicians, technicians, and other users must be familiar with clinical procedures surrounding ECGs in cardiac rehabilitation and trained in the use of a PC before using the equipment.

Failure to follow the conditions set forth below shall limit, to the extent allowed by law, the responsibility of Welch Allyn for the safety, reliability, and performance of this equipment.

The user manual must be read in full by each operator before using the product for the first time.

Assembly operations, extensions, readjustments, modifications, or repairs must be carried out only by Welch Allyn trained or authorized personnel.

The electrical wiring within the instrument's setting and the electrical installation of the instrument must comply with the applicable local or provincial requirements.

The equipment must be used in accordance with the instructions for use.

Overview of System

The Q-Tel RMS system is a computer-based cardiac and pulmonary rehabilitation data acquisition and editing system. It provides rehabilitation functionality using telemetry units that transmit patient ECG signals to a PC platform running the Microsoft Windows 10 operating system.

The primary functions of the system are:
- ECG monitoring
- Reporting of data and analysis of results.

The Q-Tel RMS system also maintains a database that contains complete rehabilitation case records.

Q-Tel RMS is scalable from a single tower monitoring (for example) 4 patients (Figure 1) up to a larger network monitoring up to 32 patients (Figure 2).

Figure 1 Single Tower System

1	Laser Printer
2	Rehab Monitor Tower
3	Wi-Fi Transmitter
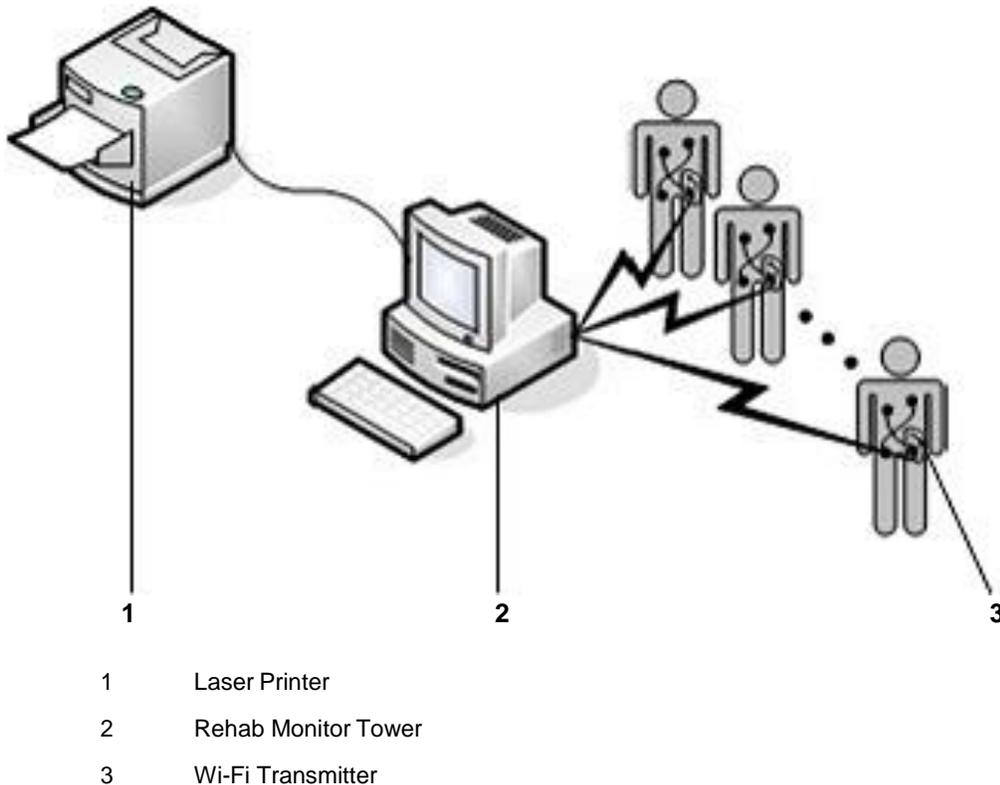
Figure 2 Networked System Concept
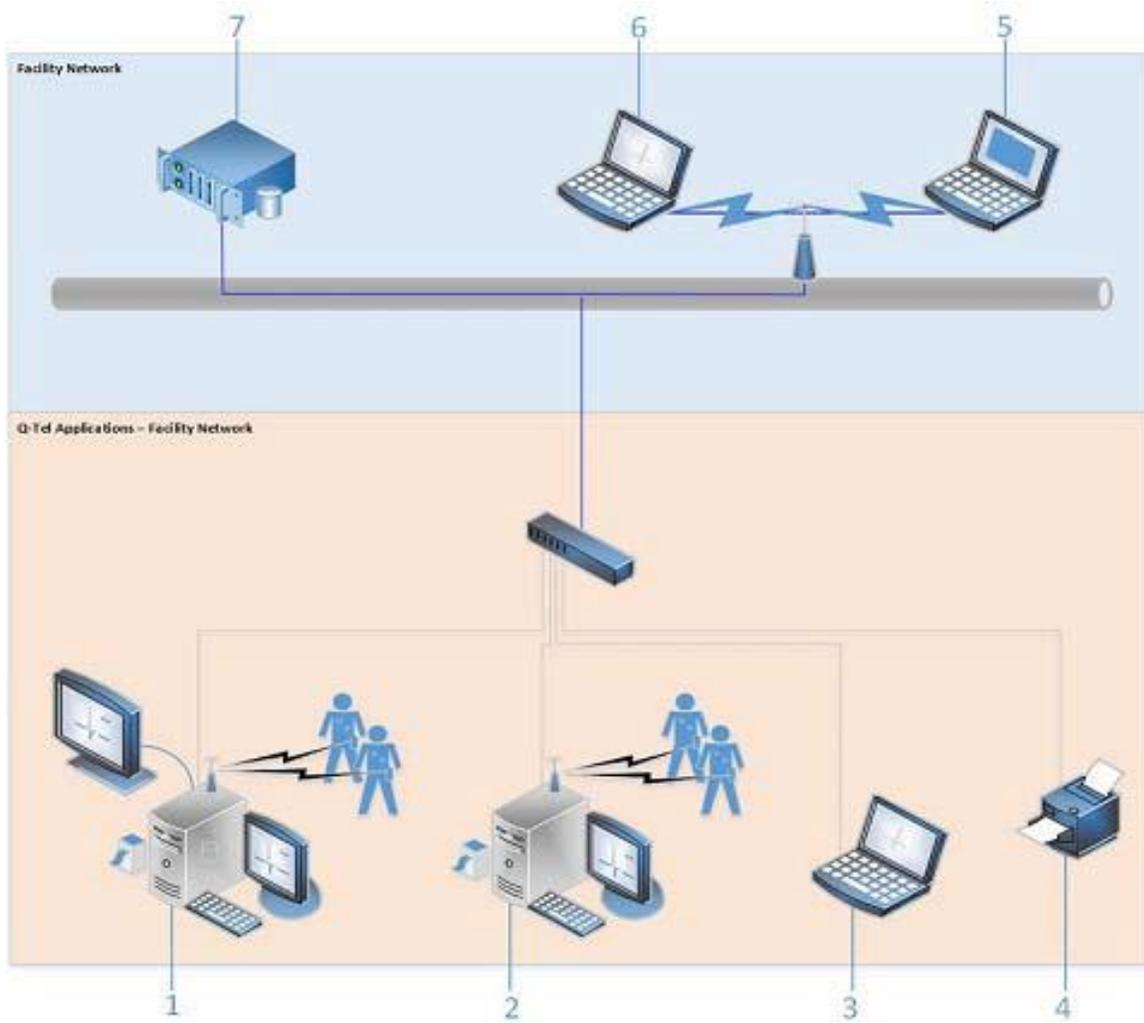
1	Q-Tel RMS Main Tower	6	Q-Tel RMS Software Workstation
2	Q-Tel RMS Secondary Tower	7	Facility Server
3	Q-Tel RMS Turnkey Workstation		
4	Q-Tel RMS Laser Printer		
5	Q-Tel RMS Q-Progress Workstation		

System Configuration and Settings

Windows is configured for optimum performance of Q-Tel RMS. Changing the settings can affect the performance. Q-Tel RMS disables screensavers.

It is recommended that all Q-Tel RMS systems be periodically updated with Microsoft critical and security updates to protect their system from malware attacks and to fix critical Microsoft software issues. The following guidelines apply for Microsoft updates;

- Customer is responsible for applying Microsoft Updates
- Configure Microsoft updates to be *manually* applied
- Do not install Microsoft updates during use of the product
- After installing updates, verify proper system operation before monitoring patients

Each Q-Tel RMS product release is tested against the cumulative Microsoft updates at the time of product release. There are no known Microsoft update conflicts with the Q-Tel RMS application. Please contact Welch Allyn Technical Support if conflicts are identified.

Workstation Configurations

This document describes the operation of the Q-Tel RMS software for both the tower and software workstations. However, statements and claims within this document specific to computer software and hardware components apply only to those components purchased from Welch Allyn. If a component has been purchased from a different vendor, consult the vendor documentation for proper operation and use.

If you use the workstation software option, you are responsible for purchasing the hardware that meets the specifications as set by Welch Allyn. See *Workstation Software Specifications*.

Function

The Q-Tel RMS system measures the electrical activity of a patient's heart during exercise and transmits it via Wi-Fi to a central monitoring station. The monitoring station displays the patient's concurrent, real-time ECG waveforms and uses programmable alarms to indicate the presence of arrhythmias. When alerted by the alarm, the clinician can determine whether the event causing the alarm is benign or clinically significant. The Q-Tel RMS system enables the clinician to view, edit, and record ECG strips and print tabular reports.

Product Components

A Q-Tel RMS system consists of Towers, Workstations, telemetry units, and printers.

Towers and Workstations

A Q-Tel RMS system consists of at least one "Main" Tower, and optional Secondary towers. Towers admit patients for monitoring. The Main tower includes the Q-Tel RMS database. The optional Secondary Towers and Workstations use the database that resides on the Main Tower. Both the Main Tower and the Secondary Towers can serve as rehab monitors and administrative workstations.

Workstation software can be ordered as a Turnkey Workstation (configured with software and hardware), or be installed on customer supplied equipment. Workstations include similar session management capabilities as the Tower(s).

