Experion MX MSS and EDAQ Data Acquisition

System Manual

6510020381 Rev 01
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Introduction

The purpose of this manual is to provide an introduction to the Experion MX MSS and EDAQ Data Acquisition.

Audience

This manual is intended for use by engineers or process engineers and assumes that the reader has some knowledge of the operation of a scanning Quality Control System and a basic understanding of mechanical, electrical and computer software concepts.

About This Manual

This manual contains thirteen chapters and an appendix.

Chapter 1, System Overview, describes operating principles and system specifications.

Chapter 2, Network Architecture, provides details on the scanner network IP addresses, the Measurement Sub System (MSS) IP addresses, and the server IP setup.

Chapter 3, MSS, describes the MSS, including its installation and setup.

Chapter 4, Backing-up and Cloning the MSS, describes procedures to back up and/or clone the MSS.

Chapter 5, EDAQ, describes the principles and operation of the Ethernet Data Acquisition (EDAQ) board.
Chapter 6, **Obtain Status Information**, describes the various methods of obtaining status information.

Chapter 7, **EDAQ Function and Position Code Overrides**, describes the procedures for when function and position codes need to be hardcoded.

Chapter 8, **Technical MSS and EDAQ Field Procedures**, describes common field procedures.

Chapter 9, **Tasks**, describes procedures for maintenance, diagnostic, and troubleshooting tasks.

Chapter 10, **Troubleshooting**, describes symptoms, alarms, possible causes, and links to associated diagnostic or troubleshooting tasks.

Chapter 11, **EDAQ Error Messages**, provides a list with descriptions of the error messages the EDAQ might display.

Chapter 12, **Storage, Transportation, and End of Life**, describes methods for storing, transporting, and disposing sensor components.

Chapter 13, **Glossary**, describes terms and acronyms used in this manual.

Appendix A, **Part Numbers**, lists current part numbers for parts and kits.

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**Related Reading**

The following documents contain related reading material.

<table>
<thead>
<tr>
<th>Honeywell Part Number</th>
<th>Document Title / Description</th>
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</thead>
<tbody>
<tr>
<td>Gnu Public License</td>
<td></td>
</tr>
<tr>
<td>Experion MX license</td>
<td></td>
</tr>
<tr>
<td>6510020331</td>
<td>Basis Weight Measurement System Manual</td>
</tr>
</tbody>
</table>

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Conventions

The following conventions are used in this manual:

**ATTENTION** Text may appear in uppercase or lowercase except as specified in these conventions.

**Boldface**

Characters in this special type indicate your input. For example, **filename** represents any filename. **Button** names, button menus, fields on a display, parameters, or commands that must be entered exactly as they appear. For example, **SXDEF 1 [ENTER]**.

**Special Type**

Characters in this special type that are not boldfaced indicate system prompts, responses, messages, or characters that appear on displays, keypads, or as menu selections.

**Italics**

In a command line or error message, words and numbers shown in italics represent filenames, words, or numbers that can vary; for example, filename represents any filename. In text, words shown in italics are manual titles, key terms, notes, cautions, or warnings.

**lowercase**

In an error message, words in lowercase are filenames or words that can vary. In a command line, words in lowercase indicate variable input.

**Type**

Type means to type the text on a keypad or keyboard.

**Press**

Press means to press a key or a button. **[ENTER]** is the key you press to enter characters or commands into the system, or to accept a default option. In a command line, square brackets are included; for example: **SXDEF 1 [ENTER]**.

**[CTRL]**

[CTRL] is the key you press simultaneously with another key. This key is called different names on different systems; for example, **[CONTROL]** or **[CTL]**.

**[KEY-1]-KEY-2**

Connected keys indicate that you must press the keys simultaneously; for example, **[CTRL]-C**.

**Click**

Click means to position the mouse pointer on an item, then quickly depress and release the mouse button. This action highlights or "selects," the item clicked.

**Double-click**

Double-click means to position the mouse pointer on an item, and then click the item twice in rapid succession. This action selects the item “double-clicked.”

**Drag X**

Drag X means to move the mouse pointer to X, then press the mouse button and hold it down, while keeping the button down, move the mouse pointer.

**Press X**

Press X means to move the mouse pointer to the X button, then press the mouse button and hold it down.

**ATTENTION**

The attention icon appears beside a note box containing information that is important.

**CAUTION**

The caution icon appears beside a note box containing information that cautions you about potential equipment or material damage.

**WARNING**

The warning icon appears beside a note box containing information that warns you about potential bodily harm or catastrophic equipment damage.
1. System Overview

1.1. Introduction

For the next generation of Experion MX scanners in both the paper and CWS industry, a new data acquisition architecture was developed. This is a common platform of hardware, but implemented differently in the Q4000 series scanner than in the CWS 4080 and 4084 scanners (referred to here as the 408x series).

The new hardware consists of a Measurement Sub System (MSS, also referred to as the PMP in CWS), and a data acquisition (signal processing) card called the Ethernet Data Acquisition (EDAQ) board.

The EDAQ boards perform all the digitization for the sensors, and pass data via Ethernet to any other client on the network. An EDAQ and an associated expansion board, together referred to as the Frame Controller- (FC) EDAQ, are used for frame motion control.

The MSS is a generic CPU that collects all the sensor data and bins the signals before transmission to the QCS server. These data are largely compatible with what a previous generation MSS would be providing. However, the older MSS generation also performed motion control. This task is now running on the FC-EDAQ. The physical hardware used in the Q4000-80 scanner for the MSS is a more powerful processor than for the CWS scanner, but the software, and disk content, are the same.

Section 1.2 and Section 1.3 detail some of the differences on how the new MSS and EDAQs are used in the two scanner series. Most of the chapters in this manual apply equally to both scanner systems. Prominent exceptions are information related to the user panel interface (Q4000 series only), the radiation interlock, and the power track. Software installation, upgrading, maintenance tasks, and web interfaces are identical in both systems.
1.2. Overview of the EDAQ and MSS (Q4000)

The Experion MX Q4000-80 scanner is the first scanner in a new line that uses local smart data acquisition cards and a generic MSS.

With each sensor having its own EDAQ board, the power track is reduced to Ethernet, power, and some special signals such as the hardwired green light safety signal and infrared (IR) chopper synchronization signal.

In addition to the sensor EDAQs, the Q4000-80 has two alley EDAQs, one in each head to control and interface with generic head functions and signals.

The new architecture has the following advantages:

- sensors can be added more or less plug and play to head
- new signals from sensors can easily be added to system and/or retrofitted
- much simpler endbell scanner cabling (especially with respect to radiation interlocks)
- increased diagnostics

For most sensor types, the EDAQs typically:

- collect data from all sub-systems (ADC, DIO, USB, Serial, and so on)
- time-stamp the data (with better than 50 microsecond absolute precision)
- make data available to anyone on the network (not only MSS) using the EDAQ data acquisition layer, EDAL, software communication layer
- listen to requests from anyone to control digital outputs and analog outputs
- run a local Web server

New tasks performed by the EDAQs:

- for radiation sensors, the EDAQs deal with low level interlocks, for example, checking whether the state of the shutter matches observed signal in the receiver, checking the state of the red light, and so on
• perform PID control for the head temperature (sheetguide, air wipes)

• convert to engineering units some of the auxiliary signals, such as temperatures and so on

• act as a converter board for RS-485 serial signals to Ethernet (for example in the color sensor, FotoForm, FotoFiber, and so on)

For example, the upper head alley EDAQ:

• reads signals from the Z-sensor

• reads signals from the Sheet Temp sensor if it is configured in the system

• controls the clutch (actuator) to split the heads using a digital output

• reads head split magnet signal

• reads accelerometers from the head power distribution board

• performs PID loop control on the sheetguide and air wipe heaters

The upper head alley EDAQ will broadcast the state of the head split to any of the other EDAQs that need to know the state. In this case, all nuclear and X-ray sensors will subscribe to this data from this EDAQ so that they can make the appropriate interlock decision. Data subscription is how EDAQs make data available to other clients on the network. The EDAQs can publish the same ADC data simultaneously to any number of other clients (such as the MSS, other EDAQs, or debugging software running on a Windows® PC).

To allow data from various EDAQs to be binned according to the position of the scanner, each EDAQ has a clock that has to be highly synchronized. This is achieved by implementing the *IEEE1588 Networking Synchronization Standard* [2002]. Each EDAQ board receives clock data packets from the MSS, which acts as the master clock for the system. This signal arrives a few times per second and keeps all EDAQ system clocks the synchronized to the MSS. An accuracy of 50 microseconds or better is expected at all times.

### 1.3. Overview of the EDAQ and MSS (408x)

Most of the chapters in this manual were written for the Q4000 series scanner, but the bulk of the text applies to the Q4000 and the 408x scanners. In the Q4000-80 scanner, the EDAQs are mounted at each sensor position and digitize the signals in the head. In the 408x scanners, the EDAQs are not dedicated to a particular
sensor, but act as generic data acquisition (DAC) cards similar to the previous
generation of National Instruments DAQ cards. The EDAQ I/O functions consist
of digital inputs and outputs, analog inputs and outputs, a frequency counter,
several serial interfaces, and USB and temperature measurements.

1.3.1. Differences in the MSS

The Q4000 series scanner uses a more powerful processor due to the large amount
of sensor data it needs to process. The PC used in the 408x scanners, a FitPC2i at
the time of writing, has more modest specifications. However, the software and
operating system running on both is the same. The same base installation image is
applied to both PCs, and the same MSS updates (described in Chapter 3) are
applicable to both unless explicitly notified by Honeywell Engineering. The intent
is to keep the systems 100% compatible and interchangeable.

1.3.2. Differences in the EDAQs

The EDAQ hardware used in the 408x scanners consists of one or two EDAQs at
the endbell to digitize the sensor signals, and an additional EDAQ used as an FC-
EDAQ. The latter consists of an EDAQ mounted on an I/O expansion board. All
three EDAQs are identical in software and hardware, and may be freely inter-
changed. All EDAQs should automatically identify their function in the scanner
and load appropriate firmware and application code. The EDAQs can be
interchanged between the 408x and the Q4000 series scanners. For details on the
automatic identification, see Chapter 7.

1.3.3. Safety Interlock and Watchdog Functions

In the paper Q4000 scanner the EDAQs can run dedicated code depending on the
sensor function detected at boot up time. For example, the radiation sensors have
sophisticated safety interlocking which is processed on the EDAQ. These EDAQs
will check for the status of the red light, the head split switch, and the receiver
signals before allowing the command to set a digital output to be processed.
Details may be found in Basis Weight Measurement System Manual (p/n
6510020331). In the 408x scanners this functionality is handled by the MSS and
some dedicated hardware at the endbell.

The EDAQs do not run code specific to the type of sensors mounted on the
scanner. In other words, they operate as non-intelligent DAC cards, running
generic EDAQ code that does not inhibit commands from the MSS. This code is
identical to the code that is running on IR sensor-associated EDAQs that have no
interlocking functionality.
As an additional layer of safety against failure, a software watchdog is implemented on the 408x endbell EDAQs. Because the logic to operate the nuclear shutters runs on the MSS, and the connection between the EDAQs and the MSS could potentially fail (or be unplugged), the EDAQs will turn off all digital outputs if no *stay-alive* message is received from the MSS in a specific time period. The time period is in the order of a few seconds and may be changed in the RAE database.

**WARNING**

Do not configure higher than the default setting for radiation safety, as the radiation safety interlocks are run in the MSS for 408x scanners.

Advanced users will find this in the RTDR area under the sensor job set/setup record with the name */Setup/EDAQ Watchdog Timeout Sec*. Also see the RAE alarm information in Chapter 10.
2. Network Architecture

2.1. Introduction

This section provides details on the scanner network IP addresses, the MSS IP addresses, and the server IP setup. Figure 2-1 shows the scanner network for a Q4000 paper scanner. The architecture is the same for the 408x scanners except that the EDAQs are physically not with the sensors (as shown) but at the endbell. All other information in this chapter applies to both scanner types.

Figure 2-1 Scanner Network and IP Architecture (upper and lower head alley EDAQ not shown)
The MSS has two network cards. As shown in Figure 2-1, one card is part of the scanner network and always has an address of 192.168.0.1. Also shown is the FC, with fixed address 192.168.0.2. This Q4000 scanner has two EDAQ boards in the top and bottom heads, with addresses assigned through their position in the head (position 202/102 as shown in Figure 2-1, resulting in IP addresses 192.168.0.102 and 192.168.0.202.). See Section 5.3 for more information on location numbers and IP addresses. The structure and IP assignments inside the scanner network are fixed and should not be changed at installation.

In addition to the scanner devices, Figure 2-1 shows a laptop plugged into the network. The local DHCP server (inside the scanner network) assigned it the temporary address 192.168.0.38. Because the MSS is configured to act as a network router, this laptop has access to both the scanner network and the network at the next level up (that of the MSS-RAE server network, shown in Figure 2-2.). This means that remote desktop applications on the laptop may access the QCS server. In the example network shown in Figure 2-2, access the server using the address 192.168.10.1.

Figure 2-2 MSS and Server Network for a Two-scanner System

Within the scanner network, the MSS Web pages may be accessed using the scanner address http://192.168.0.1/. Each EDAQ may be directly accessed using the IP address, for example, http://192.168.0.102 for the lower head EDAQ and
http://192.168.0.2 for the FC. In the 408x scanner, the IP addresses of the FC and the MSS are what they are in the Q4000. The two possible endbell EDAQs have IP addresses of 192.168.0.3 and 192.168.0.4.

Figure 2-2 also indicates the function of the MSS as a Web proxy server. Any device on the MSS-RAE network can access the EDAQ Web pages by appending the network name to the address.

The MSS-RAE network is the next level up and typically connects all the scanners at site to the server. The network cards in the MSS server segment may have default addresses from the factory, but they may be changed on-site without restrictions. There is no DHCP server on this network segment, although it can easily be added on request.

Figure 2-2 shows two scanners, where the second MSS was assigned IP address 192.168.10.102 at installation, and the first MSS retained its default address. Laptops connected into this network segment can access the MSS Web pages using their addresses (http://192.168.10.101 and http://192.168.10.102/). Also indicated in Figure 2-2 is the optional forwarding of port 22 on the QCS server to the same ports on the MSS. This will allow technical support direct access to the MSS and hence to the EDAQs in each scanner.

2.2. Ethernet Switch Information (Q4000 & 408x)

All scanner devices are auto-negotiating their speed and duplex mode and hence all the scanner switches are set up for auto mode only. For any switch connected directly to the MSS, it is important to avoid setting it to 100 Mb/s full-duplex. According to the Ethernet standard, when an auto-negotiating device detects a non-auto-negotiating device it will revert to half-duplex mode. A 100 Mb/s full-duplex set switch will force the MSS to half-duplex, causing large amounts of re-transmitted and, eventually, lost data.

Aside from the auto-negotiation, there is no particular required feature of switches between the MSS connection and the RAE server. You can set duplex rates on the switch port connecting to the server (assuming the server is also set to fixed rates), but not on the port connected to the MSS.

Note that the scanner Ethernet switches are not generic switches and cannot be easily replaced. The MSS communicates time synchronization data to all EDAQs over a high-priority VLAN tagged packet. Timing synchronization fails if the switch:

1. does not recognize VLAN tags
2. does not have priority queuing set up by default
In that case, the EDAQ will believe the date is January 1st, 1970 at boot-up. The RAE system will notify you that the data time stamp on the EDAQs is bad. There are many managed switches that support 1 and 2, but you have to set it up properly. There are few switches on the market that have both features enabled off the shelf. In particular, this means that you cannot remote install the MSS (remove from endbell) and insert a booster switch in between to get long cable distances, unless you use another Phoenix Contact switch such as is in the endbell.

Finally, the Rapid Spanning Tree protocol, which automatically enables a redundant Ethernet cable in the power track, is possible in the Q4000 series scanner but not presently enabled. There are a number of issues to be resolved at the time of writing, such as:

- creating an alarm in RAE
- the switch-over time is large enough that the scanner would generate a safety fault regardless and would go offsheet

Therefore, at present do not connect all four LAN cables on both the head and endbell sides.
2.3. MSS Web Page

The **PHP MSS Page** (see Figure 2-3) is the main focus point for EDAQ, FC, and MSS information. Many of the EDAQ, FC, and MSS diagnostics are displayed on the **PHP MSS Page**. The MSS IP address and time are set here, and all the devices are upgraded through this interface. High speed analog signals from the sensor can be displayed as can numerous other functions.

![Figure 2-3 MSS Main Web Page](image)

By default, the **PHP MSS Page** can presently only be accessed by devices on the Experion MX scanner network such as the server or MSS itself, but not on separated networks. For example, operator stations connected on a separate (possibly FTE) network do not see the MSS IP addresses and cannot access the Web page. This issue can be fixed if the RAE server is set up to forward HTTP requests (see Section 8.7).
Thin-client operator stations are effectively run from the RAE server and can see the MSS IP address. You may use any of the methods described in Chapter 3 to access the page in a Web browser. Two of them are:

- On the RAE server, open Internet Explorer and navigate to the MSS IP address. The IP address \texttt{http://192.168.10.101} is the factory default for the first scanner, but this is site-specific.

