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Welch Allyn®

ELI® Link

ELI Electrocardiograph's

Link to PC

Administrator Manual

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User Safety Information

 WARNING: Means there is the possibility of personal injury to you or others.

 Caution: Means there is the possibility of damage to the device.

Note: Provides information to further assist in the use of the device.

 WARNING(S)

- When the 40 Hz filter is used for PDFs, the frequency response requirement for diagnostic ECG equipment cannot be met. The 40 Hz filter significantly reduces high-frequency components of the ECG and pacemaker spike amplitudes, and is recommended only if high-frequency noise cannot be reduced by proper procedures.

- Delayed patient care could result from improper installation and configuration. Proper installation and configuration of ELIs, ELI Link, and 3rd party ECG management system must be verified before using for patient care.

- Changes to the ELI Link host computer including OS patches, OS configuration changes, installation or reconfiguration of other software, etc. could cause ELI Link to malfunction and result in delayed patient care. Changes to the network and/or the 3rd party ECG management system could also result in delayed patient care. After changes are made, tests should be performed to verify proper functionality before resuming use for patient care.

- When configured to send HL7 results messages, the ELIs will report successful ECG transmissions before the HL7 result messages are sent. See the MDI Service Manual, REF 9516-166-51 for information about monitoring the HL7 interface so failed ECG transmissions can be detected as soon as possible.

 Caution(s)

- None.

Note(s)

- None.

Table of Contents

1 Installation

This administrator's manual contains information about the installation and configuration of ELI Link gateway software. While this manual does provide some information on configuring an ELI electrocardiograph for use with ELI Link, the user should refer to the ELI product manual for specific details.

> *NOTE: This manual may contain screen shots. Any screen shots are provided for reference only. Consult the actual screen in the host language for specific wording.*

1.1   Introduction

ELI Link is a Microsoft Windows service that acts as a data exchange gateway for Welch Allyn's line of ELI electrocardiographs. ELI Link supports all modes of electrocardiograph communications including USB serial communication, USB flash memory, analog modem, LAN, and WLAN. It supports all ELI communications protocols including UNIPRO, UNIPRO32 and UNIPRO64. It also supports the protocol extensions for clock synchronization and extended query codes.

ELI Link v5.2.0 has been tested to run on the following Microsoft operating systems:
- Windows 10 (64 bit).
- Windows Server 2012 R2 (64-bit),
- Windows Server 2016
- Windows Server 2019

PLEASE NOTE: This manual contains references to the "EMIS", "SCI Store" and "AllScripts" modes and settings. Starting with ELI Link version v5.2.0 these three modes and settings are not supported and should not be used. In addition, this manual references the "Pyramis "and "HeartCentrix" installation modes and configuration settings. Starting with ELI Link version v5.2.0, Pyramis/Heartcentrix mode and associated configuration settings are renamed to "Heart Centrix" only.

```
┌──────────────┐        ┌──────────┐        ┌────────────────────┐
│     ECG      │        │          │        │   Welch Allyn ELI  │
│  Management  │ <────> │ ELI Link │ <────> │  Electrocardiograph│
│    System    │        │          │        │                    │
└──────────────┘        └──────────┘        └────────────────────┘
```
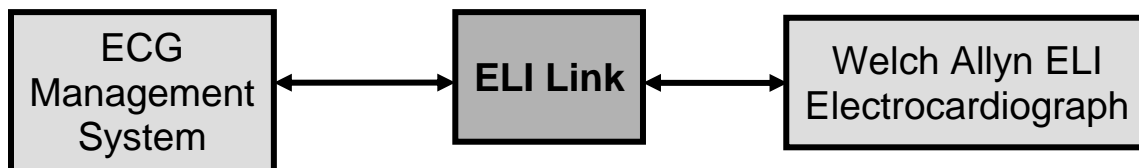
1.2   ELI Link Capacity

Only one instance of ELI Link can be installed on a computer. Each installation of ELI Link supports:

- Up to 8192 sites.
- A single encryption key for all encrypted communications.
- A single direct USB serial connection.
- Up to 32 modems.
- A single, active Local transaction (retrieve orders, send results). If multiple ELI electrocardiographs request orders from a directory or store ECG outputs in a directory at the same time, each ELI electrocardiograph must wait its turn to perform its local transaction.
- A single, active DICOM transaction. If multiple ELI electrocardiographs request MWL or storing ECGs at the same, each ELI electrocardiograph must wait its turn to perform its DICOM transaction.

- A single, active Pyramis® or HeartCentrix® transaction. If multiple ELI electrocardiographs request a MWL or storing ECGs at the same, each ELI electrocardiograph must wait its turn to perform its Pyramis or HeartCentrix transaction.
- A single, active HL7 transaction (retrieve patient list, retrieve orders, and send results). If multiple ELI electrocardiographs perform an HL7 transaction at the same time, each ELI electrocardiograph must wait its turn to perform the HL7 transaction.
- A single, active Allscripts transaction (retrieve orders, send results). If multiple ELI electrocardiographs perform an Allscripts transaction at the same time, each ELI electrocardiograph must wait its turn to perform its Allscripts transaction.
- A single, active EMIS Store transaction (retrieve orders, send results). If multiple ELI electrocardiographs perform an EMIS Store transaction at the same time, each ELI electrocardiograph must wait its turn to perform its EMIS transaction.
- A single, active SCI Store transaction (retrieve orders). If multiple ELI electrocardiographs perform a SCI Store transaction at the same time, each ELI electrocardiograph must wait its turn to perform its SCI Store transaction.

1.3   Installation Steps

The installation of the ELI Link application requires that the user performing the installation have local administrator privileges for the computer on which the application is being installed. Note that "roaming" Windows user accounts are not supported.

These installation steps for the ELI Link application are intended for a clean system which is defined here as an operating system that has not had ELI Link installed on it previously.

NOTE: When installed for DICOM, all ELIs must be configured for DICOM as well, even if ELI Link is not configured to make DICOM connections to other information systems. ELI Link will refuse communications from ELIs that are not enabled for DICOM. Refer to the ELI manuals for more details about configuring them for DICOM.

1. Install .NET Framework 3.5 using *Server Manager* or *Windows Features* if not already installed.

   For Windows 10 (64-bit)
   - i. Go to the **Control Panel**.
   - ii. Launch **Programs and Features** (located under **Programs**).
   - iii. Click **Turn Windows features on or off**. This launches Windows Features.
   - iv. Check to confirm if **.NET Framework 3.5 (includes .NET 2.0 and 3.0)** feature is turned on. This is confirmed by looking for a filled box to the left of this feature.
   - v. If **.NET Framework 3.5 (includes .NET 2.0 and 3.0) feature** is already turned on, click **Cancel** and go to DONE
   - vi. If **.NET Framework 3.5 (includes .NET 2.0 and 3.0)** is turned off, select **.NET Framework 3.5 (includes .NET 2.0 and 3.0)**. Note, the additional features for HTTP and Non-HTTP Activation are unnecessary. Click **OK**.
   - vii. Window Features dialog comes up. prompting *Windows needs files from Windows Update to finishing installing some features*, select **Let Windows Update download the files for you**.
   - viii. After completion of downloading required files and applying changes, Window Features dialog comes up prompting *Windows completed the requested changes*, select **Close**.
   - ix. DONE and close the Programs and Features screen.

For Windows Server 2012 R2, 2016 and 2019
   i. Go to the **Control Panel**.
   ii. Launch **Programs and Features** (may be located under **Programs**).
   iii. Click **Turn Windows features on or off**. This launches Server Manager.
   iv. On the page *Before you begin* comes up, click **Next >**.
   v. On the page *Select installation type*, select **Role-based or feature-based installation**. Click **Next >**.
   vi. On the page *Select destination server*, select the local server if not already. Click **Next >**.
   vii. On the page *Select server roles*, make no changes. Click **Next >**.
   viii. On the page *Select features*, select **.NET Framework 3.5 Features.** Click **Next >**.
       Note: .NET Framework 3.5 (includes .NET 2.0 and 3.0).
   ix. Ignore the warning about "Do you need to specify an alternate source path?". Windows will download the files from Windows Update. Click **Install**.
   x. Installation progress is displayed with a status bar. When Installation succeeded is displayed, click **Close**.
   xi. **Close** the Server Manager application.
   xii. Run **Windows Update** to apply any missing updates.

2. ELI Link can be configured to work with a local/remote SQL Server Enterprise or a local instance of SQL Server Express. SQL Server versions supported are 2012 SP4, 2017 and 2019.

   IMPORTANT: If installing ELI Link onto WIN Server 2016 or 2019 with a remote SQL database, the prerequisite file needed for ELI Link to connect to the database (SQLCMD.EXE) is not installed. The following two components will need to be manually loaded from Microsoft.com prior to proceeding with the installation.

   - Microsoft ODBC Driver 17 for SQL Server (x64)
   - SQLCMD.EXE

   Reboot the system after loading the two files.

   Note, the following steps are for the Express editions only.

   a. Browse to the folder *SQL Server Installer* on the ELI Link installation DVD (P/N 107347). Launch the desired edition of Microsoft SQL Server Express, by double clicking on the appropriate .exe file as listed:

      For Microsoft SQL Server 2012 Express with Tools SP4 installer:

         en_sql_server_2012_express_edition_with_tools_with_service_pack_4_x64_100066349.exe

      For Microsoft SQL Server 2019:

         SQLEXPRADV_x64_ENU_2019.exe

   Notes
   - Microsoft SQL Server Express 2017 is not provided on the DVD. If desired the executable will have to be download from the Microsoft site.
   - When 201x is used in the following steps, x is indicating 2, 7 or 9 displayed depending on the SQL Server version installed (2012, 2017 or 2019).

     b. If prompted *Do you want to allow this app to make changes to your device?* Click **Yes**.

     c. If prompted *Choose Directory For Extracted Files,* select default (directory where .exe file is located). click **Ok**.

     d. SQL Server Installation Center / Installation: Click **New SQL Server stand-alone installation or add features to an existing installation**

     e. If prompted for License Terms. **Check** *I accept the license terms*. If available, leave *Send feature usage…* unchecked. Click **Next >**.

     f. If Microsoft Updates are recommended a dialog comes up asking *Use Microsoft Update to check for updates (recommended)*. Select the box and click **Next >**.

     g. If prompted *There are no updates for SQL Server found online*. Click **Next >**.

     h. SQL Server 201x Setup / Install Rules: The status of the Rules is displayed. Click **Next >**.

     i. SQL Server 201x Setup / Feature Selection, select the features:
        - **Database Engine Services**
        - **Management Tools – Basic** (only applicable for SQL Server 2012 SP4)
        - **SQL Client Connectivity SDK**
        Uncheck all other features. Leave the default settings for the Shared directories. Click **Next >**.

     j. SQL Server 201x Setup / Instance Configuration: Leave default instance name: **SQLExpress**. Click **Next >**.

     k. SQL Server 201x Setup / Server Configuration: Leave *SQL Server Data Engine Startup Type* set for **Automatic** and set *SQL Server Browser Startup Type* to **Manual**. Click **Next >**.

     l. SQL Server 201x Setup / Database Engine Configuration / Server Configuration tab:
        - Set Authentication Mode to: **Mixed Mode**
        - Set the custom sa password. *Example: Eli_Link_7865*
        - Add other users/groups to the SQL Server Administrators list if necessary.
        - Click the Data Directories tab. Set the Data Root Directory to be **C:\ProgramData\Mortara Instrument Inc\ELI_LINK_SQL.** The other directories will adjust accordingly. Click **Next >**.

     m. Displayed for SQL Server 2012 version only, SQL Server 2012 Setup / Error Reporting: Uncheck *Send Windows and SQL Server Error Reports…* Click **Next >**.

     n. SQL Server 201x Setup / Complete: Verify that all features were installed successfully.

     o. If prompted *One or more affected files have operations pending. You must restart your computer after the setup process is completed*. Click **OK**.

     p. Click **Close** to exit SQL Server 201x Setup.

     q. Close the *SQL Server Installation Center* application.

3. Run **setup.exe** from the *ELI Link* folder on the installation DVD (P/N 107347).

4. If the **Visual C++ Runtime Libraries (x86)** are not already on the computer, follow the prompts to install them.

5. If prompted *Do you want to allow this app to make changes to your device?* Click **Yes**.

6. ELI Link / Welcome to the ELI Link Setup Wizard: Click **Next >**.

7. ELI Link / Select Installation Folder: Leave the default folder when possible, otherwise choose another appropriate location for the application files. Click **Next >**.

8. ELI Link / Confirm Installation: Click **Next >**.

9. ELI Link / ELI Link Installation: Select **Complete Install with Database** when this is the first time this version of ELI Link is being installed and it has never created a database in SQL Server. Click **Next >**.

10. If prompted *Do you want to allow this app to make changes to your device?* Click **Yes**.

11. Database Connection Configuration: Enter the information to connect to the SQL Server that will be used for the ELI Link database, like the one that may have been installed earlier in this procedure.

Mode	Description
Server Name	Hostname or IP address of the SQL Server. Default: **localhost**
Instance Name	Database instance name. Default: **SQLExpress**
DB Username	A database user that has administrative privileges. Default: **SA**
DB Password	The custom password for the DB user. Default: **Eli_Link_7865**

12. Click **ok**.

Notes:
   a) If you do not have correct database connection configuration, you will be taken back to the configuration screen and you will not be able to complete the installation. You can exit out the installer by clicking **cancel** and come back to it later when you have correct database connection configuration.
   b) If the database connection fails for other reasons like database not available or permission issues, you will be taken back to the configuration screen and you will not be able to complete the installation. You can exit out the installer by clicking **cancel** and come back to it later when the database is available and accessible.

13. ELI Link Installation modes / Please Select ELI Link Mode: Select one of the installation modes as show below, then click **NEXT**.

Mode	Description
LOCAL	Supports XML orders
HL7	Supports HL7 orders and results. Select this for MDI integration.
DICOM	Supports DICOM Modality Worklist and DICOM ECG Storage. All ELIs must be configured for DICOM, even if ELI Link is not configured to make DICOM connections to other information systems. ELI Link will refuse communications from ELIs that aren't enabled for DICOM. Refer to the ELI manuals for more details about configuring them for DICOM.
Heart Centrix	Supports HeartCentrix

14. ELI Link / Installation Complete: Click **Close**.

15. Click **Yes** to restart the computer.

1.4   ELI Link SQL Database Migration

The Database Migration process is to be performed when moving to a newly supported operating system (Microsoft Windows Server 2016 or 2019) - and/or - SQL database (Microsoft SQL Server 2017 or 2019, Express or Enterprise).

For detailed steps on the Database Migration Process contact Hillrom Technical Support to reference the latest revision of MIS-18-166-11 (section titled "Eli Link SQL Database Migration").

Note: This Database Migration Procedure will require:

- a new/clean server instance (with OS) to be established before installing the new version of ELI Link and then migrating the database configuration

- SQL Server Management Studio (SMSS) to be installed on both the Target and Source systems.

2 Device Communications

ELI electrocardiograph communications to ELI Link are specified on the **Device Communications** tab. ELI Link accepts connections from ELI electrocardiographs via USB serial connections, networking, and analog modems. It can also accept UNIPRO files dropped into the configured Import folder.

2.1   USB Serial Configuration

When a USB serial connection will be used, check the **Enable Serial Commination** box: select USB when using a USB cable. USB connections are fixed at 115200 baud.

2.2   Network Configuration

When a network connection via LAN or WLAN will be used, check the **Enable Network Communication** box, and specify an unused TCP/IP port (default port is 5101). Verify all networking software and hardware between the electrocardiograph(s) and ELI Link are configured to allow TCP/IP traffic between them. If firewall software is running on the ELI Link computer, it must be configured to allow connections on the configured port. An administrator may need to add the TCP/IP port to the list of firewall exceptions. To add an exception to the Windows Firewall, do the following:

1. Launch **Windows Firewall** from the **Control Panel**. In case of Windows Server 2019, from Windows start button select **Windows Security** and then **Firewall & network protection**.
2. Click **Advanced settings**.
3. If prompted *Do you want to allow this app to make changes to your device?* Click **Yes**.
4. Click **Inbound Rules**.
5. Click **New Rule…**
6. Select **Port**, then click **Next >**.
7. Select **TCP** and specify the configured port e.g. **5101**, then click **Next >**.
8. Select **Allow the connection**, then click **Next >**.
9. Check **Domain**, **Private**, and **Public**, then click **Next >**.
10. Name the rule, e.g. "**ELI Link**".
11. Click **Finish**.