Review workstation software is supplied without the Session Management license capabilities. It is installed on customer supplied equipment.

Workstation Functions

Function	Turnkey	Workstation S/W	Review
Enter rehab patient information	X	X	X
Edit session data in charting and editing	X	X	X
View ECG waveforms in non-real-time	X	X	X
Generate reports	X	X	X
Take control of session data for patients admitted to active sessions	X	X	
Edit Session Management information	X	X	

Workstations without session management do not permit control of patients admitted to active sessions and all Session Management functionality is read-only.

Q-Tel RMS Tower and workstations include:

Tower and Workstation Components

Function	Q-Tel RMS Tower	Q-Tel RMS Turnkey Workstation	Q-Tel RMS Review Workstation
Proprietary Q-Tel RMS software	X	X	X
A basic computer including the CPU, monitor, mouse, and keyboard	X	X	
Telemetry electronics for the reception of the ECG signals from the patient worn transmitters	X		
Speakers	X	X	

Telemetry Unit

The telemetry unit consists of lead wires and a transmitter (with a call button as a means to send a remote request to the system). The unit supports the transmission of four and five lead ECG data with electrode clips or snaps marked with AHA or IEC lead identifiers. It provides ECG data at a rate of 500 samples per second per channel.

The S2 telemetry unit supports bidirectional data transfer. ECG data is sent to Q-Tel RMS. The Q-Tel RMS sends connection status information, patient demographics and heart rate to the telemetry unit. The bidirectional data flow is encrypted to reduce any risk-related personal health information (PHI) violation by unauthorized individuals.

Printers

The Q-Tel RMS system supports a laser printer.

⚠️ *WARNING! Patient Protection.*

Do not connect the printer directly to the Main tower. Instead, connect the printer via a network connection in order to comply with the IEC60601-1 standard.

Laser Printer

The laser printer produces full-page reports on 8 ½ by 11-inch paper and supports text, graphics, and waveforms. It prints with a minimum resolution of 600 dpi in both horizontal and vertical directions to support quality ECG data.

The laser printer can also be used to print ECG strips of up to two channels scaled at 25mm/sec.

Uninterruptible Power Supply (UPS)

The Q-Tel RMS system requires a steady supply of power during its operation. If power failures or brownouts are a problem in the area, purchase a line conditioner or use the UPS provided with the tower to ensure optimal operation of the system. The computer, monitor, and speakers can be plugged into the UPS.

⚠ *Caution: Possible improper system performance.*

Do not plug the laser printer into the UPS with the other Q-Tel RMS components.

UPS requirements differ based on the AC voltage available with the system.

Remote Monitor (optional)

A Q-Tel RMS Tower with software v5.0.1 or higher supports two monitors at 1980 x 1020 resolution. A second monitor is connected to the Q-Tel RMS Tower using the dual-head video card. The displayed image is the same on both monitors at all times.

Q-Tel Specifications

Overall System

	Specification
Performance	AAMI Standard EC:11:1991 for diagnostic ECG*
Display and Analysis Filters	Baseline wander, muscle artifact, 50/60 Hz line filters
Gain	2.5, 5, 10, 20, 40 mm/mV
Lead Groups	4 and 5 wire lead sets, supporting the standard Limb set, Limb plus one chest lead, and the Modified Chest Lead
Power	100-120 VAC 50/60 Hz 2.5A nominal 200-240 VAC 50/60 Hz 1.3A nominal

NOTE: Q-Tel does not offer a calibration pulse, and prints exclusively at 25mm/s.

Software

	Specification
Off the Shelf	Windows 10 Professional (64-bit), Microsoft Office Standard 2019, Microsoft SQL 2014, Adobe Acrobat Reader 9.0
Welch Allyn	Q-Tel RMS software, Q-Progress software

PC Hardware

	Tower Specifications	Turnkey Workstation Specifications
CPU	Intel compatible P4, 3.2 GHz	Intel compatible P4, 3.4 GHz
RAM	4 GB	2 GB (Min)
Hard drive	500 GB	20 GB (min)
DVD	8x DVD-RW	16X/40X DVD-ROM

Laser Printer

	Specification
Type	Multiple format ECG waveform and alphanumeric printing
Paper	Weight: 50 lb.-65 lb. Size: A, 8.5 x 11 in.
Resolution	600 DPI minimum

Back-up External Hard Drive

	Specification
Type	USB
Capacity	500 GB or greater

Monitor Display

	Specification
Content	4 and 8 channel ECG display and alphanumeric data I/O
Size	24" color LCD, 1920 x 1080
ECG Display (Tower)	3.5 – 8 seconds, depending upon number of channels
Displayed Data	ECG traces, heart rate, target heart rate, blood pressure, patient demographics and risk profiles, workload, METS, RPE, patient weight, and other user selectable parameters

Report Capabilities

	Specification
Session Reports	Succinct and complete session reports, full disclosure reports
Administrative Reports	Billable patient sessions, patient demographics, patient prescription, and lists for patients, insurance providers, physicians

ECG Analysis

	Specification
Heart Rate	Moving median estimate based upon R-R intervals
Arrhythmia Analysis	Mortara ECG algorithms

Q-Tel RMS S2 Telemetry Transmitter

Refer to the Welch Allyn S2 Transmitter User Manual, 9515-210-50-ENG for specifications.

Environmental Conditions

	Specification
Temperature	Operating: 59° to 90° F (15° to 32° C) Storage: 32° to 113° F (0° to 45° C)
Relative Humidity	Operating: 30 to 80% non-condensing Storage: 20-90% with condensation

WLAN Infrastructure Requirements

Medical facility network requirements for secure deployment of the S2 telemetry transmitter with the Q-Tel RMS system are listed in the table below.

	Specification
WIRELESS PROTOCOL	802.11a/b/g/n 2.4 GHz and 5 GHz Disable 802.11b support on WLAN
802.11a Supported Rates	6, 9, 12, 18, 24, 36, 48, and 54 Mbps
802.11g Supported Rates	6, 9, 12, 18, 24, 36, 48, and 54 Mbps
802.11n Supported Rates	MCS0 through MCS7 6.5, 13, 19.5, 26, 39, 52, 58.5, and 65 Mbps
S2 TRANSMITTING POWER	17 dBm for 802.11b/g 2.4 GHz; 16 dBm for 802.11n 2.4 GHz 19 dBm for 802.11a/n 5 GHz
CHANNELS	Dependent on local WI-FI regulations per country ***NOTE:*** *Disabled dynamic channel selection on WLAN is recommended to reduce the possibility of data gaps.*
WI-FI SUPPORTED COUNTRY CODE	**United States** – FCC with the declared channels: 2.4 GHz: 1-11 *(channels 1, 6 and 11 are recommended)* 5 GHz U-NII-1: 36, 40, 44, 48 *(recommended for best 5 GHz performance)* 5 GHz U-NII-2: 52, 56, 60, 64, 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140 5 GHz U-NII-3: 149, 153, 157, 161, 165 ***NOTE:*** *Optimal channels must be identified during the site survey and at the time of system installation.*
WIRELESS SECURITY PROTOCOLS	WPA2-PSK-AES (WPA2-Personal), Passphrase
WMM / QoS	Data loss: < 5ppm; Disconnections: < 0.05 per device/day; Transient Latency: < 1900 ms
SSID Requirements	**Dedicated SSID** *(Hidden SSID is not supported.)* SSID and Pre-shared Passphrase up to 32 and 63 ASCII characters. SSID prioritization and minimum bandwidth configuration recommended. Disabled or exclusion of Period Session Timeout or similar policies in the SSID dedicated to the S2 is recommended to reduce the possibility of gaps when the AP terminates the session. Dedicated Monitoring VLAN is recommended.
IP ADDRESS ASSIGNMENT	Static or DHCP
MAXIMUM DEVICES PER ACCESS POINT	16
IP PROTOCOLS AND PORTS	UDP: one port per device according to the system configuration. Actual ports are communicated upon definition of system configuration; ICMP for management.
MINIMUM SIGNAL STRENGTH	-65 dBm in the coverage area
MINIMUM SIGNAL-TO-NOISE RATIO (SNR)	20 dB in the coverage area
BANDWIDTH USAGE	Outbound: < 80 Kbps Inbound: < 10 Kbps
TARGET TOTAL CHANNEL OCCUPANCY	< 50% is recommended

Workstation Software Specifications

This section contains the computer and accessory system requirements to operate the Q- Tel RMS Workstation on a computer other than one purchased from Welch Allyn.

Welch Allyn strongly recommends that the user purchase hardware listed on the Windows Hardware Compatibility List. A regularly updated list can be found on the Internet at http:// www.microsoft.com/whdc/hcl.

Upon customer request, Welch Allyn will install the workstation software on customer-provided hardware. Contact your local representative or Welch Allyn Sales Support for more information on availability and applicable fees.

Welch Allyn will not install or support Q-Tel RMS software if any component of the customer-provided hardware or accessories does not meet the requirements listed in this document. Customer-provided hardware must be completely assembled and software installed per Welch Allyn installation instructions prior to commencement of applications training. The integrity of any 3rd party software other than the operating system cannot be guaranteed after installation of the Q-Tel RMS.

Workstation software requires some specific network settings in order to function properly. Contact your local representative for more details on the network requirements.

Computer

	Specification
Processor	Intel Pentium 4; clock speed 2.4 GHz or faster
System Memory	1 GB minimum
USB Ports	One (1) for optional USB peripherals
CD or DVD Drive	8X or faster
Hard Drive	20 GB minimum
Video	1280 x 1024 resolution

Other

	Specification
Operating System	Windows 10 Professional (64-bit)
Network	802.11G (minimum) wireless card

Ventilation Clearances

Allow at least 6 inches behind each Q-Tel RMS computer for ventilation. There are no side clearance requirements except for the laser printer, which requires about 3 inches minimum on each side.

Fuse Replacement

Blown fuses are to be replaced by a Quinton field service representative or qualified technician only.

BTU Output

The estimated heat output from each system can be computed using this formula: Maximum amperage x 120 V x 3.41 = BTU/hr.