- Connect a laptop to the scanner LAN (one of the scanner switches in the endbell or in the sensor head), and navigate to the local MSS address which is always \texttt{http://192.168.0.1}. This is not site-specific, and is the same for all scanners on a machine.
3. MSS

This chapter describes the MSS, including installation and setup. The function and software are identical on the Q4000 and the 408x scanner series, but the physical hardware is not.

3.1. Q4000

3.1.1. Hardware Description and Installation

The exact model of the MSS supplied with the scanner may change over time. At program release the hardware was Advantech UNO-2182, which may be replaced by a Value Line IPC from Phoenix Contact. The minimum requirements of the system are:

- at least 1 GB of RAM
- Solid State Drive (SSD) 32 GB in size
- duo core CPU running at 1.5 GHz or higher
- one serial port (for EDAQ debugging purposes only)
- two 100 Mb/s Ethernet cards
- monitor, keyboard, and mouse (required only for troubleshooting)

The Advantech UNO-2182 is shipped without the internal 32 GB solid-state SATA drive. The kit contains the CPU, drive, installation DVD, and a set of plastic screws (see Subsection 3.1.2).
The MSS runs the Linux operating system (Ubuntu 10.04.2 at the time of writing), which is installed at the factory. When the MSS boots, it does not load any software from the QCS server.

The software is licensed under the Gnu Public License (GPL), a copy of which is included with the Experion MX license. Copies of software that have been modified and are subject to the license can be found at http://www.honeywell.com/ps/thirdpartylicenses as well as on the QCS server. Source code to the remaining GPL licensed code may be obtained at http://www.ubuntu.com.

It is possible to temporarily replace the MSS with alternative hardware by moving the hard drive to a new machine. However, the hardware (in particular the Ethernet and graphics cards) must be supported by the version of Linux released in 2010. Although most standard desktop PCs on the market are supported, PCs containing hardware designed after 2010 may require drivers that are not part of the installation.

A switch is not required between the MSS and the QCS server, and the connecting CAT 5e cable can be either crossover or straight.

### 3.1.2. Hardware Setup

The Advantech UNO-2182 model comes without a drive (drives are normally installed when the scanner is built). It can be installed by removing the six screws on the back plate. The drive is attached to the plate with four screws.

> **ATTENTION**
> The screws must be nylon or other insulating material because some drive manufacturers connect the +24 V return to chassis and this would ground the Q4000 lower head power supply to the frame.

The SATA serial cable and the SATA power cable, which are both part of the Advantech UNO-2182 kit, must be installed.

There are two Ethernet interfaces, LAN1 and LAN2. LAN1 on the Advantech UNO-2182 should be connected to the QCS server. LAN2 is connected to the scanner endbell switch.
There are no switches or other settings on either of the models under consideration; however, the BIOS may need to be adjusted. In particular, the following settings on the Advantech UNO-2182 should be checked:

1. Press **DEL** during boot, enter the BIOS, and check that:

   - **Standard BIOS Features: Halt ON [All, But Keyboard]**
   - **Advanced BIOS features: First Boot Device [USB-ZIP] or [USB-CDROM]**
   - **Advanced BIOS Features: Second Boot Device [Hard Disk]**
   - **Advanced Chipset Features: Boot Display [CRT]**

2. During PXE (network) boot, press **[SHIFT]–F10** and disable PXE booting.

MSS Ethernet cards are hard coded to run in auto-negotiation mode. In particular, setting any switches or server ports directly connected to the MSS to fixed 100 Mb/s full-duplex causes network failures as the auto-negotiating partner defaults to half-duplex.

### 3.2. CWS 408x Scanner Hardware

#### 3.2.1. Hardware Description and Installation

The exact model of the MSS supplied with the CWS scanner may change over time. At program release the hardware was a CompuLab FitPC2i. The minimum requirements of the system are:

- 1 GB, or more, of RAM
- solid state disk 32 GB, or more, capacity
- duo core or hyper-threading CPU running at 1.0 GHz, or higher
- one serial port (for EDAQ debugging purposes only)
- two 100 Mb/s Ethernet cards
- monitor, keyboard, and mouse (required only for troubleshooting)

The Fit-PC2i is shipped without the internal 32 GB solid-state SATA drive.
The MSS runs the Linux operating system (Ubuntu 10.04.3 at the time of writing), which is installed at the factory. When the MSS boots, it does not load any software from the QCS server.

The software is licensed under the GPL, a copy of which is included with the Experion MX license. Copies of software that have been modified and are subject to the license can be found at http://honeywell.com/ps/thirdpartylicenses as well as on the QCS server. Source code to the remaining GPL licensed code may be obtained at http://www.ubuntu.com.

It is possible to temporarily replace the MSS with alternative hardware by moving the hard drive to a new machine. However, the hardware (in particular the Ethernet and graphics cards) must be supported by the version of Linux released in 2010. Although most standard desktop PCs on the market are supported, PCs containing hardware designed after 2010 may require drivers that are not part of the installation.

A switch is not required between the MSS and the QCS server, and the connecting CAT 5e cable can be either crossover or straight.

### 3.2.2. Hardware Setup

The Fit-PC2i model comes without a drive (normally installed when the scanner is built). It can be installed by removing the four screws on the back plate (the drive is attached to the plate with four screws).

There are two Ethernet interfaces, LAN1 and LAN2. LAN1 on the MSS should be connected to the QCS server. LAN2 is connected to the scanner endbell switch.

There are no switches or other settings on either of the models under consideration.

MSS Ethernet cards are hard coded to run in auto-negotiation mode. In particular, setting any switches or server ports directly connected to the MSS to fixed 100 Mb/s full-duplex causes network failures as the auto-negotiating partner then defaults to half-duplex.

### 3.3. Initial Factory Software Installation

Initial factory installation and restoration follow essentially the same procedure and is applicable to all scanner series.
Each system is shipped with a restoration DVD or USB flash drive, containing a compressed 2.5 GB image of the 32 GB MSS solid-state drive. Both media are self-booting. At the time of writing, these media were created using the Clonezilla tool (www.clonezilla.org). The media contain a Linux operating system which boots and restores the drives. Recovery is easier from the USB flash drive because no external USB DVD drive is required. However, the DVD (if it is produced with Clonezilla) may be transferred to a self-booting USB flash drive (of at least 4 GB capacity) using free tools available on the internet: Tuxboot and UNetbootin (see Chapter 4).

To install the software:

1. Attach a monitor and keyboard to the MSS (a mouse is optional).

2. Insert the flash drive and reboot the MSS CPU by recycling either the main scanner power supply or by using the +24V fuses connected to the MSS in the endbell (the latter method is preferred, since this leaves the sensors on).

The Clonezilla logo should appear. If not, verify in the BIOS that the PC is set up to boot from the DVD or USB drive as the first boot device. Also verify whether the SSD drive is detected by the BIOS.

Some USB flash drives get detected as USB hard disk drives. In these cases, set the **Hard Disk Boot Priority** in **Advanced BIOS Features** to give the USB drive a greater priority than the SATA hard disk drive.

3. Wait until the special, temporary Linux operating system boots.

4. If the boot is successful, Clonezilla asks twice to make sure you want to erase your existing drive, and then proceeds to copy the image to the disk. The entire operation should take no more than five minutes (longer when using the DVD install media).

5. Remove the USB flash drive and re-boot the MSS.

After booting with Linux installed, the screen may remain blank with a small cursor at the top-left. This is normal. A login screen can be called up by pressing the key combination **[CTRL]-[ALT]-F2**, through **[CTRL]-[ALT]-F8**. This should generate a prompt displaying the message:

Ubuntu 10.04.03 LTS
MSS login:
3.4. Setting the MSS IP Address and Time

After the initial image is created, the MSS will have a default address on the Ethernet port connected to the QCS server network of 192.168.10.101. If this is not the desired address it can be changed from the MSS Web address.

If the QCS server can temporarily be set up at the 192.168.10.* address, use the server to access the MSS Web page as described in Subsection 3.5.2. Otherwise, connect a PC to the scanner network or to the second MSS Ethernet interface and browse to the fixed address of http://192.168.0.1.

The present MSS IP addresses are always displayed on the main MSS page. Use the **Ethernet Settings** (called **Change IP Address** in versions before R104.0) option on the left hand side to set the MSS IP address. Provide the address of the QCS server. Check the subnet mask. The software checks the validity of the input fields. The new address does not take effect until the MSS is rebooted.

From the main MSS Web page (see Chapter 6), use the **Set MSS Time** option on the left hand side. Note that the MSS does not correct for daylight savings time automatically. It is expected that the MSS clock will drift a few minutes per month relative to the QCS server. The absolute value of the MSS clock is not used to correlate scanner data to scanner position; however, it is convenient if the time stamps on the scanner logs correspond to the QCS server alarm page times.

3.5. MSS Software Upgrade

3.5.1. Overview

The MSS and EDAQ files are released in tandem. At the date of the release of this manual, they are released by Engineering more frequently than RAE releases. The release notes explicitly state what RAE releases the EDAQ and MSS software are compatible with. The two upgrade files, one for the MSS and one for the EDAQ, can be downloaded from an HPS ftp site or from a site address provided by Engineering with the notification. These files are roughly 50 MB in size and named as *mss-files.Rabc.n.SVNuvwx.tar.z* and *edaq-files.Rabc.n.SVNuvwx.tar.z*. In the filename, *abc* refers to the major scanner software release number, and *n* refers to the maintenance update number, as referenced in Experion MX release documentation. The *uvwx* numbers refer to the technology source control system.
numbers. To update the MSS software, `mss-files.Rabc.n.SVNuwx.tar.z` must be loaded to the MSS computer.

As of the date of release of this manual, version R105.0 is released against RAE 600 - 603.

### 3.5.2. Procedures

To upgrade the MSS software:

1. Press the **Scanner Stop** button on the endbell door to ensure that the scanner is stopped.

   ![WARNING]

   It is important to stop the scanner, before proceeding, to avoid unexpected head movement. For best safety practice, lock out the scanner drive.

2. Copy the file `mss-files.Rabc.n.SVNuwx.tar.z` to QCS server folder `C:\Program Files\Honeywell\Experion MX\MSS\SenLan\Images` (this is the recommended location for all versions, including previous versions for roll back).
3. Access the Web interface using one of the following three methods:

Method 1: On the QCS server, navigate to the MSS Setup Diagnostics tab (3a-1) and click MSS Monitor (3a-2). Select the required MSS from the drop down list. Click MSS Web Page (3a-3). See Figure 3-1.

![Figure 3-1 MSS Diagnostic Display](image)

**ATTENTION**

For systems with multiple scanners, select the correct MSS first.

Method 2: On the QCS server, open Internet Explorer and navigate to the MSS IP address. The IP address [http://192.168.10.101](http://192.168.10.101) is the factory default for the first scanner but this is site-specific.

Method 3: Connect a laptop to the scanner LAN (one of the scanner switches in the endbell or in the sensor head), open Internet Explorer and navigate to the local MSS address which is always [http://192.168.0.1](http://192.168.0.1). This is not site-specific and is the same for all scanners on a machine.
After completing any one of the three methods, the display shown in Figure 3-2 appears.

![Figure 3-2 MSS and EDAQ Info Page: Active Hosts](image-url)
4. Click **Update MSS** on the left side of the page to call up the **MSS and EDAQ Info Page** display (see Figure 3-3).

![Figure 3-3 MSS and EDAQ Info Page: Update MSS Image](image)

5. In the **MSS and EDAQ Info Page** display, click **Upload New Image** to MSS (use Browse button).

6. Click **Browse...** to identify the file to upload, and navigate to the folder `C:\Program Files\Honeywell\Experion MX\MSS\SenLan\Images`. Select the file `mss-files.Rabc.n.SVNuvwx.tar.z`.

7. Click **Upload and Burn**. The upload takes approximately 45 seconds.
8. When uploaded, the display shown in Figure 3-4 appears. Ensure that the correct (latest uploaded) version is selected, click **Update MSS**.
9. After approximately 15 seconds, the display shown in Figure 3-5 appears. Verify that the operation completed successfully by checking the **Revision Information After Update** textbox.

![Figure 3-5 Revision Information After Update](image)

10. Click **Restart MSS** to reboot the MSS. On the next page, choose **Hard Reset**. The reboot takes anywhere from 25–40 seconds. Release the **Scanner Stop** button on the endbell door.
11. The MSS software upgrade is now complete. To verify that the new code has been loaded and the MSS has rebooted, click **Home** on the left hand navigation bar. The display shown in Figure 3-6 appears. The MSS is listed in the **Active Hosts** list. This implies that the MSS is running and communicating. In addition, the MSS source control revision number is shown. This should coincide with the *uvwz* value in the file name that was downloaded.

![Figure 3-6 MSS and EDAQ Info Page: Active Hosts list](image)

Also on the display shown in Figure 3-6 are the present MSS revision number and revision date outlined in red near the top of page.
3.6. Replace the MSS With a Spare

This section describes the procedure for configuring the MSS after replacing it with a spare MSS or with another SSD.

At a minimum, the Q4000 or 408x MSS kits contain:

- CPU
- Solid State Drive (SSD) 32 GB in size
- base installation DVD

A USB DVD player is required to program the MSS.

Alternatively, the DVD can be used to create a self-booting USB flash drive (see Chapter 4), a one-time operation.

Hardware required:

- USB-DVD drive
- DVI monitor
- USB keyboard
- + 24 V power supply (Q4000), or + 12 V power supply (408x)

Steps:

1. For the Q4000 MSS: remove the rear panel from the MSS and connect the solid-state drive (two cables, one for power, one for SATA serial data).

   Use the plastic screws provided to mount the disk drive on to the rear panel. This is important to avoid scanner grounding issues.

2. For the 408x MSS: remove the four screws at the back of the unit, removing the small cover plate. Slide in the new drive until seated.

3. Connect monitor, keyboard, DVD drive, and power to the MSS.

4. If the DVD does not boot up, enter the BIOS (using the Del key) and change the disk boot order, and, if required, the hard drive boot priority.

5. Allow Clonezilla restoration software to boot up.
6. You are asked twice whether to continue the restoration. There are no options to confirm or adjust. The copy from DVD takes about 10 minutes.

7. Disconnect the DVD drive and test whether the MSS boots from the internal SSD.

Verify that the IP address is correct, and upgrade the MSS to the revision running on the previous MSS:

1. Press the **Scanner Stop** button on the endbell door to ensure that the scanner is stopped. Disconnect Ethernet cables and un-mount MSS from the scanner endbell.

2. Connect a laptop to a scanner network switch. After obtaining a DHCP network address, open Internet Explorer and navigate to the MSS web page at `http://192.168.0.1/`.

3. The MSS-RAE measurement LAN (LAN 1) address may be changed to suit the site-specific needs. The LAN1 address can be configured using MSS Web interface (see Section 6.2.1):

   Click **Ethernet Settings** (**Change IP Address** in versions prior to R104) under **MSS Functions** in the left menu. Configure the new MSS LAN1 IP address, netmask, and IP address of the **MX Server MSS LAN** interface.

   Click **Restart MSS** under **MSS Functions** in the left menu, and **Hard Reset** on the **MSS Reset Page**.

4. Note the MAC address of the MSS displayed on the main page under **RAE LAN (eth0)**. This needs to be entered in **MSS Setup** display under the **MSS Setup Diagnostic** tab.

5. Upgrade the MSS (see Section 3.5).

6. Install the MSS back on to the scanner end bell and release the **Scanner Stop** button.

### 3.7. MSS Troubleshooting

If the **MSS Summary Page** (**MSS Setup Diagnostic** tab) does not have a green light next to the appropriate MSS, or the MSS monitor page does not show process DR events, then the MSS is not communicating with the Experion MX system.
These are troubleshooting options:

1. Verify that the Q4000 MSS has + 24 V DC power (green LEDs at power connector on all models). The Advantech version also has a white power-reset button (PWR) at the back of the unit that may be pressed to restart the CPU as shown in Figure 3-7.

Figure 3-7 Rear View of the Q4000-80 MSS

The 408x MSS has a green LED indicating whether power is applied.

2. Connect to the MSS Web page (see Subsection 3.5.2) and verify that the page loads and shows the present IP addresses and MAC addresses. Verify these against the Experion MX MSS IP setup page, being careful to note that the Experion MX page uses dots (unconventionally) to separate the hexadecimals in the MAC address numbers.

3. Connect to the MSS Web page. There should be a line labeled mss in the Active Hosts table display. Verify when hovering the mouse over the Process column that all listed processes show a green icon.