2.3   Modem Configuration

When an analog modem will be used, check the **Enable Modem Communication** box and the modem COM ports that will be used. Check the modem initialization string and hang-up string to make sure the settings are appropriate for the modems being used. The default modem strings are for a US Robotics Sportster modem. The COM ports available to ELI Link default to ports 1 through 4096.

2.4   Directory Configuration

UNIPRO, UNIPRO32 and UNIPRO64 files from other Welch Allyn devices such as Surveyor™ and HScribe™ should be dropped into the "UNIPRO Import" Folder. ELI Link will process these files like all other ECGs it receives. It will automatically delete the UNIPRO files as they are processed. If any files fail to be processed, they will be moved into a subfolder named "failed."

2.5   Encryption Key

Some ELI models encrypt transmissions over networks and analog modems. By default, the encryption key is blank. When it is blank, ELI Link expects all encrypted transmissions to be using the Welch Allyn key built into the devices. If a different encryption key is used, enter it into the **Key** field. The key may be up to 16 characters.

Check **Hide Encryption Key** to hide the key on the screen. The same key must be entered into all the ELI electrocardiographs transmitting ECGs to ELI Link, so choose characters that can be entered on the ELI keyboards. If this key is changed after initial setup, be sure to change the key on all ELI electrocardiographs communicating with it.

3 Organizations / General

3.1 Organizations

Multiple Organizations may share a single instance of ELI Link. Each Organization has its own:
- **Sites** of ELIs
- **Devices** authorized to connect
- **ECG** transmission sets
- **Orders** sources
- **Patient List** sources
- **Authentication** of ELI users
- **Custom ID** layouts
- **Query Codes** sets
- **PDF** layouts
- **Rhythm PDF layouts**
- **Patient Demographics Query** sets.

3.2 General Tab

To create an Organization, go to the **General** tab and click **Add**. Name the Organization and select a **Language**. The Language setting is used by ELI Link to decode the strings in the ECGs and to select the demographic, measurement, and lead labels for PDFs. The Language setting depends on whether any UNIPRO ELI electrocardiographs are using a language other than English:

- If all UNIPRO ELIs are using English, then set Language to "Per Cart". This allows newer UNIPRO32 and UNIPRO64 ELIs to use other (non-English) languages.

- If some UNIPRO ELIs are not using English, then set Language to match the ELI's language. When in this mode, all ELIs, no matter which version of UNIPRO they are using, must be using this same language.

Check **Enable Serial Number Checking** if ELI Link should check device serial numbers. When checked, ELI Link will reject communications from devices that are not attached to a Site; it will only accept communications from attached devices. Note, devices are configured on the **Devices** tab, and they are attached to sites on the **Sites** tab.

4 Sites

4.1   Sites Tab

It is important to do some planning before configuring a new ELI Link and a fleet of connected devices. The devices may be grouped to optimize configuration management and clinical workflow. Give careful thought to Sites and Query Codes before configuring ELI Link so the devices will not need to be reconfigured after they are in use throughout the facility and remote sites.

A **Site** organizes the configuration for a pool of interchangeable devices. The only information distinguishing ECGs coming from different devices in the same Site are the device serial numbers and user-assigned cart numbers. A Site can represent a care area like an "Emergency Department," a location like "Maplewood Clinic," a clinical trial like "Compound 123 TQT Trial," or some other logical grouping of the devices. The site identifier is stored in ECG records and is often used to identify where the test was performed.

Each Site is uniquely identified by its **Site Number**. Devices using UNIPRO and UNIPRO32 support site numbers from 0 to 4095. Devices using UNIPRO64 support site numbers from 0 to 8191. The site number must be programmed into each of the devices communicating with ELI Link.

After one or more configuration sets have been created for ECG Transmissions, Orders Download, Patient List, Authentication, Custom ID, Query Codes, PDF, Rhythm PDF, and Patient Demographics Query, the Sites can be configured by clicking the **Sites** tab. The Sites tab displays the currently configured Sites and their associated configuration sets. Column headers can be clicked to sort the list.

On the right, **Devices** can be attached to the Site. When the Organization is enabled for *Serial Number Checking*, attaching Devices to the Site authorizes them to be in the Site, and Devices not attached to the Site will be denied access to ELI Link. Also on the right, one or more **ECGs** Transmission Sets can be attached to the Site. ECGs received from devices in the Site will be sent to each Transmission Set attached to the Site.

Click **Add** to create a new Site. The next available **Site Number** will be provided, but it can be changed to any other unused Site Number. Then select configuration sets to be associated with the Site.

Each site must have a **Site Name**. This is a short name that describes the site and is often used to identify where the test was performed. It can be the name of the institution, department, clinical trial, investigator site, or something else descriptive. It is used in the footer of PDF ECGs exported from ELI Link. It is exported as the Site Name in XML files and the Institution Name (0008,0080) in DICOM files.

Each site can also be configured to use a Patient Demographics Query (PDQ) set. The configuration for the PDQ set is in the **Patient Demographics Query** tab.

> *NOTE: The site name is independently programmed into ELI Link and the ELI electrocardiographs. ELI Link uses its site name for UNIPRO and UNIPRO32 ECGs. ELI Link uses the ELI electrocardiograph's site name for UNIPRO64 ECGs. It is highly recommended to program the same site name into both ELI Link and the ELI electrocardiographs to avoid confusion.*

5 Devices

5.1 Devices Tab

If an Organization has opted to enable **Serial Number Checking** (see General tab), all the organization's devices must be configured on the Devices tab. For each device, click the **Add** button. Give the device a descriptive **Name** that can be used to distinguish it within ELI Link. If the Organization has assigned it an Asset ID or Tag, it may be entered into the **Organization Asset ID** field. Enter the device's **Model Name** (e.g. ELI 380), **Software Version**, **Reference Number** (found near the serial number, e.g. EL380-X-Y), organization-assigned **Cart Number**, and **Serial Number**. **Max Sites** will normally be 1, but set it to 3 if the device has the Multi-Study / Multisite feature primarily used by investigators participating in research studies.

If Sites have been defined, attach each Device to its Site on the right side of the Devices form.

6 ECG Transmissions

6.1   ECG Transmissions Tab

ECG Transmission Sets are defined on the ECG tab. Use the Add button to create a new Transmission Set. Give the set a descriptive **Name** so it can be selected in the Site configuration tab. Check **Remove Appended Confirm Status** if the confirmation status statement, e.g. UNCONFIRMED REPORT, should be removed from the automatic interpretation statements in all structured exports, e.g. XML, DICOM, and HL7. Check **500s/s** if the ECG waveforms should be down-sampled to 500 samples per second in all exports.

6.2   Local Transmission Set

Set the Type to **Local** to export ECGs as files. Define the full path to an export directory for each type of file that should be exported in the Transmission Set. The path can be directly entered into the text box or the **Browse…** button can be used to find or create a directory. Paths may be local paths starting with a drive letter, or they may be UNC paths in the form **\\<hostname>\<path>**. When an ECG is received from an ELI, ELI Link will store the configured file types into the configured directories. If a directory does not exist or the ELI Link service does not have permission to create files in that directory, the ELI will report a transmission failure to the user. The account that the ELI Link service runs under may need to be changed when directory permissions are restricted to certain accounts and groups.

File Type	Description	Output Directory	File Name Format
UNIPRO UNIPRO32	Native binary file format from older-model ELIs.	ELI Output Directory	UNIPRO File Name Format
UNIPRO64	Native XML file format from late-model ELIs. Ordered ECGs export a second "order" file.	ELI Output Directory	UNIPRO64 Format UNIPRO64 Order Format
PDF	Vector-drawn PDF created according to the Site's PDF layout.	PDF Output Directory	PDF File Name Format
Rhythm PDF	Vector-drawn PDF created according to the Site's Rhythm PDF layout.	Rhythm PDF Output Directory	Rhythm PDF File Name Format
XML-MI	Mortara Instrument XML format includes all data from the ECG including patient demographics, ECG acquisition information, automatic interpretation results, and the waveform samples.	XML-MI Output Directory	XML-MI Format
XML-FDA	FDA-XML, aECG, Annotated ECG HL7 message primarily used by clinical research tools and FDA's ECG Warehouse.	XML-FDA Output Directory	XML-FDA Format
XML-ALT	Primarily for McKesson Horizon Cardiology systems prior to version 12.	XML-ALT Output Directory	XML-ALT Format
XML Receipt	When XML orders are used, an XML order file is exported into this directory as an ordered ECG is received by ELI Link.	XML Receipt Output Directory	XML Receipt Format
Rhythm XML	UNIPRO64 based Native XML file format from late-model ELIs for Rhythm ECG recordings.	Rhythm XML Output Directory	Rhythm XML File Name Format

The filename formats can be customized with the following variables:

Variable	Description
<Site>	ECG site number.
<ID>	Patient ID.

Variable	Description
<AdmissionID>	Admission ID.
<AccessionNumber>	DICOM accession number.
<LName>	Patient last name.
<FName>	Patient first name.
<MName>	Patient middle name.
<DOB>	Patient birth date in yyyyMMdd format.
<Sex>	Patient sex: Default If from DICOM MWL Male M = Male Female F = Female Unknown O = Other
<TestDate>	ECG acquisition date in yyyyMMdd format.
<TestTime>	ECG acquisition time in HHmmss format.
<RepDate>	File export date in yyyyMMdd format.
<RepTime>	File export time in HHmmss format.

If the PDF files will be used by Welch Allyn's Athena product, the filenames should conform to the following format:

```
R^ECG^_<Site>_<ID>^<LName>^<FName>^_<TestDate><TestTime>_<RepDate><RepTime>.pdf
```

6.3   DICOM Transmission Set

Set the Type to **DICOM** to export ECGs as DICOM files or send them to a DICOM C-Store Service Class Provider (SCP). Click the **Echo** button at the bottom to check the CSTORE SCP settings.

Item	Description
CSTORE Code Page	Windows Code Page used to encode character strings in the DICOM object. When using UNIPRO or UNIPRO32 ELIs in Hungarian, Czech, or Polish, set to 1250. When using UNIPRO or UNIPRO32 ELIs in other languages, set to 1252. When using only UNIPRO64 devices, any of the values may be chosen. **65001** (UTF-8) is the recommended setting. | Code Page	Description	DICOM Value
---	---	---
874	ANSI/OEM Thai (ISO 8859-11)	ISO_IR 166
932	ANSI/OEM Japanese	ISO_IR 13
1250	Central and East European	ISO_IR 101
1252	West European	ISO_IR 100
20127	US ASCII (7-bit)	ISO 2022 IR 6
20949	Korean Wansung	
28591	ISO 8859-1 Latin 1; Western European	ISO_IR 100
28592	ISO 8859-2 Central European	ISO_IR 101
28593	ISO 8859-3 Latin 3	ISO_IR 109
28594	ISO 8859-4 Baltic	ISO_IR 110
28595	ISO 8859-5 Cyrillic	ISO_IR 144
28596	ISO 8859-6 Arabic	ISO_IR 127
28597	ISO 8859-7 Greek	ISO_IR 126
28598	ISO 8859-8 Hebrew	ISO_IR 138
28599	ISO 8859-9 Turkish	ISO_IR 148
50222	ISO 2022 Japanese JIS X 0201-1989	ISO 2022 IR 159
54936	GB18030 Simplified Chinese (4 byte)	GB18030
65001	Unicode (UTF-8)	ISO_IR 192	
CSTORE Local AE	Application Entity (AE) Title given to ELI Link.
CSTORE Remote AE	AE Title of Storage SCP.
CSTORE Remote Host Name	The network name or IP address of the Storage SCP server.
CSTORE Remote Port Number	The TCP port number used by the Storage SCP.
Stored AE Title	Same as "CSTORE Local AE", so leave blank.
Stored Station Name	DICOM Station Name (0008,1010) value put into the DICOM ECGs. Can be a combination of fixed text and the variables <SITE> and <CART>. ELI Link will substitute the site number for <SITE> and the cart number for <CART>. Example: if Station Name is configured to be "Dept_<SITE>_Cart_<CART>", and an ECG is acquired by cart 34 in site 6, the Station Name will be "Dept_6_Cart_34" in the stored DICOM ECG.
ECG Waveform Object	Specifies the type of ECG Waveform Object to export. **No** – Does not export an ECG Waveform Object. Use this if Encapsulated PDF is the only type of DICOM object to export. **12-Lead** – Exports a 12-lead ECG Waveform object. **General** – Exports a General ECG Waveform object.
Encapsulated PDF Object	Check to export a DICOM Encapsulated PDF object. The PDF is generated according to the PDF layout associated with the Site.
DICOM Output Directory	Full path to the folder where DICOM files (.DCM) should be exported. This is optional and generally only needed for troubleshooting.

Item	Description
ECG Waveform File Name Format	Filename format for the ECG Waveform files.

6.4 HL7 Transmission Set

Set the Type to **HL7** to export ECGs as HL7 messages using MDI. Configure the **Facility ID** that the ECGs will be sent to. If the HL7 message will include an embedded or reference to a PDF of the ECG, configure the **PDF Output Directory** and **PDF File Name Format**. Note, if a PDF file is needed for other purposes, configure a PDF directory in the Local Transmission Set attached to the Site.

Refer to the **MDI HL7 EHR Implementation Guide, REF 9506-166-50** for details about configuring the HL7 messages and interfaces.

ELI Link accepts ECGs from the ELIs before sending the HL7 results messages. After the device tells the user that the ECG transmission was successful, there is still a possibility that the HL7 result message could be delayed if the receiving system is unresponsive. To minimize clinical workflow interruptions, it is important to test the HL7 interface prior to collecting ECGs on patients and to periodically check the ELI Link logs and HL7 interface. Refer to the **Monitoring** section of the **MDI Service Manual, REF 9516-166-51**.

6.5 Pyramis Transmission Set

Set the Type to **Pyramis** to export ECGs to Pyramis or HeartCentrix (HC). Configure the connection to Pyramis or HeartCentrix using the following settings:

Item	Description
URL	The URL to the HeartCentrix or Pyramis application web site. Use an IP address because DNS hostnames are not supported. This field needs to be manually edited. Default URL values for HeartCentrix and Pyramis are; HeartCentrix; http://XXX.XXX.XXX.XXX/HeartCentrixAPI/UserWebApi.asmx Pyramis; http://XXX.XXX.XXX.XXX/PyramisWeb/UserWebApi.asmx
Username	Username to be used by the ELI Link service for authentication to the HeartCentrix or Pyramis web site. Default it "cardiac".
Password	Password to be used by the ELI Link service for authentications to the HeartCentrix or Pyramis web site. Default is "science".
Device ID	This is the name of the computer in which the ELI Link application is installed. This results in a unique value that identifies the source of ECG tests sent to Pyramis or HeartCentrix.
Provider ID	User Provider to which the User Name/Password belong. The provider ID is used by the ELI Link service for authentication of the User Name/Password to HeartCentrix or Pyramis web site. Default value is blank.
Default Department Name	Pyramis/HC Department Name to use when an ECG does not already have a Department Name. This allows unordered ECGs to be placed into a specific department within Pyramis/HC.
Institution Number	Orders are retrieved from Pyramis/HC by Institution Number and Department Name. ELI Link assumes the Pyramis/HC Custom Header ID is the same as the specified Institution Number.