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7. PREVENTIVE MAINTENANCE

Preventive Maintenance Schedule

MAINTENANCE TYPE	PERIOD	NOTES
System Cleaning	As Needed	Perform annually at a minimum per cleaning instructions below.
Visual Inspection	Quarterly	Refer to inspection criteria listed in the Peripherals and Accessories section of the maintenance instructions below.
Preventive Maintenance	Annually	Refer to the maintenance instructions below.

Equipment Required:

- ESD Rated Vacuum or Compressed Air
- Mild Detergent
- Lint-free cloth
- Isopropyl alcohol (70-80%)
- Patient Simulator
- S2 Transmitter
- AA Battery

Customer/User Interview:

Identify an appropriate resource at the facility who manages the area where the equipment is used and ask for feedback on the following topics as related to the QTel system.

- System Down-Time
- Error messages, or unexpected behavior
- Overall system performance
- ECG Signal reception
- Areas of concern

If any responses are received that raise an alleged deficiency with the QTel system (in accordance with the instructions for use), contact Welch Allyn technical support to report the information.

Computer Cleaning:

General cleaning safety precautions

- Never use solvents or flammable solutions to clean the computer.

- Never immerse any parts in water or cleaning solutions; apply any liquids to a clean cloth and then use the cloth on the component.

- Always unplug the computer when cleaning with liquids or damp cloths.

- Always unplug the computer before cleaning the keyboard, mouse, or air vents.

- Disconnect the keyboard before cleaning it.

- Wear safety glasses equipped with side shields when cleaning the keyboard.

Cleaning the computer case

Follow all safety precautions in General cleaning safety precautions before cleaning the computer.

To clean the computer case, follow the procedures described below:

- To remove light stains or dirt, use plain water with a clean, lint-free cloth or swab.

- For stronger stains, use a mild detergent diluted with water. Rinse well by wiping the surface with a cloth or swab dampened with clear water.

- For stubborn stains, use isopropyl (rubbing) alcohol. No rinsing is needed; alcohol will evaporate quickly without leaving a residue.

- After cleaning, always wipe the unit with a clean, lint-free cloth.

- Occasionally clean the air vents on the computer. Lint and other foreign matter can block the vents and limit the airflow.

⚠️ **Caution:** Static electricity can damage electrical components.

Using an ESD rated vacuum or compressed air, remove any accumulated dust and debris from the PC. Take particular care to cleaning around cooling fans and inside media access slots (refer to cooling fan inspection below).

Inspection of PC cooling fans

Inspect CPU fan, and power supply fan. If they are running too slowly or are making any unusual noises during operation, they should be replaced. For improperly operating PC power supply fans, the entire power supply should be replaced to prevent system failure.

Cleaning the keyboard

Follow all safety precautions in General cleaning safety precautions before cleaning the keyboard.

To clean the tops of the keys or the keyboard body, follow the procedures described in Cleaning the computer case.

 WARNING:

Use safety glasses equipped with side shields before attempting to clean debris from under the keys.

- Visible debris underneath or between the keys may be removed by vacuuming or shaking.

- Canned, pressurized air may be used to clean debris from under the keys. Caution should be used as too much air pressure can dislodge lubricants applied under the wide keys.

- If you want to remove a key, use a specially designed key puller to prevent damage to the keys. This tool is available through many electronics supply outlets.

 Caution:

Never remove a wide, level key (like the space bar) from the keyboard. If these keys are improperly removed or installed, the keyboard may not function properly.

- Cleaning under a key may be done with a swab moistened with isopropyl alcohol and then squeezed out. Be careful not to wipe away lubricants necessary for proper key functions. Use tweezers to remove any fibers or dirt in confined areas. Allow the parts to air dry before reassembly.

Cleaning the monitor

Wipe the monitor screen with a towelette designed for cleaning monitors or with a clean cloth moistened with water.

 Caution:

Do not use sprays or aerosols directly on the screen; the liquid may seep into the housing and damage a component. Never use solvents or flammable liquids on the monitor.

To clean the monitor body follow the procedures in Cleaning the computer case.

Peripherals and Accessories:

Visual Inspection:

S2 Transmitter(s) and Battery Charger:

- Check the case and chassis of the S2, AC power cord, and Li-Ion Battery Charger for any visible damage.

- Inspect the S2 touchscreen and controls for proper function and appearance.

- Inspect the Li-Ion Battery Charger indicator LEDs for proper operation and indication of battery charging and AC connection.

- Inspect patient accessories for any visual damage.

- S2 patient input connector - Verify the pins on the patient input connector are all present and are not bent or damaged in any way. The recessed area for the patient connector should be free from debris and clean. Use compressed air to remove any debris that has entered into the connector area.

- S2 display – Verify there are no deep scratches or physical damage to the S2 transmitter's display. Inspect the display bezel to ensure it is firmly adhered to the device housing. Contact Welch Allyn Technical Support if the display or display bezel require replacement.

- S2 battery door – Verify the S2's battery door for proper opening and closing. Inspect the plastic door assembly for signs of excessive wear or cracking, including the door seal to prevent fluid ingress. Replace the battery door assembly if necessary. S2 Battery Compartment – Inspect the S2's battery spring contacts and the battery door latching mechanism for signs of excessive wear. If the battery compartment has been damaged, contact Welch Allyn Technical Support for assistance.

- Battery Charger bay – Inspect the Li-Ion Battery Charger's contacts and mechanisms for signs of excessive wear.

- Rechargeable Li-Ion Battery – Follow the instructions and note the cautions labeled on the rechargeable battery. Contact Welch Allyn for replacement.

- Device Labeling – Inspect the device labeling for signs of wear and legibility. If the labeling is no longer clear and legible, contact Welch Allyn Technical Support for assistance.

Network Switch and Cabling (as applicable):

- Inspect the network switch for any visual damage.

- Inspect the AC cord and network cabling for signs of cracking, damage, and appropriate routing to avoid hazards with personnel working in the area. Re-route and secure cabling if needed.

Monitor:

- Check the positioning of the monitor for optimal viewing and adjust if necessary.

- Observe the monitor for color, brightness, and contrast to ensure it is operating properly. Make any necessary brightness or contrast adjustments needed for optimal viewing in the local environment.

Printer:

- Inspect the printer for signs of toner spillage, and clean the interior space if necessary using a dry lint-free cloth.

- Inspect and clean the paper pickup roller(s) using 70-80% isopropyl alcohol.

Hard Drive Space Maintenance

As the Q-Tel RMS system is used, temporary files are created on the hard drive in the system temp folder. These temporary files can use excessive amounts of hard drive space. Deletion of the temp files, per the process defined below, can improve system performance.

Delete Temp Files

To delete temporary files:

1. Make sure all applications are closed.
2. Log into the system with any account.
3. Click the Start button.
4. In the Search field type **%temp%.**
5. Double-click the folder named **QTel User** or the user account you normally are logged in with when using your Q-Tel RMS system. Click the **Temp** folder at the top of the results window.
6. Hold the **Ctrl** key and press **A** to select all files.
7. Hit the Delete key on your keyboard.
8. Select **Yes** at the Delete Multiple Items confirmation window.
9. Choose **Skip** for any items that you are alerted cannot be deleted at this time.
10. Close the Temp folder window.
11. If needed, repeat steps 2 – 10 using a different account.

Defragment Hard Disk

Over time, performance on the hard drives degrades because of file fragmentation. This is a normal process on machines that run the Microsoft Windows operating system and can be avoided by periodically performing the disk defragmentation function, located in the Windows Administrative Tools menu.

For Q-Tel RMS machines, it is recommended to perform disk defragmentation annually for each installed hard drive. Disk defragmentation may take considerable time depending on the drive size, so this activity should only be performed when ample time is available to complete the task. It is best to be run overnight if possible to ensure there is enough idle system time available.

Operational Testing:

Q-Tel RMS Main & Secondary

For the functional testing below, ensure that you are logged into your Q-Tel RMS Towers with a user account that is already a member of the QTelUsers or QTelAdmins group.

Prior to conducting a signal quality check for the covered area, the Signal Quality logging must be enabled on the QTel system by using the Registry Editor to set the data value for "TypeProtocolEnable" from a zero(0) to a one(1). Follow the instructions in the Enable Signal Quality Logging section to enable the necessary logging.

The signal quality logging should be disabled once the testing is completed.

Ensure that you have powered on and configured S2 transmitters and an available ECG source for testing with.

1. Double-click on the **Q-Tel RMS Tower** icon
2. Select **Patient Information** from the splash screen
3. Verify that the audio alarm test is performed and click the **Yes** to acknowledge the test success.
4. Click **New Patient** and enter a First name, last name, and MRN number for your test patient.
5. Click **OK**
6. Click the **Session Management** button in the upper left corner of the application.
7. Highlight your test patient in the patient list and click the **Admit** button.
8. If prompted with a Sessions Reminder, click **OK**
9. Select the Unit ID of the S2 transmitter you are using.
10. Verify that **Comm Fail** is not displayed on the ECG tile and that an ECG trace begins shortly after admissions. Observe the ECG waveform presented for the test patient and verify that there are no gaps and that the heart rate matches the output of the ECG source.

   Signal Quality Check:

11. With the transmitter actively transmitting data to the QTel system, physically walk around the entire covered area (as defined by the customer) pausing momentarily at various points that would be considered worst case locations within the covered area. These would be areas on the outer edges of the covered area, or perhaps areas with physical obstruction to the nearest access point.

12. Once the transmitter has been moved throughout the entire covered area, the log file data should be reviewed for signal strength measurements taken. Pass criteria would be all measurements taken at or above the -65dbm threshold (-65dbm to 0dbm). Record the worst reading onto the test data record.

   A sample log file is provided in the LOG FILE section of this manual, which provides additional information regarding how to read the content of the log file to determine the QTel "bed" assignment, Quality Index, and Signal Strength.

13. Click the **Discharge** tab, select **Cancelled Session** and then click the **Discharge** button.
14. Click **Yes** at the confirmation prompt.
15. Repeat steps 6 – 10 for each S2 transmitter configured for this Tower. During one of these repeats, click the **Print** button next to **Demographics** at the top of the application. Verify that this report prints out on your default printer.
16. After the final S2 transmitter test is discharged, close the Q-Tel RMS application.