4. If the Web page is not accessible from the server, verify the network connection: On the QCS server, use Start à Run and enter ping 192.168.10.101 (adjust for proper local MSS address), and observe status of the link. If there is no response the same test can be performed from a laptop connected to the scanner network (use the fixed address 192.168.0.1 for the ping test).

5. If Step 4 fails, connect a keyboard, DVI monitor, and mouse to the MSS and reboot. The display should show the BIOS status, then briefly the Ubuntu boot display, and within 30 seconds, an empty dark console (press [CTRL] - [ALT] - [F4] to obtain the login prompt, which should say mss login:. A default username is evolution and password is the same.)

6. If Step 5 shows the BIOS and initial Linux boot but still fails to result in a working system, consider booting to the alternate partition (see
Section 3.5), or replacing the SSD and restoring the image as described in Section 3.8.

7. If the MSS appears to be running, the Web pages display, and all processes (in particular, the *emss* process) are active, check the MSS-Link program is running on the QCS server using Windows Task Manager.

8. Check that the host file on the QCS server contains the correct IP address of the Ethernet interface connected to the scanner, with the MSSLink alias (usually the entry would be in the form 192.168.10.1 MSSLink).

9. Check that the MAC address in the QCS server MSS IP setup window is all lower case.

10. Free tools such as Wireshark can be used to monitor the network traffic. This should be installed on the QCS server, otherwise the traffic between the server and the MSS will not be captured. There should be periodic UDP messages from the MSS to the QCS server containing the MAC address of the MSS. This would indicate that there is an issue with QCS server not responding. In that case, the MSS (and EDAQs) write extensive log files that can be accessed through the Web server (see Chapter 6).

### 3.8. Alternative Partition Boot

Each MSS hard drive contains two identical images of the operating system and applications. If the MSS boots but makes no connections to RAE, or if you suspect that a recent upgrade caused issues, you can boot into the other partition.
There are two ways to access the other partition. If the Apache Web server is still running on the MSS, the main MSS Web page provides an option for setting the next boot default to the other partition (see Figure 3-8).

Figure 3-8 Set Boot Partition
If the Web server cannot be contacted, the only option is to attach a monitor, keyboard, and mouse, and to interrupt the MSS boot process by using the up or down arrow keys. The display will briefly look like the display shown in Figure 3-9. Move the cursor keys to the second kernel image containing the text \( \text{(on } /\text{dev/sda7)} \) as shown in Figure 3-9.

![Figure 3-9 MSS Boot Loader Display](image)

**Figure 3-9 MSS Boot Loader Display**

On the display shown in Figure 3-9, all the references above \textit{Memory test} refer to boots into the same partition. Boot options to the second partition are indicated with partition name, in this instance \textit{/dev/sda7}. The memory test option may also be run as a diagnostic.

Select the last line on the screen shown in Figure 3-9, and the MSS boots into the previously unused partition. However, this will not automatically be the default for subsequent boots. To set the new partition as the default, call up the MSS Web page and click \textbf{Set Boot Partition} to call up the Web page shown in Figure 3-8, and use this to set the new partition as the default.
Update the MSS to the latest revision, or to the revision used before the troubles began.

The other partition likely has the factory default IP address for the MSS (192.168.10.101) set so that the MSS Web page is accessed from within the scanner network (connect a laptop to the endbell switch). Bring up the fixed **MSS IP address** page (http://192.168.0.1), and the IP set address set using the **Set MSS IP** function on the Web page.
4. Back up and Clone the MSS

If a recent installation DVD (or the ISO file for that DVD) is available, there is little reason to create an MSS backup. Except for the assigned IP address, there is nothing scanner- or system-specific. It is therefore recommended that an MSS be restored by taking a base install image prepared by Honeywell Engineering and installing the latest MSS release on top of that (release R103.1 as of the release of this manual). Similarly, if you want a spare disk prepared and ready to go, make it from the base install plus the latest update files.

The latest installation DVD ISO file can be obtained from Honeywell Engineering and burned to a DVD.

Restore a broken MSS by plugging in a USB DVD player. The MSS BIOS setting may have to be adjusted to boot from the DVD drive. The live DVD boots to Linux, and asks you whether you want to over-write the hard disk drive. Answer y to both questions. For details, see Section 3.3.

In addition, the ISO file may be turned into a bootable USB flash drive using programs such as UNetbootin http://unetbootin.sourceforge.net/ or Tuxboot. This eliminates the use of a USB DVD player. This procedure is described in Section 4.1.

This chapter applies to all MxProLine scanner series.
4.1. Create a Self-booting USB Flash Drive

On a Microsoft Windows PC, use a program such as Roxio to create a disk image from the DVD. The resulting file will have a file extension of ISO or GI, and should have a size of approximately 2.5 GB.

1. Download the latest UNetbootin. This description is based on Windows version 5.49 (http://unetbootin.sourceforge.net/unetbootin-windows-latest.exe).

2. Connect the USB drive that is to be made into a bootable drive to a computer, and start UNetbootin (see Figure 4-1).

![Figure 4-1 UNetbootin Main Display](image)

3. Point the Diskimage to the ISO file downloaded in Step 1, and select the USB drive.

4. Click OK to start the process. Reboot the computer at the end of the process to test booting from the new USB drive.

Experience has shown there is some variability in the types and default formatting of USB flash drives. Most boot as flash devices, but some boot as disk drives and often require a change to the BIOS settings (hard disk boot priority) to become the default boot device. A few types and brands fail to boot at all.

4.2. Back Up the MSS Hard Drive

If an image of the MSS is required, it can be done using any third-party software that supports the Linux ext3 and ext4 file systems; check the documentation. At present the backup tool of choice is Clonezilla, which may be used to back-up any Windows- or Linux-based drives, and has the unique capabilities of making a
self-booting restoration image on a USB flash drive, or on a DVD, for either Windows or Linux.

The required software packages Clonezilla and UNetbootin can be downloaded for no cost from the respective Websites.

Hardware required (in addition to the MSS):

- two USB flash drives
- DVI capable monitor (or VGA/DVI cable)
- USB keyboard
- USB hub or a monitor with USB ports (MSS has only two USB ports, and this procedure requires three USB devices to be connected at one point)

Backup image size of a typical MSS factory installation is about 3 GB. One of the USB drives should be big enough to hold three times the MSS image size. Ensure that there are no data on these drives as it may be lost by the actions performed in the procedure.

Follow these steps:

1. Create a Clonezilla USB boot drive (see Subsection 4.2.1). This is a one-time operation and can be re-used for creating additional backups.

2. Boot the MSS using the Clonezilla USB boot drive, and create a backup image of the MSS hard disk on another USB drive (see Subsection 4.2.2).

3. Create an ISO recovery file from the MSS backup image. A recovery ISO file can be created on the same USB drive (see Subsection 4.2.3).

4. Create the MSS restore USB drive using the recovery ISO file and UNetbootin (see Subsection 4.2.4).

To create an MSS backup follow Steps 1 and 2. Steps 3 and 4 enable the creation of a self-booting restoration image. This is not strictly required–an MSS disk may be re-imaged from the backup files by re-running Clonezilla. The self-booting image created in Steps 3 and 4 has the advantage of being entirely self-contained, and requires no additional technical skill from the operator.
4.2.1. Create a Clonezilla USB Flash Drive


2. Download the latest UNetbootin. This description is based on Windows version 5.49 (http://unetbootin.sourceforge.net/unetbootin-windows-latest.exe).

3. Connect the USB drive that is to be made into a bootable drive to a computer, and start UNetbootin (see Figure 4-1).

4. Point the Diskimage to the Clonezilla ISO file downloaded in Step 1, and select the USB drive.

5. Click OK to start the process. Reboot the computer at the end of the process to test booting from the new Clonezilla USB drive.

4.2.2. Create a Backup Image of the MSS Hard Disk

To create a backup image of the MSS hard disk:

1. Connect the monitor, keyboard, and Clonezilla USB boot drive to MSS, and reboot MSS.

2. In order to ensure the boot sequence is set correctly, press DEL (multiple times), when the restart screen appears, to enter into the BIOS settings.

3. Enter Advanced BIOS Features, and ensure that the first boot device is USB-ZIP, and the second boot device is Hard Disk. Note that some USB drives (even flash drives) are detected as a hard drive by the BIOS. In such cases, the USB drive must be configured with a higher boot priority than the internal hard drive. To do this, select Hard Disk Boot Priority and see whether the Clonezilla USB boot drive appears in that list. The internal hard drive typically appears as a Kingston device. If there is drive listed below that, press PAGE-UP to bring it above the internal hard drive. Press F10 to save the settings and reboot. MSS will now boot using Clonezilla USB drive and show boot options.
4. Select **Clonezilla-live (Default settings...)** and press **ENTER**. Be patient as it takes up to a minute before the screen changes to show the boot is in progress.

5. Clonezilla (see Figure 4-2) will prompt for a number of options, most of which have default answers as shown in Steps 6–10 (use the arrow keys to choose to cancel at any prompt).

![Clonezilla](image)

**Figure 4-2 Clonezilla**
6. Select language: **en_US.UTF-8 English**.

7. Select policy for handling keymaps: **Don’t touch keymap**.

8. Start Clonezilla.

9. On the next screen, select: **device-image**.
10. Select **local_dev** (such as the USB drive to backup to).

![Figure 4-3 Mount Clonezilla Image Directory](image)

11. A message will appear at the bottom of the screen prompting you to connect the USB device. Connect the USB drive on which the backup image is to be created and wait until a couple of (cryptic) lines are displayed indicating the USB device is detected by the system (shown in Figure 4-3 as `sd 3:0:0:0:0 [sdb] Assuming drive cache: write through, indicating the target device has obtained drive letters sdb`).

12. Press **ENTER** to continue.
13. At the next prompt, scroll down to select the USB drive as the target (copy-to-) drive, typically mounted as sdb1 or sdc1, but never sdaX, which is the source drive.

14. Next, Clonezilla displays the first level of directories in the target USB drive. Select a directory where the image needs to be created, if needed. You may leave it at the top level as Clonezilla creates a directory by default. The example in Figure 4-4 was created using an empty USB flash drive, and there were no sub-folders.

15. Clonezilla will display the disk space usage (not shown). Press ENTER to continue. Answer further prompts and options as shown in Figure 4-5. Select Beginner.
16. Select **savedisk**.

![Image of Clonezilla options interface](image)

17. If required, edit the name of the destination image folder.

![Image of Clonezilla image input interface](image)

18. Select the source disk. There should be only one disk option in the MSS, **sda**.

![Image of Clonezilla disk selection interface](image)

19. Clonezilla will ask for confirmation before proceeding to make the image.

```
The selected devices: sda5 sda6 sda7 sda8
Getting /dev/sda5 info...
Getting /dev/sda6 info...
Getting /dev/sda7 info...
Getting /dev/sda8 info...

The following step is to save the harddisk/partition(s) on this machine as an image:

Machine: VirtualBox
sda (PV: VBOX_HARDDISK_ata-ATA-VD/G:ATA0/0/SAM9-5523B86c)
sda5 (VBOX/HARDISK_ata-ATA-VD/G:ATA0/0/SAM9-5523B86c)
sda6 (VBOX/HARDISK_ata-ATA-VD/G:ATA0/0/SAM9-5523B86c)
sda7 (VBOX/HARDISK_ata-ATA-VD/G:ATA0/0/SAM9-5523B86c)
sda8 (VBOX/HARDISK_ata-ATA-VD/G:ATA0/0/SAM9-5523B86c)

> /home/partimag/2011-12-02-20-imag.
Are you sure you want to continue? [y/n]
```
20. The backup process takes about 10 minutes to complete. When finished, check for any error messages and press **ENTER** to continue.

21. You now have a set of backup files that can be used to restore the MSS, and the steps in Subsection 4.2.3 need to be completed only if you want to create a self-booting restoration image.

### 4.2.3. Create Self-booting Restoration Image

1. Select **Start over** in Step 20 of Subsection 4.2.2 to continue to the next step of creating recovery ISO file, or reboot the Clonezilla USB flash drive.

2. Boot MSS using Clonezilla USB boot drive as described in Subsection 4.2.2.

3. Select all options described in Subsection 4.2.2, but in Step 16, instead of choosing **savedisk**, choose **recovery-iso-zip**.

4. From the list of presented folders, choose the backup folder created in Section 4.2.2.

5. On the next screen, for the device to be restored, accept the default.

6. Accept defaults for the next two screens that suggest keyboard and language.

7. On the next screen, select **Create ISO** file when asked for the type of file to create.

8. Ignore the warning about exceeding the size of a regular CD image.

9. The program will now create the self-restoring ISO image in your USB folder. The image will be about 2.5 GB so the flash drive should have at least that much free space.

### 4.2.4. Copy Image to DVD or USB Flash Drive

The ISO image file created may be used directly to create a bootable DVD—any number of programs may be used to burn it. Alternatively, the ISO file may be used to create a self-booting USB flash drive by following the procedure described in Subsection 4.2.1.
4.2.5. Restore MSS from USB Flash Drive

A BIOS change might be required to force the MSS to boot from the newly created USB flash drive (or the DVD). The restoration is the same as described in Section 3.3.

4.3. Clone the MSS to a Virtual Machine

The MSS installation image, or the recovery ISO file, can be transferred to a virtual machine (VM):

1. Use the usual VMware procedure to create a new machine, defining a SCSI or SATA (not IDE) disk of at least 32.5 GB.

2. Direct the VM to boot off the DVD or its corresponding ISO file and, as during a restoration, Clonezilla will copy the MSS image to the VM disk.

3. Reboot.

This simple procedure works because the Linux image contains all known hardware drivers and will rediscover the new (virtual) hardware at boot time. Note, however, that the difficult part is mapping the virtual Ethernet devices onto the appropriate (physical) hardware so that the IP addresses the MSS assigns (192.168.0.1 to interface 2 and 192.168.10.101 to interface 1) connect to the appropriate real network. This requires VMware network configuration tool, which is not supplied with VMware Player. A VM version of the MSS is therefore of limited use to the field.
5. EDAQ

The EDAQ board is responsible for converting all analogue and digital signals to and from sensors to Ethernet.

It replaces the functionality of the National Instruments™ cards seen in previous Honeywell scanner systems.

The board is based on an ARM CPU running the Linux™ operating system and a Field-Programmable Gate Array (FPGA) that controls real-time data acquisition.

The EDAQ contains software licensed under third party licenses including the Gnu Public License (GPL). A copy of that software and its source code can be obtained from http://www.honeywell.com/ps/thirdpartylicenses or found on the Experion MX distribution media under C:\Program Files\Honeywell\Experion MX\MSS\SenLan\Images\GPL.

The EDAQ board contains a large number of I/O systems, including:

- analog inputs (16 inputs of 12 bits @ 4 kHz and 8 inputs of 10 bits @ 1 Hz)
- analog outputs (2 @ 12 bits)
- digital inputs (16 @ 24 V logic)
- digital output (16 @ 24 V logic)
- frequency input (60 Hz to 500 kHz)
- Three serial ports
- USB (presently unused)
- Ethernet
Except for a few dedicated signals such as the green light (radiation safety), all sensor signals connect through the EDAQ to the new Experion MX MSS by Ethernet.

The EDAQ contains sensor specific code for all sensors at all times. All EDAQs, including the EDAQ performing frame motion control (in the endbell) and the head alley EDAQs are identical and can be interchanged.

As shown in Figure 5-1, all the high speed data acquisition components connect to the FPGA. The ARM CPU controls the USB, serial, slow analog inputs, and Ethernet.

![Figure 5-1 Schematic Overview](image)

Almost everything in this Chapter is generic to the EDAQ and applies to all MxProLine scanner series. Where the text refers to EDAQs in the scanner head, these would be the EDAQs in endbell for the 408x scanner.
5.1. Physical Layout

Figure 5-2 and Figure 5-3 show the EDAQ PCBA. On the left are the digital and analog I/O, which connect directly to a sensor. Below these two large connectors is a 16-pin expansion connector that is only used when the EDAQ is attached to the FC expansion board.

To the right are Ethernet port, some diagnostic LEDs, serial connections, and temperature inputs. There are no test points for use in the field.
Figure 5-3 LEDs and I/O Connectors (EDAQ board, upper right corner)

A serial debug port is available (115200KBS, no flow control, 8N1) that may be connected to any PC running a serial terminal program. For diagnostic purposes, service personal may be asked to connect a serial cable between this debug port and the RS-232 of any neighboring EDAQ.

5.1.1. Hardware Status Information

There are four diagnostic LEDs on the EDAQ. See Figure 5-3.

- The 3.3 V LED. When lit, this indicates that all power supplies on the board are functional. The signal is derived from the 3.3 V power supply, which in turn is derived from the 15 V power supply, which is derived from the +24 V input.

- The CPU OK LED. This LED is under control of the central ARM CPU. It will be lit when the main sensor application (edaqapp) is running on the CPU.