Below is how ELI Link sets some of the values in the ECGs it sends to Pyramis and HeartCentrix:

Pyramis/HeartCentrix Field	Exported Value
Patient ID	If blank, #STAT#YYYYMMDDHHMMSS. For example, if the ECG was acquired at 2:35:45PM on the 18th of June, 2014, the exported patient ID will be #STAT#20140618143545.
Test Priority	From Pyramis/HC order, or set to "Routine"
QTc Formula	"Unknown"
Interpretation statements	Automatic interpretation statements, no edited statements.
Interpretation reasons	(not exported)
Interpretation status	"Preliminary"
Print interpretation?	"Yes"
PP Interval	(not exported)
ECG Lead E1	ECG Lead X
ECG Lead E2	ECG Lead Y
ECG Lead E3	ECG Lead Z
Clinical History	(not exported)
Medication Name	Quinidine/Norpace –> Quinidine Calcium antagonist –> Calcium Blocker Proc/Lido/Tocainide –> Procainide

When a STAT ECG is taken without a patient ID, ELI Link will fill in a temporary ID before sending the ECG to Pyramis/HC. The ID will be in the format: **#STAT# Date-Time-Stamp**. For example, if the ECG was acquired at 2:35:45PM on the 18th of June, 2014, the ECG in Pyramis/HC will have a patient ID of `#STAT#20140618143545`.

6.6   EMIS Transmission Set

Set the Type to **EMIS** to export ECGs to an EMIS system. Configure the following settings for the EMIS connection:

Item	Description
URL	Enter just the hostname for the EMIS API. Default is **webInterop.spine.emis.thirdparty.nhs.uk**.
Username	Username ELI Link uses for EMIS API. Default is **EliLink.**
Password	Password ELI Link uses for EMIS API.
Database Name	Typically the practices' *Organisation ID* assigned by EMIS.

Click the **Echo** button to test the connection.

6.7 AllScripts Transmission Set

Set the Type to **AllScripts** to export ECGs to an Allscripts system using the Unity API. Configure the following settings for the Unity connection:

Item	Description
URL	The Unity or Ubiquity endpoint.
Username	Username defined in the EHR to store ECGs.
Password	Username ELI Link used to connect to the Unity API.
Client ID	Allscripts Client ID.
Product ID	Must be one of the following, spelled exactly: **Allscripts Touchworks** **Allscripts Pro EHR**
Ubiquity ID	The Unity or Ubiquity ID.
Client Name	Name of the Allscripts client, e.g. "Main Street Clinic".
Application Name	Name of ELI Link application known to the Unity API, e.g. "mortara.cloud.ProdApp".
Service Name	Service username for the Unity API.
Service Password	Service password for the Unity API.
Document Type	The Document Type where the ECGs will be stored in the Allscripts EHR.

7 Orders

7.1 Orders Tab

Orders Download Sets are configured on the Orders Tab. For each download set, click the **Add** button. Give the source a Name, and select the Type of download set:

Mode	Description
LOCAL	Orders are received as XML files in the local filesystem.
HL7	Orders are received as HL7 messages and temporarily stored in the local MDI database, e.g. v2 ORM messages.
ALLSCRIPTS	Orders are retrieved from an Allscripts EHR.
DICOM	Orders are retrieved from a DICOM Modality Worklist Service Class Provider (SCP)
PYRAMIS	Orders are retrieved from Pyramis or HeartCentrix.
SCI STORE	Look up patient demographics using the Query Code entered by the ELI user
EMIS	Look up patient demographics using the Query Code entered by the ELI user

7.2 Local Orders Download Set

A Local Orders Download Set defines the root of a directory tree where XML order files are received. Define a different Download Set for each directory tree required by the Organization. Typically just one is needed. Each Site that uses the Download Set will get its own directory within the root directory (named with the Site Name), and then each Query Code used by the Site will get a directory within the Site directory (named with the Query Code).

Click **Add** to create a new Orders Download Set. Name the set and pick Type **Local**. Then configure the path to the root of the orders directory tree, and set the purge duration and refresh. Orders that go unfulfilled for the number of **Purge Days** will automatically be deleted. Checking **Refresh** allows the orders to be downloaded by all the devices because ELI Link will leave the XML file in the directory until a matching ECG is received. Unchecking Refresh will cause each order to be downloaded only once because ELI Link will delete it after the first ELI retrieves it. Be sure to configure the Refresh setting on each ELI to match the Refresh setting in ELI Link.

7.3 DICOM Orders Download Set

A DICOM Orders Download Set defines the connection settings for Modality Worklist (MWL) and Modality Performed Procedure Step (MPPS) Service Class Providers (SCPs). Select Type **DICOM**, configure the settings, and click the **Echo** buttons at the bottom to test the connections.

Item	Description
MPPS Local AE	Application Entity (AE) Title given to ELI Link.
MPPS Remote AE	AE Title of MPPS SCP.
MPPS Remote Host Name	The network name or IP address of the MPPS SCP server.
MPPS Remote Port Number	The TCP port number used by the MPPS SCP.
MWL Local AE	Application Entity (AE) Title given to ELI Link.
MWL Remote AE	AE Title of MWL SCP.

Item	Description
MWL Remote Host Name	The network name or IP address of the MWL SCP server.
MWL Remote Port Number	The TCP port number used by the MWL SCP.

7.4 HL7 Orders Download Set

Create an Orders Download Set with Type HL7 when receiving **HL7** orders and demographics. Enter the Facility ID (usually from MSH-4) into the **Facility ID** field.

When receiving HL7 orders, devices may perform one type of patient-specific query using one of these **Criteria**: by **Patient Name** (PID-5), by **Patient ID** (PID-3), by **Accession Number** (ORC-2/OBR-2), or by **Account Number** (PID-18). Select **None** if no patient-specific query is needed, or select **All** to retrieve all orders when the device user sends a blank Query Code.

7.5 Pyramis Orders Download Set

Set the Type to **Pyramis** to configure an Orders Download Set for Pyramis or HeartCentrix (HC). Configure the connection to Pyramis or HeartCentrix using the following settings:

Item	Description
URL	The URL to the HeartCentrix or Pyramis application web site. Use an IP address because DNS hostnames are not supported. This field needs to be manually edited. Default URL values for HeartCentrix and Pyramis are; HeartCentrix; http://XXX.XXX.XXX.XXX/HeartCentrixAPI/UserWebApi.asmx Pyramis; http://XXX.XXX.XXX.XXX/PyramisWeb/UserWebApi.asmx
Username	Username to be used by the ELI Link service for authentication to the HeartCentrix or Pyramis web site. Default is "cardiac".
Password	Password to be used by the ELI Link service for authentications to the HeartCentrix or Pyramis web site. Default is "science".
Device ID	This is the name of the computer in which the ELI Link application is installed. This results in a unique value that identifies the source of ECG tests sent to Pyramis or HeartCentrix.
Provider ID	User Provider to which the User Name/Password belong. The provider ID is used by the ELI Link service for authentication of the User Name/Password to HeartCentrix or Pyramis web site. Default value is blank.
Default Department Name	
Institution Number	Orders are retrieved from Pyramis/HC by Institution Number and Department Name. ELI Link assumes the Pyramis/HC Custom Header ID is the same as the specified Institution Number.

7.6   EMIS Orders Download Set

Set the Type to **EMIS** to retrieve patient demographics from an EMIS system. Configure the following settings for the EMIS connection:

Item	Description
URL	Enter just the hostname for the EMIS API. Default is **webInterop.spine.emis.thirdparty.nhs.uk**.
Username	Username ELI Link uses for EMIS API. Default is **EliLink.**
Password	Password ELI Link uses for EMIS API.
Database Name	Typically the practices' *Organisation ID* assigned by EMIS.

Click the **Echo** button to test the connection.

7.7   SCI Store Orders Download Set

Set the Type to **SCI Store** to retrieve patient demographics from an SCI Store system. Configure the following settings for the SCI Store connection:

Item	Description
URL	Web service URL for SCI Store.
Login Username	Username ELI Link uses to access the SCI Store web service.
Login Password	Password ELI Link uses to access the SCI Store web service.
Name Search	When the user searches for patients by last name, this sets how the search should be performed: • Search Equals – The last name must fully match the entered text. • Search Contains – The last name must contain the entered text. • Search Begins* – The last name must begin with the entered text. * Recommended setting
ID Search	When the user searches for patient by ID, this sets how the search should be performed: • Search Equals* – The ID must fully match the entered text. • Search Contains – The ID must contain the entered text. • Search Begins – The ID must begin with the entered text. * Recommended setting
System Code	Provides additional information to SCI Store about the organization.
System Location	Provides additional information to SCI Store about the organization.
Username	Provides additional information to SCI Store about the organization.
Friendly Name	Provides additional information to SCI Store about the organization.

Click the **Echo** button to test the connection.

7.8   Allscripts Orders Download Set

Set the Type to **AllScripts** to retrieve orders from an Allscripts system using the Unity API. Configure the following settings for the Unity connection:

Item	Description
URL	The Unity or Ubiquity endpoint.
Username	Username defined in the EHR for ELI Link to use.
Password	Password associated with the Username above.
Client ID	Allscripts Client ID.
Product ID	Must be one of the following, spelled exactly: **Allscripts Touchworks** **Allscripts Pro EHR**
Ubiquity ID	The Unity or Ubiquity ID.
Client Name	Name of the Allscripts client, e.g. "Main Street Clinic".
Application Name	Name of ELI Link application known to the Unity API, e.g. "mortara.cloud.ProdApp".
Service Name	Service username for the Unity API.
Service Password	Service password for the Unity API.
Requested Procedure Location	For TouchWorks, this is the Requested Procedure Location of the ECG orders. For Pro EHR, this is the Procedure Name used for the ECG orders.

8 Patient List

8.1 Patient List Tab

Certain devices can store a Patient List in their memory to facilitate quick demographics lookup, even when the device is not connected to the network. When an Organization wants to use this feature, a Patient List source must be configured. Click the **Add** button on the Patient List tab to create a new Patient List Set. Give the set a Name, and select the Type of Patient List source:

- **HL7** – patient demographics are stored in the MDI database populated with HL7 v2 ADT messages from a hospital information system (HIS)

8.2 HL7 Patient List Set

Choose the HL7 type when demographics will be stored in the MDI database and populated from HL7 ADT messages. Configure the HL7 Facility ID (normally from PV1-3-4) to narrow down the set of patients that are in this Patient List. Note, if the MDI database is managing multiple Patient Lists for multiple Organizations and Sites, be sure the Facility ID is set in a way to separate the Patient Lists for each.

9 Authentication

9.1   Authentication Tab

Define an Authentication Set to define how device users will be authenticated and authorized to perform tasks on the device. Click the **Add** button to add a new Authentication Set. Select the Type of Authentication Set:
- **Local** – uses the LDAP server on the local network for the configured Domain.
- **Allscripts** – communicates with Allscripts EHR to authenticate users.

9.2   Local Authentication Set

This uses an LDAP server (e.g. Active Directory) on the local network to authentic device users. When devices in the associated Site are configured to authenticate users, the devices will send the usernames and passwords to ELI Link, and ELI Link will verify them with the domain's LDAP service.

Once a username and password have been verified, ELI Link checks the user's security groups. If the user is a member of a group permitted to be a device Administrator, the device will allow that user to view protected health information (PHI) and make configuration changes on the device. If the user is a member of a group permitted to be a device Technician, the device will allow that user to view PHI, but will not allow any device configuration changes. If the user is not a member of any device Technician or Administrator groups, the user will not be allowed access to any PHI or to make any configuration changes; the user will only be permitted to perform unordered tests with manual demographic entry. If the user a member of multiple groups, he will be granted the most permissions allowed.

Security Group Membership	Perform Unordered Tests	Use Patient List	Perform Ordered Tests	View Stored ECGs	Change Configuration
(None)	Yes	-	-	-	-
Guest	Yes	-	-	-	-
Technician	Yes	Yes	Yes	Yes	-
Administrator	Yes	Yes	Yes	Yes	Yes

To add a domain security group to one of the device groups, enter the security group into the textbox above the *Add* button, then click **Add**. Note, the domain security groups must be spelled exactly as they are in the domain's directory services. Use the **Edit** and **Delete** buttons to change and remove domain security groups already in the device groups.

*Tip: if you are unsure of the exact security group spellings, a utility like **AD Explorer** may be helpful. **AD Explorer** is available from Microsoft's TechNet website:* *https://technet.microsoft.com/en-us/sysinternals/adexplorer*

Setting	Description
Set Name	A short, meaningful name for the Authentication Set, e.g. "Memorial West". Appears in the Site's dropdown list.
Domain	The fully-qualified domain name of the device user accounts, e.g. "memwest.org".
Guests Groups	The list of domain security groups allowed to perform **unordered tests** with manual demographic entry. Pay careful attention to case and punctuation. *Note, users that are not a member of any Guests, Technician, or Administrator group are still allowed to use the devices as Guests.*

| Technician Groups | The list of domain security groups allowed to **access protected health information** (PHI), perform **ordered tests**, and **view ECGs** stored on the device. Pay careful attention to case and punctuation. |
| Administrator Groups | The list of domain security groups allowed to access protected health information (PHI), perform ordered tests, view ECGs stored on the ELI, and **make device configuration changes**. Pay careful attention to case and punctuation. |

9.3 Allscripts Authentication Set

Set the Type to **AllScripts** to authenticate devices users in an Allscripts EHR using the Unity API. Configure the following settings for the Unity connection:

Item	Description
URL	The Unity or Ubiquity endpoint.
Username	Username defined in the EHR for ELI Link to use.
Password	Password associated with the Username above.
Client ID	Allscripts Client ID.
Product ID	Must be one of the following, spelled exactly: **Allscripts Touchworks** **Allscripts Pro EHR**
Ubiquity ID	The Unity or Ubiquity ID.
Client Name	Name of the Allscripts client, e.g. "Main Street Clinic".
Application Name	Name of ELI Link application known to the Unity API, e.g. "mortara.cloud.ProdApp".
Service Name	Service username for the Unity API.
Service Password	Service password for the Unity API.

10 Custom ID

10.1 Custom ID Tab

A Custom ID is a user-definable set of demographic fields. It is required if the devices in a Site will be retrieving orders. If orders will never be used, a Custom ID is optional and any of the device's built-in ID layouts may be used.

Older-model devices using UNIPRO/UNIPRO32 must download their Custom ID from that same ELI Link that will provide orders and store the ECGs. ELI Link remembers one previous Custom ID layout per Site so it can still decode the untransmitted ECGs; however, when a Site's Custom ID is updated, all previously acquired ECGs should be transmitted before the Custom ID is updated again. UNIPRO and UNIPRO32 ECGs acquired with an old Custom ID, or with a Custom ID obtained from a different ELI Link or E-Scribe™ data management system cannot be fully decoded by ELI Link. ELI Link will be able to transfer the primary demographic fields (last name, patient ID, gender, and age); other fields may not be transferred. UNIPRO64 ECGs, though, can be fully decoded no matter where the Custom ID was obtained.

Custom IDs are defined on the Custom ID Tab. Click the **Add** button to create a new Custom ID layout. Name the Custom ID and put it in the **Set Name** textbox. Next select fields from the list of **Available** fields and move them into the **Current** using the arrow buttons. Add the fields to the Current box in the order that the device user should be prompted for the information when starting a new test.

After the set of fields have been moved into the Current box, select each one and configure the field's maximum length and location in the Print and LCD layouts. The **Print** layout determines how the fields will be printed on a resting ECG. The **LCD** layout determines how the fields appear on the screen of older-model devices that do not manage the onscreen layouts themselves.
1. First configure the field's **Max Data Length**. Some fields are a fixed length and cannot be changed. ELI Link will shorten values in orders according to the Max Data Length before it returns them to the device.
2. Next, enter the field **Labels**, if any, for the Print and LCD layouts.
3. Then use the **Label Col**, **Data Col**, and **Row** arrow buttons to position the Label column, the Data column, and the Row to display the field. Be sure to position the field in both the Print and LCD layouts.

Custom IDs may use up to 12 of the fields listed below, but the following four fields are always required:
- Patient ID Number
- Patient Last Name
- Patient Age
- Patient Gender

Field Name	Num or Alpha	Max Len	XML Field ID UNIPRO UNIPRO32	XML Field ID UNIPRO64	DICOM Tag	Description
Patient Last Name	A	20	1	LastName	(0010,0010)	Family name.
Patient ID Number	A	23	2	PatientID	(0010,0020)	Primary patient identifier.
Patient Age	N	3	3	Age	(0010,1010)	Length must be 3.
Patient Gender	-	7	4	Gender	(0010,0040)	(blank), male, female, unknown.