Operational Testing: Q-Tel RMS Workstation

For the functional testing below, ensure that you are logged into your Q-Tel RMS Towers with a user account that is already a member of the QTelUsers or QTelAdmins group.

Ensure that you have powered on and configured S2 transmitters and an available ECG source for testing with.

1. On your Main Tower, double-click on the **Q-Tel RMS Tower** icon
2. Select **Session Management** from the splash screen
3. Verify that the audio alarm test is performed and click the **Yes** to acknowledge the test success.
4. Highlight your test patient in the patient list and click the **Admit** button.
5. If prompted with a Sessions Reminder, click **OK**
6. Select the Unit ID of the S2 transmitter you are using.
7. Verify that **Comm Fail** is not displayed on the ECG tile and that an ECG trace begins shortly after admissions. Observe the ECG waveform presented for the test patient and verify that there are no gaps and that the heart rate matches the output of the ECG source.
8. On your Workstation, double-click on the **Q-Tel RMS Workstation** icon
9. Select **Session Management** from the splash screen
10. When the application finishes loading, verify that your test patient is present in the active session list.
11. Double-click the checkbox to the right of the patient name, below the ECG icon.
12. Verify that the patient ECG is presented.
13. Double-click the checkbox below the downward pointing finger icon.
14. Verify that the list is replaced with the customers session control interface.
15. Select the **Discharge** tab, click the **Session Report** checkbox under the printer icon, and click the **Discharge** button.
16. Verify that the **Session Report** prints and that the patient ECG tile vanishes from the Main Tower.

Customer Relations:

Upon completion of the preventive maintenance activities, a copy of the preventive maintenance record should be provided to the customer or user of the system. In addition, any observations or issues identified during the maintenance activities should be discussed to identify any further action items that may be warranted as a result of the maintenance activity.

QTel Preventive Maintenance Report

Q-Tel System Serial #: _____

Customer/User Interview Conducted	Yes / No
PC Cleaning Performed	Yes / No
Peripherals and Accessories	
Transmitter(s)/Charger Inspection	Pass / Fail
Network Gear Inspection	Pass / Fail
Monitor Inspection	Pass / Fail
Printer Inspection	Pass / Fail
Printer Cleaning Performed	Yes / No
Hard Drive Maintenance Performed	Yes / No
Operational Testing	
Application launch	Pass / Fail
Audio alarm test	Pass / Fail
Patient Admit / No Comm Fail	Pass / Fail
ECG Waveform test	Pass / Fail
Signal Quality Check (-65 – 0dbm)	Pass / Fail _____ dbm
Patient Discharge	Pass / Fail
Additional Transmitter Testing	Pass / Fail
Printer Test Page	Pass / Fail
Workstation Testing	**Yes / NA**
Workstation application launch	Pass / Fail
Patient data presented	Pass / Fail
Customer Session Control	Pass / Fail
Patient discharge	Pass / Fail
Session Report printing	Pass / Fail
Review PM findings with customer/user	Yes / No

Performed By: _____ Date: _____

8. SERVICE LOG FILES

The following log files are available for the QTel system to assist with the troubleshooting and diagnosis of unexpected behavior. Technical support personnel may ask for this information or require remote access to obtain the log files in order to properly investigate a reported issue.

Log file collection

Start by creating a new folder on the desktop. This will be the log repository folder. Name the folder according to the system type (main, secondary, or workstation) and the customer's name.

Mortara Restart App Log

1. Locate the folder labeled **Log** on the desktop
2. Open the **Log** folder
3. Copy the file named **MortaraRestartApp**
4. Paste the file in the log repository folder

Windows Event Logs and MSDTC Logs

1. Click into the search bar in the lower left corner
2. Type in **This PC** and click on the **This PC** icon to open it
3. Open local disk **C:**
4. Open the **Windows** folder
5. Open the **System32** folder
   a) Copy the **MSDTC** folder to your log repository folder on your desktop
   b) Copy the **winevt** folder to your log repository folder on your desktop

Q-Tel RMS logs

1. Click into the search bar in the lower left corner
2. Type in **This PC** and click on the **This PC** icon to open it
3. Open local disk **C:**
4. Click on **View** in the upper left corner and check the box next to **Hidden Items**
5. Open the **Program Data** folder
6. Open the **Quinton** folder and then open **QTel RMS**
7. Right-click the log folder and choose **Copy**
8. Open the log repository folder on your desktop
9. Create a new folder and name it **QTel RMS**
10. Right-click this newly created **QTel RMS** folder and choose paste

SQL logs (Master Tower Only)

1. Click into the search bar in the lower left corner
2. Type in **This PC** and click on the **This PC** icon to open it
3. Open local disk **C:**
4. Open the **Program Files** folder
5. Open the **Microsoft SQL Server** folder
6. Open the **MSSQL12.CSCQTELRMS** folder
7. Open the **MSSQL** folder
8. Right-click the logs folder and choose copy
9. Open the log repository folder on your desktop
10. Create a new folder and name it **SQL**
11. Right-click this newly created folder and choose paste

System Information Report

1. Click into the search bar in the lower left corner
2. Type in **System Information** and click on the **System Information** icon
3. Click file and choose save
4. Browse to and select your log repository folder
5. Name the file **System Info** and press save

After all files have been collected, zip the log repository folder to compress the data.

Enable Signal Quality Logging

Signal Quality logging must be enabled on the QTel system by using the Registry Editor to set the data value for "TypeProtocolEnable" from a zero(0) to a one(1). This entry can be located at the path shown below.

Registry Editor is accessed by typing "regedit" into the Windows Search utility in the system tray.
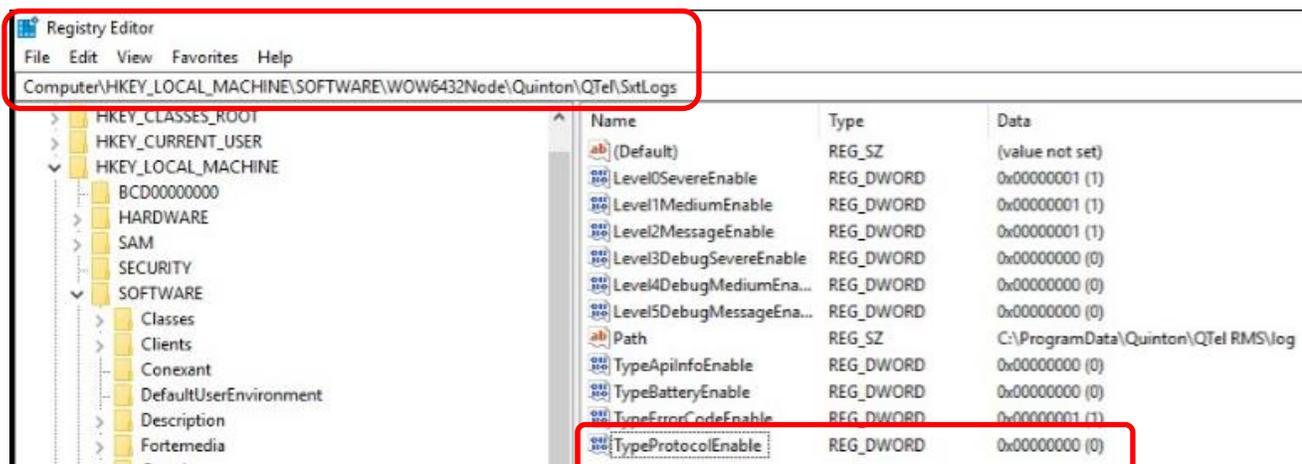
Once enabled, the log files (SxTLog_0X) will be saved under the Log folder of Q-Tel main PC, with the .0x file extension indicating the day of the month the file was created.
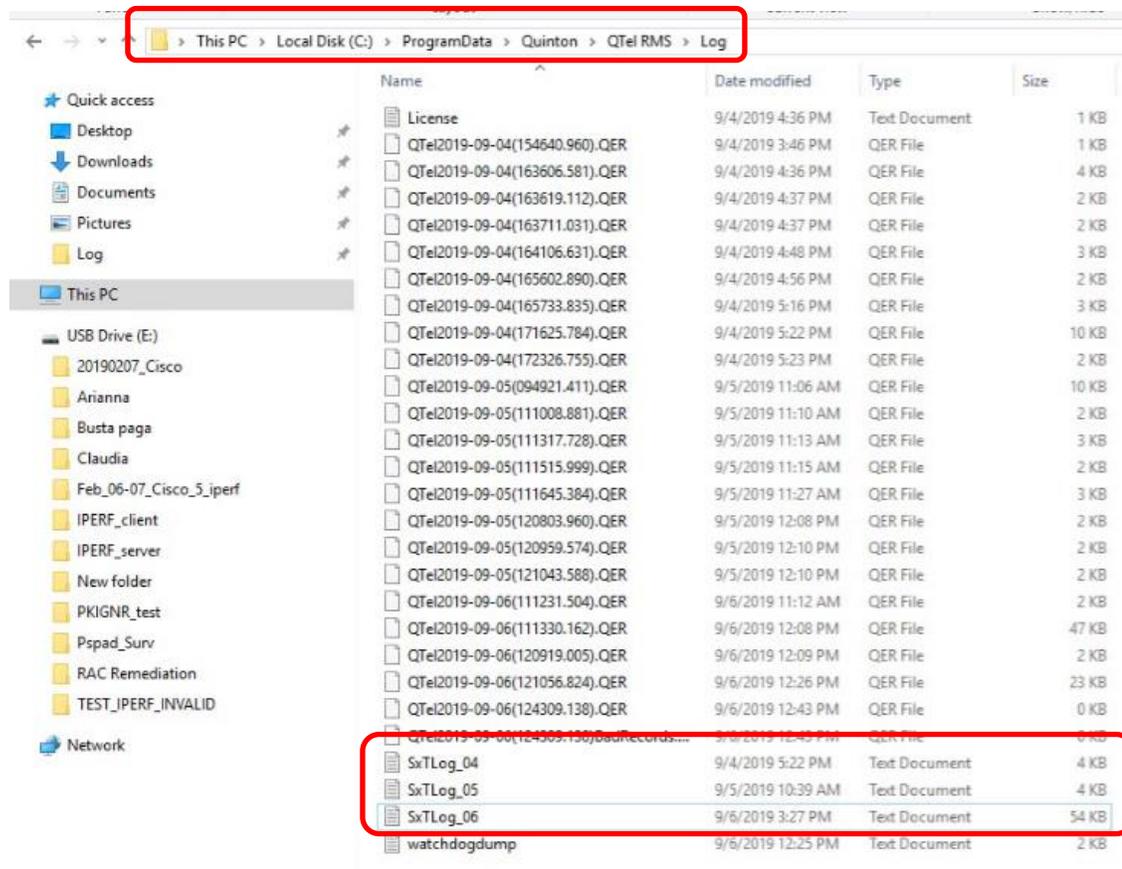
Configure an S2 transmitter with a patient simulator as input data to properly communicate to the QTel system (per the QTel User manual). The Network Diagnostic screen on the S2 can be used to monitor the general signal quality. Both the Signal Strength and a Signal Quality Index will be presented. The Quality Index is represented by a number between 0 and 3 as defined on the table below. The minimum Signal Strength value considered to be acceptable is -65dbm.