- The Fpga ok 1 (not used at present).

- The Fpga ok 2. This LED will blink if the FPGA is loaded and running code.
In addition, the Ethernet connector contains two LEDs, with amber indicating good link to the switch, and green indicating activity on the network.

5.2. EDAQ Reset

A soft reset of the EDAQ may be performed through the Web interface running on the scanner Measurement Sub System (MSS). This interface may be accessed from a real-time application environment (RAE) station as indicated in Subsection 3.5.2.

A hardware reset can be performed by pressing the white button next to the debug port. This resets both the CPU and FPGA and is equivalent to a power on/off.

5.2.1. EDAQ Boot Sequence

The EDAQ boot takes about 25 seconds, depending on whether it finds a valid position location resistor on the digital I/O harness.

During reboot, the EDAQ performs these steps:

1. Load the Linux operation system.
2. Read the Position & Function identification resistors.
3. Determine the IP address and call up the network interface.
4. If (no identification found) request address from DHCP server.
5. Start the time synchronization client process.
7. Load the FPGA with the appropriate VHDL code for data acquisition.
8. Start the generic EDAQ application (edaqapp). This will load sensor specific functions if required.
5.3. EDAQ Sensor Identification and IP Addressing

All EDAQs are identical. EDAQs can be freely interchanged between sensors and the scanner endbell.

Each EDAQ contains all the code for all supported sensors and loads the appropriate software depending on the identification ID code read at boot time. The EDAQ software includes firmware for the FPGA chip that handles the data acquisition. Most sensors run the same firmware but there are presently about four different files loaded into the FPGA depending on the application.

Two resistors are used to uniquely identify the EDAQ functions.

In the Q4000 series scanner, for sensor-connected EDAQs, there is a sensor model resistor embedded in the cable harness connecting the sensor to the EDAQ. This resistor determines the function code. Function codes are unique for each sensor model that needs to be differentiated by the EDAQ. For example, all Source 9 094201XX Basis Weight Measurement Sensors presently have the same function code, regardless of radioactive isotope. The table of resistor values, their tolerances and associated functions is available from the main MSS Web page.

In addition, the head power distribution board connects a resistor value to each port (sensor module platform) that determines the position of the EDAQ in the head. The EDAQ can therefore self-identify both its position and function. See Section 7.3 for the number convention of the six-pack head.

In the 408x scanner the sensor model resistor is part of the sensor complement dependent harness between the EDAQ and the end-term board. The position identifying resistors are fixed and part of the endbell-terminal PCB.

For all scanner models the FC-EDAQ reads both resistors directly from the terminal block TB2, part of the FC expansion board.

Every EDAQ has a unique IP address on the scanner network. If the EDAQ can identify its position, it will set its IP address to 192.168.0.XYZ (where XYZ is the position number in the head. The FC-EDAQ always sets itself to IP number 192.168.0.2. The MSS is always 192.168.0.1 on the scanner network.

If an EDAQ fails to determine a position, it requests an address from the local DHCP server (which is presently running on the MSS). Similarly any laptop will get an IP address once plugged into any of the scanner Ethernet switches.
If there is no DHCP server available and there was no other method of identification, the EDAQ will eventually assign itself the IP address 192.168.0.99, which can take up to five minutes.

Although the EDAQ on a scanner should be able to correctly assign its position, there may be a need to hard-code this value (see Chapter 7).

5.4. Upgrade EDAQ Software

This section applies to all scanner models. To upgrade the EDAQ software, a file named edaq-files.Rabc.n.SVNuvwx.tar.z must be loaded to the MSS. The MSS will extract a number of files to be transferred to the EDAQ flash memory.

In the filename, *abc* is the major scanner software release number and *n* is the maintenance update number as referenced in Experion MX release documentation. The *uvwx* numbers correspond to the technology source control system numbers.

As of the date of this notification, version R105.0 is released against RAE 600-603. For later versions, substitute the new revision number in the files names referred to in the procedure in this section.

Upgrading an EDAQ is a two part process. In the first part, the image is transferred to the scanner MSS. In the second part, the EDAQ copies individual files from the MSS and burn them to its flash partition.

To upgrade EDAQ software:

1. Press the **Scanner Stop** button on the endbell door to ensure that the scanner is stopped.

   **WARNING**

   Lock out the scanner before proceeding to avoid unexpected head movement.

2. Copy the file *edaq-files.Rabc.n.SVNuvwx.tar.z* to QCS server folder *C:\Program Files\Honeywell\Experion MX\MSS\SenLan\Images*. This is the recommended location for all versions (including previous versions for roll back).
3. Access the MSS Web page (see Section 3.5) and click **Update EDAQ**’s. Figure 5-4 appears.

![Figure 5-4 EDAQ Update Display](image)

**Figure 5-4 EDAQ Update Display**

4. To copy the new EDAQ files to the MSS, select the **Upload New Image from local PC to MSS for burning (use Browse button)** option.

5. To identify the file to upload, click Browse and navigate to the folder `C:\Program Files\Honeywell\Experion MX\MSS\SenLan\Images\edaq`. Select the appropriate file, for example `edaq-files.Rabc.n.SVNuvw.tar.z`. 
6. Click **Upload EDAQ Image**. Figure 5-5 appears.

![Figure 5-5 EDAQ Second Update Display](image)

7. Select the EDAQs to be upgraded (usually all). The required options below the EDAQ list are automatically populated (these include **Reburn Root File system** sometime **Reburn Kernel**). The Web page provides details and recommended defaults for these options.

The **Copy Motion Setup File** applies only to the FC-EDAQ. For RAE version 602 and above, copying this file to the new image is not necessary since it is entirely populated from the RAE RTDR. For RAE versions 600 and 601, the Q4000 UPI/HMI panel settings are recorded here and the checkbox should be selected. See text step 8 for the **Reburn Kernel** option.
8. Some upgrades include a new Linux kernel, the core of the operating system. The release information will explicitly state this and in this case, the **Reburn kernel** option will automatically be checked.

9. Some upgrades require a previous revision level. For example, upgrades for version higher than R101.0 required first an upgrade to R101.0. This is because upgrades may include one-time changes (such as a Linux kernel change), not supplied again with the next revision. This will be explicitly stated in the release notes.

10. Click **Burn Image to EDAQ**. When the progress messages are done (after approximately 60 seconds), the list of EDAQs is redisplayed.

   **ATTENTION**

   A warning message, **Permanently Added…** (see Figure 5-6) may appear for some or all of the EDAQs. This message is related to the secure shell (SSH) communication to the EDAQ and can be ignored.

---

**Figure 5-6 EDAQ Third Update Display**

11. Reset the EDAQs by clicking **Hard Reset** at the end of the EDAQ list. EDAQs may also be reset by selecting the **Reset EDAQ’s** option on
the leftmost side of the page (see Figure 5-7). Use **Hard Reset** to reboot the EDAQs into the newly flashed partition, completing the process.

![Figure 5-7 EDAQ Reset Display](image-url)
To verify that the EDAQs successfully rebooted, go to the home page. The EDAQs are present in the list of **Active Hosts**, and the **Process Status** has a green indicator signaling success (see Figure 5-8).

**Figure 5-8 MSS Main Page After Update**
13. The EDAQ software upgrade is now complete. To verify that all EDAQs are now running the expected version, click **Detailed EDAQ Info** (under **EDAQ Functions** on the left panel of Web page). After approximately 60 seconds, a table is created on the screen showing the file system revision number in the second-to-last column (see Figure 5-9).

![Figure 5-9 Typical Detailed EDAQ Display](image)

In the example shown in Figure 5-9, only three of the four EDAQs were upgraded to the rev R100.8.

14. On the Operation Station, click **Scanner Control**.

15. Click **Restart MSS** to clear sensor safety fault and do a **Send Kill** from the MSS diagnostic tab, **MSS Monitor Vi**. This will also re-download the RAE scanner motion parameters to the FC.

### 5.5. Replace EDAQ With a Spare

A spare EDAQ ordered from Honeywell Engineering contains initial programming, but it may not be the same revision version of the other EDAQs running on the scanner.
The version could be newer, but it is possible that it is not compatible with previous version, for example, from time to time, the data format used to exchange messages between EDAQs may be changed.

To avoid any issues, the spare EDAQ should be upgraded or downgraded to the revision level of rest of the system.

To change the version of the spare EDAQ:

1. Use the MSS display Detailed EDAQ Info option on the left hand side to obtain a list of revisions on all EDAQs. An example would be R100.4.

2. Connect the EDAQ to the scanner network. Connect the sensor harness to make sure the EDAQ identifies correctly. If a sensor harness is not available, the EDAQ will use DHCP (see Section 5.3).

3. Use the upgrade procedure described in Section 5.6. The upgrade file is probably already on the MSS, so in step 4 choose Use existing EDAQ image already on MSS.

4. If the desired version is not listed in the resulting drop-down menu, check the RAE files system under c:\Program Files\Honeywell\Experion MX\mss\SenLan for the EDAQ installation file. Contact Honeywell Engineering if the files (size about 50 MB) are not found.

5. After programming and rebooting, repeat Step 1 to ensure all EDAQs are running the same revision.

6. If the EDAQ is used for ferro-resonant caliper sensors, make sure the W1 jumper (freq) is in. There are no other configurable items on the EDAQ.

See Section 5.6 for upgrading an EDAQ without replacing an existing one.

5.6. Upgrade the Spare EDAQ

If the site has any spare EDAQs they can be upgraded when they are placed in the head. In the EDAQ Update display (see Figure 5-4), choose Update EDAQ From Existing Image already on MSS because the required image was previously uploaded in this step.

Alternatively, the EDAQ can be prepared prior to installation. The safest approach is to use a spare MSS:
1. Connect the MSS, EDAQ, and a regular PC to the second Ethernet interface (the scanner LAN interface) using an available switch. The PC should be set up to obtain an IP address automatically (DHCP).

2. Bring up a browser and navigate to the MSS Web page at the permanent address http://192.168.0.1.

3. The new EDAQ appears on the Web page with an address in the range 192.168.0.20 to 192.168.0.50. Follow the steps described in Section 5.4.

4. If no spare MSS is available, the new EDAQ can be connected to +24 V at the scanner endbell and connected to the Ethernet switch in the endbell. However, you must be sure that this EDAQ has not previously been hardcoded with an IP address that might clash with existing EDAQs in the head, or FC, to avoid IP address clash, which will halt the scanner.

5. A newly ordered EDAQ will not have a hard-coded identity. Navigate to the MSS Web display (see Section 5.5) and upgrade using this upgrade procedure, selecting only this new EDAQ for upgrade. This can be done with the scanner running in production environment.
6. Obtain Status Information

This chapter applies to all scanner models. Where appropriate, separate screenshots are provided for the various scanner models.

6.1. Experion MX Platform

An overall status page is available from an Operation Station under the MSS Setup Diagnostics tab. Select the MSS Summary page. Figure 6-1 and Figure 6-2 show, on the left, a list of all expected EDAQ boards with three types of status indicators (from left to right).

Figure 6-1 408x Scanner
Table 6-1 describes the **MSS Summary** display status indicators.

**Table 6-1 Status Indicators and Descriptions**

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSS Communication with EDAQ</td>
<td>EDAQ is communicating (through the EDAL protocol) with the MSS</td>
</tr>
<tr>
<td>EDAQ Data Timestamps</td>
<td>Data that the MSS is expecting from that EDAQ is being supplied at the expected rate</td>
</tr>
<tr>
<td>EDAQ Card Safety Status</td>
<td>EDAQ is not reporting any errors such as interlock or motion control issues</td>
</tr>
</tbody>
</table>

Sensors that are part of the RAE database, but are not enabled on the scanner, show in the left-most column indicator as red (for example, **07-p caliper upper** in Figure 6-2).
6.2. MSS and EDAQ Web Pages

6.2.1. Access to the Web Page

Much more detail is available on the MSS and the EDAQs, which all run Web servers and can display server pages containing information on the state of the system. As a general rule, consult the MSS Web pages first. They are accessible in several different ways:

- from Operation Station, by going to the **MSS Diagnostic** tab, clicking on **MSS Monitor**, choosing the appropriate MSS, and clicking on **MSS Web page**

- by opening a browser on any computer connected to the Experion MX level network and using the address `http://192.168.10.101/mss.php` (the first MSS on the LAN) or the address set up for the MSS in the Experion MX system

- by opening a browser on any computer connected to the scanner LAN switch and using the address `http://192.168.0.1/mss.php` or `http://192.168.10.101` (for the first MSS on the system)

- by logging onto the MSS computer native console

When neither RAE nor a laptop are available, access the MSS Web interface through the MSS console at the CPU:

1. Connect a monitor with a DVI interface, a USB keyboard, and a USB mouse, to the MSS.

2. Press `CTRL` - `[ALT]` - `[F2]` to access the login prompt.

3. Login using the username root and the password `Measurex` (case sensitive; upper case M).

4. Enter the command `startx` at the command prompt to launch the graphical user interface (GNOME desktop).

5. Launch the Firefox Web browser using the toolbar icon and enter `http://localhost` in the address bar to bring up MSS Web interface.
6.2.2. Main MSS Page Overview

Figure 6-3 shows the main MSS Web page (PHP MSS Page) for a typical Q4000 paper scanner.

![PHP MSS Page: Q4000 Scanner](image-url)
Figure 6-4 shows the **PHP MSS Page** for a much more sparsely populated 408x CWS scanner.

![PHP MSS Page](image)

**Figure 6-4 PHP MSS Page: 408x Scanner**

The left panel shows a column of options divided into:

- **MSS Functions**
- **EDAQ Functions**
- **Frame Controller Functions**

The main panel shows two tables. The top table contains transmission volume information to and from the MSS. The device labeled `eth1 (Scanner LAN)` typically shows it receiving a few MBs. The MAC addresses of the MSS are also shown—the `eth0 (RAE LAN)` address is the one required in the RAE setup.

The bottom table lists:

- all EDAQs discovered on the scanner LAN, and their IP addresses
- a brief description related to model number
• a program status column
• the associated function code
• the position code
• whether the communication protocols are running (http, SSH, and Edal, the proprietary sensor data transmission protocol)

The EDAQ network name is specified by edaq-pXYZ where XYZ is both its position and the last octet of the IP address. The EDAQs attached to the head power distribution boards are known as upper and lower alley respectively. The FC-EDAQ is the frame controller EDAQ.

The Proc/Run status column is green if all processes known to run on the EDAQ are present. Hovering the cursor over the status indicator brings up a list of running and stopped processes. All processes listed should be running at all times.

Enter the username admin and the password hmxresult for advanced diagnostic options that are not necessary for normal operation and not discussed in this manual.

### 6.2.3. Detailed EDAQ Information

More detailed information on each EDAQ can be obtained by clicking Detailed EDAQ Info on the left panel.
The resulting table (see Figure 6-5) shows a number of technical details that are not discussed in this document. Important columns include Process Load (usually less than 0.5), local time (matches MSS time clock shown at top) and Offset From MSS (should be less than 50 microseconds a few minutes after start-up). The table also shows the software revision number running on the particular EDAQ. This should be checked after an upgrade to verify the EDAQ is indeed running the expected revision.

![Detailed EDAQ info](image)

*Figure 6-5 Partial Display of Detailed EDAQ Information*
6.2.4. EDAQ, MSS, and FC Scanner Log Files

To get the logs, from the **PHP MSS Page**, go to the **MSS and EDAQ Info Page: Log Retrieval Page** (see Figure 6-6).

![MSS and EDAQ Info Page: Log Retrieval Page](image)

Figure 6-6 MSS and EDAQ Info Page: Log Retrieval Page

The log files are automatically closed and renamed once per day if they exceed 25 MB. Generally, the log file size limit is 25 MB (uncompressed). The current log files are always named `edaq.log`, `fc.log`, and `mss.log`. Older files are named with an index number, with 1 being the second most recent file, for example `edaq.1.log`.

By default only the two most recent files are left uncompressed. Compressed files are given the `gz` identifier, so the third most recent EDAQ file would generally be named `edaq.log.2.gz`.

There is a limit of 20 log files left on the machine at any given time, so the minimum time that log files for a given event remain on the MSS is 20 days, but
in practice this could be much longer. Note that most Windows-based Zip programs can handle these log file formats.

Get the log file by right-clicking and selecting **Save To Desktop**. The files use the standard Unix/Linux end-of-line (line feed only) convention so they must be opened in MS WordPad or MS Word. A preferred utility is Notepad++, available for free.

At the bottom of the page there is a tool to extract log files by date (see Figure 6-7).

**Figure 6-7 Log File Selection By Date**

Select the start and end dates using the calendar selection tools. Click **Extract Log File to Zip File**. The Web server will now go through all existing log files on the MSS and create a new file that includes the range of dates selected. This is done for the three log file types. A combined zip file is created and presented to you as a hyperlink. Please note that this process can take a few minutes.