Field Name	Num or Alpha	Max Len	XML Field ID		DICOM Tag	Description
			UNIPRO UNIPRO32	UNIPRO64		
Patient Race	-	17	5	Race	(0010,2160)	(blank), Caucasian, Black, Oriental, Hispanic, American Indian, Aleut, Hawaiian, Pacific Islander, Mongolian, Asian.
Medication	-	20	6	Medication	(0040,A043) =G-02D0	(blank), digitalis, beta blocker, Quinidine/Norpace, diuretic, calcium antagonist, Proc/Lido/Tocainide, other antiarrhythmic, psychotropic, unknown.
Medication 2	-	20	6	Medication2	(0040,A043) =G-02D0	(blank), digitalis, beta blocker, Quinidine/Norpace, diuretic, calcium antagonist, Proc/Lido/Tocainide, other antiarrhythmic, psychotropic, unknown.
Patient First Name	A	20	7	FirstName	(0010,0010)	Given name.
Patient Height	N	3	9	Height	(0010,1020)	Length must be 3.
Patient Weight	N	3	10	Weight	(0010,1030)	Length must be 3.
Soc. Sec. Number	A	11	11	SSN	(1455,1003)	U.S. social security number.
Patient Second ID	A	23	12	SecondID	(0010,1000)	Recommend "Admission ID" for visit, encounter, case, account, and financial numbers.
Patient Middle Name	A	23	13	MiddleName	(0010,0010)	Second name.
Patient Location	A	23	14	Location	(0038,0300)	Patient's room, bed, or department.
Patient Room	A	23	15	Room	(0038,0400)	Patient's room or bed. When no value is received from MWL in (0038,0400), ELI Link copies part of the Patient Location field (0038,0300) into this field - the part after the first dash.
Patient Birth Date	-	10	16	DOB	(0010,0030)	
Comment	A	23	17	Comment	(0038,4000)	
Reason For Procedure	A	23	18	Reason	(0040,1002)	Reason for ordering the ECG.
Referring Physician	A	23	19	RefPhys	(0008,0090)	Physician referring patient for the ECG.
Attending Physician	A	23	20	AttendingPhys	(1455,1004)	Physician caring for patient.

Field Name	Num or Alpha	Max Len	XML Field ID		DICOM Tag	Description
			UNIPRO UNIPRO32	UNIPRO64		
Overreading Physician	A	23	21	OverrPhys	(0008,1060)	Physician over reading (confirming) the ECG. Upon confirmation, confirming physician name will copy into the field overwriting anything entered by the electrocardiograph operator.
Technician	A	23	22	Technician	(0008,1070)	Name, initials, or ID of person acquiring the ECG.
Diagnosis	A	23	23	Diagnosis	(0032,1030)	
Note 1	A	23	24	Notes	(1455,1006)	
Note 2	A	23	25	Notes2	(1455,1007)	
Order Number	A	23	26	OrderReqNum	(1455,1008)	This is an internal order number and meaningless to other IT systems.
Systolic Blood Pressure	N	3	27	BaselineSysBP	(0040,A043) =F-008EC	Length must be 3. Units of mmHg.
Diastolic Blood Pressure	N	3	28	BaselineDiaBP	(0040,A043) =F-008ED	Length must be 3. Units of mmHg.
Requesting Physician	A	23	29	RequestingPhysician	(0032,1032)	Physician requesting (ordering) the ECG.
Accession Number	A	16	30	AccessionNumber	(0008,0050)	Sequential number assigned by ordering system. Primarily used in DICOM.
Admission ID	A	23	31	AdmissionID	(0038,0010)	Encounter number, visit number, account number, billing number, etc.
Requested Proc Desc	A	23	32	RequestingProc	(0032,1060)	Requested Procedure Description
Scheduled Proc Step Loc	A	16	33	ScheduledProcStep	(0040,0011)	Scheduled Procedure Step Location
Initials	A	16	34	Initials	(1455,1010)	Subject initials, generally used for research studies.
Visit	A	23	35	Visit	(1455,1011)	Protocol visit for research studies.
User List 1	A	32		UserList1	(1455,1015)	User-defined pick list. The list can have up to 16 values.
User List 2	A	32		UserList2	(1455,1016)	User-defined pick list. The list can have up to 16 values.
User List 3	A	32		UserList3	(1455,1017)	User-defined pick list. The list can have up to 16 values.

10.2 ELI 280 Custom ID

Because the ELI 280 LCD dimensions are different from other ELI devices, special considerations must be made when creating a Custom ID that will be used by an ELI 280.

The ELI 150c/250c have displays that support a 32 x 10 layout. The ELI 280 has a display that supports a 64 x 5 layout. Both layouts support the same number of cells.
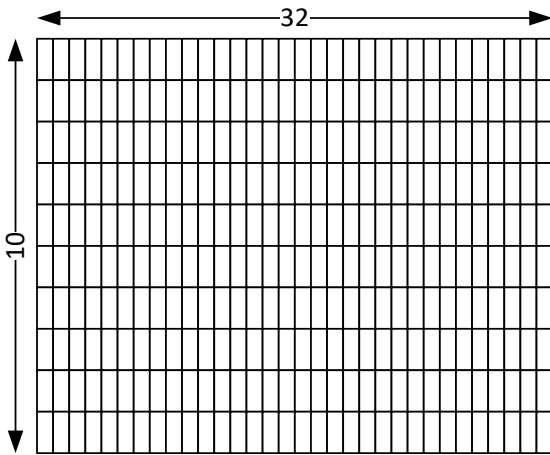
ELI 150/250, 150c/250c
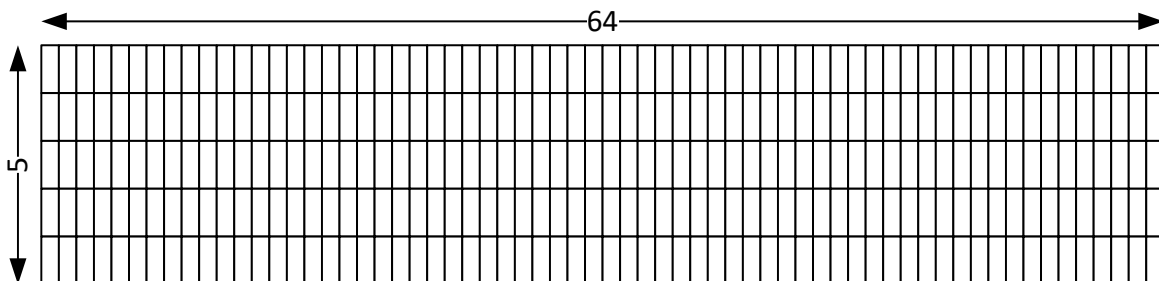
ELI 280

10.3 ELI 280 LCD Layouts

Since the LCD display for the ELI 280 is exactly twice as wide and half as tall, it simply displays the 10 rows of the LCD layout in 2 columns. Rows 0-4 are displayed on the left side; rows 5-9 are displayed on the right side. If rows 0-4 use more than 32 columns they will overlap rows 5-9 when drawn on the display.
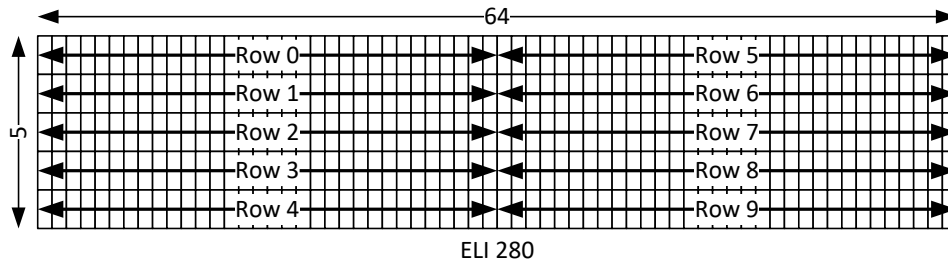
ELI 280

10.4 ELI 280 Age Field

The ELI 280 allows the user to specify Age Units when entering an age, and will always display a Units selection box to the right of the Age data entry box. The Units selection box takes up an additional 8 columns following the 3 columns for the value. When creating the LCD layout in ELI Link, remember to leave 8 blank columns following the age value.
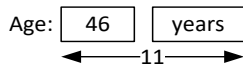
10.5 ELI 280 Date of Birth Field

The ELI 280 uses 3 separate data entry boxes, each with its own label, for entry of the patient's date of birth (DOB). Although ELI Link only shows that 10 columns are used for a DOB value, at least 30 columns (an entire row) must be allocated for the value when creating the LCD layout.
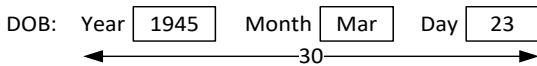
When the DOB is on lines 0-4, the label should be kept as short as possible so as to not spill over into rows 5-9. Start the row to the right of DOB, row (DOB row# + 5), in column (DOB value column# - 3).

In the following example, the DOB is on row 3 and the DOB data field starts in column 5. As such, the DOB row spills over into row 8 (3 + 5). The label for row 8 must, therefore, start at column 2 (5 – 3 = 2).

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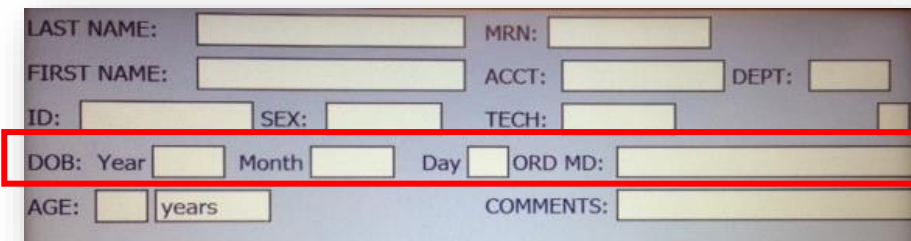
10.6 Pyramis and HeartCentrix Custom Headers

Pyramis and HeartCentrix (HC) use Custom Headers to define a set of demographic fields just like the ELI's use Custom IDs. The field mappings between Pyramis/HC and the ELIs are shown in the table below. The corresponding fields must be defined in both the Pyramis/HC Custom Header as well as the ELI Custom ID for data to flow between them. The "Filled by Orders" column indicates which fields can be populated from Pyramis/HC orders.

Pyramis Custom Header Field		ELI Custom ID Field	Filled by Orders
Department Name	←→	Patient Location	Yes
ECG Date	←	Acquisition Date	
ECG Time	←	Acquisition Time	
Last Name	←→	Patient Last Name	Yes
First Name	←→	Patient First Name	Yes
ID#	←→	Patient ID Number	Yes
EIN	←→	Patient Second ID	Yes
Encounter #	←→	Admission ID	Yes
Date of Birth	←→	Patient Birth Date	Yes
Age	←	Patient Age	
Sex	←→	Patient Gender	Yes
Race	←→	Patient Race	Yes
Technician	←	Technician	
Room	←→	Patient Room	Yes
Drugs1	←	Medication 1	
Drugs2	←	Medication 2	
Height	←	Patient Height	
Weight	←	Patient Weight	
Systolic BP	←	Systolic Blood Pressure	
Diastolic BP	←	Diastolic Blood Pressure	
Comment	←	Comment	
Diagnosis	←	Diagnosis	
Requisition #	←→	Accession Number	Yes
Ordering MD *(Pyramis Referring MD)*	←→	Requesting Physician	Yes
Consulting MD	→	Referring Physician	Yes
Attending MD *(Pyramis Assigned Reviewing MD)*	←		
Reviewing MD	←	Overreading Physician	

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11 Query Codes

11.1 Query Codes Tab

When ECG orders workflow is used, devices in a given Site can offer the technician one or more ways of retrieving orders. Later model devices offer convenient sorting and searching functions to assist in quickly finding particular orders within the set of previously downloaded orders. If the devices in the site support these search functions, consider using a single query (e.g., "Get All") that retrieves a broad range of orders covering all the patients within a Site. If the devices in the Site do not support these search functions, consider defining multiple queries that retrieve smaller sets of orders. These queries can be limited to locations within the Site or even orders for specific patients.

Sets of Query Codes are configured on the **Query Codes** Tab. Click the **Add** button to add a new Query Codes Set. Give the Query Codes Set a name so it can be distinguished within ELI Link and associated with Sites. Next select the **Type** of Query Codes set:
- **Local** – Each Query Code will be a separate directory within the Site directory that uses this Query Codes Set. XML order files in the directory will be returned to devices requesting orders for that Query Code.
- **Allscripts** – Define one Query Code for each Allscripts Orders Download Set. The Query Code can be given any name, but consider naming it according to the Requested Procedure Location in the associated Orders Download Set.
- **DICOM** – Define one Query Code for each type of Modality Worklist to be retrieved.
- **HL7**
- **Pyramis**

Add each query code by clicking the **Add** button. The Query Code will be displayed to the device user, so the name should be meaningful in that context. Older-model ELIs only support 8-character codes. Later-model ELIs support extended query codes up to 23 characters in length. If the Sites using this Query Codes Set have older-model ELIs, limit all the Query Codes to no more than 8 characters. For any ELI Link modes, the **Add** button, for adding query code is disabled, if the current number of query codes reach 50.

11.2 Local Query Codes Set

When using XML files to receive orders, sites and query codes are mapped to individual directories. The ordering system must place the XML files into the corresponding query-code directories. When a device requests orders for a particular query code, ELI Link returns the current contents of the corresponding directory. The directory structure is depicted below. The root of the tree is defined by the Orders Path in the Orders Download Set associated with the Site. Each Site using the same Orders Download Set will have its own directory named with its Site Name. Then within the Site directory there will be a directory named for each Query Code in the Query Codes Set associated with the Site. A directory named "blank" is always created; this is used when a device requests orders without a query code.

```
Orders Download Set
Orders Path
    │
    └── Site
        Site Name
            │
            ├── "blank"
            │
            ├── Query Codes Set
            │   Query Code 1
            │
            ├── Query Codes Set
            │   Query Code 2
            │
            └── Query Codes Set
                Query Code 3
```
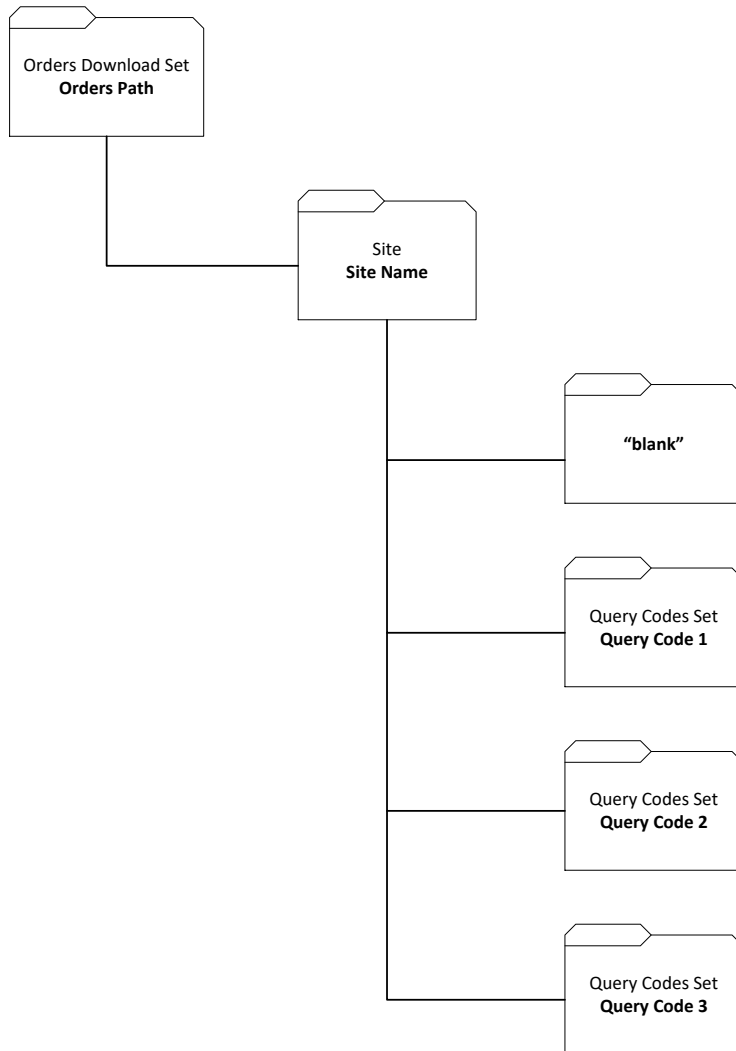
11.3 DICOM Query Codes Set

DICOM Modality Worklist (MWL) offers a lot of flexibility when querying for orders. The following diagram shows three example sites configured with various types of queries. In this example, Memorial Hospital has queries for three care areas of the hospital. Maplewood Clinic has just one query defined to get all orders for that institution. All Saints supports a patient-directed query that looks up orders by patient ID, and another query that gets all orders for the institution.