S2 Display
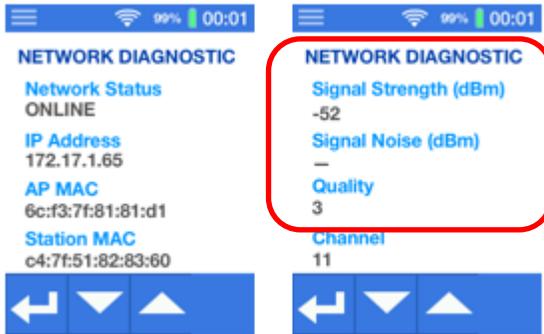
Quality Index	Description	RSSI (dBm)
0	No or too low WIFI signal	< -75
1	Poor WIFI signal	-75 to -68
2	Fair WIFI signal	-67 to -55
3	Good WIFI signal	> -55

The following information is an example of a S2/QTel log file with the main areas of interest identified for monitoring channel signal strength.

SxTLog_xx

2: 2019-09-06 15:47:17.224 : S2TSrv.cpp : S2TSrv::init_and_open_server : 124 : S2-T, base port 30000, used port 30200, monid 2;0: Started

2: 2019-09-06 15:47:17.227 : S2Tlib.cpp : CreateInstance : 189 : Instance created with following configuration

2: 2019-09-06 15:47:17.231 : S2Tlib.cpp : LogConfiguration : 67 : base_port 30000, unit 2, bed 0, queue_size 1250, discon timeout 10000

2: 2019-09-06 15:47:17.234 : S2Tlib.cpp : LogConfiguration : 69 : Log: protocol 1, battery 0, apinfo 0, err_codes 1

2: 2019-09-06 15:47:17.237 : S2Tlib.cpp : LogProtocolConfiguration : 75 : packet_buffer_size 256, max_read_per_loop 16, rsp_msg_period_ms 900, rtx_req_period_ms 450

2: 2019-09-06 15:47:17.240 : S2Tlib.cpp : LogProtocolConfiguration : 77 : wait_for_packet_lost 10, seq_error_thr 12, wait_before_retx_req 0, wait_before_next_retx_req 3, max_retx_req 3, send_clock_period_sec 10

2: 2019-09-06 15:47:17.354 : S2TProtocolMgr.cpp : S2TProtocolMgr::RegisterDevice : 226 : MonID(2;0): registering device C4:7F:51:04:EA:DD

2: 2019-09-06 15:47:17.358 : S2TSrv.cpp : S2TSrv::process_params : 720 : ;S2T-E;2;0;MAIN;00040000

2: 2019-09-06 15:47:17.361 : S2TSrv.cpp : S2TSrv::process_params : 752 : S2 FIRMWARE VERSION: STM-MAIN (1.1.0.22); STM-WIFI (1.1.0.22); SAM-ECG (1.3.4.0)

2: 2019-09-06 15:47:17.365 : S2TSrv.cpp : S2TSrv::pop_pck : 418 : MonID(2;0): Initializing protocol parameters: samples per send (80), wait for lost packet limit (10), sequence error threshold (12)

2: 2019-09-06 15:47:17.369 : S2TSrv.cpp : S2TSrv::process_protocol : 764 : ;S2T-P;2;0;PCKRDN;12;11;6;3;-46;0;

2: 2019-09-06 15:47:17.432 : S2TImpl.cpp : S2TImpl::isDeviceConnected : 672 : MonID(2;0): DEVCOM_STATE_CHANGE: From SxT_NEVER_CONNECTED to SxT_CONNECTED

2: 2019-09-06 15:47:17.515 : S2TSrv.cpp : S2TSrv::process_protocol : 764 : ;S2T-P;2;0;PCKRDN;13;12;7;3;-46;0;

2: 2019-09-06 15:47:17.675 : S2TSrv.cpp : S2TSrv::process_protocol : 764 : ;S2T-P;2;0;PCKRDN;14;13;8;3;-46;0;

2: 2019-09-06 15:47:17.840 : S2TSrv.cpp : S2TSrv::process_protocol : 764 : ;S2T-P;2;0;PCKRDN;15;14;9;3;-46;0;

2: 2019-09-06 15:47:17.998 : S2TSrv.cpp : S2TSrv::process_protocol : 764 : ;S2T-P;2;0;PCKRDN;16;15;10;3;-48;0;

2: 2019-09-06 15:47:23.594 : S2TSrv.cpp : S2TSrv::process_params : 720 : ;S2T-E;2;0;MAIN;00000000

2: 2019-09-06 15:47:32.396 : S2TSrv.cpp : S2TSrv::process_protocol : 764 : ;S2T-P;2;0;PCKREQ;104;0;105;2;-51;0;

2: 2019-09-06 15:47:32.558 : S2TSrv.cpp : S2TSrv::process_protocol : 764 : ;S2T-P;2;0;RTXSRV;104;106;104;2;-56;0;

2: 2019-09-06 15:47:45.517 : S2TSrv.cpp : S2TSrv::process_protocol : 764 : ;S2T-P;2;0;PCKREQ;186;0;187;2;-66;0;

2: 2019-09-06 15:47:45.679 : S2TSrv.cpp : S2TSrv::process_protocol : 764 : ;S2T-P;2;0;RTXSRV;186;188;186;2;-66;0;

2: 2019-09-06 15:48:00.075 : S2TSrv.cpp : S2TSrv::process_protocol : 764 : ;S2T-P;2;0;PCKREQ;277;0;278;3;-54;0;

2: 2019-09-06 15:48:00.233 : S2TSrv.cpp : S2TSrv::process_protocol : 764 : ;S2T-P;2;0;RTXSRV;277;279;277;3;-54;0;

2: 2019-09-06 15:48:27.432 : S2TSrv.cpp : S2TSrv::process_protocol : 764 : ;S2T-P;2;0;PCKREQ;448;0;449;3;-45;0;

2: 2019-09-06 15:48:27.597 : S2TSrv.cpp : S2TSrv::process_protocol : 764 : ;S2T-P;2;0;RTXSRV;448;450;448;3;-45;0;

2: 2019-09-06 15:48:37.877 : S2TSrv.cpp : S2TSrv::close_server : 145 : S2-T, base port 30000, used port 30200, monid 2;0: stopped

Indicates Signal Strength = -48dbm

2,0 Indicates Bed ID, Unit ID *

Indicates Quality Index = 3

* As defined by the QTel transmitter assignments in the system configuration.

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9. DISASSEMBLY AND REPAIR

Before You Begin

1. Use an electrostatic discharge (ESD) wrist strap to avoid damaging any circuitry.
2. Remove all devices (such as diskettes and CD-ROMs) from the computer.
3. Power off the computer and any peripheral devices that are connected to it.

⚠️ WARNING:
Be sure the AC power cord is disconnected prior to performing servicing.

4. Disconnect the power cord from the electrical outlet and then from the computer. When the computer is plugged into an AC power source, there is always voltage applied to the system board. You must disconnect the power cord from the power source before opening the computer to prevent system board or component damage.
5. Disconnect all peripheral device cables from the computer.

Static Electricity

Static electricity can damage electrical components. Before removing or replacing a component, utilize static protection equipment, or physically contact a grounded metal object to discharge static electricity. Also observe the following precautions to prevent damage to electric components and accessories:

- To avoid hand contact, transport products in static-safe containers such as tubes, bags, or boxes.
- Protect all electrostatic parts and assemblies with conductive or approved containers or packaging.
- Keep electrostatic-sensitive parts in their containers until they arrive at static-free stations.
- Place items on a grounded surface before removing them from their container.
- Always be properly grounded when touching a sensitive component or assembly.
- Avoid contact with pins, leads, or circuitry.
- Place reusable electrostatic-sensitive parts from assemblies in protective packaging or conductive foam.

Disassembly

- During disassembly, label each cable as you remove it, noting its position and routing, or take a photo of the cable positions and routing before and/or during the disassembly process. This will make the replacement of the cables much easier and will ensure that the cables are rerouted properly to protect the cables.

- Keep all screws with the device it was removed from. The screws used in the computer may be of different thread sizes and length; installing screws incorrectly could damage the device.

HP Model Z2 PC

Figure 1 - Z2 Tower Diagram
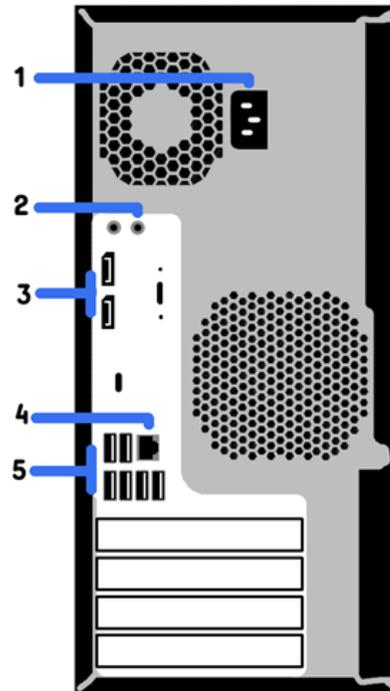
Overview

1 – Power cord socket
2 – Audio line out
3 – DisplayPort output
4 – Network port
5 – USB ports

Required Tooling:

- Phillips #2 Screwdriver
- Torx 15 Screwdriver
- Flat-bladed screwdriver (may sometimes be used in place of T15 driver)

Access Panel Removal

⚠️ **WARNING:**

Be sure the AC power cord is disconnected prior to performing servicing.