While the log files may be viewed with any number of suitable Windows applications, a dedicated log file viewer and analysis program is available from Honeywell Engineering.
7. **EDAQ Position and Function Code Overrides**

This chapter applies to all scanner models, except that the 408x CWS scanner has only three possible EDAQ locations:

- a frame controller
- maximum of two EDAQs for a two-sensor head

In the Q4000 series scanner, the detection of position and function by the EDAQ is sufficient for the RAE system to set up the I/O channel assignments and calculate the physical offsets off the sensor.

In the 408x scanner with dual sensors, you must let the system know which EDAQ is dedicated to the first sensor, and which is dedicated to the second sensor. This is done through the **MSS Card Setup** screen under the **MSS Setup Diagnostic** tab on the QCS server. In the instance of a single sensor, the system will assume the EDAQ in position 1 is connected to the sensor.

Ideally, position and function codes are auto-detected by the EDAQ board, and no specific configuration needs to be implemented. If the EDAQ cannot perform this detection reliably, it is recommended to hardcode (override) the function and/or position codes.

### 7.1. Override Procedures

The MSS Web pages may be accessed as described in Section 6.2.
7.1.1. Check Present Function and Codes

To view the position and function codes for any running EDAQs in a system (that is, on the sensor LAN), check the MSS Summary page. Navigate to Scanner ↓ Sensor ↓ MSS Setup Diagnostics ↓ MSS Summary page, and note the Node (position code) and the Fun (function code) columns (see Figure 7-1).

Figure 7-1 MSS Summary Page
7.1.2. Identify a Configured Override

This procedure describes how to identify whether an EDAQ has a position or function code override configured.

1. Launch the MSS Web interface, and wait for the EDAQs to appear in the **Active Hosts** list (see Figure 7-2). Note that the EDAQ may take up to a minute to appear if recently booted.

![Figure 7-2 MSS and EDAQ Info Page: Active Hosts](image)

2. Click on **Detailed EDAQ Info** and wait until the table is populated (see Figure 7-3).

![Figure 7-3 Detailed EDAQ Info](image)
The two columns on the far right (Pos override and func override) show whether the EDAQ has a hard coded position and/or function code.

### 7.1.3. Edit the Position and/or Function Code

1. From the main MSS Web page, click the EDAQ name (edaq-pXXX) to navigate to the EDAQ-specific page (see Figure 7-4).

![EDAQ Identification Information](image)

**Figure 7-4 EDAQ Identification Information**

This page also shows whether the attempts to read the identification resistors were successful. If the resistor values were required, but are missing or noisy, the error messages will be displayed in red. Messages displayed in yellow are warning only.
2. Click **Edit ID File** from the left menu to display the `/etc/override_id` file (see Figure 7-5).

![Figure 7-5 Editing File /etc/override_id Display](image)

All lines in this file starting with the character `#` are comment lines and can be ignored. Look for lines that start with the keyword `position_code:` or `function_code:`. These lines specify the hardcoded position and function number for the EDAQ. Note that if multiple similar lines exist, the last line will take effect.

3. If no configuration changes are to be made, simply close the Web page. If one or more EDAQs have overrides, it is good practice to record these configurations in a logbook for future reference.
If a change is made to the override file, the following actions need to be taken:

1. Click **Update File Content**.

2. Click **Restart** on the left menu, and the **EDAQ Functions** display will appear (see Figure 7-6):

   ![EDAQ Functions](image)

   **Figure 7-6 EDAQ Functions**

3. Click **Hard Reset** to reboot the EDAQ.

4. Click **Return to MSS** on the left menu, and make sure that the EDAQ reboots with the configured position and function codes.
7.2. Determine Sensor Type Override Codes

To determine the sensor codes, navigate to the main MSS Web page and select **Display Resistor File** from the menu as shown in Figure 7-7.

![Functions Menu]

Figure 7-7 Functions Menu
Figure 7-8 shows an excerpt from the file showing several sensor types and their associated function code.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<td>23</td>
<td>360</td>
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<td>SOURCE</td>
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<td>\textit{\textless}x6 nuclear receivers</td>
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<td>362</td>
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<td>SOURCE</td>
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<td>\textit{\textless}x9 gauge source</td>
</tr>
</tbody>
</table>

Figure 7-8 Table for sensor\_function Display

The second column, **Resistor (Ohm)**, is the nominal resistor value measured in Ohms. The third column, **Tolerance (Ohm)**, is the allowed tolerance on that resistance at manufacturing. The fourth column, **Meas. Limits (Ohm)**, is the tolerance the software uses to recognize the resistor as corresponding to the function.

Figure 7-9 shows the table subsection for the 408x CWS scanner endbell EDAQs.

<table>
<thead>
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<tr>
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</table>

Figure 7-9 Position Codes & Resistor Values
7.2.1. Connect an EDAQ to the Sensor Network

This subsection describes how to connect an EDAQ (for example, a spare EDAQ) to the sensor LAN. This should be done if you want to check and possibly configure an override in an EDAQ, or to upload new EDAQ code.

Because the state of the EDAQ is unknown at this point (it may have a fixed position code and a fixed IP address), it should not be connected to a running scanner.

To avoid conflict with another EDAQ already on the sensor LAN, follow one of the following two procedures.

Procedure 1: Using a Spare MSS (preferred)

1. Boot up a spare MSS.
2. Connect 24 V DC power to the EDAQ.
3. Connect the EDAQ to the sensor LAN interface (LAN2).
4. Bring up the MSS Web interface (see Section 6.2).

Procedure 2: Using the Existing Scanner System

1. Disconnect the sensor LAN from the MSS LAN2 port.
2. Connect the EDAQ Ethernet port to the MSS LAN2 port.
3. Bring up the MSS Web interface (see Section 6.2).
4. When complete, disconnect the EDAQ and reconnect the sensor LAN.
7.3. Determine Sensor Position Numbers (Q4000)

The schematic in Figure 7-10 defines the codes based on the sensor position relative to the paper path.

Figure 7-10 Head Position Numbering Convention

All lower head sensors are in the 1xx range. All upper head sensors are in the 2xx range. The lower alley EDAQ is 100. The upper alley EDAQ is 200.

The sensors internal to the six-pack head are in the range 101–106 and 201–206 for the lower and upper heads respectively.

External sensor position codes will depend on where the EDAQ connects to the power distribution board. External sensor connections are labeled J1xx/2xx. Lower head positions are in the range 123–126. Upper head external positions are in the 223–226 range.
7.4. Recalibrate the Position and Function Resistance Measurement

7.4.1. Overview

Depending on the software revision loaded at the factory, the EDAQ memory contains either a single calibration constant for both the position and function channel, or two separate constants. In either case, these constants may be recalculated and reset in the field. The new values will be maintained after a software upgrade.

7.4.2. Recalibration Procedure

Navigate to the main MSS web page as described in Section 6.2. At the top left, enter the username admin and password hmxresult to obtain additional user functionality. The Calibrate ID Resistor Gains button appears under EDAQ Admin Functions on the lower left as shown in Figure 7-11.

Figure 7-11 Calibrate ID Resistor Gains Button

You must select the appropriate EDAQ and measure the value of the position and function resistor using a precision multi-meter.

1. Remove the head covers and identify the EDAQ to be calibrated. All necessary precautions to remove the head covers must be followed.

2. Power off the EDAQ by disconnecting the 24V power connector J7. Disconnect the sensor harness 50-pin connector from the EDAQ connector J1. Measure the function resistor between pins 1 & 2 and position resistor between pins 3 & 4 of the 50-pin connector.

3. Reconnect 50-pin connector to EDAQ J1 and reboot EDAQ by connecting back 24V power to EDAQ J7.

4. Click Calibrate ID Gain (see Figure 7-12). The next page displays the results and asks for confirmation before writing the gains to the
EDAQ. The web page will refuse to write noise values or values likely to be incorrect.

Figure 7-12 EDAQ Resistor ID Gain Calibration Page

The gain values used by the EDAQ are stored in the file /etc/override_id. See Section 7.1.3 for accessing the file using web interface and scroll to the end of the file.
8. Technical MSS and EDAQ Field Procedures

This chapter applies to all MxProLine scanner models.

8.1. EDAQ Hardware Self-test

Many of the EDAQ hardware components may be self-tested using a Web-based test interface that is programmed into every EDAQ. A special cable harness that loops the various outputs to the various inputs on the EDAQ is required. The test will show whether the EDAQ functions as expected, but if there is a failure mode there will be an ambiguity on whether it is the driving component, for example, analog outputs, or the receiving component, for example, analog inputs.

The EDAQ must be powered up with +24 V and connected to any PC (running either the Windows or Linux operating system) through an Ethernet cable (straight or crossover). The Ethernet card IP address should be set to a number in the range 192.168.0.(20–50) with netmask of 255.255.255.0. With the testing cable plugged in, the EDAQ will configure itself with the correct function and position codes (250) for the self test. If the configuration fails, the EDAQ will eventually configure itself with the default address 192.168.0.99.

The self-test page is accessed by bringing up an internet browser and entering the address http://192.168.0.250. Enter the username admin and the password hmxresult on the left hand side. A new option, Self Test, appears under Admin Functions.
Click **Self Test** to call up the **EDAQ Self Test Page** (see Figure 8-1). You can choose to run all or a sub-set of the available tests.

![EDAQ Self Test Page](image)

**Figure 8-1 EDAQ Self-test Main Page**

The program sets digital outputs, analog outputs, and serial communication interfaces, and reads back the values in the digital inputs, analog inputs, and complementary serial ports.

The **Slow ADC Channels**, which normally read the external and internal temperature sensors, will be tested against fixed input resistances on the tester harness.
Figure 8-2 shows a passed test result. If there is a failure, however, this test cannot point to the exact cause. Because EDAQ is testing its own components, there is an ambiguity whether the failed component is the input or output. Return the EDAQ to Honeywell.

The test program has a set of default test limits that must be satisfied for a channel to pass. It is possible that a slight gain difference between EDAQs results in a failed test when the component is functionally working. Click **Edit Test Limits** (see Figure 8-1) to edit the parameters. These parameter changes are lost when an EDAQ is upgraded to a different software revision.
8.2. Optional Windows-based Software Tools

**Edaq_scope**

A Tcl/Tk-based program was created to retrieve raw data from EDAQs and display it. The program is installed by default on the MSS (Linux version) and called `edaq_scope.tcl`. A windows executable that requires no installation is also available on the mss at [http://192.68.10.101/windows](http://192.68.10.101/windows) (substitute applicable local MSS IP address for 192.168.10.101). The latest version can be obtained from Honeywell Engineering.

It is an oscilloscope-like tool that can display 4 kHz raw data from multiple EDAQs simultaneously, display digital input and output states, and perform basic data analysis such as fast Fourier transforms.

**Putty**

Putty allows you to open a Telnet-like window to the MSS, and then to the EDAQs. It is used for quick and dirty work, or for looking at log files, or anything for which a GUI application is not required. There are some alternatives such as Tera Term. Search Google using `SSH application for windows` for alternatives. The executable file `putty.exe` does not need to be installed on your computer—it is a single executable file.

**WinSCP**

WinSCP is a drag-and-drop copy program between Linux and Windows systems. It uses SSH to make the actual connection. This program is useful for retrieving a file from the MSS, or to copy over a single file to the MSS for debugging. You can also use it to set the file description bits, which is necessary to make a program executable on a Linux machine. Linux refuses to execute programs that are not specifically set up to be executed.

**NoMachine NXclient**

NoMachine NXclient is a full remote-desktop application for Linux and Windows (only the Linux version is free). The MSS comes with a NoMachine NX server installed and running. It is similar to RadMin or VNC, and is used when running GUI applications such as the EDAQ data grabber, Firefox, or Wireshark. NoMachine uses SSH for its communications. When setting it up, ensure that you choose GNOME as the desktop manager, not KDE (which is not installed on the MSS).
A Linux VM

You can use a Linux Virtual Machine (VM) as an alternative to NoMachine NX Client. A Linux VM runs the same display software (X11) as the MSS, so you can open up applications from the MSS. Basically, you are using your VM as a thin-client. To get a Linux VM running you do not have to install it. You can get pre-installed VMWARE or VirtualBox from http://www.vmware.com/appliances/directory/cat/0?k=ubuntu 10.04 or http://virtualboxes.org/.

Installing from scratch is easy, and both VMware and Virtual box are Ubuntu aware, meaning they will recognize it and set it up properly. Choose Ubuntu 10.04 or higher.

When connecting from a Linux VM:

1. Open a terminal windows, usually Applications ➤ Accessories ➤ Terminal, when using a standard Ubuntu 10.4 installation.

2. Use the command ssh evolution@192.168.10.101.

3. Start the required application (for example, Wireshark).

8.3. Check the Health of MSS Through Linux

Although the MSS Web interface can provide most of the information required for scanner operations, it is sometimes useful to log into the MSS directly.

There are two users defined on the MSS: username evolution with password evolution and user name root with password Measurex (note the capitalization, which is important for all commands and names under Linux). The latter is the system administration account and should be used with great care. For simple file transfers and checking of the MSS health it is preferred to log in as user evolution and use the temporary elevation of privilege command sudo for operations requiring system privileges.

Assuming you are logged in to the MSS using the username evolution, the items described in Subsections 8.3.1 through 8.3.3 should be checked.
8.3.1. Disk Usage

Use the command, `df -h`. A typical output is described in Figure 8-3.

```
evolution@mss: df -h
Filesystem Size Used Avail Use% Mounted on
/dev/sda5 6.9G 2.6G 4.1G 39% /
none 493M 284K 493M 1% /dev
none 497M 24K 497M 1% /dev/shm
none 497M 108K 497M 1% /var/run
none 497M 0 497M 0% /var/lock
none 497M 0 497M 0% /lib/init/rw
tmpfs 497M 32K 497M 1% /evolution_info
/dev/sda6 6.9G 887M 5.7G 14% /var
```

**Figure 8-3 Typical Output: Disk Usage**

The partitions of interest are labelled / (partition /dev/sda5 in this case) and /var (partition /dev/sda6 in this case). The / partition should contain about 2.5 GB of operation system and program files and should not grow in size over time. The /var partition stores the scanner log files (under /var/log/scanner). It can grow, but should not exceed 80% of its capacity. If the /var partition shows more than 80% full, it might be wise to remove some of the log files. To check which folders or directories contain the largest files, execute the following command:

```
du -a -b | sort --key=1 -r -n | more
```

This will list all the files and sizes (`du`) sort them in reverse order (`sort`) and display them page by page (`more`). Most likely, the large files will be in the folder /var/log/scanner. Navigate there:

```
cd /var/log/scanner
```

Then use the `ls -l` command to list the files and their sizes. Use the `rm` command to remove the offending large file:

```
rm edaq.log.14.gz
```
8.3.2. CPU Usage

Use the command, `top`. A typical output is described in Figure 8-4.

```
top - 17:43:12 up 11 days, 6:15, 1 user, load average: 0.61, 0.57, 0.57
Tasks: 121 total, 2 running, 119 sleeping, 0 stopped, 0 zombie
Cpu(s):  4.5%us,  2.6%sy,  0.1%ni,  92.0%id,  0.0%wa,  0.0%hi,  0.5%si,  0.0%st
Mem:   191704k total,   69456k used,  322592k free,  184760k buffers
Swap:  1951736k total,  0k used,  1951736k free,  374812k cached
```

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<td>0S</td>
<td>S</td>
<td>0.0</td>
<td>0:19.86</td>
<td>migration/0</td>
<td></td>
</tr>
<tr>
<td>4 root</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0S</td>
<td>S</td>
<td>0.0</td>
<td>2:47.23</td>
<td>ksoftirqd/0</td>
<td></td>
</tr>
</tbody>
</table>

Figure 8-4 Typical Output: CPU Usage

Expect the `emss` process (data binning and alignment process) to occupy 10–20% of the CPU at any given moment. Any percentage much higher signifies a problem. Quit the program using `CTRL-C`.

8.3.3. Replace a Single Binary or Library on the MSS

The most important binary running on the MSS is the `emss` process, which collects data from the EDAQ cards and bins the data using the FC position information. Upgrades to the MSS are typically done through the Web pages. An MSS upgrade file contains new copies of all the Honeywell software as well as some modified system files to ensure that there is no doubt what version is being run on the scanner; however, it may be useful to copy one or two files for testing at Engineering’s request.

8.3.3.1. Method 1: WinSCP

The easiest way to get a file on the MSS from Windows is to use an SSH-based free GUI client such as WinSCP. It is strongly recommended to install this on a local PC. Use of the program is fairly intuitive. Log in with user name `evolution` and drag and drop the files to be copied to the `evolution` home folder.
8.3.3.2. Method 2: Manually Mount a USB Flash Drive

1. Put the file on a USB flash drive, insert the drive in the MSS, and manually mount the USB device.

2. Log in to the MSS using SSH as user root. The command is:
   
   mkdir /media/usb
   
   mount -t vfat /dev/sdb1 /media/usb

3. Copy files from /media/usb/ to wherever you need.
   
   The command, cp /media/usb/myfile /home/evolution, will copy myfile to the user evolution home folder.

