Honeywell

Q3090 Scanner

System Manual

6510020550 Rev 01

Q3090 Scanner

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Introduction

The purpose of this manual is to provide an introduction to the Q3090 Scanner.

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 paper machine and a basic understanding of mechanical, electrical and computer software concepts.

About this manual

This manual contains 7 chapters.

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

Chapter 2, **Prerequisites/Site Setup**, describes the training, hazards, safety features, and procedures associated with the scanner in order to provide a safe working environment.

Chapter 3, **EDAQ**, describes the principles and operation of the Ethernet Data Acquisition (EDAQ) board.

Chapter 4, **System Components**, provides an installation checklist and describes installation procedures.

Chapter 5, **Installation/Startup**, describes installation and set up tasks for the system.

Chapter 6, **Operations**, describes operation of the system.

Chapter 7, **Preventive Maintenance**, provides a schedule for recommended ongoing maintenance procedures, with links to procedures descriptions in Chapter 8.

Chapter 8, **Procedures**, describes installation, maintenance, repair and replacement procedures.

Chapter 9, **Troubleshooting**, describes the meaning of scanner alarms and troubleshooting.

Chapter 10, **Storage, Transporation, and End of Life**, describes methods for storing, transporting, and disposing scanner components.

Related reading

The following documents contain related reading material:

Honeywell Part Number	Document Title / Description
6510020381	Experion MX MSS & EDAQ Data Aquisition

Conventions

The following conventions are used in this manual:

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

`Boldface`	Style: User Command. Boldface characters in this special type indicate user input.
`Special Type`	Style: System Response. 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	Style: Filename. 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.

Boldface	Style: Button and Menus. Boldface characters in this special type indicate button names, button menus, fields on a display, parameters, or commands that must be entered exactly as they appear.
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] or **[RETURN]**	**[ENTER]** Style: Key Command. This is the key the user presses 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 the user presses 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 the user 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 the user about potential equipment or material damage.
WARNING	The WARNING icon appears beside a Note box containing information that warns the user about potential bodily harm or catastrophic equipment damage.

1. System Overview

This product is designed to measure various sheet properties for continiuous web process applications. Typically this product is installed on-process with a sensor or sensor complement that depends on the user's needs.

1.1. Terminology

Terminology specific to this product will be used to describe various subassemblies or components. This section introduces some of these terms to help make subsequent sections easier to understand.

Measurement Modules – Upper and lower autonomous scanning 'head' assemblies composed of primary sensors, sheet edge detectors, radiation safety indicators, drive system, signal processing electronics, and communications systems.

Rail System – An assembly of tensioned structural support and power cables, protective covers, timing belts, and position magnets which allows the measurement modules to be accurately positioned during scanning.

Scanning Measurement Device – An upper and lower **Measurement Module** set, with associated electrical panel and **Rail System**, forming a scanning measurement system.

Freestanding Cable-support Structure – An optional assembly of vertical supports and spreader beams, used when the rail system cannot be directly mounted to the frame of a web production machine.

1.2. Scanner specifications

Category	**Specification**
Environmental conditions	**Power Distribution Panel:** Max temperature: 10ºC to 40ºC, non-condensing **Sensor Heads:** • Max temperature: 10ºC to 40ºC, non condensing without cooling option • Max temperature: 10ºC to 50ºC, non condensing with the fan cooling option
Maximum distance between end supports	6m
Scanner mounting	Pedestal mount, from below. (Typical)
AC power requirement	• 120/240VAC, 50/60Hz auto switching • 500W Maximum

2. Scanner Safety

This chapter describes the training, hazards, safety features and procedures associated with the scanner in order to provide a safe working environment.

Any person working with or within the general area of the scanner needs to read this chapter prior to operating, installing, commissioning, maintaining or troubleshooting this product.

WARNING	Failure to read this chapter and any referenced manuals or sections contained within this manual could lead to serious injury.

Before starting any work on the scanner review the following questions:

1. *Do I have the correct training to do the work?*

   Refer to Section **2.1**, for an overview of the required training.

2. *Have I reviewed the hazards associated with the area and systems with which I am working?*

   Refer to Section **2.2**, for a listing of mechanical, electrical, and radiation hazards.

3. *Have I reviewed the work procedures to familiarize myself with the safety precautions, task, tools, and parts required?*

   Review work instructions and safety tasks such as Lockout/Tagout (LOTO).

4. *Do I have the required personal protective equipment (PPE)?*

   Always wear safety glasses.

Refer to the individual tasks in Chapter 8 for cautions and special equipment lists.

5. *Do I understand the function of the safety features of the scanner so that I can identify problems and keep the features in good working condition?*

   Refer to Section **2.3**.

2.1. Scanner Safety Training

2.1.1. Authorized Persons

Only machine operators and appropriate technical support staff should operate this system.

Only trained and authorized personnel are permitted to perform maintenance, repairs or testing on the scanner system. Authorized personnel are described in the *Radiation Safety Manual For Honeywell Customers*, (p/n 6510020197).

All persons authorized to perform their duties with or in the vicinity of the scanner system must read the relevant sections of this manual.

Additional information is available for authorized persons in the *Radiation Safety Training Manual* (p/n 6510020199).