Lift latch handle to remove side cover.

Power Supply Replacement

- Prepare the computer for disassembly.
- Remove the access panel.
- Remove the 4 mounting screws shown below.
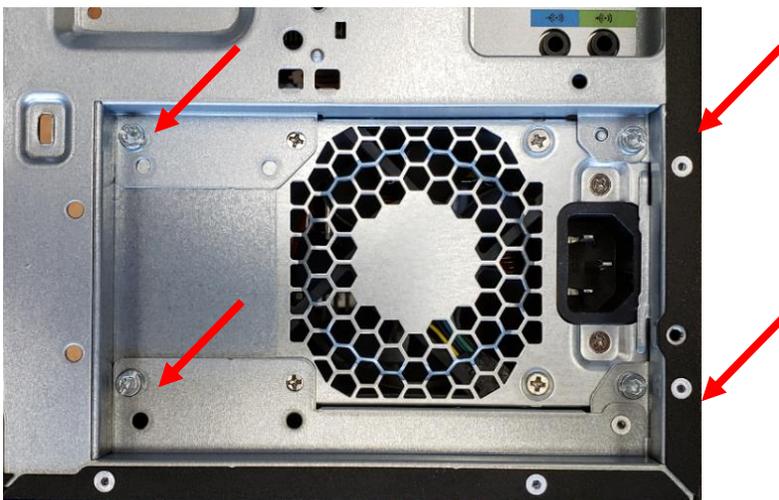
⚠️ **Caution:** Static electricity can damage electrical components.

Disconnect the power supply interconnect cables (DVD Drive, motherboard, hard drive), and slide them out of the retaining clip used to position the wires.

Once completed, remove the Power Supply from the PC by depressing the retention tab on the chassis to allow the power supply to slide out of its mounted position.

Reinstall in reverse order.
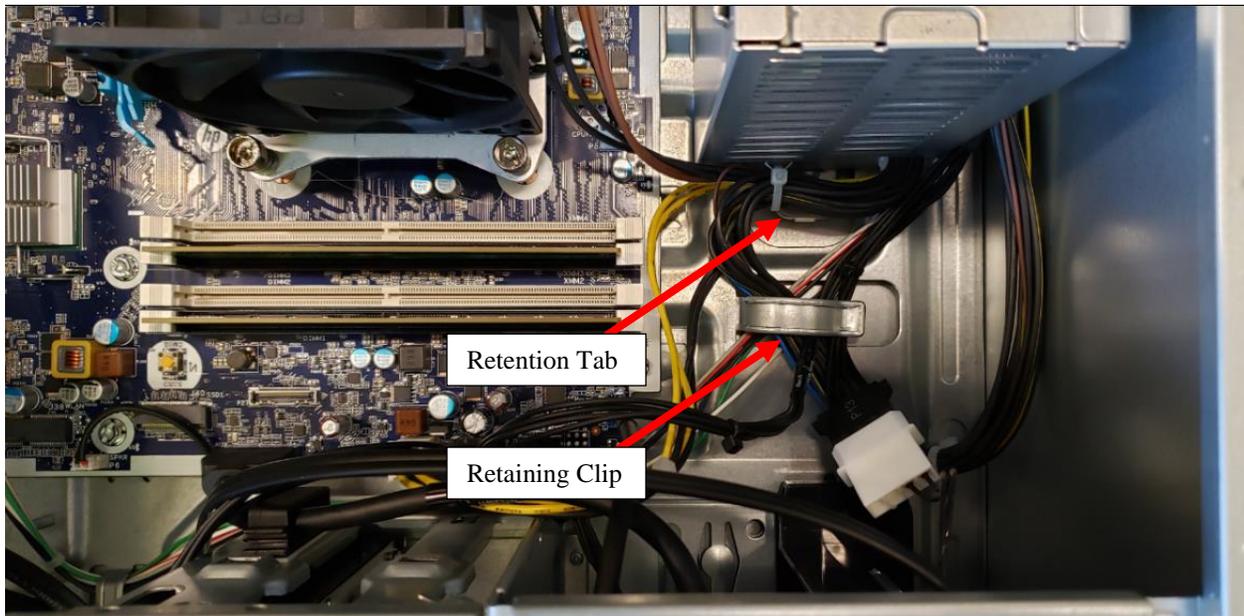
Hard Drive Replacement

⚠️ **Caution:** Static electricity can damage electrical components.

- Prepare the computer for disassembly
- Remove the access panel
- Disconnect the data and power cables from the hard drive (labeled A and B below respectively).
- Squeeze the retaining clips gently together to allow the hard drive to slide out of the drive rack.
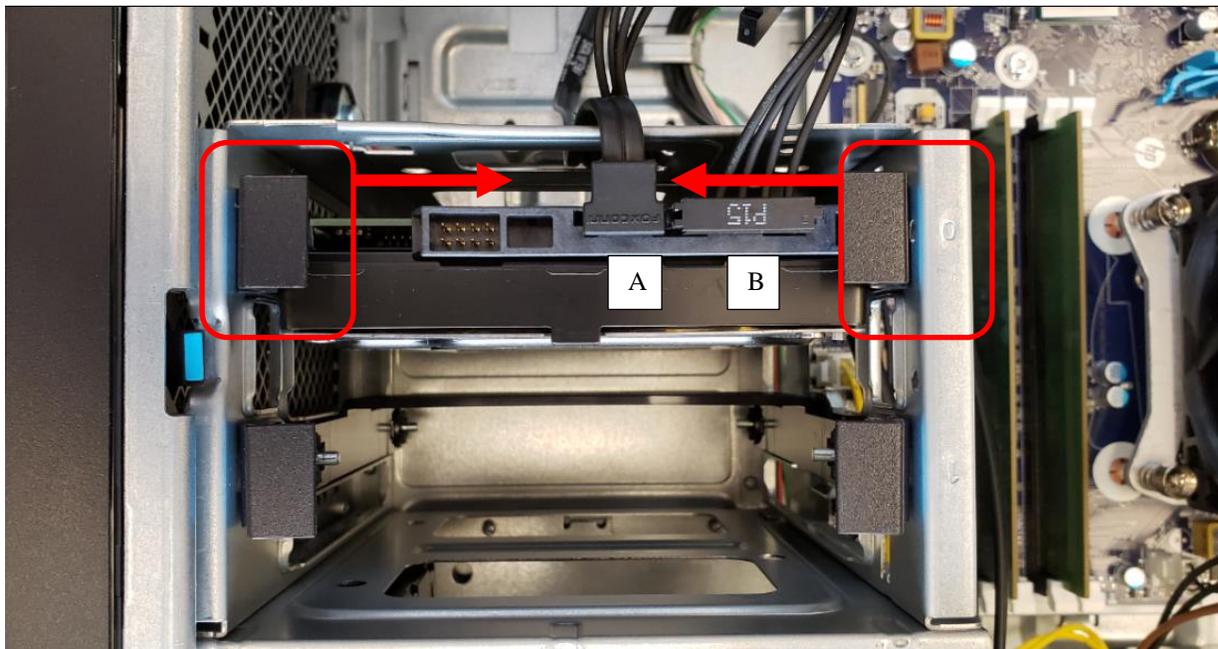
The drive rails will need to be removed and mounted to the new drive prior to installation by flexing the plastic rail material to allow the mounting pins to exit the drive holes.

Once the rails are in place, slide the new drive into the drive rack, and reinstall the data and power cables.

RAM (Random Access Memory) Replacement

⚠️ **Caution:** Static electricity can damage electrical components.

To replace the RAM

1) Push down and out on the side tabs for the RAM module to be removed.

2) Take note of the notch on the RAM stick (offset from center) when installing replacement RAM.

3) Install the replacement RAM into the notched RAM slot and push down on the sides of the RAM to lock into place. The latching tabs should move into a vertical position to hold the RAM into place firmly.

Motherboard Replacement

⚠️ **Caution:** Static electricity can damage electrical components.

- Prepare the computer for disassembly
- Remove the access panel
- Disconnect all cables and storage devices from the PC motherboard.
- Remove the 7 mounting screws with a T15 Torx or straight blade screwdriver.
- Loosen the 4 retention screws attached to the CPU cooler that are also connected to the PC chassis.
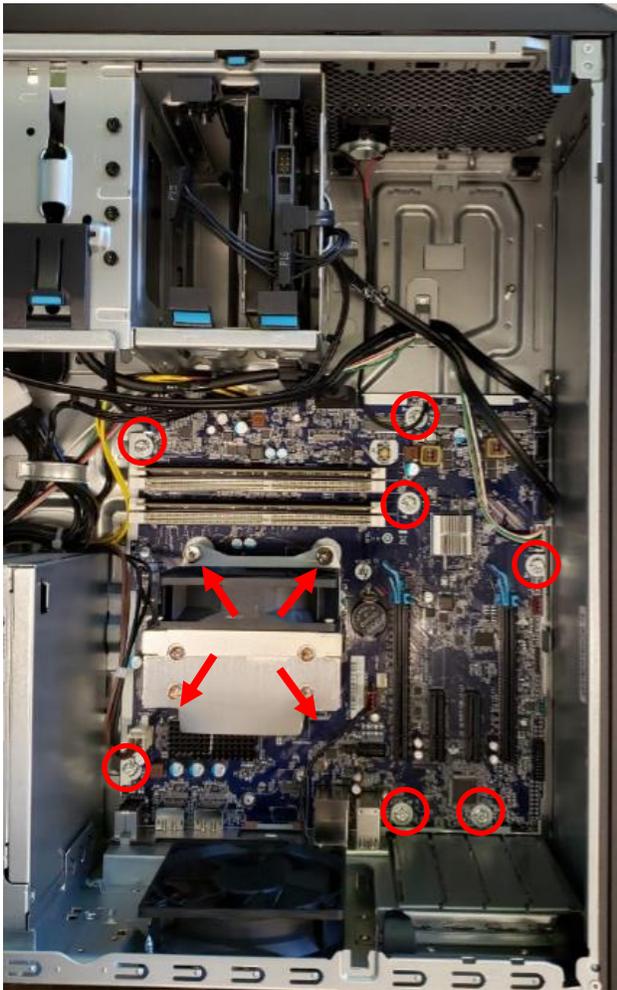
Zoom View of data cable connections

NOTE: When replacing the system board, be sure that the CPU cooler and system memory are removed from the defective motherboard and installed on the replacement motherboard.