> *NOTE: The DICOM field "Scheduled Procedure Step Location" is usually used for scheduled location. The DICOM MWL queries normally set modality to "ECG," constrain the scheduled date range, and look for Requested Procedure Descriptions matching those used for resting ECG tests (to separate them from stress and Holter ECG tests).*

Memorial Hospital

Institution="Memorial"
Scheduled Location="ICU" — ICU   CCU

Institution="Memorial"
Scheduled Location="CCU"

Institution="Memorial"
Scheduled Location="ED" — ED   All

Institution="Memorial"

Maplewood Clinic

Institution="Maplewood" — All

DICOM MWL SCP

All Saints Hospital

Institution="All Saints"
Patient ID="332425" — MRN?

Institution="All Saints" — All

Site
Query Code

Legend

When planning query codes, first decide if a site needs to be able to retrieve orders for specific patients. If so, decide if the orders will be retrieved by patient ID, admission ID, or last name. Name the *first* query code to prompt for the patient-specific information, e.g., "MRN?," "ACCT#?," or "L NAME?" The *second* query code should be "All," and it should retrieve all the orders for that site. If other location-specific queries are needed for the site, define additional query codes for those locations. Use the decision tree below to help guide the process of defining a query code set.

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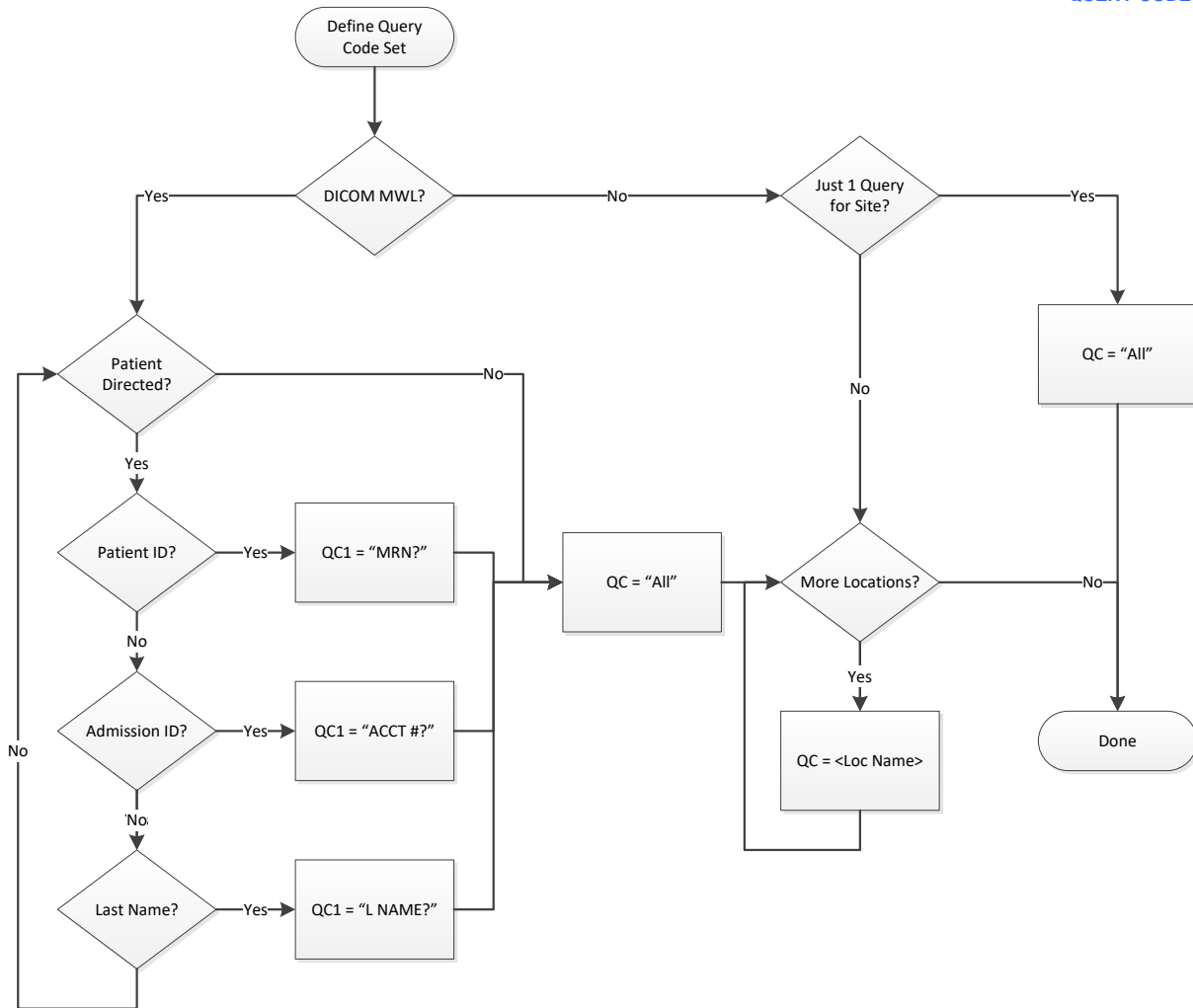
For DICOM, each query code has its own MWL query filter. Select an existing query code from the list and click **Edit**, or click **Add** to add a new query code. The Add/Edit Query Code dialog will display. Name the new Query Code with up to 8 characters for older-model ELI electrocardiographs that do not support Extended Query Codes; use up to 23 characters for newer-model ELI electrocardiographs that do.

If the query code set will include a patient-directed query, the first query code must be used for that. To query by Patient ID, enter the string "<QC>" into the Patient ID field. Name the query code to prompt the ECG technician for the patient information, e.g., "MRN?," or "ID?."

When configuring a query code for a patient-directed query by Admission ID, enter ("0038," "0010") for the user specified tag, and enter "<QC>" for the value. Name the query code to prompt the ECG technician for the patient information, e.g., "ACCT#?," "VISIT#?," or "CASE#?."

Most MWL servers recognize the asterisk (*) wild card symbol for queries. To query for orders by Patient Name, add the asterisk after the "<QC>" variable in the Patient Name field ("<QC>*"). This will cause the MWL server to return all orders for patients with last names starting with the text entered on the device. Name the query code to prompt the ECG technician for the patient's last name, e.g., "L NAME?"

The following DICOM Modality Worklist (MWL) fields can be configured for each query code. Enter text into the fields that will be used to filter the query.

Attribute Name	DICOM Tag	Comment
Patient Name	(0010,0010)	Formatted according to the DICOM standard: last^first^middle^prefix^postfix The most useful configuration is to map the query code "<QC>" followed by an asterisk so the user can enter the first few characters of the patient's last name: <QC>*
Patient ID	(0010,0020)	The most useful configuration is to map the query code "<QC>" to this field. This will only work if the site uses patient IDs no longer than the maximum length query code (i.e. 8 characters for legacy carts). Scanning patient IDs from a wristband is possible.
Modality	(0008,0060)	Usually set to "ECG", as specified by the DICOM standard.
Accession Number	(0008,0050)	The most useful configuration is to map the query code "<QC>" to this field so the order can be retrieved directly. Scanning the accession number from a paper order is possible.
Scheduled Station AE Title	(0040,0001)	
Scheduled Procedure Step Start Date	(0040,0002)	Set this field to a fixed date if orders for that date will always be retrieved. The date format is yyyyMMdd. Using a fixed date is probably not useful in a clinical setting except when troubleshooting specific issues. To filter based on a date range relative to "today", use the Scheduled Procedure Days Back and Days Forward fields described below.
Scheduled Procedure Step ID	(0040,0009)	
Scheduled Station Name	(0040,0010)	
Scheduled Procedure Step Location	(0040,0011)	
Current Patient Location	(0038,0300)	
Requested Procedure ID	(0040,1001)	
Requested Procedure Location	(0040,1005)	
Requested Procedure Description	(0032,1060)	If this is set, the MWL query will only return items matching this one Requested Procedure Description. If there are multiple procedure descriptions used for resting ECGs, leave this field blank and configure the list of Requested Procedure Descriptions in the Query Codes Set dialog.
Scheduled Procedure Days Back	(0040,0002)	Sets the lower boundary of the date range for "Scheduled Procedure Step Start Date". This is the number of days prior to "today". Set to 0 if the lower boundary should be today (i.e., orders no earlier than today). Leave blank if no lower boundary is needed (i.e., all orders scheduled prior to today).

Attribute Name	DICOM Tag	Comment
Scheduled Procedure Days Forward	(0040,0002)	Sets the upper boundary of the date range for "Scheduled Procedure Step Start Date". This is the number of days after "today". Set to 0 if the upper boundary should be today (i.e., orders no later than today). Leave blank if no upper boundary is needed (i.e., all orders scheduled in the future).
AE Title	-	This is the DICOM AE Title used in establishing the DICOM communications link with the MWL SCP. If blank, the Local AE Title in the MWL communications configuration is used. If set to a value, it is used to override that value. This may be useful when the MWL SCP does its own filtering based on the AE Title making the request.
User Specified Tag	-	This can be used to define one additional DICOM tag that isn't in the list above. For example, Admission ID, (0038,0010) (a.k.a. visit, encounter, billing number) may be useful with the <QC> variable to retrieve orders for a specific patient.
Use Institution	(0008,0080)	Search by the Institution Name. ELI Link uses the Institution (Site Name) value configured in the Site dialog.

Each query code set shares a list of **Requested Procedure Descriptions**, DICOM tag (0032,1060). ELI Link uses this list of procedure descriptions to filter the MWL query results even further. This is necessary because queries using Modality = "ECG" will likely return all diagnostic ECG orders including resting, stress, and Holter. The primary DICOM tag used to distinguish between the different ECG procedures is the Requested Procedure Description. Use the **Add** and **Delete** buttons on the Edit Query Codes Set dialog to manage the list of procedure descriptions. Each description must be entered exactly as it appears in the DICOM field (case sensitive). (Note, it can be helpful to use the DICOM communication logs to discover the complete set of requested procedure descriptions received by ELI Link.)

11.4 HL7 Query Codes Set

Decide if a "Get All" query code should be defined to get all the orders for the Facility ID defined in the Orders Download set. Then decide if additional query codes for specific **Assigned Patient Locations** (PV1-3-1) within the Site's Facility ID are needed.

Use the **Add**, **Edit**, and **Delete** buttons to define a Query Codes Set. For the "Get All" code, leave the Assigned Patient Location blank. Set **Scheduled Procedure Days Back** and **Forward** to 0 to just get tests scheduled for "today".

11.5 Pyramis Query Codes Set

Set Type to **Pyramis** to define a set of Query Codes so orders can be retrieved from Pyramis or HeartCentrix (HC). The Query Codes must be the **Department Names** as defined in Pyramis/HC. The special Query Code **default** can be defined in the Query Code Set. When "default" is used to retrieve orders, Pyramis/HC will return all "current" orders for the Institution.

12 PDF

12.1 PDF Tab

PDF layouts are defined on the PDF Tab. Click the **Add** button to define a new layout. Give it a **Set Name** and configure the layout settings. Check **Use Forms** to cause UNIPRO64 ECGs from later-model devices to be exported as fillable PDF forms. When a fillable PDF form is opened in Adobe Reader, the user can edit the demographic fields, measurements, and interpretation. The user can then sign the ECG and save it as a signed document (without the editable fields). This setting does not apply to UNIPRO or UNIPRO32 ECGs.

For **Lead Order,** select **Standard** to put the ECG leads into the standard I, II, III, aVR, aVL, aVF layout. Select **Cabrera** to put the ECG leads into the Carbrera aVL, I, -aVR, II, aVF, III layout. Select **Per Cart** to match the setting of the device at the time the ECG was acquired.

The **Trace Thickness** ranges from 1 (very thin) to 99 (very thick). The values are in units of 100th's of a millimeter, and the default value 20 works best in most cases.

Select the **12-Lead** and **15-lead Layouts** according to the following table. Select the **Rhythm** leads for the 3+1 and 3+3 layouts.

Layout	12-Lead ECGs	15-Lead ECGs
3+1	2.5 seconds of 12 leads in a 3-channel format and the fourth channel is a 10-second rhythm strip of the first rhythm lead.	2.0 seconds of 15 leads in a 3-channel format and the fourth channel is a 10-second rhythm strip of the first rhythm lead.
3+3	2.5 seconds of 12 leads in a 3-channel format plus a 10-second rhythm strip of the three specified rhythm leads.	2.0 seconds of 15 leads in a 3-channel format plus a 10-second rhythm strip of the three specified rhythm leads.
6 ch	5 seconds of 12 leads in a 6-channel format.	Not available.
12 ch	10 seconds of 12 leads in a 12-channel format.	Not available.
Per Cart	Uses the plot format specified on the electrocardiograph when the ECG was acquired. This setting only applies to UNIPRO32 and UNIPRO64 records. The layout will default to 3+1 when 12-lead UNIPRO files are received.	

The **Gain** setting defines the plotted waveform amplitude in millimeters per millivolt in the PDF files. 10 mm/mV is the usual setting for gain. The height of the calibration pulse at the beginning of each waveform indicates the scale for 1 millivolt. The paper **Speed** can be set to 25 mm/s or 50 mm/s. The 25 mm/s setting gives a single page report. The 50 mm/s setting gives a 2-page report, but the measurements and interpretation are only included on the first page so a printed report will not look like 2 separate ECG reports. Check **Pace Spike** to include the pace spike channel at the bottom of UNIPRO64 ECGs. This setting does not apply to UNIPRO or UNIPRO32 ECGs.

The waveform **Filter** (also known as print filter, noise filter, display filter, low pass filter, or plot filter) can be set to 300 Hz, 150 Hz, 40 Hz, or Per Cart. 300 Hz setting will not cause any additional filtering of the waveforms because this is the native bandwidth of the waveforms from the ELI devices. The 150 Hz filter will attenuate high-frequency noise above 150 Hz. The 40 Hz filter will attenuate high-frequency noise above 40 Hz. The 40 Hz filter will attenuate the most noise in the plotted waveforms. Per Cart will use the same filter setting that the device was using at the time the ECG was acquired.

⚠️ *WARNING*: *When the 40 Hz filter is used, the frequency response requirement for diagnostic ECG equipment cannot be met. The 40 Hz filter significantly reduces high-frequency components of the ECG and pacemaker spike amplitudes, and is recommended only if high-frequency noise cannot be reduced by proper procedures.*

Specify **Weight Units** and **Height Units**, or use **Per Cart** to use the same units that were used on the device. In the case of Per Cart, UNIPRO ECGs will default to pounds and inches. Specify the Date Format to use for the ECG acquisition date and the patient's birth date. Examples:

    DD-Mon-YYYY = 17-Feb-2009
    DD.MM.YYYY = 17.02.2009
    MM/DD/YYYY = 02/17/2009

Specify the **Time Format** to use for the ECG acquisition time. Examples:

    12 Hour   = 2:35:09 PM
    24 Hour   = 14:35:09

The **Grid Settings** define the type and color of the grid in the PDF files. The grid may be excluded by selecting None, or it may be included as 1mm or 5mm. The default grid color is light pink, but may be changed by clicking **Select Color…**. Clicking **Default Color** resets the grid color back to the default.

Check **Hide Interpretation** if the PDF should not include the device's automatic interpretation. Check the optional measurements to include them with the rest of the global measurements:

Avg RR = average RR interval

QTcB = QT corrected using the Bazett formula $QTcB = \dfrac{QT}{(RR[s])^{1/2}}$

QTcF = QT corrected using the Fredericia formula $QTcF = \dfrac{QT}{(RR[s])^{1/3}}$

13 Rhythm PDF

13.1 Rhythm PDF Tab

Rhythm PDF layouts are defined on the Rhythm PDF Tab. Click the **Add** button to define a new layout. Give it a **Set Name** and configure the layout settings.