4. Finish with, umount /media/usb before removing the flash drive.

8.3.3.3. Method 3: Through a Web Page

The MSS Web page has a file upload option under the administrative options. On the MSS Web page, log in with the user name admin and password hmxresult. You can click Upload File to MSS on the lower right. Browse for the file to copy, then choose as destination one of the three allowed paths:

/usr/local/mss/

/usr/local/apache/

/usr/local/edaq/

The Web page does not have write privilege to other folders on the disk at the time of writing.

When the file exists on the MSS, move or copy the file to the correct location. Assume Engineering asked for the field to update the main communication library, libedal.so.1.6. Use Putty to establish a terminal to the MSS and log in as user root. Enter:

```
cp /user/local/mss/libedal_x86.so.1.6 /usr/local/lib
```

where in this case the target folder for the library is /usr/local/lib/. Then change to that folder and check:

```
ls -l (ls and lower case -L)
```
A possible partial listing:

```
root@mss:/usr/local/lib# cd /usr/local/lib/
root@mss:/usr/local/lib# ls -l
total 12324
lrwxrwxrwx 1 root root 21 2011-07-26 19:42 edal.so -> libphpedal_x86.so.1.0
lrwxrwxrwx 1 root root 20 2011-08-24 13:23 libedal_x86.so -> ./libedal_x86.so.1.4
-rwxr-xr-x 1 root root 398871 2011-03-28 19:22 libedal_x86.so.1.0
-rwxr-xr-x 1 root root 306867 2011-03-30 21:29 libedal_x86.so.1.1
-rwxr-xr-x 1 root root 307902 2011-04-26 04:39 libedal_x86.so.1.2
-rwxr-xr-x 1 root root 318951 2011-07-13 21:47 libedal_x86.so.1.3
-rwxr-xr-x 1 root root 322803 2011-08-23 20:11 libedal_x86.so.1.4
-rwxr-xr-x 1 root root 322803 2011-08-26 22:11 libedal_x86.so.1.6
lrwxrwxrwx 1 root root 15 2011-08-24 13:23 libphp5.so -> libphp5.so.2.11
-rwxr-xr-x 1 root root 10967444 2010-03-10 18:56 libphp5.so.2.11
lrwxrwxrwx 1 root root 21 2011-08-24 13:23 libphpedal_x86.so -> libphpedal_x86.so.1.0
-rwxr-xr-x 1 root root 28899 2010-03-10 18:56 libphpedal_x86.so.1.0
-rw-r--r-- 1 root root 44973 2010-07-12 15:19 php.ini
drwxrwxr-x 4 root staff 4096 2011-02-11 13:08 python2.6
drwxr-xr-x 3 root root 4096 2011-08-23 20:12 tcltk
```

The new library is clearly there; however, as a rule, Linux makes extensive use of symbolic links to point a generic program/library name to a specific revision of that file. In this case, the generic name, `libedal_x86.so` points to `libedal_x86.so.1.4`. Just copying the file is not sufficient, you have to re-assign the symbolic link as well for the software to use the right version:

```
root@mss:/usr/local/lib# rm libedal_x86.so
root@mss:/usr/local/lib# ln -s libedal_x86.so.1.6 libedal_x86.so
```

Note the command on the second line is lower case L, lower case N.

The first command removes the old link, not the file it is pointing to. The second command recreates the link to point to your new library.

As a second example, assume that engineering has supplied a new MSS executable, `emss.1.4`.

Copy the file to the correct location (`/usr/local/bin` in this case). Assume that the symbolic link for the emss program was already correct and pointing to the old file, `emss.1.4`. During the copy, it is likely that the execution bit on the file was not set. Linux will refuse the execute files that do not have execute permission. Correct this with the command:

```
cp /home/evolution/emss.1.4 /usr/local/bin
```
cd /usr/local/bin
chmod +x emss.1.4

Note that the WinSCP program supports setting execution and other bits:

1. Right click on the file (once it has been copied to Linux), and choose Properties.

2. Ensure that the X (=execution) check box is selected for the owner.

WinSCP also supports creating new symbolic links, so in principle the entire operation (copying, setting executing bits, adjusting the link) can be done without logging into the MSS with your SSH client.

8.4. Manually Edit Files On the EDAQ

Although most functions can be performed via Web pages, there might be a reason to transfer files to and from the EDAQs. There are several ways to do so.

8.4.1. Method 1: WinSCP

Connect a laptop to the scanner network and use WinSCP to connect directly to a particular EDAQ. For example, to transfer files to and/or from the upper alley EDAQ, use WinSCP to host 192.168.0.200 and login as username root and password measurex (all lower case).

8.4.2. Method 2: WinSCP to MSS

Use WinSCP to transfer the file to some location in the MSS. Connect a SSH session (Putty) to the MSS as user root or evolution. Then use the command line version of the SSH copying program:

scp myfile.txt root@edaq-p102
scp myfile.txt root@192.168.0.102:/usr/local/lib/

You will be asked for the root password measurex.
8.4.3. Method 3: MSS Web Interface

On the main MSS Web page, log in with username admin and password hmxresult to show the administrative functions. There is a File Copy to EDAQ option. Browse to your file, select the target EDAQs, and remember the destination path.

To edit files on the EDAQ (for example the EDAQ identity override file), do a double SSH connect. Use Putty to connect to the MSS (as username evolution or root). Once you have a terminal connection, SSH again to the target EDAQ:

```
ssh root@edaq-p202
```

The password will be measurex.

To edit a file, use the built-in edit nano. This simple editor is easy to use. Press [CTRL]-X to save the file and exit the program.

```
edaq-p33:~# nano /etc/override_id
```

8.5. Change the EDAQ Boot Partition

The EDAQ goes through four boot stages:

- ROM boot, internal to the ARM processor
- AT91_BootStrap (proprietary to Atmel®, the chip maker)
- U-boot (operating system loader)
- Linux

The codes for the first and second stages are in the first NAND flash disk partition. The Linux kernel, stage four, is in the second partition. The two copies of the Linux file system and Honeywell software occupy partitions three and four.

Partitions three and four are identical at manufacture. The EDAQ will boot up and use partition three until it is upgraded. The upgrade image will be written to partition four. A reboot then switches to this partition. A second upgrade will now write to partition three and this is activated after a second reboot.

The previous EDAQ image therefore always exists on the NAND flash, and it is possible to force the EDAQ to reboot to it. This might be useful if the last update broke a working system or somehow the EDAQ NAND flash was corrupted and the EDAQ no longer boots.
NAND flash corruption is also possible in partitions one and two, but much less likely because nothing is ever written to that part of the disk memory, and it is only read once at boot time. Therefore, a corrupted EDAQ will at least boot to the U-boot stage, and that U-boot will be able to chain-load the Linux kernel.

If the EDAQ is still operating properly, you can revert to the previous image using the MSS Web page. On the main MSS Web page, log in with username admin and password hmxresult. A Revert EDAQ option will appear at the bottom of the page. Use this Web page to re-program the EDAQ U-boot code to boot the previous partition. It will automatically discover whether the older version is on partition three if now running from four, or vice versa.

8.6. Connect to the EDAQ through Serial Debug Port

If the EDAQ is not working, it is worth checking whether it can be manually convinced to boot to the older partition. To do this you need to power up the EDAQ and connect a debug serial cable from EDAQ connector J1 to a standard PC serial connector. The pin assignment is as follows:

<table>
<thead>
<tr>
<th>EDAQ J1 3-pin Molex</th>
<th>Standard DB9 Serial Connector, Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>5 (GND)</td>
</tr>
</tbody>
</table>

The connection should set to 115200 bps, 8N1. Any Windows serial communication program such as HyperTerm, or Putty (in serial mode) will do. The serial connection establishes both an output channel for Linux kernel errors, as well as a logging type console connection for the boot stages.
Power up the EDAQ and press any key a few times to stop the automatic U-boot boot phase. A typical boot display is shown in Figure 8-5.

![Typical Boot Display](image)

**Figure 8-5 Typical Boot Display**

Some items in Figure 8-5 should be noted. The first line, RomBoot, corresponds to stage 1 of the boot process. As shown in Figure 8-5, it failed despite hitting the EDAQ reset button four times. The power was then reset and the boot continued past the RomBoot stage, going to the Start AT91BootStrap... stage 2. Finally, U-boot started and a keyboard key was pressed to stop the boot process there.

Print out the value of the boot variables using the `printenv` command. If the boot variable `bootargs` (see Figure 8-6) indicated the boot partition was `mtdblock3`, change it to `mtdblock2`. 
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8.7. Opstation Access to the MSS Web Pages

For the version of RAE to at least version R602, the MSS and EDAQ web pages are only accessible from either the scanner network or the Experion MX-MSS network. Opstations are generally connected to the QCS server from a separate Ethernet card and therefore exist on a separate network. The QCS server is not set up to forward requests from this network to the Experion MX-MSS network. Note that thin-clients are essentially processes on the QCS server and should be able to access the MSS directly.
Figure 8-7 illustrates a typical network topology for a system with two scanners and three opstations (the QCS server is the only connection between the two networks).

![Figure 8-7 Typical Network Topology](image)

If access to the scanner is required from the opstations, or any other PC connected to that part of the LAN, the QCS server must be set up to forward the request. This can be done using the Microsoft IIS server. The following software is required:

- IIS 7.0 or IIS 7.5 (included in Windows 2008, Windows 2008 R2, Windows Vista, and Windows 7)
- URL Rewrite 2.0
- Application Request Routing

In addition, an XML-based IIS re-write file (web.config) is required. If not already installed on the server, that file is shipped on each MSS and can be accessed from the RAE server by accessing `http://192.168.10.101/windows` (correct the address for the address of the MSS of the local system).

To set up:

1. Copy the file web.config to the standard location `C:/inetpup/wwwroot/web.config`. 
2. From the Microsoft site, obtain the two packages, UrlReWrite and Application Request Routing.

http://www.iis.net/download/URLRewrite

http://www.iis.net/download/ApplicationRequestRouting

3. Follow the automatic installation procedure.

4. Enable Proxy support in ARR.

Launch IIS Manager using Start ➔ AdminTools ➔ IIS manager.

Click the server node in the tree view.

Double click the application request routing cache icon.

Select the Server Proxy Settings… task in the Actions panel

Ensure that Enable Proxy is checked. This allows any request in the server that is rewritten to a server that is not the local machine to be routed to the right place automatically without any further configuration.

5. Still in IIS manager, click the default web site on the left hand side.

6. Double click URL ReWrite.

7. On the right, click Manage Server Variable, and add the variable HTTP_ACCEPT_ENCODING.

8. Add all the MSS IP addresses to the system32/drivers/etc/hosts file with appropriate names such as:

   10.10.1.40 mss1

   10.10.1.41 mss2

The web pages are accessible using http://SERVERNAME/mss1/index.php.
9. Tasks

This chapter contains procedures for maintaining or troubleshooting the EDAQ. A number of these activities are relevant to the Q4000 series scanner only, not the CWS 4080 scanner. All of the tasks in this chapter are referred to by the lists of RAE alarms described in Chapter 10. An RAE alarm seen on a 4080 scanner system may be first looked up in Chapter 10. The tasks detailed in this chapter will then facilitate troubleshooting the problem.

Activity numbers that appear in the task description tables are for the use of the sensor diagnostics display only, and do not reflect model numbers for the tasks. To determine whether the task applies to your sensor, check Applicable Models. If a value in the task description table is blank, that means it is not applicable to that task.

9.1. Verify EDAQ Connections

This task refers to verifying the electrical connections between the head power distribution board, the EDAQ board, and the sensors.

<table>
<thead>
<tr>
<th>Activity Number:</th>
<th>80801767-81500030-ACT-001</th>
<th>Applicable Models:</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of procedure:</td>
<td>Inspect</td>
<td>Expertise Level:</td>
<td>Honeywell Expert</td>
</tr>
<tr>
<td>Priority Level:</td>
<td>Average</td>
<td>Cautions:</td>
<td>High Temperature</td>
</tr>
<tr>
<td>Availability Required:</td>
<td>Scanner Offsheet</td>
<td>Reminder Lead Time:</td>
<td></td>
</tr>
<tr>
<td>Overdue Grace Period:</td>
<td></td>
<td>Frequency (time period):</td>
<td></td>
</tr>
<tr>
<td>Duration (time period):</td>
<td>30 min</td>
<td># of People Required:</td>
<td>1</td>
</tr>
</tbody>
</table>

Prerequisite Procedures:
MSS & EDAQ

Post Procedures:

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Quantity</th>
<th>Lead Time</th>
</tr>
</thead>
</table>

Required Parts: Multi-meter

Required Tools:

Power to the EDAQ is most easily verified by checking for the green 3.3 V LED on the EDAQ next to the Ethernet connector (see Figure 5–3) and the serial debug port connector. If that is lit, all of the +24 V, +15 V, and +3.3 V are present on the EDAQ. There could still be a failure of the +5 V, the 1.0 V, or 1.2 V converters.

1. Check network connectivity by visually inspecting the Ethernet connector. The green and amber lights should both be lit up and at least one of them flashing.

2. Check that the FPGA and CPU are running by inspecting the LEDs on the EDAQ (see Figure 5–3); the LEDs between the reset button and the flash memory chip.

3. Check the +24 V and ±12 V (used by sensors, not the EDAQ) on the head power distribution board connector (see Table 9-1).

<table>
<thead>
<tr>
<th>Pin Number(s)</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>12, 24</td>
<td>+12 V and -12 V</td>
</tr>
<tr>
<td>11, 23</td>
<td>Returns for ±12 V</td>
</tr>
<tr>
<td>1–5</td>
<td>+24 V</td>
</tr>
<tr>
<td>13–17</td>
<td>+24 V returns</td>
</tr>
<tr>
<td>6, 18</td>
<td>EDAQ position resistor</td>
</tr>
</tbody>
</table>

Table 9-1 Head Power Distribution Pin Assignments

9.2. Verify EDAQ ID

EDAQ networking errors or even interlock errors can be reported if the EDAQ does not identify itself properly and load the appropriate sensor code.

<table>
<thead>
<tr>
<th>Activity Number:</th>
<th>Applicable Models:</th>
<th>Type of procedure:</th>
<th>Expertise Level:</th>
<th>Priority Level:</th>
<th>Cautions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>80801767-81500030-ACT-002</td>
<td>All</td>
<td>Inspect</td>
<td>Honeywell Expert</td>
<td>Average</td>
<td>High Temperature</td>
</tr>
</tbody>
</table>

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EDAQ identification issues are best checked from the main MSS display, which can be accessed on the RAE server or any PC connected to the scanner network. See Subsection 3.5.2, or Subsection 6.2.1, for methods of accessing the main MSS display.

The main MSS display lists all EDAQs expected in the head along with their function and position codes. EDAQs that do not identify properly are labeled *generic* and have IP addresses outside the expected range (see Section 5.3).

Chapter 7 describes in detail how to hardcode the EDAQ function to the desired numbers.

### 9.3. Verify EDAQ Process Health

<table>
<thead>
<tr>
<th>Activity Number:</th>
<th>80801767-81500030-ACT-003</th>
<th>Applicable Models:</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of procedure:</td>
<td>Inspect</td>
<td>Expertise Level:</td>
<td>Technician</td>
</tr>
<tr>
<td>Priority Level:</td>
<td>Average</td>
<td>Cautions:</td>
<td>High Temperature</td>
</tr>
<tr>
<td>Availability Required:</td>
<td>none</td>
<td>Reminder Lead Time:</td>
<td></td>
</tr>
<tr>
<td>Overdue Grace Period:</td>
<td></td>
<td>Frequency (time period):</td>
<td></td>
</tr>
<tr>
<td>Duration (time period):</td>
<td>30 min</td>
<td># of People Required:</td>
<td>1</td>
</tr>
<tr>
<td>Prerequisite Procedures:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post Procedures:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The **MSS Summary** page under the **MSS Setup Diagnostic** tab will display the list of expected EDAQs, and show the three status lights. If all three lights are green, the EDAQ is communicating and the data time stamps from the EDAQ are synchronized with the other clocks on the network.

A second method is to access the MSS Web page (see Subsection 3.5.2, or Subsection 6.2.1). The main page shows a list of detected devices on the scanner network. You can hover the mouse pointer over the **Process Status** column indicator light. A popup menu displays the processes expected on the EDAQ, and whether or not they are running. If any of the processes are not running, the first course of action is to restart the EDAQ using the **Reset EDAQs** function on the left hand side of the page (see Section 6.2). If a reboot is not successful in restarting the processes, replace the EDAQ and download the corresponding EDAQ log files using the MSS Web pages (see Subsection 6.2.4), for analysis by Honeywell Engineering or TAC. See Section 5.5 for a description of replacing EDAQs.