Remove the CPU cooler and set it aside to be used when installing the new motherboard.

Remove the motherboard from the chassis.
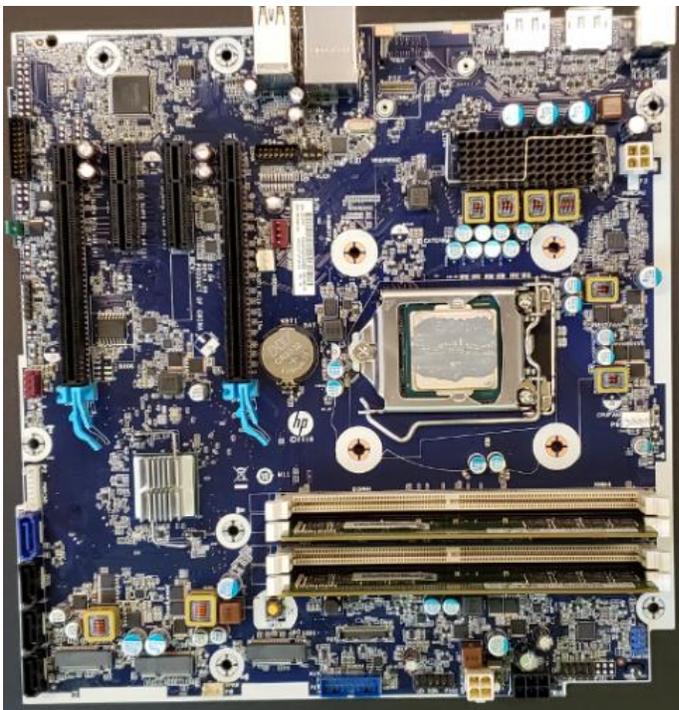
Install the new motherboard by angling the board into the chassis with the external connectors being lowest point as it is placed onto the chassis mounts.

Reassemble in reverse order.

Q-TEL Item Description Listing	
Material Number	**Item Description**
749585	HP Z2 G4 Dual HDD Workstation
749846	Z2 HDD 1 TB 7200RPM SATA Ent 3.5 in (both drives are identical)
749847	Z2 RAM 8GB DDR4 2666 DIMM ECC
749849	Z2 Keyboard USB Bus Slim US
749850	Z2 TWR G4 90 500W Chassis Power Supply
749851	Z2 Mouse
749852	Z2 PC Motherboard
SERV R749585	RECON PC HP Z2 w/WINDOWS 10 64BIT

Additional PC Information:

Lithium coin cell battery

The battery that comes with the computer provides power to the real-time clock and has a minimum lifetime of about three years.

10. TROUBLESHOOTING

This chapter describes how to troubleshoot or resolve software and hardware issues that may affect the Q-Tel RMS.

⚠️ *WARNING! Contact Technical Support.*

> If at any time you suspect your Q-Tel RMS system is not working properly, immediately contact Technical Support. See *Contact information*.

Software: Diagnostic/Service Programs and Procedures

View the log file using a text editor such as Microsoft Notepad. At the beginning of the log file is a line of information about the log itself.

```
<QuintonErrorLog Version="1.1" StartTime="12/27/01 08:23:41">
```

The following table describes the standard log entries. Not all contents indicate error. Some messages contain informational data.

Sample Log Entry	Explanation
<QuintonEvent>	Begin logged event.
<QuintonEvent version="1.0" Forwarded="n" Count="1" RawTime="1009470402" Type="11" Severity="105" ContextID="1200" hResult="800A0BCD">	Information about the version, number of times the event was detected, type, severity and context of the event.
<Date>Thu Dec 27 08:26:42 2001</Date>	Date and time in human format.
<Guid>{5CFF4640-ACC6-11D3-8F63-0000C0282FFD}</Guid>	ID of the object (if any).
<MachineName>Q-Tel</MachineName>	Machine where the log file is written.
<Message>Test started</Message>	Message text for the log entry.
<Location>CBOBase::GetVal(Long)</Location>	Code module and function where the error occurred.
<LineNumber>1394</LineNumber>	Line number in that module/function.
<UserName>Administrator</UserName>	Logged-in user.
<Data>0</Data>	Any data associated with the event.
</QuintonEvent>	End of event.

Laser Printer

In the event of a printer problem, consult the user guide that came with the printer.

Transmitter Troubleshooting

⚠️ *WARNING! Contact Technical Support.*

If at any time you suspect your Q-Tel RMS system is not working properly, immediately contact Technical Support. See *Contact information*.

S2 WIFI Transmitter Troubleshooting:

Refer to the 95115-210-50-ENG S2 User manual for troubleshooting instructions.

Speakers

Use the following table to troubleshoot the Q-Tel RMS speakers.

Symptom	Possible Cause	Resolution
No Alarm Sound	Power cord is not plugged into the power strip.	Verify power cord is firmly plugged into power strip.
	The Speaker cord is not plugged into the PC.	Verify that the speaker cord is firmly plugged into the PC.
	Volume on the speaker is turned down.	Check that the speaker volume is at the correct level.
	Windows volume is turned down.	Check the sound volume in the Windows control panel.

Application will not launch – Auto Import DB Corruption

If an XML file was imported via Q-Exchange that did not conform to the QTel field length restrictions (such as >40 characters for the Order Number), and it is written to the database, the QTel application may crash when attempting to launch.

To avoid this situation from occurring the instructions for using and configuring Auto-Import in the Q-Tel Install Manual (9515-193-60-ENG) should be followed specifically.

If this situation does occur, contact Technical Support for assistance.

Error Messages

The errors in the following table refer to messages generated by the Q-Tel RMS application rather than those that are generated by the Microsoft operating system. If the given remedies for these errors are ineffective, contact Technical Support. See *Contact information*.

#	Error Message	Resolution
411	Warning, an unexpected error has occurred while saving data. Continuing to run the application in this state can result in unexpected behavior and/or loss of data. Click OK to continue without saving or Cancel to attempt to resolve the problem.	Select **OK** to discard your input. Select **Cancel** to return to the data fields to change your input. If you continue to receive this message, restart the Q-Tel RMS application.
465	There is a problem with alarm manager.	Verify that Windows has an active default sound device selected. If multiple sound devices are present, try setting a different sound device as default.
466	We are unable to create all our components.	Call Technical Support.
467	The transmitter setup has a problem.	Use the Configuration utility to view your transmitter setup. Check that the transmitters for your system are configured properly.
468	The default alarm setup has a problem.	Use the Configuration utility to view the default alarm setup. Verify all alarm settings.
469	Event Manager was unable to start.	Reboot the computer.
470	Report Manager could not start. You will not be able to run reports.	Call Technical Support.
471	Chart Manager could not start. You will not be able to print chart strips.	Call Technical Support.
727	You must discharge your patients before closing.	The Q-Tel RMS application cannot be closed if patients are being monitored. Discharge the patients and then close the application.
906	Audible Alarm Error. An error occurred that prevented an audible alarm from sounding.	Call Technical Support.
912	Alarm Error. An error occurred that can result in unreliable alarm indications.	Call Technical Support.
1016	Q-Tel RMS requires a minimum screen resolution of [1920 x 1080]. The current screen resolution is [#### x ####].	Go to the Windows **Control Panel** and under **Display Settings**, set the **Screen Resolution** to a resolution equal to or higher than **1920 x 1080**.
1460	You may need to adjust the alarm volume. Select OK to retest the alarm volume or Cancel to run Q-Tel RMS with Session Management disabled.	If you responded **No** to the alarm volume test dialog when you started the Q-Tel RMS application, this error message displays. Check the speaker connector and volume.
1551	The SQL DTC (Distributed Transaction Coordinator) service is not running.	Call Technical Support.
1552	There is not enough file space available.	Your system is running low on disk space. Delete temp files and defrag the hard disk as described in Q-Tel RMS Tower Hard Drive Space Maintenance.
1553	There is not enough file space available to admit any more patients.	Your system is running on disk space. Delete temp files and defrag the hard disk as described in Q-Tel RMS Tower Hard Drive Space Maintenance.
1554	The Q-Tel RMS database is ##% full and is almost out of space.	Perform the Purge/Archive function to free up space in your database.

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#	Error Message	Resolution
1556	The Q-Tel RMS is in an unknown state and cannot run. Please call Technical Support for assistance.	Call Technical Support.
1557	There is only enough file space available to run fewer than one hundred one-hour sessions.	Your system is running low on disk space. Delete temp files and defrag the hard disk as described in Q-Tel RMS Tower Hard Drive Space Maintenance.
1558	The system has detected that you started the Q-Tel RMS application yesterday. Before you can admit another patient you must shut down and restart the application.	Exit the Q-Tel RMS application and then restart it.
	Cannot connect to {Main Tower Name} as Q-Tel Server	Verify that this system has read/write access to the QTelAppsPath share on the Main Tower. For systems not using Active Directory for user authentication, verify that the password for your local user account matches the password set for that user account on the Main Tower. Verify that the your Firewall solution is configured properly on this system and the Main Tower as described in the Installation Manual.
	Failed to instantiate QDataLockManager component	Verify that the HOST file entry, if present on this system, accurately points to the Main Tower as described in the Installation Manual. Verify that the your Firewall solution is configured properly on this system and the Main Tower as described in the Installation Manual.
	Failed to instantiate COM+ application	Verify that the HOST file entry, if present on this system, accurately points to the Main Tower as described in the Installation Manual. Verify that the your Firewall solution is configured properly on this system and the Main Tower as described in the Installation Manual.
	Unable to connect to Q-Tel database: <server>\CSCQTELRMS	Use the Backup Restore Utility ATTACH DB function to re-attach the database as described in the User Manual. Configure your Firewall solution to allow all inbound traffic.