For **Lead Order,** select **Standard** to put the ECG leads into the standard I, II, III, aVR, aVL, aVF layout. Select **Cabrera** to put the ECG leads into the Carbrera aVL, I, -aVR, II, aVF, III layout. Select **Per Cart** to match the setting of the device at the time the ECG was acquired.

The **Trace Thickness** ranges from 1 (very thin) to 99 (very thick). The values are in units of 100th's of a millimeter, and the default value 20 works best in most cases.

Note, there is no 12-Lead and 15-lead layout selection in the **Rhythm PDF** tab

The **Gain** setting defines the plotted waveform amplitude in millimeters per millivolt in the PDF files. 10 mm/mV is the usual setting for gain. The height of the calibration pulse at the beginning of each waveform indicates the scale for 1 millivolt. Select Per Cart to match the setting of the device at the time the ECG was acquired.

The paper **Speed** can be set to 25 mm/s or 50 mm/s. The 25 mm/s setting gives a single page report. The 50 mm/s setting gives a 2-page report, but the measurements and interpretation are only included on the first page so a printed report will not look like 2 separate ECG reports. Select Per Cart to match the setting of the device at the time the ECG was acquired.

The waveform **Filter** (also known as print filter, noise filter, display filter, low pass filter, or plot filter) can be set to 300 Hz, 150 Hz, 40 Hz, or Per Cart. 300 Hz setting will not cause any additional filtering of the waveforms because this is the native bandwidth of the waveforms from the ELI devices. The 150 Hz filter will attenuate high-frequency noise above 150 Hz. The 40 Hz filter will attenuate high-frequency noise above 40 Hz. The 40 Hz filter will attenuate the most noise in the plotted waveforms. Per Cart will use the same filter setting that the device was using at the time the ECG was acquired.

14 Patient Demographics Query (PDQ)

14.1 Patient Demographics Query Tab

Patient Demographics Query (PDQ) configuration is defined in the Patient Demographics Query Tab. Click the **Add** button to define a new PDQ set. Give it a **Set Name** and configure the settings.

Select the **Type** from the dropdown, currently only one type PDQ_Mirth_MLLP is supported.

Upon selecting the Type, additional settings will be displayed. In case of type PDQ_Mirth_MLLP, the additional settings are the **Host Name or IP Address** and **Port Number**. Enter the information for the Mirth Server that is going to communicate with Patient Administration Server for demographic query.

The diagram below demonstrates the communication between various systems and devices to support Patient Demographics query:

ELI Cart

ELI Link

Mirth Server

Patient Administration Server
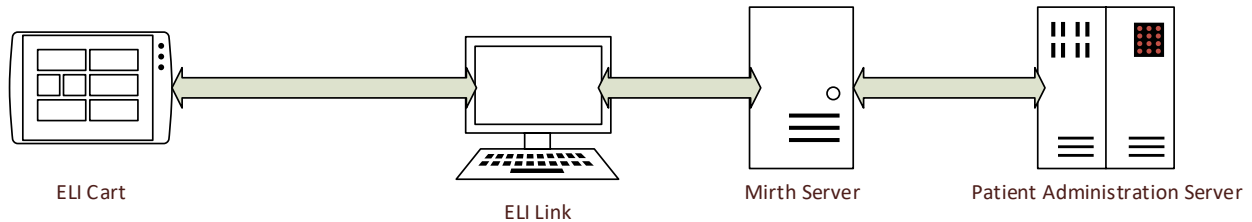
The ELI Cart sends a demographic query request to ELI Link application that in turn sends the request over TCP/IP to Mirth. Mirth then communicates with Patient Administration Server using HL7 and passes on the response back to ELI Link that then sends the information back to the ELI Cart.

15 Device Configuration

15.1 Configuring Devices to Communicate with ELI Link

Refer to the ELI user manual for instructions on how to configure the ELI electrocardiographs to communicate with ELI Link. Pay close attention to the following settings:

ELI Setting	Comment
Site Number	This must match the Site Number in ELI Link. If the Site Number is not configured in ELI Link, all communications will fail.
Site Name	It is recommended that this Site Name be configured to match the Site Name (or Institution) configured in ELI Link.
Cart Number	Used to identify the particular ELI. The number can be copied into the DICOM Station Name to help troubleshooting.
Comm. Media	This is the communications media used to communicate with ELI Link. This will typically be LAN or WLAN. In either case, ELI Link will be configured to accept network connections on a particular TCP/IP port.
Host IP Sync IP	When using LAN or WLAN configure this to the IP address of the computer running ELI Link. If ELI Link is behind a firewall, the firewall will need for be setup for port forwarding.
Port Number	When using LAN or WLAN configure this to the port number ELI Link is configured to listen on for network connections
Transmit Protocol	This must be set to DICOM if ELI Link is configured for DICOM.
Worklist Management	Set this to Refresh for DICOM or when XML Order Refresh is checked.

> *NOTE: If a firewall is running on the ELI Link computer, ensure the configured TCP/IP port number is open and allows incoming connections from the ELI electrocardiographs.*

15.2 Download Custom ID

After configuring the ELI electrocardiograph to communicate with ELI Link, use the **Custom ID Download** function on the electrocardiograph to retrieve the Custom ID and query code set from ELI Link.

15.3 Download MWL or Orders

When using orders workflow, use the **Modality Worklist** or **Orders Download** function on the ELI electrocardiograph. The ELI will prompt for the query code to use for the orders download. Select the appropriate query code or enter patient-specific information when using a patient-directed query.

15.4 Transmitting ECGs

When one or more new ECGs have been acquired, use the ELI electrocardiograph's **SYNC** or **XMT** function to transmit the ECG(s) to ELI Link. ELI Link will return a success/failure message back to the ELI so the ECG technician knows the ECG was exported and stored.

NOTE: If ELI Link is configured to send HL7 results messages, a successful status will be returned to the ELI even though the HL7 result message has not yet been sent. It is important to monitor the HL7 interface to verify results messages are being sent successfully.

16 EMIS Configuration

16.1 EMIS Patient Query and ECG Storage

ECGs are stored in EMIS as they are transmitted to ELI Link. Storage will fail if the patient ID does not match a known patient in EMIS. As such, it is strongly recommended to download patient demographics from EMIS *before* acquiring each ECG.

Downloading patient demographics is done by using the ELI's **Download Orders** feature. Although EMIS does not provide actual ECG orders, the ELI devices and ELI Link use the orders download feature to retrieve patient demographics from EMIS. The user will not pick from a list of query codes, but will enter something about the patient as the query code. EMIS will do its best to find patients matching the string entered by the user, and ELI Link will return a list of matching patients back to the ELI. The user will pick from the list of patients and load the proper demographics before acquiring and storing the ECG.

Some ELI models and configurations only allow 8 characters to be entered for the query code, and this potentially limits the types of queries the user can make. At the time this manual was created, the ELI 280 limits the query code length when it is in the UNIPRO32 and DICOM32 modes. It must be in the DICOM32ext mode before it will accept longer query codes (up to 23 characters). The ELI 150c and ELI 250c v2.0 and later will accept long query codes in both the UNIPRO and DICOM modes.

Below are the steps to follow for acquiring an ECG with EMIS:

1. Go to **Download Orders** or **Download MWL**.
2. Enter a **query code**. The query code must be something that identifies the patient:
   a. The patient's **ID** used to organize his records in EMIS (the *EMIS No.*).
   b. The first part of the patient's **last name** (e.g., "Brow" for *John Brown*).
   c. The first parts of the patient's **first and last names** separated by a space (e.g., "J Brown" for *John Brown*).
   d. The patient's **date of birth** entered as DD/MM/YYYY (e.g., "18/07/1956" for the 18th of July, 1956).
   e. The patient's **phone number**. Use numbers only without spaces or other special characters.
   f. Part of the patient's **address** like street name, town, or postal code.
3. Make the query and view the returned patients. If no patients are returned, try entering a different piece of information about the patient.
4. Start a **new ECG** and select the patient's demographics from the list of "orders" previously downloaded. If you cannot find the correct patient demographics, simply enter them using the ELI's keyboard, and take care to enter the EMIS patient ID/No. correctly.
5. Verify the demographics and **perform the test**.
6. **Transmit** the ECG. The ECG will be stored in EMIS with the rest of the patient's records.

17　Troubleshooting Tips

There are a number of tools and techniques available for troubleshooting ELI electrocardiographs and ELI Link communications.

17.1　DICOM Connections

There are several communications links to verify during troubleshooting. Refer to the diagram below identifying each link to be verified.

Storage SCP
TCP/IP
5
2
MWL SCP
TCP/IP
4
1
ELI Link
TCP/IP　TCP/IP
6
3
ELI ECG
TCP/IP
Network Layer
Application Layer
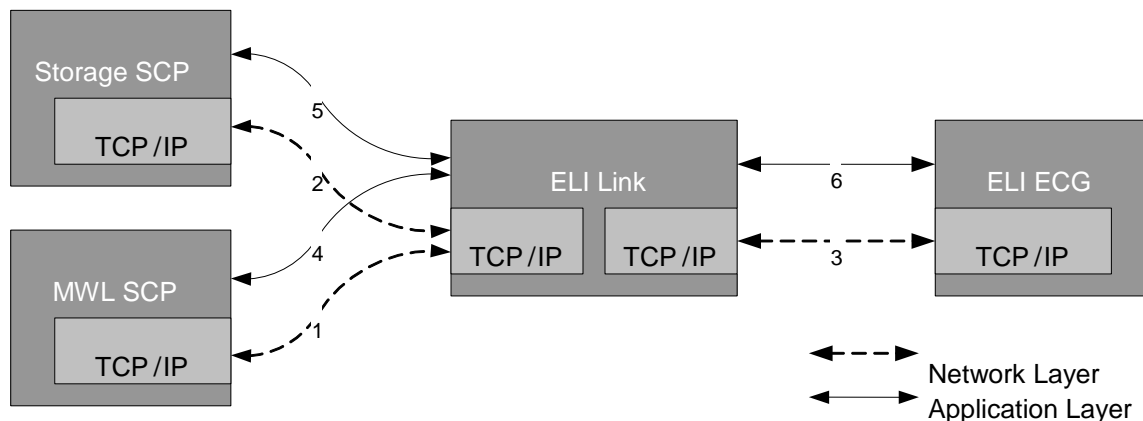
1. TCP/IP networking between the ELI Link and MWL SCP server. In a command window, use the tools **ping** and **tracert**. Use the name or IP address of the MWL SCP host configured in ELI Link. Verify network communications are working between the two computers.

2. TCP/IP networking between the ELI Link and Storage SCP server. In a command window, use the tools **ping** and **tracert**. Use the name or IP address of the Storage SCP host configured in ELI Link. Verify network communications are working between the two computers.

3. TCP/IP networking between the ELI Link and the ELI electrocardiograph. As the electrocardiograph does not have a low-level network diagnostic, this link can not be easily verified independently of the application-level link 6. If diagnosing a LAN connection to an ELI configured with a static IP address, a **ping** from the ELI Link computer to the ELI may be possible.

4. Application-level link between ELI Link and MWL SCP. Use the **Echo** button in the DICOM configuration screen of ELI Link to check that both applications are configured to communicate with each other.

5. Application-level link between ELI Link and Storage SCP. Use the **Echo** button in the DICOM configuration screen of ELI Link to check that both applications are configured to communicate with each other.

6. Application-level link between ELI Link and the ELI electrocardiograph. Initiate a simple communication from the electrocardiograph, like a **Custom ID Download**, to verify both applications are communicating correctly.

17.2　ELI Link Service Log Files

The ELI Link service logs events and errors to files in **C:\ProgramData\Mortara Instrument Inc\ELI Link\Log Files** folder. There is a text file for every day of the month. The files are named "LogDD.txt" where DD is the 2-digit day of the month. A day's log file is overwritten on that same day one month later. These files are the most detailed.

17.3 ELI Link Configuration Log Files

The ELI Link configuration utility writes to separate files in the same **C:\ProgramData\Mortara Instrument Inc\ELI Link\Log Files** folder. There is a text file for every day of the month. The files are named "DlgLogDD.txt" where DD is the 2-digit day of the month. A day's log file is overwritten on that same day one month later.

17.4 ELI Link Transaction Log Files

ELI Link logs events and transactions to files in the **C:\ProgramData\Mortara Instrument Inc\ELI Link\Event Files** folder. There is a text file for every day of the month. The files are named "EventsDD.txt" where DD is the 2-digit day of the month. A day's log file is overwritten on that same day one month later. These files only contain one line of text per event or transaction. They can be used to get a quick view of all the events and transactions processed by ELI Link.

The **Logs** tab can be used to view the transactions. Up to 5000 transaction logs entries can be displayed in the user interface, however the transactions can be filtered by checking the **Range?** box, specifying a date range and clicking the **Search** button. In addition to the date range, the transaction logs can also be filtered by selecting an **Attribute** and a corresponding value (selection or free text, based on the attribute type).

Clicking on the column header, corresponding to an attribute of the transaction logs, results in the sorting of displayed transaction logs in an ascending or descending order of the selected attribute value.

17.5 DICOM Log Files

The DICOM communications library (Merge) used by ELI Link has its own log. Modify the file C:\ProgramData\Mortara Instrument Inc\ELI Link**Merge.ini** to turn logging on. Remove the comment symbol, #, in front of the last lines of the file to turn on the various levels of logging. There are comments in the file to indicate what is logged at each level. Messages will be logged into the file C:\ProgramData\Mortara Instrument Inc\ELI Link**merge.log**. When changes are made to the merge.ini file, the ELI Link service and configuration utility must be restarted before the changes take affect:

1. **Stop** the ELI Link service using the systray icon context menu (right click on ELI Link icon in the systray).
2. **Exit** the configuration utility using the context menu again.
3. Restart the configuration utility using **All Programs -> ELI Link -> Configure service**.
4. Restart the ELI Link service using the context menu of the systray icon.

The Merge library uses an environment variable called **MERGE_INI**. If there is some question where Merge is looking for its INI and DLL files, check this variable. If it is not set, Merge will use a default search path (e.g., current working folder, system32, etc.).

17.6 Error Messages

1. (XML Only) Stopping because no export folders are specified. Run configuration utility and specify at least one export folder.
2. Stopping because no serial port, network port, modem or input directory is specified. Run configuration utility and specify at least one communication option.
3. MonitorPort: invalid serial port id: XX.
4. MonitorPort: serial port already active: XX.
5. MonitorPort: invalid modem port id: XX.
6. MonitorPort: modem port already active: XX.
7. MonitorPort: invalid network port id: XX.
8. MonitorPort: network port already active: XX.
9. MC_Register_Application returned XX with C-STORE ApplicationID = XX, Local AE = XX.
10. TerminatePort: invalid port id: XX.
11. TerminatePort: port not active: XX.
12. PortStatus: invalid port id: XX.
13. Port XX would not terminate.
14. TerminatePort: invalid modem port id: XX.
15. TerminatePort: modem port not active: XX.
16. PortStatus: invalid modem port id: XX.
17. Modem port XX would not terminate.
18. TerminatePort: invalid network port id: XX.
19. TerminatePort: network port not active: XX.
20. PortStatus: invalid network port id: XX.
21. Network port XX would not terminate.
22. RecordTransmission failed Record->NumberOfBytes = XX, Record->Record = XX.
23. RecordTransmission failed DecodeUnipro failure.
24. RecordTransmission DecompressUnipro failed.
25. RecordTransmission DeriveUnipro failed.
26. RecordTransmission failed - Files must be 1000s/s.
27. C_STORE_main returned 1. (C-Store failed).
28. RecordTransmission SavePatientData failed. (Results file creation failed)
29. Failed to export ELI file: XX.
30. Failed to export PDF file: XX.
31. Failed to export XML MI file: XX.
32. Failed to export XML-ALT file: XX.
33. Failed to export XML FDA file: XX.
34. RequestsRetrievalXML did not find matching site number = XX.
35. RequestsRetrievalXML 0 files in XX.
36. RequestsRetrievalXML unable to open XX.
37. RequestsRetrievalXML XML Order Import Folder not specified.
38. C_FIND_main returned XX. XX = -1: Failure, else XX = Number of orders.
39. Field XX exceeds max length (XX), changed from XX to XX.
40. ReadFormats unable to open reading XX.
41. ReadFormatFields unable to open XX.
42. ReadLcdFormats unable to open XX.
43. ReadLcdFormatFields unable to open XX.
44. WriteFormatFields unable to open XX.
45. Could not open XX.
46. WriteMWLConfig could not open XX.
47. ReadConfiguration() Unable to open XX.