### 9.4. EDAQ Self-test

Using a special test harness and a regular PC, the hardware I/O of the EDAQs may be tested outside of the scanner environment.

<table>
<thead>
<tr>
<th>Activity Number:</th>
<th>80801767-81500030-ACT-004</th>
<th>Applicable Models:</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of procedure:</td>
<td>Inspect</td>
<td>Expertise Level:</td>
<td>Honeywell Expert</td>
</tr>
<tr>
<td>Priority Level:</td>
<td>Average</td>
<td>Cautions:</td>
<td>High Temperature</td>
</tr>
<tr>
<td>Availability Required:</td>
<td>none</td>
<td>Reminder Lead Time:</td>
<td></td>
</tr>
<tr>
<td>Overdue Grace Period:</td>
<td></td>
<td>Frequency (time period):</td>
<td></td>
</tr>
<tr>
<td>Duration (time period):</td>
<td>30 min</td>
<td># of People Required:</td>
<td>1</td>
</tr>
<tr>
<td>Prerequisite Procedures:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post Procedures:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Quantity</th>
<th>Lead Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required Parts:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required Tools:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
9.5. Increase RTDR Limits

<table>
<thead>
<tr>
<th>Activity Number:</th>
<th>80801767-81500030-ACT-005</th>
<th>Applicable Models:</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of procedure:</td>
<td>Inspect</td>
<td>Expertise Level:</td>
<td>Honeywell Expert</td>
</tr>
<tr>
<td>Priority Level:</td>
<td>Average</td>
<td>Cautions:</td>
<td></td>
</tr>
<tr>
<td>Availability Required:</td>
<td>none</td>
<td>Reminder Lead Time:</td>
<td></td>
</tr>
<tr>
<td>Overdue Grace Period:</td>
<td></td>
<td>Frequency (time period):</td>
<td></td>
</tr>
<tr>
<td>Duration (time period):</td>
<td>10 min</td>
<td># of People Required:</td>
<td>1</td>
</tr>
<tr>
<td>Prerequisite Procedures:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post Procedures:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required Parts:</td>
<td>Access to RAE server or Operator Station with admin privileges</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required Tools:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The EDAQ PCB over-temp limit may safely be increased to 60 °C (140 °F). In the RAE-RTDR browser, locate the PCB temperature limit. An example of the RTDR path is:

/Scanner 1/Mss/Ss1 nuclear/Job set/Sx edaq pcb head temp/Limit
9.6. Improve Head Cooling

Activity Number: 80801767-81500030-ACT-006  
Applicable Models: All

Type of procedure: Inspect  
Expertise Level: Honeywell Expert

Priority Level: Average  
Cautions:

Availability Required: none  
Reminder Lead Time:

Overdue Grace Period:  
Frequency (time period):

Duration (time period): 1 hour  
# of People Required: 1

Prerequisite Procedures:

Post Procedures:

Part Number | Quantity | Lead Time
---|---|---

Required Parts:

Required Tools:

See your scanner manual for details of water cooling, controlling flow, and temperature setpoints.

9.7. Verify HMI Panel Operation

Activity Number: 80801767-81500030-ACT-007  
Applicable Models: All

Type of procedure: Inspect  
Expertise Level: Technical

Priority Level: Average  
Cautions: none

Availability Required: Scanner Offsheet  
Reminder Lead Time:

Overdue Grace Period:  
Frequency (time period):

Duration (time period): 30 min  
# of People Required: 1

Prerequisite Procedures:

Post Procedures:

Part Number | Quantity | Lead Time
---|---|---
The amber lights indicating that the radiation gauge is ready to operate are ultimately controlled by the respective sensor source EDAQ. These EDAQs receive the human/machine interface (HMI) button-press signals through the FC through Ethernet, and in turn request the amber light to turn on through Ethernet through the FC. Feedback indicating that the amber light is on is returned through the FC to the EDAQ.

Details on the HMI unit can be found in your scanner manual.

To check whether the FC is communicating with the panel:

1. There should be one power green LED ON (right hand side corner), and two communication green LEDs ON (middle, left side) on the back of the HMI. The two communication LEDs indicate that the poll command is received and data is answered back to the FC.

2. If you see only one LED, data is received by the panel but the panel is not enabled, therefore it will not answer. To get the panel to answer, enable two panels using the MSS Setup Diagnostic tab and select MSS EFC Miscellaneous Setup (in RAE 6.02 or higher).

3. If you see any of the communication LEDs blinking, packets are lost and communication is not reliable. The FC will log and report the error in the FC log file as \textit{timeout} or \textit{retry limit may}. The HMI will be requested by the FC to run a self-test.

4. If you do not see the power LED, there is an unplugged cable or a bad HMI board.

\section*{9.8. Verify Red Light}

\begin{table}[h]
\centering
\begin{tabular}{|l|l|l|}
\hline
Activity Number: & 80801767-81500030-ACT-008 & Applicable Models: \\
\hline
Type of procedure: & Inspect & All \\
\hline
Expertise Level: & Technician & \\
\hline
Priority Level: & Average & Cautions: \\
\hline
Availability Required: & Scanner Offsheet & Reminder Lead Time: \\
\hline
\end{tabular}
\end{table}
The red lights are turned on at the HMI panel through serial communication with the FC. The FC relays this information to and from the radiation emitting gauges source EDAQ board via Ethernet. Details on the HMI unit can be found in your scanner manual.

To check whether the FC is communicating with the panel:

1. There should be one power green LED ON (right hand side corner), and two communication green LEDs ON (middle, left side). The two communication LEDs indicate that the poll command is received and data is answered back to the FC.

2. If you see only one LED, data is received by the panel but the panel is not enabled, therefore it will not answer. To get the panel to answer, enable two panels using the MSS Setup Diagnostic tab (in RAE 6.02 or higher).

3. If you see any of the communication LEDs blinking, packets are lost and communication is not reliable. The FC will log and report the error: timeout or retry limit may occur and the HMI will be requested to run a self-test by the FC.

4. If you do not see the power LED, there is an unplugged cable or a bad UPI board.

5. If visual inspection of the HMI panel does not indicate problems, check whether the MSS page reports both the FC-EDAQ and the nuclear and/or X-ray source EDAQ (see Subsection 6.2.2).

6. There could be a hardware failure in the red light path. See Honeywell drawing p/n 6580801566 Sheet AS14 for details on the red and green light wiring.
9.9. Inspect Head Gap

<table>
<thead>
<tr>
<th>Activity Number:</th>
<th>80801767-81500030-ACT-009</th>
<th>Applicable Models:</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of procedure:</td>
<td>Inspect</td>
<td>Expertise Level:</td>
<td>Operator</td>
</tr>
<tr>
<td>Priority Level:</td>
<td>Average</td>
<td>Cautions:</td>
<td>High Temperature</td>
</tr>
<tr>
<td>Availability Required:</td>
<td>Scanner Offsheet</td>
<td>Reminder Lead Time:</td>
<td></td>
</tr>
<tr>
<td>Overdue Grace Period:</td>
<td></td>
<td>Frequency (time period):</td>
<td></td>
</tr>
<tr>
<td>Duration (time period):</td>
<td>10 min</td>
<td># of People Required:</td>
<td>1</td>
</tr>
<tr>
<td>Prerequisite Procedures:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post Procedures:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Required Parts:

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Quantity</th>
<th>Lead Time</th>
</tr>
</thead>
</table>

### Required Tools:

1. Check whether the upper and lower sheetguides appear aligned. There should be no visible displacement between them in the cross direction (X) or machine direction (Y).

2. Check whether there are any items in the gap that might be obstructing the magnetic signal indicating head split. The head split magnet is part of the alley, the centre part of the sheetguide in the machine direction.

3. If required, remove the scanner beam cover right above the head and check whether the clutch actuator is inserted (see your scanner manual for details).

9.10. Inspect HMI Panel

<table>
<thead>
<tr>
<th>Activity Number:</th>
<th>80801767-81500030-ACT-010</th>
<th>Applicable Models:</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of procedure:</td>
<td>Inspect</td>
<td>Expertise Level:</td>
<td>Honeywell Expert</td>
</tr>
<tr>
<td>Priority Level:</td>
<td>Average</td>
<td>Cautions:</td>
<td>none</td>
</tr>
<tr>
<td>Availability Required:</td>
<td>none</td>
<td>Reminder Lead Time:</td>
<td></td>
</tr>
</tbody>
</table>
Overdue Grace Period: | Frequency (time period):
---|---
Duration (time period): 5 min | # of People Required: 1

Prerequisite Procedures:
Post Procedures:

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Quantity</th>
<th>Lead Time</th>
</tr>
</thead>
</table>

Required Parts:
Required Tools:

When diagnosing Heads Are Split alarm, check whether the head split key is in the ON position rather than in the OFF position on either of the two HMI user panels at the ends of the scanner. The head split key I/O signal does not appear in the I/O pages, but any state change is logged by the FC in the FC log files (see Subsection 6.2.4).

9.11. Check Time Synchronization Processes

<table>
<thead>
<tr>
<th>Activity Number: 80801767-81500030-ACT-011</th>
<th>Applicable Models: All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of procedure: Inspect</td>
<td>Expertise Level: Honeywell Expert</td>
</tr>
<tr>
<td>Priority Level: Average</td>
<td>Cautions: none</td>
</tr>
<tr>
<td>Availability Required: none</td>
<td>Reminder Lead Time:</td>
</tr>
<tr>
<td>Overdue Grace Period:</td>
<td>Frequency (time period):</td>
</tr>
<tr>
<td>Duration (time period): 5 min</td>
<td># of People Required: 1</td>
</tr>
</tbody>
</table>

Prerequisite Procedures:
Post Procedures:

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Quantity</th>
<th>Lead Time</th>
</tr>
</thead>
</table>

Required Parts:
Required Tools:

Loss of time synchronization between the MSS and EDAQ points to either of the master (MSS) or slave (EDAQs) processes not running. The easiest way to check
this is to bring up the main MSS web and to hover the mouse over the Process Status column as shown in Figure 9-1.

![Figure 9-1 Process Status Indicators](image)

All processes listed should have a check mark. In particular, on the EDAQ the process to check is called `ptpd.arm`. On the MSS system, look for the `ptpd.x86` process.

Reboot the respective devices that are missing. Note that that MSS or EDAQ or FC log files written to the MSS will have further information or warning messages if time synchronization fails, and these files can be viewed or downloaded from the main MSS web page (see Subsection 6.2.4). Finally, time synchronization will fail if the correct Ethernet switches are not installed in the scanner, because they will not pass the VLAN tagged time synchronization messages.

Contact Honeywell Engineering if this time synchronization error happens.
10. Troubleshooting

This chapter provides details of the Experion MX alarms that are EDAQ-related rather than sensor-related, and refers you to an appropriate task to investigate and resolve the issue.

Only a subset of these alarms are generated on the 4080 CWS scanner. For example, the Experion MX alarms that refer to the HMI panel or radiation lights are relevant to the Q4000 scanner series only, and the alarm described in Section 10.14 is relevant to the 408x scanner only and does not occur in the Q4000-80.

10.1. EDAQ I/O Not Ready

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause(s)</th>
<th>Solution (Tasks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSS failed to receive EDAQ data</td>
<td>Source or receiver EDAQ powered down</td>
<td>Verify EDAQ Connections</td>
</tr>
<tr>
<td></td>
<td>EDAQ incorrectly configured</td>
<td>Verify EDAQ ID</td>
</tr>
<tr>
<td></td>
<td>EDAQ process not running</td>
<td>Verify EDAQ Process Health</td>
</tr>
</tbody>
</table>

10.2. EDAQ I/O Timestamps

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause(s)</th>
<th>Solution (Tasks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSS failed to receive EDAQ data at the expected rate</td>
<td>Source or receiver EDAQ powered down</td>
<td>Verify EDAQ Connections</td>
</tr>
<tr>
<td></td>
<td>EDAQ incorrectly configured</td>
<td>Verify EDAQ ID</td>
</tr>
<tr>
<td></td>
<td>EDAQ process not running</td>
<td>Verify EDAQ Process Health</td>
</tr>
</tbody>
</table>
10.3. **SxEdaqPcb Head Temp High**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause(s)</th>
<th>Solution (Tasks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-board EDAQ temperature measurement exceeded limit set in RTDR</td>
<td>Internal head temperature too high</td>
<td>Increase RTDR Limits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improve Head Cooling</td>
</tr>
<tr>
<td></td>
<td>Failed EDAQ temperature measurement</td>
<td>EDAQ Self-test</td>
</tr>
</tbody>
</table>

10.4. **RxEdaqPcb Head Temp High**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause(s)</th>
<th>Solution (Tasks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-board EDAQ temperature measurement exceeded limit set in RTDR</td>
<td>Internal head temperature too high</td>
<td>Increase RTDR Limits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improve Head Cooling</td>
</tr>
<tr>
<td></td>
<td>Failed EDAQ temperature measurement</td>
<td>EDAQ Self-test</td>
</tr>
</tbody>
</table>

10.5. **Amber Light Not Lit**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause(s)</th>
<th>Solution (Tasks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear radiation sensor was enabled, but the feedback from the amber light not received by the nuclear source EDAQ</td>
<td>HMI panel issue</td>
<td>Verify HMI Panel Operation</td>
</tr>
<tr>
<td></td>
<td>FC not running</td>
<td>Verify EDAQ Process Health</td>
</tr>
</tbody>
</table>
10.6. Red Light Not Lit

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause(s)</th>
<th>Solution (Tasks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shutter open command was given but the red light feedback signals at the endbell or scanner head failed to respond</td>
<td>HMI panel issue</td>
<td>Verify HMI Panel Operation</td>
</tr>
<tr>
<td></td>
<td>Red light failure on scanner head</td>
<td>Verify Red Light</td>
</tr>
<tr>
<td></td>
<td>The FC cannot be accessed</td>
<td>Verify EDAQ Process Health</td>
</tr>
</tbody>
</table>

10.7. Lost Receiver LAN Con

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause(s)</th>
<th>Solution (Tasks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear source EDAQ unable to contact nuclear receiver EDAQ</td>
<td>Nuclear receiver EDAQ failed or not powered</td>
<td>Verify EDAQ functionality EDAQ Self-test</td>
</tr>
<tr>
<td></td>
<td>Nuclear receiver EDAQ not on network</td>
<td>Verify EDAQ Process Health</td>
</tr>
<tr>
<td></td>
<td>Nuclear receiver EDAQ does not have proper identification</td>
<td>Verify EDAQ ID</td>
</tr>
</tbody>
</table>

10.8. Lost Frame Controller LAN Con

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause(s)</th>
<th>Solution (Tasks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear source EDAQ unable to contact the FC EDAQ to request information on the status of the HMI panel lights</td>
<td>FC-EDAQ failure or not powered</td>
<td>Verify EDAQ functionality EDAQ Self-test</td>
</tr>
<tr>
<td></td>
<td>The FC-EDAQ not on network</td>
<td>Verify EDAQ Process Health</td>
</tr>
</tbody>
</table>
10.9. Lost Lower Alley LAN Con

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause(s)</th>
<th>Solution (Tasks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear or X-ray Source EDAQ was unable to contact the Lower Alley EDAQ for information</td>
<td>Lower EDAQ failed</td>
<td>Verify EDAQ functionality</td>
</tr>
<tr>
<td></td>
<td>Lower alley EDAQ network disconnected</td>
<td>EDAQ Self-test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Verify EDAQ Process Health</td>
</tr>
</tbody>
</table>

10.10. Lost Upper Alley LAN Con

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause(s)</th>
<th>Solution (Tasks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear or x-ray source EDAQ was unable to request information (in particular, status of the head split) from the upper alley EDAQ</td>
<td>Upper alley EDAQ failed</td>
<td>Verify EDAQ functionality</td>
</tr>
<tr>
<td></td>
<td>Upper alley network disconnected</td>
<td>EDAQ Self-test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Verify EDAQ Process Health</td>
</tr>
</tbody>
</table>

10.11. Heads are Split

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause(s)</th>
<th>Solution (Tasks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head split interlock reed switch is open when required closed for requested operation</td>
<td>Heads are split</td>
<td>Inspect Head Gap</td>
</tr>
<tr>
<td></td>
<td>Head split key switch is on</td>
<td>Inspect HMI Panel</td>
</tr>
<tr>
<td></td>
<td>Alley EDAQ failed digital input</td>
<td>Check EDAQ functionality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EDAQ Self-test</td>
</tr>
</tbody>
</table>
10.12. **EDAQ Time Synch**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause(s)</th>
<th>Solution (Tasks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time synch test failed. The EDAQ's local time is too far from the master clock in the MSS</td>
<td>MSS master clock stopped running</td>
<td>Check Time Synchronization Processes</td>
</tr>
<tr>
<td></td>
<td>EDAQ clock synch process stopped</td>
<td>Check Time Synchronization Processes</td>
</tr>
</tbody>
</table>

10.13. **EDAQ FPGA Error**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause(s)</th>
<th>Solution (Tasks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FPGA chip on the EDAQ failed to return new or good data</td>
<td>EDAQ board failure</td>
<td>EDAQ Self-test</td>
</tr>
</tbody>
</table>

10.14. **EDAQ GPIO Watchdog**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause(s)</th>
<th>Solution (Tasks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endbell EDAQ sensor safety watchdog expired. Watchdog was not refreshed by the MSS jobset in the required time</td>
<td>MSS stalled or disconnected</td>
<td>Verify MSS status and LAN between the MSS and EDAQs</td>
</tr>
</tbody>
</table>
11. EDAQ Error Messages

The EDAQ boards generate their own set of error messages that are visible to the Experion MX system and the scanner Web pages. On the Operation Station these are displayed on the MSS Summary page under the MSS Setup Diagnostic tab, or the I/O point monitor. The main MSS Web page has a button to display all the latest messages from all EDAQs.