Network Errors

#	Error Message	Resolution
1909 1910	Network connection to Q-Tel RMS Server is down.	Click **Cancel** to shut down the application. Click **Retry** to continue after you have corrected your Q-Tel RMS network issue. Make sure that all Q-Tel RMS System network cables are plugged in securely to the Q-Tel Machines and switches. Check your machine's System log and verify there are no entries related to your network card.
1910 1911 1912	Session Management function is not available due to network connection problem. You need to restart RMS application on Secondary Tower(s).	Ensure that Q-Tel RMS System network cables are plugged in securely to the Q-Tel machines and switches. Restart Q-Tel RMS towers and

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TROUBLESHOOTING

		Workstations to regain full functionality.
1903 1908	Session Management function is not available due to network connection problem. You need to restart your Q-Tel RMS Workstation.	Ensure that Q-Tel RMS System network cables are plugged in securely to the Q-Tel machines and switches. Restart Q-Tel RMS Workstation to regain full functionality.
1905	This computer has lost the connection to the network for more than 5 minutes. You cannot run the Q-Tel RMS application on this computer until the network connection has been re-established and the application has been restarted. The Q-Tel RMS application will exit when you click the Close button	Make sure that all of your Q-Tel RMS Systems Network cables are securely plugged into the Q- Tel RMS machines and switch. Click the **Close** button to shut down the application. Correct the Q- Tel RMS Network issues then restart your Q-Tel RMS Secondary Tower(s) and Q-Tel RMS Workstation(s).

Configuration Errors

#	Error Message	Resolution
800	Warning - [Application you are trying to start] and [application already running] cannot be run at the same time. Please shut down [application already running] before running [Application you are trying to start].	Q-Tel RMS, Configuration, Backup Restore, and Q-Progress cannot be run concurrently. To switch to another Q-Tel application, close the current application before trying to open another.
	DICOM Service was disabled and is enabled on this computer now. The application will terminate. Please reboot the machine to take effect of the set.	The Q-Tel applications require DICOM to be enabled. If DICOM is disabled, the system detects the error and enables DICOM. You must reboot the system for the change to take effect.

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11. SYSTEM UTILITIES

Qtel System Licenses

QTel system licenses can be viewed by using the License Utility, which is accessed via a command prompt window as follows.

1. Open command prompt window   Start – Windows System – Command Prompt

2. Change the directory path   cd C:\Program Files (x86)\Quinton\QTel RMS

3. Launch utility   inilicreader.exe

Current license information should be provided similar to the example below:
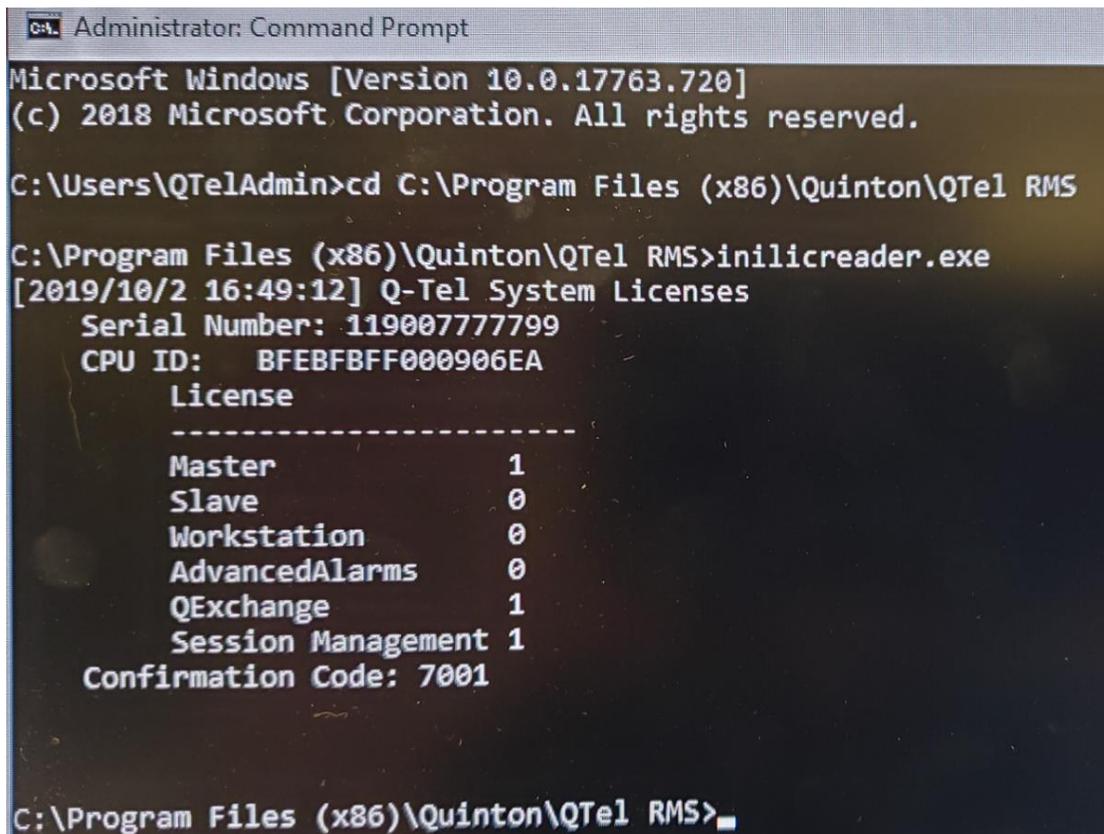
Refer to procedure MIS-12-193-01 for further information regarding QTel licensing.

12. BACKUP AND RESTORE FUNCTIONS

The Q-Tel RMS system includes a Backup/Restore utility. Use the Backup/Restore utility to back up your system and restore the patient rehab data in the event of a catastrophic hardware failure (for example, a hard disk crash). Q-Tel RMS data included in the backup is stored in three areas:

Data	Source
Patient demographic and session data	Microsoft SQL database
Full Disclosure ECG data and ECG strips	Direct access binary files
Q-Progress patient reports	Individual Microsoft Excel workbooks

The backup does not include PDF reports generated by Q-Tel RMS.

The Backup/Restore utility copies data from all three sources to your selected backup media; network drive or external hard drive for backup storage. **Note:** The Backup/Restore utility saves the rehab data located on the Q-Tel RMS computer ONLY. If you have set up the Q-Progress directory for storage of the Excel to a folder other than the default (C:\Program Files\Quinton\QTel RMS\QProgressCSVData) on the Q-Tel RMS system then these files are not saved with the backup. You should ensure that your system administrator is properly backing up these files, along with any other data critical to your operation on a regular basis.

Backup media should be stored in a secure location physically separate from the Q-Tel RMS system to mitigate loss due to fire or flood. Ensure environmental conditions specified for the backup media are maintained. If backing up to a network drive, ensure appropriate safeguards are in place.

Backup

This section describes how to back up data on the Q-Tel RMS system.

Backup Frequency

The frequency of your system backups should be based on the effort required to do the backups versus the effort to recover from the loss of data. Whether you back up to external hard drive or to a network drive, it is recommended that you perform a backup of your Q-Tel RMS system daily. The backup process can run unattended.

1. Perform the backup process described in the next section.
2. Leave for the day.
3. The next morning close the Backup/Restore utility.

Backing up Q-Tel RMS

You cannot use the Q-Tel RMS system while a backup is in process.

The backup can take several hours depending on how much rehab data is on your system. It is best to begin the backup before leaving for the day.

> *NOTE: You must be logged into the system using an account with administrator privileges in order to run the Backup/Restore Utility.*

To back up the Q-Tel RMS system:

1. Close all applications.
2. Double-click on the **Q-Tel Backup Restore** icon on the Q-Tel RMS system desktop. The system displays the **Backup/Restore Utility** screen.
3. Select the backup location in the **Data Destination** section. If you are backing up to tape, insert a tape.
4. Click on Start Backup.
   - If you selected **Hard Drive** as your data destination, the system displays the **Select Backup Folder** screen.
   - To back up to a networked drive, your Q-Tel RMS computer must be mapped to that drive:
     a. Click the down arrow on the **Select Backup** Folder.
     b. Select the drive for the backup files.
     c. Select a folder and the path for the backup files.
     d. Click **OK**.
5. The Backup/Restore utility checks to make sure there is enough space for the backup.

⚠️ *Caution: Possible improper system performance.*

> Backup does not overwrite the previous backup. Periodically you must delete old backups in order to ensure there is room on the drive for new backups.

The directories are listed in the **Backup** tab as they are backed up. When the backup is complete, the system displays a message indicating that the backup was successful.

6. Click **OK**.
7. Close the Backup/Restore utility.

Restore

The Restore function writes all of the data from the backup media to the Q-Tel RMS system, completely restoring the Q-Tel RMS SQL database, the associated ECG files, and any Q-Progress files stored in the C:\ProgramFiles\Quinton\QTel RMS\QProgressCSVDatafolder.

You cannot use the Q-Tel RMS system while Restore is active.

The Restore process can take several hours depending on how much rehab data was backed up.

⚠️ *Caution: Possible data loss.*

> Restoring an old backup file will overwrite any existing data, including the Q-Tel RMS database, ECG files, and Q-Progress files. Do not perform a restore if you require any of the data on the system hard drive.

To restore data from a backup:

1. Close all applications.
2. Double-click on the **Backup Restore** icon on the Q-Tel RMS system desktop. You must have administrative privileges to run the Restore function.
3. Click the **Restore** tab.
4. Verify the correct backup media is selected.
5. Click **Start Restore**. The system displays a message warning that all rehab data on the Q-Tel RMS system will be overwritten with the contents of the backup.
6. Select **Yes** to proceed with the Restore or select **No** to cancel the Restore.

7. For a restore from the hard drive, select the location of the backup you want to use for the restore process; click on the backup name, then click **OK**. The system restores the selected backup. When the restore is complete, the system displays a message indicating that the Restore was successful.
8. Click **OK**.
9. Close the Backup/Restore utility.

Messages

The Backup/Restore utility detects the following conditions and displays a dialog box:

Error Condition	Description
Incompatible data	The backup media and the Q-Tel RMS system contain different software versions.
Missing data	The backup files are not in the specified folder.

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