17.7 DICOM Error Messages

1. OrderMatch last name compare failed: Order XX Last Name: XX File Last Name: XX.
2. OrderMatch first name compare failed: Order XX First Name: XX File First Name: XX.
3. OrderMatch ID compare failed: Order XX ID: XX File ID: XX.
4. OrderMatch DOB compare failed: Order XX DOB: XX File DOB: XX.
5. OrderMatch Sex compare failed: Order XX Sex: XX File Sex: XX.
6. WriteOrderID unable to open XX.
7. ReadOrderID unable to open XX.
8. CanAppend database failed OrderID = XX.
9. CanUpdate database failed OrderID = XX.
10. UpdateOrderStatusInDB CanUpdate database failed OrderID = XX.
11. C_FIND_main MC_Open_Association MWL_Filter.ApplicationID XX, Remote AE XX, Port XX, Remote Host XX returned XX.

17.8 DICOM Error Codes

1.	MC_NORMAL_COMPLETION
4000.	MC_ALREADY_REGISTERED
4001.	MC_ASSOCIATION_ABORTED
4002.	MC_ASSOCIATION_CLOSED
4003.	MC_ASSOCIATION_REJECTED
4004.	MC_ATTRIBUTE_HAS_VALUES
4005.	MC_BUFFER_TOO_SMALL
4006.	MC_CALLBACK_CANNOT_COMPLY
4007.	MC_CALLBACK_DATA_SIZE_NEGATIVE
4008.	MC_CALLBACK_DATA_SIZE_UNEVEN
4009.	MC_CALLBACK_PARM_ERROR
4010.	MC_CALLBACK_REGISTERED
4011.	MC_CANNOT_COMPLY
4012.	MC_CANT_ACCESS_PROFILE
4013.	MC_CONFIG_INFO_ERROR
4014.	MC_CONFIG_INFO_MISSING
4015.	MC_DDFILE_ERROR
4016.	MC_DOES_NOT_VALIDATE
4017.	MC_EMPTY_VALUE
4018.	MC_END_OF_DATA
4019.	MC_EXT_INFO_UNAVAILABLE
4020.	MC_FOUND
4021.	MC_FUNCTION_UNAVAILABLE
4022.	MC_INCOMPATIBLE_VR
4023.	MC_INCOMPATIBLE_VALUE
4024.	MC_INVALID_APPLICATION_ID
4025.	MC_INVALID_APPLICATION_TITLE
4026.	MC_INVALID_ASSOC_ID
4027.	MC_INVALID_CHARS_IN_VALUE
4028.	MC_INVALID_COMMAND
4029.	MC_INVALID_DATA_TYPE

4030. MC_END_OF_LIST
4031. MC_INVALID_GROUP
4032. MC_INVALID_HOST_NAME
4033. MC_INVALID_ITEM_ID
4034. MC_INVALID_LENGTH_FOR_TITLE
4035. MC_INVALID_LENGTH_FOR_VR
4036. MC_INVALID_LICENSE
4037. MC_INVALID_MESSAGE_ID
4038. MC_INVALID_MESSAGE_RECEIVED
4039. MC_INVALID_PARAMETER_NAME
4040. MC_INVALID_PORT_NUMBER
4041. MC_INVALID_PRIVATE_CODE
4042. MC_INVALID_SERVICE_LIST_NAME
4043. MC_INVALID_TAG
4044. MC_INVALID_TRANSFER_SYNTAX
4045. MC_INVALID_VALUE_FOR_VR
4046. MC_INVALID_VALUE_NUMBER
4047. MC_INVALID_VR_CODE
4048. MC_LOG_EMPTY
4049. MC_MESSAGE_EMPTY
4050. MC_MESSAGE_VALIDATES
4051. MC_MISSING_CONFIG_PARM
4052. MC_MSGFILE_ERROR
4053. MC_MUST_BE_POSITIVE
4054. MC_NETWORK_SHUT_DOWN
4055. MC_NO_APPLICATIONS_REGISTERED
4056. MC_NO_CALLBACK
4057. MC_NO_CONDITION_FUNCTION
4058. MC_NO_FILE_SYSTEM
4059. MC_NO_INFO_REGISTERED
4060. MC_NO_LICENSE
4061. MC_NO_MERGE_INI
4062. MC_NO_MORE_ATTRIBUTES
4063. MC_NO_MORE_VALUES
4064. MC_NO_PROFILE
4065. MC_NO_REQUEST_PENDING
4066. MC_NON_SERVICE_ATTRIBUTE
4067. MC_NOT_FOUND
4068. MC_NOT_ONE_OF_ENUMERATED_VALUES
4069. MC_NOT_ONE_OF_DEFINED_TERMS
4070. MC_NULL_POINTER_PARM
4071. MC_NULL_VALUE
4072. MC_PROTOCOL_ERROR
4073. MC_REQUIRED_ATTRIBUTE_MISSING
4074. MC_REQUIRED_DATASET_MISSING
4075. MC_REQUIRED_VALUE_MISSING

4076. MC_STATE_VIOLATION
4077. MC_SYSTEM_CALL_INTERRUPTED
4078. MC_SYSTEM_ERROR
4079. MC_TAG_ALREADY_EXISTS
4080. MC_TEMP_FILE_ERROR
4081. MC_TIMEOUT
4082. MC_TOO_FEW_VALUES
4083. MC_TOO_MANY_BLOCKS
4084. MC_TOO_MANY_VALUES
4085. MC_UNABLE_TO_CHECK_CONDITION
4086. MC_UNACCEPTABLE_SERVICE
4087. MC_UNEXPECTED_EOD
4088. MC_UNKNOWN_ITEM
4089. MC_UNKNOWN_SERVICE
4090. MC_VALUE_MAY_NOT_BE_NULL
4091. MC_VALUE_NOT_ALLOWED
4092. MC_VALUE_OUT_OF_RANGE
4093. MC_VALUE_TOO_LARGE
4094. MC_VR_ALREADY_VALID
4095. MC_LIBRARY_ALREADY_INITIALIZED
4096. MC_LIBRARY_NOT_INITIALIZED
4097. MC_INVALID_DIRECTORY_RECORD_OFFSET
4098. MC_INVALID_FILE_ID
4099. MC_INVALID_DICOMDIR_ID
4100. MC_INVALID_ENTITY_ID
4101. MC_INVALID_MRDR_ID
4102. MC_UNABLE_TO_GET_ITEM_ID
4103. MC_INVALID_PAD
4104. MC_ENTITY_ALREADY_EXISTS
4105. MC_INVALID_LOWER_DIR_RECORD
4106. MC_BAD_DIR_RECORD_TYPE
4107. MC_UNKNOWN_HOST_CONNECTED
4108. MC_INACTIVITY_TIMEOUT
4109. MC_INVALID_SOP_CLASS_UID
4110. MC_INVALID_VERSION
4111. MC_OUT_OF_ORDER_TAG
4112. MC_CONNECTION_FAILED
4113. MC_UNKNOWN_HOST_NAME
4114. MC_INVALID_FILE
4115. MC_NEGOTIATION_ABORTED
4116. MC_INVALID_SR_ID
4117. MC_UNABLE_TO_GET_SR_ID
4118. MC_DUPLICATE_NAME
4119. MC_DUPLICATE_SYNTAX
4120. MC_EMPTY_LIST
4121. MC_MISSING_NAME

4122. MC_INVALID_SERVICE_NAME
4123. MC_SERVICE_IN_USE
4124. MC_INVALID_SYNTAX_NAME
4125. MC_SYNTAX_IN_USE
4126. MC_NO_CONTEXT
4127. MC_OFFSET_TABLE_TOO_SHORT
4128. MC_MISSING_DELIMITER
4129. MC_COMPRESSION_FAILURE
4130. MC_END_OF_FRAME
4131. MC_MUST_CONTINUE_BEFORE_READING
4132. MC_COMPRESSOR_REQUIRED
4133. MC_DECOMPRESSOR_REQUIRED
4134. MC_DATA_AVAILABLE
4135. MC_ZLIB_ERROR
4136. MC_NOT_META_SOP
4137. MC_INVALID_ITEM_TRANSFER_SYNTAX
4138. MC_LICENSE_ERROR

Mortara XML Format Description

XML Tag	Description
/ECG	Root element of Mortara's resting ECG XML format.
@ACQUISITION_TIME	Date and time the ECG waveforms were recorded. In the format yyyyMMddHHmmss.
@ACQUISITION_TIME_XML	Date and time the ECG waveforms were recorded. In the format yyyy-mm-ddThh:mm:ss
@ROOM	From the Patient Room field.
@LOCATION	From the Patient Location field.
@COMMENT	From the Comment field.
@AGE	Patient's age at time of ECG acquisition.
@AGE_UNITS	Age units: Y = years M = months W = weeks D = days H = hours
@HEIGHT	Patient's height.
@HEIGHT_UNITS	Height units: I = inches C = centimeters
@WEIGHT	Patient's weight.
@WEIGHT_UNITS	Weight units: L = pounds K = kilograms G = grams O = ounces
@NUM_QRS	Total number of beats detected by VERITAS resting ECG interpretation algorithm.
@AVERAGE_RR	Average RR interval calculated by VERITAS. Expressed in milliseconds.
@VENT_RATE	Average ventricular rate (heart rate) calculated by VERITAS. Expressed in beats-per-minute.
@TECHNICIAN	From the Technician field.
@SYSTOLIC_BP	From the Systolic BP field.
@DIASTOLIC_BP	From the Diastolic BP field.
@SEQUENCE_NUMBER	Sequence number assigned to the ECG by the electrocardiograph. It is the electrocardiograph's accession number.
/ECG/DEMOGRAPHIC_FIELDS/DEMOGRPHIC_FIELD	Lists all demographic fields used in the Custom ID, regardless if they appear in other parts of the XML.

XML Tag	Description
@ID	UNIPRO and UNIPRO32 Field identifier: 1= Patient Last Name 2= Patient Id Number 3= Patient Age 4= Patient Gender (Male, Female, Unknown) 5= Patient Race ((blank), Caucasian, Black, Oriental, Hispanic, American Indian, Aleut, Hawaiian, Pacific Islander, Mongolian, Asian) 6= Medication ((blank), Digitalis, Beta blocker, Quinidine/Norpace, Diuretic, Calcium antagonist, Proc/Lido/Tocainide, Other antiarrhythmic, Psychotropic, Unknown) 7= Patient First Name 8= LCD Request 9= Patient Height 10= Patient Weight 11= Soc Sec Number 12= Patient Second ID 13= Patient Middle Name 14= Patient Location 15= Patient Room 16= Patient Birth Date (yyyyMMdd) 17= Comment 18= Reason Code 19= Referring Physician 20= Attending Physician 21= Overreading Physician 22= Technician 23= Diagnosis 24= Note 1 25= Note 2 26= Order Number 27= Systolic Blood Pressure 28= Diastolic Blood Pressure 29= Requesting Physician 30= Accession Number 31= Admission ID
@LABEL	Field label defined in the Custom ID.
@VALUE	Field value.
@UNITS	Value units, if applicable. See descriptions for AGE, HEIGHT, and WEIGHT.
/ECG/SITE	
@ID	The site number assigned to the electrocardiograph.
/ECG/SUBJECT	
@LAST_NAME	Patient's last name.
@FIRST_NAME	Patient's first name.
@GENDER	Patient's gender: Male, Female, Unknown.
@ID	Patient's primary ID or medical record number (MRN).
@DOB	Patient's date of birth in the yyyyMMdd format.
@DOB_XML	Patient's date of birth in the yyyy-mm-ddThh:mm:ss format.
/ECG/MEDICATION	

XML Tag	Description
@CLASS_CODE	Medication class code: 1= Digitalis Preparation 2= Antiarrhythmic 3= Diuretics 4= Antihypertensive 5= Antianginal 6= Anticoagulants 7= Beta blockers 8= Psychotropic 9= Calcium Blockers 10= Antihypotensive 11= Anticholesterol
@DRUG_CODE	Drug code.
@NAME	Drug name: (blank) Digitalis Beta blocker Quinidine/Norpace Diuretic Calcium antagonist Proc/Lido/Tocainide Other antiarrhythmic Psychotropic Unknown
/ECG/SOURCE	
@TYPE	Type of device that recorded the waveforms: RESTING HOLTER STRESS
@MANUFACTURER	Name of the device manufacturer.
@MANUFACTURER_ID	Manufacturer ID according to the UNIPRO standard. 10 = Mortara
@MODEL	Electrocardiograph model number.
@ID	Electrocardiograph's cart number.
@TRANSMISSION_TIME	Date/time when the ECG was transmitted from the electrocardiograph in the yyyyMMddHHmmss format.
@TRANSMISSION_TIME_XML	Date/time when the ECG was transmitted from the electrocardiograph in the yyyy-mm-ddThh:mm:ss format.
@ACQUIRING_DEVICE_INSTITUTION_NUMBER	Acquiring device site number right sifted by 4 bits.
@ACQUIRING_DEVICE_DEPARTMENT_NUMBER	The 4 LSBs of acquiring device site number.
@ACQUIRING_DEVICE_CART_ID	The cart number assigned to acquiring device.
@ACQUIRING_DEVICE_DEVICE_TYPE	Acquiring device type: C = Electrocardiograph S = System.
@ACQUIRING_DEVICE_MANUFACTURER_CODE	Acquiring device manufacturer code. 10= Mortara
@ACQUIRING_DEVICE_MODEL_DESCRIPTION	Acquiring device model description.
@ANALYZING_DEVICE_INSTITUTION_NUMBER	Analyzing device site number right sifted by 4 bits.