Most of the error messages generate Experion MX alarms and are covered in Chapter 9 and Chapter 10. All possible EDAQ error messages, and their meanings, are listed in Table 11-1. Most of these messages are sensor-specific. As such, all except for the last two in Table 11-1 are never generated on a 408x CWS scanner.

Table 11-1 EDAQ Error Messages

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Error String</th>
<th>Description</th>
<th>Applicable Sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sensor is not enabled.</td>
<td>Sensor was operated from the Experion MX displays before enabling from the HMI panel. Check HMI panel enable button and key switch if applicable.</td>
<td>No X X X</td>
</tr>
</tbody>
</table>

(nuclear, X-ray, and laser sensors)
<table>
<thead>
<tr>
<th>Error Code</th>
<th>Error String</th>
<th>Description</th>
<th>Applicable Sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Sensor became disabled while in operation.</td>
<td>Sensor became disabled from HMI panel while in operation. Check HMI panel enable button and key switch if applicable. Check serial cable connection between frame controller EDAQ and the HMI panel.</td>
<td>Safety Fault? (nuclear, X-ray, and laser sensors)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yes X X X X X</td>
<td>Basis Weight</td>
</tr>
<tr>
<td>3</td>
<td>Lost network connection with the FC.</td>
<td>One or both sensor EDAQs lost network connection with the FC. Check that the FC EDAQ is up and the frame controller application is running. Check Ethernet cable connection to the sensor EDAQs and to the FC.</td>
<td>Yes X X X X X</td>
</tr>
<tr>
<td>4</td>
<td>Lost network connection with MSS.</td>
<td>One or both sensor EDAQs lost network connection with MSS. Check MSS computer is up and the MSS application is running. Check Ethernet cable connection to the sensor EDAQs and to the MSS.</td>
<td>No X</td>
</tr>
<tr>
<td>5</td>
<td>Lost network connection with partner EDAQ.</td>
<td>Sensor EDAQ pair lost network connection between them. Check both sensor EDAQs are up and the EDAQ application is running in both. Check Ethernet cable connection to the sensor EDAQs.</td>
<td>Yes X X X X</td>
</tr>
<tr>
<td>6</td>
<td>Lost network connection with upper alley EDAQ.</td>
<td>Source side EDAQ lost network connection to the upper alley EDAQ. Check upper alley EDAQ is up and the EDAQ application is running. Check Ethernet cable connection to the source side EDAQ and to the upper alley EDAQ.</td>
<td>Yes X X X</td>
</tr>
<tr>
<td>7</td>
<td>Lost network connection with lower alley EDAQ.</td>
<td>Not currently used.</td>
<td></td>
</tr>
<tr>
<td>Error Code</td>
<td>Error String</td>
<td>Description</td>
<td>Applicable Sensors</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>8</td>
<td>Partner EDAQ is in an incompatible state.</td>
<td>Operating state of the sensor EDAQ pairs do not match. This error is caused only by a software issue. Report the incident to technical support and power cycle both EDAQs to recover.</td>
<td>Yes X X X</td>
</tr>
<tr>
<td>9</td>
<td>Upper and lower parts of the head is not aligned or split.</td>
<td>Upper and lower parts of the head are not aligned or the head-split switch is activated. Check the head alignment and the wiring from upper alley EDAQ to the head-split switch.</td>
<td>Yes X X X</td>
</tr>
<tr>
<td>10</td>
<td>Receiver is not in place or not inserted all the way inside.</td>
<td>Receiver assembly is not fitted correctly or the receiver-in-place switch is not activated. Check the receiver assembly and the wiring from the receiver EDAQ to the receiver-in-place switch.</td>
<td>Yes X X X</td>
</tr>
<tr>
<td>11</td>
<td>Amber light did not turn on in expected time.</td>
<td>Amber light for the sensor in the HMI panel did not turn on at all. Check the amber light lights up for at least half a second when enable push button is pressed. Check the serial cable connection between the FC EDAQ and HMI panel.</td>
<td>Yes X X X</td>
</tr>
<tr>
<td>12</td>
<td>Amber light turned off while in operation.</td>
<td>Amber light for the sensor in the HMI panel was on for some time and then turned off. Check the amber light lights up for at least half a second when enable push button is pressed. Check the serial cable connection between the FC EDAQ and HMI panel.</td>
<td>Yes X X X</td>
</tr>
<tr>
<td>13</td>
<td>Scanner red light did not turn on in expected time.</td>
<td>The main scanner red light in the HMI panel or the red lights on the frame head did not turn on at all. Check the panel and head red light LEDs and the serial cable connection between the FC EDAQ and HMI panels.</td>
<td>Yes X X X</td>
</tr>
<tr>
<td>Error Code</td>
<td>Error String</td>
<td>Description</td>
<td>Applicable Sensors</td>
</tr>
<tr>
<td>------------</td>
<td>--------------</td>
<td>-------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>14</td>
<td>Scanner red light turned off while in operation.</td>
<td>The main scanner red light in the HMI panel or the red lights on the frame head were on for some time and then turned off. Check the panel and head red light LEDs and the serial cable connection between the FC EDAQ and HMI panel.</td>
<td>Safety Fault? (nuclear, X-ray, and laser sensors) Basis Weight Ash Weight Contacting Caliper Extensional Stiffness FotoSurf FotoForm FotoFiber Color</td>
</tr>
<tr>
<td>15</td>
<td>Shutter red light did not turn on in expected time.</td>
<td>Shutter red light for the sensor in the HMI panel did not turn on at all. Check the panel red light LEDs and the serial cable between the FC EDAQ and HMI panel.</td>
<td>Yes X X</td>
</tr>
<tr>
<td>16</td>
<td>Shutter red light turned off while in operation.</td>
<td>Shutter red light for the sensor in the HMI panel was on for some time and then turned off. Check the panel red light LEDs and the serial cable between the FC EDAQ and HMI panel.</td>
<td>Yes X X</td>
</tr>
<tr>
<td>17</td>
<td>Interlock board failed to turn on power in expected time.</td>
<td>Interlock board controlling power to the source module was unable to turn the power on. Check the connections from the source EDAQ and the sensor to the interlock board.</td>
<td>Yes X X X</td>
</tr>
<tr>
<td>18</td>
<td>Interlock board turned on power without request.</td>
<td>Interlock board controller power to the source module turned on the power unexpectedly without the request from EDAQ. Check the connections from the source EDAQ and sensor to the interlock board.</td>
<td>Yes X X X</td>
</tr>
<tr>
<td>19</td>
<td>Receiver measurement is below absolute minimum.</td>
<td>Receiver measurement is not functioning at all. Check connections from receiver EDAQ to the sensor and the sensor receiver assembly.</td>
<td>Yes X X</td>
</tr>
<tr>
<td>Error Code</td>
<td>Error String</td>
<td>Description</td>
<td>Applicable Sensors</td>
</tr>
<tr>
<td>------------</td>
<td>-------------</td>
<td>-------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>20</td>
<td>Receiver measurement is above absolute maximum.</td>
<td>Receiver measurement is not functioning at all. Check connections from receiver EDAQ to the sensor and the sensor receiver assembly.</td>
<td>Yes</td>
</tr>
<tr>
<td>21</td>
<td>Receiver measurement is above HiClosedSafeLimit.</td>
<td>Receiver measurement while the shutter is closed is higher than expected maximum. Make sure the shutter is getting closed properly. Check the connections from the receiver EDAQ to the sensor and the sensor receiver assembly.</td>
<td>Yes</td>
</tr>
<tr>
<td>22</td>
<td>Receiver measurement is below LoOpenSafeLimit.</td>
<td>Receiver measurement while the shutter is open is lower than expected minimum. Check the air supply and make sure the shutter is opening correctly. Check the connections from the receiver EDAQ to the sensor and the sensor receiver assembly.</td>
<td>Yes</td>
</tr>
<tr>
<td>23</td>
<td>HMI panel key switch is in off position.</td>
<td>HMI panel enable push button was pressed while key switch is in off position. Turn key switch to on position and then press the push button again to enable the sensor.</td>
<td>No</td>
</tr>
<tr>
<td>24</td>
<td>Remote mode digital output got turned off.</td>
<td>Remote mode digital output state was turned off and the sensor is now controlled by the button panel on the sensor. Check the remote mode output state on the RAE MSS Card IO Point Monitor. Check the serial cable connection between EDAQ and the sensor.</td>
<td>Yes</td>
</tr>
<tr>
<td>25</td>
<td>Z Normal analog input is less than Z Max volts.</td>
<td>Wheel assembly is in a position to cause maximum deflection and may cause sheet break. Check the wheel assembly unit. Check the serial cable connection between EDAQ and the sensor.</td>
<td>Yes</td>
</tr>
<tr>
<td>Error Code</td>
<td>Error String</td>
<td>Description</td>
<td>Safety Fault?</td>
</tr>
<tr>
<td>-----------</td>
<td>------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>26</td>
<td>Insert limit switch was activated.</td>
<td>Wheel assembly is inserted unexpectedly and may cause sheet break. Check the wheel assembly unit.</td>
<td>Yes</td>
</tr>
<tr>
<td>27</td>
<td>Sensor EDAQ lost communication with the sensor.</td>
<td>Sensor EDAQ lost communication with the sensor module. Make sure that the sensor assembly is powered and running the appropriate firmware version. Check the connection between the EDAQ and the sensor assembly.</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Laser enabled feedback from the sensor failed.</td>
<td>Laser enabled feedback from the sensor failed. Check the connection between the EDAQ and the sensor assembly. Make sure that the receiver assembly is properly mounted and aligned with the source.</td>
<td>X</td>
</tr>
<tr>
<td>29</td>
<td>Color sensor bezel is not retracted; sensor will cause problems while over the sheet.</td>
<td>Color sensor bezel is not retracted and may cause sheet break. Check the wiring between EDAQ and the sensor. Check the operation of the bezel.</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Sensor EDAQ received bad status from the sensor.</td>
<td>Sensor assembly is experiencing a problem as described the error code in the WhatsWrong string. Search the sensor manual for the error description and mitigation.</td>
<td>X X X</td>
</tr>
<tr>
<td>31</td>
<td>Error accessing data from EDAQ FPGA.</td>
<td>EDAQ FPGA RAM image is corrupted. When this error is reported, EDAQ reboots without your intervention after five seconds and the error clears itself. Replace the EDAQ if the sensor does not come back operational or if this error is reported frequently.</td>
<td>Yes</td>
</tr>
<tr>
<td>Error Code</td>
<td>Error String</td>
<td>Description</td>
<td>Safety Fault?</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>32</td>
<td>EDAQ outputs disabled as it lost connection with MSS.</td>
<td>This error is reported only by EDAQs in a CWS scanner. Ensure that MSS application is running and check the network connection to the EDAQ and the MSS.</td>
<td>Yes</td>
</tr>
<tr>
<td>33</td>
<td>Time difference between local clock and master clock exceeds configured limit.</td>
<td>Time synchronization between EDAQ and MSS is not working. Time difference is now more than 1 second.</td>
<td>No</td>
</tr>
</tbody>
</table>
12. Storage, Transportation, End of Life

This chapter summarizes Honeywell policy with regards to the storage and disposal of components of the MSS/EDAQ Data Acquisition systems.

12.1. Storage and Transportation Environment

In order to maintain integrity of scanner components, storage and transportation of all equipment must be within the parameters shown in Table 12-1.

Table 12-1 Storage and Transportation Parameters

<table>
<thead>
<tr>
<th>Duration of Storage</th>
<th>Acceptable Temperature Range</th>
<th>Acceptable Humidity Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short term (less than one week)</td>
<td>-20°C–45°C (-4°F–113°F)</td>
<td>20%–90% non-condensing</td>
</tr>
<tr>
<td>Long term</td>
<td>-10°C–40°C (14°F–104°F)</td>
<td>20%–90% non-condensing</td>
</tr>
</tbody>
</table>

12.2. Disposal

Honeywell supports the environmentally conscious disposal of its products when they reach end of life or when components are replaced.

All equipment should be reused, recycled, or disposed of in accordance with local environmental requirements or guidelines.

This product may be returned to the Honeywell manufacturing location, and it will be disposed using environmental friendly methods. Contact the factory for further details and instructions.
Except where identified in this chapter, the scanner does not contain hazardous or restricted materials.

Guidelines for disposal of equipment by Honeywell or the customer for sensor-specific materials are as described in Subsection 12.2.1.

12.2.1. Solid Materials

- remove all non-metallic parts (except plastic) from the sensor and dispose of through the local refuse system
- recycle plastic parts
- wires and cables should be removed and recycled; copper may have value as scrap
- electrical and electronic components should be recycled or handled as special waste to prevent them from being put in a landfill, because there is potential for lead and other metals leaching into the ground and water
- metals should be recycled, and in many cases have value as scrap
## 13. Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARM</td>
<td>A RISC processor designed by Arm Holding Ltd. It is the main CPU in the EDAQ</td>
</tr>
<tr>
<td>EDAL</td>
<td>Honeywell proprietary software layer responsible for distributing the acquired data to clients</td>
</tr>
<tr>
<td>EDAQ</td>
<td>Ethernet data acquisition board, digitizes all the sensor signals</td>
</tr>
<tr>
<td>Flash Memory</td>
<td>Permanent storage on EDAQ. Functions like a local disk drive but is solid state. Similar to the SSD drive in the Measurement Sub System (MSS).</td>
</tr>
<tr>
<td>Field Programmable Gate Array (FPGA)</td>
<td>Programmable chip that runs code as if it were hardware design. Used for real-time control of the EDAQ data acquisition electronics</td>
</tr>
<tr>
<td>DHCP</td>
<td>Protocol that assigns a dynamic (temporary) IP address to a device. Such a server is provided on the scanner LAN</td>
</tr>
<tr>
<td>Local Area Network (LAN)</td>
<td>Refers to either the internal scanner network (EDAQs, MSS) or the network between the MSS and QCS server</td>
</tr>
<tr>
<td>Measurement Sub System (MSS)</td>
<td>CPU located at the electronics end responsible for binning sensor data and transmitting to the RAE system</td>
</tr>
<tr>
<td>Real-time Application Environment (RAE)</td>
<td>The system software used by the QCS to manage data exchange between applications.</td>
</tr>
<tr>
<td>Solid State Device (SSD)</td>
<td>Disk drive manufactured without moving parts from flash memory</td>
</tr>
<tr>
<td>User Panel Interface / Human Machine Interface (UPI/HMI)</td>
<td>The control panel at the ends of the scanner</td>
</tr>
</tbody>
</table>
A. Part Numbers

Table A-1 lists part numbers and descriptions for the Experion MX MSS & EDAQ data acquisition system.

Table A-1 Part Numbers

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value Line IPC</td>
</tr>
<tr>
<td>6540580201</td>
<td>Pins</td>
</tr>
<tr>
<td>6540580304</td>
<td>EDAQ J1 3-pin Molex</td>
</tr>
<tr>
<td>6543100025</td>
<td>Advantech UNO-2182</td>
</tr>
<tr>
<td>6543100033</td>
<td>CompuLab FitPC2i</td>
</tr>
<tr>
<td>6543120016</td>
<td>32 GB solid-state SATA drive</td>
</tr>
<tr>
<td>6543210058</td>
<td>DVD ISO file</td>
</tr>
<tr>
<td>6553780247</td>
<td>Screws</td>
</tr>
<tr>
<td>6580500111</td>
<td>Head power distribution board</td>
</tr>
<tr>
<td>6580801767</td>
<td>Installation kit</td>
</tr>
<tr>
<td>6580801773</td>
<td>Cable harness</td>
</tr>
<tr>
<td>6581500030</td>
<td>EDAQ PCBA</td>
</tr>
<tr>
<td>6581500032</td>
<td>Frame controller expansion board</td>
</tr>
</tbody>
</table>