XML Tag	Description
@ANALYZING_DEVICE_DEPARTMENT_NUMBER	The 4 LSBs of analyzing device site number.
@ANALYZING_DEVICE_CART_ID	Cart number assigned to analyzing device.
@ANALYZING_DEVICE_DEVICE_TYPE	Acquiring device type: C = Cart S = System
@ANALYZING_DEVICE_MANUFACTURER_CODE	Acquiring device manufacturer code. 10= Mortara
@ANALYZING_DEVICE_MODEL_DESCRIPTION	Analyzing device model description.
@BASELINE_ROLL_FILTER	Cutoff frequency of the high-pass baseline roll filter in units of (1/100) Hertz.
@LOW_PASS_FILTER	Cutoff frequency of the low-pass filter in units of Hertz.
@PRINT_FILTER	Cutoff frequency of the print filter in units of Hertz. The print (and display) filter is the setting applied on the cardiograph at the time of the ECG recording
@FILTER_BITMAP	This field indicates if other filters have been used during the processing of the ECG. The definition of these bits are: 0= 60 Hz notch filter 1= 50 Hz notch filter 2= Hysteresis filter 3= Baseline wander filter 4-7= Undefined
@ACQUIRING_DEVICE_EXTENDED_MODEL_DESCRIPTION	Acquiring device extended model description.
@ACQUIRING_DEVICE_SW_VERSION	Acquiring device software version (xx.yy.zz).
@ACQUIRING_DEVICE_INTERPRETATION_SW_VERSION	Acquiring device interpretation software version (xx.yy.zz).
@ACQUIRING_DEVICE_SERIAL_NUMBER	Acquiring device serial number.
@ACQUIRING_DEVICE_LANGUAGE	Acquiring device language: 0= English 1= Italian 2= Spanish 3= German 4= Finnish 5= French 6= Portuguese 7= Dutch 8= Polish 9= Swedish 10= Hungarian 11= Czech 12= Chinese 13= Japanese 14= Russian
@ACQUIRING_DEVICE_PLOT_FORMAT	Acquiring device plot format: 0= 3+1 1= 6 2= 3+3 3= 12 4= 6+6 5= 3+1 Cabrera 6= 6 Cabrera 7= 3+3 Cabrera 8= 12 Cabrera 9= 6+6 Cabrera

XML Tag	Description
@ACQUIRING_DEVICE_3P1_RHY_LEAD	Acquiring device 3+1 rhythm lead: 1= I 31= I cal 2= II 32= II cal 3= VI 33= VI cal 4= V2 34= V2 cal 5= V3 35= V3 cal 6= V4 36= V4 cal 7= V5 37= V5 cal 8= V6 38= V6 cal 9= V7 39= V7 cal 10= V2R 40= V2R cal 11= V3R 41= V3R cal 12= V4R 42= V4R cal 13= V5R 43= V5R cal 14= V6R 44= V6R cal 15= V7R 45= V7R cal 16= X 46= X cal 17= Y 47= Y cal 18= Z 48= Z cal 19= CC5 49= CC5 cal 20= CM5 50= CM5 cal 21= Left Arm 51= Left Arm cal 22= Right Arm 52= Right Arm cal 23= Left Leg 53= Left Leg cal 24= I 54= I cal 25= E 55= E cal 26= C 56= C cal 27= A 57= A cal 28= M 58= M cal 29= F 59= F cal 30= H 60= H cal 0= Unspecified lead 65-99= Reserved for future expansion 100-255= Manufacturer specific 100= V8 101= V9 102= E1 103= E2 104= E3 105= III
@ACQUIRING_DEVICE_3P3_RHY_LEAD_1	Acquiring device 3+3 rhythm lead1 (defined above).
@ACQUIRING_DEVICE_3P3_RHY_LEAD_2	Acquiring device 3+3 rhythm lead2 (defined above).
@ACQUIRING_DEVICE_3P3_RHY_LEAD_3	Acquiring device 3+3 rhythm lead3 (defined above).
@ACQUIRING_DEVICE_SPEED	Acquiring device print speed: 0= 5 mm/s 1= 10 mm/s 2= 25 mm/s 3= 50 mm/s 4= 100 mm/s

XML Tag	Description
@ACQUIRING_DEVICE_GAIN	Acquiring device ECG gain: 0= 2.5 mm/mV 1= 5 mm/mV 2= 10 mm/mV 3= 20 mm/mV
@ACQUIRING_DEVICE_SITE_NAME	Acquiring device site name – ASCII
@ACQUIRING_DEVICE_HTWT_UNITS	Acquiring device height/weight units: 0 = in/lb 1 = cm/kg
@ANALYZING_DEVICE_EXTENDED_MODEL_DESCRIPTION	ASCII Analyzing device extended model description.
@ANALYZING_DEVICE_SW_VERSION	Analyzing device software version (xx.yy.zz).
@ANALYZING_DEVICE_INTERPRETATION_SW_VERSION	Analyzing device interpretation software version (xx.yy.zz).
@ANALYZING_DEVICE_SERIAL_NUMBER	ASCII Analyzing device serial number.
@ANALYZING_DEVICE_LANGUAGE	Analyzing device language: 0= English 1= Italian 2= Spanish 3= German 4= Finnish 5= French 6= Portuguese 7= Dutch 8= Polish 9= Swedish 10= Hungarian 11= Czech 12= Chinese 13= Japanese 14= Russian
@ANALYZING_DEVICE_PLOT_FORMAT	Analyzing device plot format: 0= 3+1 1= 6 2= 3+3 3= 12 4= 6+6 5= 3+1 Cabrera 6= 6 Cabrera 7= 3+3 Cabrera 8= 12 Cabrera 9= 6+6 Cabrera

XML Tag	Description
@ANALYZING_DEVICE_3P1_RHY_LEAD	Analyzing device 3+1 rhythm lead: 1= I　　　　　　　31= I cal 2= II　　　　　　　32= II cal 3= VI　　　　　　　33= VI cal 4= V2　　　　　　　34= V2 cal 5= V3　　　　　　　35= V3 cal 6= V4　　　　　　　36= V4 cal 7= V5　　　　　　　37= V5 cal 8= V6　　　　　　　38= V6 cal 9= V7　　　　　　　39= V7 cal 10= V2R　　　　　　40= V2R cal 11= V3R　　　　　　41= V3R cal 12= V4R　　　　　　42= V4R cal 13= V5R　　　　　　43= V5R cal 14= V6R　　　　　　44= V6R cal 15= V7R　　　　　　45= V7R cal 16= X　　　　　　　46= X cal 17= Y　　　　　　　47= Y cal 18= Z　　　　　　　48= Z cal 19= CC5　　　　　　49= CC5 cal 20= CM5　　　　　　50= CM5 cal 21= Left Arm　　　　51= Left Arm cal 22= Right Arm　　　52= Right Arm cal 23= Left Leg　　　　53= Left Leg cal 24= I　　　　　　　54= I cal 25= E　　　　　　　55= E cal 26= C　　　　　　　56= C cal 27= A　　　　　　　57= A cal 28= M　　　　　　　58= M cal 29= F　　　　　　　59= F cal 30= H　　　　　　　60= H cal 0=　　　　　Unspecified lead 65-99=　　　Reserved for future expansion 100-255=　　Manufacturer specific 100=　　　　V8 101=　　　　V9 102=　　　　E1 103=　　　　E2 104=　　　　E3 105=　　　　III
@ANALYZING_DEVICE_3P3_RHY_LEAD_1	Analyzing device 3+3 rhythm lead1 (defined above).
@ANALYZING_DEVICE_3P3_RHY_LEAD_2	Analyzing device 3+3 rhythm lead2 (defined above).
@ANALYZING_DEVICE_3P3_RHY_LEAD_3	Analyzing device 3+3 rhythm lead3 (defined above).
@ANALYZING_DEVICE_SPEED	Analyzing device print speed: 0=　5 mm/s 1=　10 mm/s 2=　25 mm/s 3=　50 mm/s 4=　100 mm/s

XML Tag	Description
@ANALYZING_DEVICE_GAIN	Analyzing device ECG gain: 0= 2.5 mm/mV 1= 5 mm/mV 2= 10 mm/mV 3= 20 mm/mV
@ANALYZING_DEVICE_SITE_NAME	Analyzing device site name – ASCII
@ANALYZING_DEVICE_HTWT_UNITS	Analyzing device height/weight units: 0 = in/lb 1 = cm/kg.
@ECG_LEAD_DEFINITION	This field indicates which ECG lead set has been used. The definitions are: 0 = Standard 1 = Pediatric V3R 2 = Mason-Likar
@PULSE_OXIMETRY_DATA_SPO2	SpO_2 value in % units
@PULSE_OXIMETRY_DATA_PULSE_RATE	Pulse Rate in ppm units
/ECG/AUTOMATIC_INTERPRETATION	
/ECG/AUTOMATIC_INTERPRETATION/STATEMENT	
@STATEMENT_NUMBER	VERITAS automatic interpretation statement number, starting with 1 as the first statement.
@TEXT	Main body of the interpretation statements.
@REASON	Reasons given with the statement.
/ECG/INTERPRETATION	
@TEXT	Manual interpretation statements.
/ECG/TYPICAL_CYCLE	**Median beat/representative beat/typical cycle…**
@R_PEAK	Position of the R-peak as determined by VERITAS, expressed in milliseconds from the beginning of the typical cycle waveforms.
@P_ONSET	Position of the P-onset as determined by VERITAS, expressed in milliseconds from the beginning of the typical cycle waveforms.
@P_OFFSET	Position of the P-offset as determined by VERITAS expressed in milliseconds from the beginning of the typical cycle waveforms.
@Q_ONSET	Position of the QRS-onset as determined by VERITAS, expressed in milliseconds from the beginning of the typical cycle waveforms.
@Q_OFFSET	Position of the QRS-offset as determined by VERITAS, expressed in milliseconds from the beginning of the typical cycle waveforms.
@T_OFFSET	Position of the T-offset as determined by VERITAS, expressed in milliseconds from the beginning of the typical cycle waveforms.
@P_DURATION	Duration of the P-wave as determined by VERITAS, expressed in milliseconds.
@PR_DURATION	Duration of the PR interval as determined by VERITAS, expressed in milliseconds.
@QRS_DURATION	Duration of the QRS-wave as determined by VERITAS, expressed in milliseconds.
@QT	Duration of the QT interval as determined by VERITAS, expressed in milliseconds.

XML Tag	Description
@QTC	Duration of the QT interval normalized to 60 bpm using the linear method: $QTc = QT + \dfrac{(1000 - RR)}{7}$
@QTCB	Duration of the QT interval normalized to 60 bpm using the Bazett method: $QTcB[s] = \dfrac{QT[s]}{(RR[s])^{1/2}}$
@QTCF	Duration of the QT interval normalized to 60 bpm using the Fridericia method: $QTcF = \dfrac{QT}{RR^{1/3}}$
@P_AXIS	P axis as determined by VERITAS, expressed in degrees.
@QRS_AXIS	QRS axis as determined by VERITAS, expressed in degrees.
@T_AXIS	T axis as determined by VERITAS, expressed in degrees.
@BITS	Number of bits per sample in the encoded waveform data: 8, 16, 32.
@FORMAT	Format of the encoded waveform data: SIGNED means values can be positive and negative.
@UNITS_PER_MV	Number of units per mV in the encoded waveform data. For example, 400 units per mV is the same as 2.5 uV per unit.
@DURATION	Duration of the waveforms, expressed in milliseconds.
@SAMPLE_FREQ	Sampling frequency of the waveforms, expressed in samples per second, or Hz.
@ENCODING	Type of encoding used for the waveforms: BASE64, BINHEX.
/ECG/TYPICAL_CYCLE/TYPICAL_CYCLE_CHANNEL	
@NAME	Name of the lead: I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6, TEA.
@DATA	The encoded waveform data.
/ECG/CHANNEL	
@OFFSET	Offset from the beginning of the ECG recording where this lead starts, expressed in milliseconds.
@BITS	Number of bits per sample in the encoded waveform data: 8, 16, 32.
@FORMAT	Format of the encoded waveform data: SIGNED means values can be positive and negative.
@UNITS_PER_MV	Number of units per mV in the encoded waveform data. For example, 400 units per mV is the same as 2.5 uV per unit.
@DURATION	Duration of the waveforms, expressed in milliseconds.
@SAMP_FREQ	Sampling frequency of the waveforms, expressed in samples per second, or Hz.
@NAME	Name of the lead: I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5, V6, TEA.
@ENCODING	Type of encoding used for the waveforms: BASE64, BINHEX.
@DATA	The encoded waveform data.

EMIS Web Installation and Configuration

The combination of EMIS Web Client and Welch Allyn's ELI Link software creates a data exchange gateway between EMIS and the ELI devices. This gateway is intended to be run on a server that's always on and available for the ELI devices whenever they're in use. Although user interaction is required to install, configure, and test the gateway software, no user interaction is required during normal operation.

B.1 Installation Prerequisites

1. The computer may be running directly on physical hardware or in a virtualized environment.

2. The computer's operating system must be one of the following:
   a. Windows 10 (64 bit).
   b. Server 2012 R2 (64-bit),
   c. Server 2016 for ELI Link
   d. Server 2019 for ELI Link

3. The computer must be using a static IP address. This IP address will be programmed into the ELI devices.

4. The computer's Regional Settings must be UK with a date format of dd/MM/yyyy. Apply Locale to local services so ELI Link inherits the settings. Perform the following steps:
   a. Open **Control Panel** and launch **Region** (maybe located under **Clock and Region**).
   b. Go to the **Formats** tab.
   c. Select the format **English (United Kingdom)**.
   d. Verify the Short date format is set to **dd/MM/yyyy** format.
   e. Go to the **Administrative** tab.
   f. Click on the **Copy settings** button and when prompted *Would you like to apply your region and language changes* select **Apply**. *Welcome screen and new user accounts settings* dialog comes up.
   g. Under *Copy your current settings to:* Check the boxes **Welcome screen and system accounts** and **New user accounts**, then select **OK**.
   h. Close the Region dialog box by clicking **OK**.
   i. Close the Clock and Region screen.

B.2 Install the EMIS Web Client

EMIS provides instructions and technical support for installing and configuring their software. If the computer hosting the ELI/EMIS gateway solution does not already have the **SDS Client** and **EMIS Web Client**, please contact EMIS Support for assistance. Call 0845-1222333 and a support consultant will remotely install the software or talk through the steps over the phone. Additional support information is available at http://www.emis-online.com/about-emis-support.

B.3 Configure ELI Link Connection in EMIS Web Client

After the EMIS Web Client has been installed, a user account must be created for ELI Link, and the account must be granted permission to use the EMIS Partner API.

1. Create a user account for ELI Link.
   a. Using the EMIS Web client, go to: Configuration -> Organisation Configuration -> Add -> **Add New User**.
   b. Set the User Name to **EliLink** (no space).
   c. Pick a **password**. NOTE*: this is *not* the password that ELI Link will use for the EMIS Partner API connection.
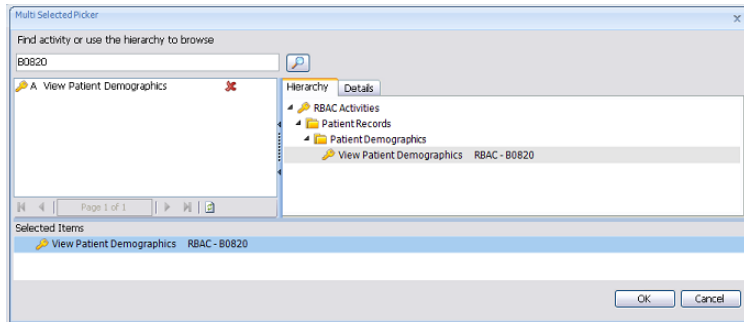
      d. *Uncheck* **User must change password on next login**.

      e. Assign the following **RBAC** Roles:

          i. B0360

          ii. B0370

          iii. B0380

          iv. B0820

2. Set an **API Password** for the EliLink user account. This is the password ELI Link will use for the EMIS Partner API.

      a. Using the EMIS Web client, go to: System Tools -> EMAS Manager -> Partner API -> **Edit Users**.

      b. Locate the **EliLink** user account in the list and check it to grant it API access.

      c. Locate the **EliLink** user account in the list and check it to grant it API access.

      d. Locate the **EliLink** user account in the list and check it to grant it API access.

      e. Select the option to the right of the EliLink user account to **create an API password** for it.

      f. Click **OK** to save the changes.
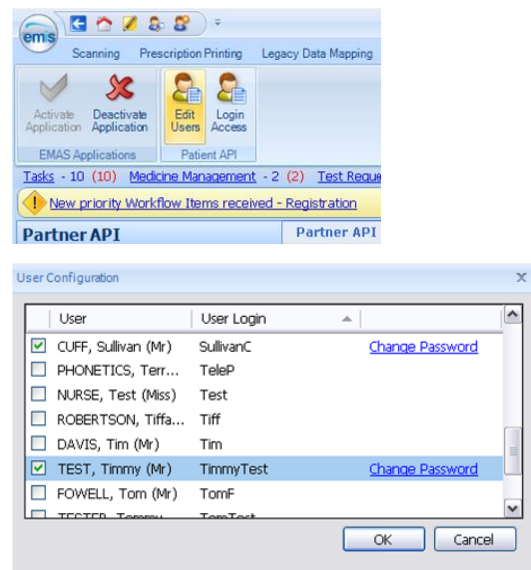
3. Activate the ELI Link **Partner API.**

      a. Using the EMIS Web client, go to: System Tools -> EMAS Manager -> **Partner API.**

      b. Highlight the **Mortara** (or ELI Link) product and click **Activate Application.**
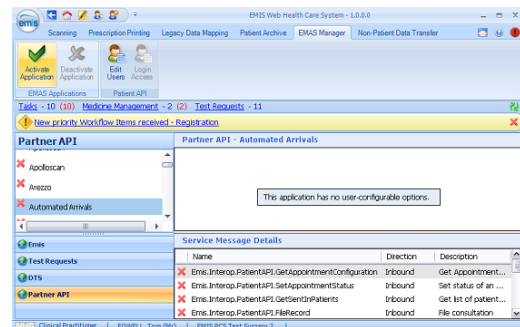
      c. While the product is still highlighted, select **Login Access**.

d. Locate the EliLink user account in the list and check the **Auto Login** and **Allow Login** access privileges.

e. Click **OK** to save changes.