2.1.2. Where to Find Information on Radiation Safety

2.1.2.1. Radiation safety training manual for customers

While this manual includes references to appropriate safety and regulatory requirements because scanners include sensors that use sources of radiation, Honeywell strongly recommends that you obtain and become familiar with the information provided in the *Radiation Safety Manual For Honeywell Customers*. A copy of the manual is shipped with each sensor that contains a radiation source. Direct questions regarding radiation safety to Radiological Operations. The main contact number for Radiological Operations is:

- ACS Global Radiological Operations in Duluth: Phone: +1 770-689-0500. group e-mail address: DLACSGlobalRadOps@Honeywell.com

2.1.2.2. Radiation safety training manual for Honeywell employees

The *Radiation Safety Training Manual* provides detailed information on:

- Sensor shipment, receipt, and installation (including testing before use)
- Requirements for periodic radiation safety testing
- Required qualifications for personnel involved in installation, use, service, and testing of sensors containing radiation sources
- Maintenance tasks (cleaning sensor heads, for example)
- Separation or removal of heads containing radiation sources
- Changing sensor air gaps
- Replacement of radiation source window in sensor head
- Modifications to sensor heads, interlocks, and other safety features
- Solving problems involving radiation source holder assembly. For example: shutter, flag, low air counts, and corrosion.
- Function and replacement of radiation warning lights
- Storage and disposal of radiation sources
- Radiation source/source holder replacement
- Requirements for shipment of radiation sources

WARNING

The basis weight or nuclear sensor contains a radioactive source (KR-85, SR-90, AM-241, or PM-147). OEMs or end users who conduct basis weight sensor installations, required safety tests, repairs, and so on, are required to obtain a radioactive materials license that explicitly authorizes the operations to be conducted and names the individuals who may perform them. Otherwise, operations of the type listed above must be performed by authorized Honeywell employees or other appropriately-licensed individuals, or as described in the *Radiation Safety Manual For Honeywell Customers*,Document #6510020197.

Ash and alternative basis weight sensors contain X-ray sources that produce intense levels of X-radiation when power is applied to the X-ray tube. Personnel who work on or with X-ray sources must be knowledgeable of and trained in the proper safety methods for X-ray devices. In most locations, a permit or registration is required to maintain, service, and install X-ray devices.

Failure to follow radiation safety procedures may cause exposure to hazardous levels of radiation.

2.1.3. Tasks

To assist with safe work practices, review work procedures outlined in this manual that include:

- Potential hazard description
- Required PPE
- Required tools and equipment
- Required parts
- Number of workers
- Approximate time for task
- Expertise level required

See **Figure 2-1** for an example of the task format.

8.1.3. Scanner lockout/tagout

Activity Number:	Q4000-80-ACT-020	**Applicable Models:**	Q4000-80
Type of Procedure:	Inspect	**Expertise Level:**	Technician
Priority Level:	Average	**Cautions:**	Electric shock
Availability Required:	Scanner offsheet	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	15 minutes	**# of People Required:**	1
Prerequisite Procedures:	Scanner Q4000 Safety Training See also Figure 8–4		
Post Procedures:	Remove scanner lockout/tagout		
Required Parts:	Part Number	Quantity	Lead Time
Required Tools:	• 8 mm, square door key • screwdriver		

1. Confirm that the beam is clear, and the heads can move freely and scan across the beam.
2. Press at least one of the **Stop** buttons on the scanner frame.
3. Identify the main power switch on the scanner cable end door, and confirm that the main power switch is in the **OFF** position.

Figure 2-1: Sample Task (grayed links)

Some tasks, such as LOTO, may need to be accomplished before and after the task is completed. These tasks are listed in the prerequisite and post procedures Table fields.

Implement safety precautions highlighted here in conjunction with local safety regulations. Where two different guidelines are prescribed, follow the stricter of the two.

2.2. Scanner Safety Hazards

There are several potential personal safety hazards associated with the scanner. This chapter has grouped the hazards by type as follows:

1. Mechanical hazards including:
    - pinch points
    - impact with moving equipment
    - stored energy (mechanical)
    - elevated work

- lifting of heavy components

2. Electrical hazards including:
   - high voltages
   - stored electrical energy
   - static discharge (machine specific)
3. Radiation exposure hazards (dependant on sensor type) including:
   - nuclear
   - X-ray

The following sections are organized by hazard type: mechanical, electrical and radiation. Areas of caution are highlighted and safe work practice procedures are referenced.

2.2.1. Mechanical Safety Hazards

Safe work practices around the scanner largely depend on the location in which the worker is positioned.

To quickly determine mechanical hazards for working on or near the scanner refer to the *hazard zone* Figures in the following sections and appropriate safety warnings and precautions listed in the accompanying Tables.

2.2.1.1. Pinch Points, Squeeze Zones, Impact, Fall

Figure 2-4 outlines area of concern regarding moving mechanical parts that can generate pinch points and impacts. When working on the scanner in one or more of these areas, refer to the color coded area in **Figure 2-4** and

Table 2-1 to determine the hazard, warning and safety precaution.

When the scanner is raised or spans open floor areas, fall protection will need to be considered in accordance with local site rules and regulations.

Warning labels for squeeze and pinchpoints, **Figure 2-2**, and **Figure 2-3** respectively, are displayed on the scanner in areas where mechanical hazards exist.

Figure 2-2: Belt Pinch Warning Label

Figure 2-3: Squeeze/Impact Warning Label

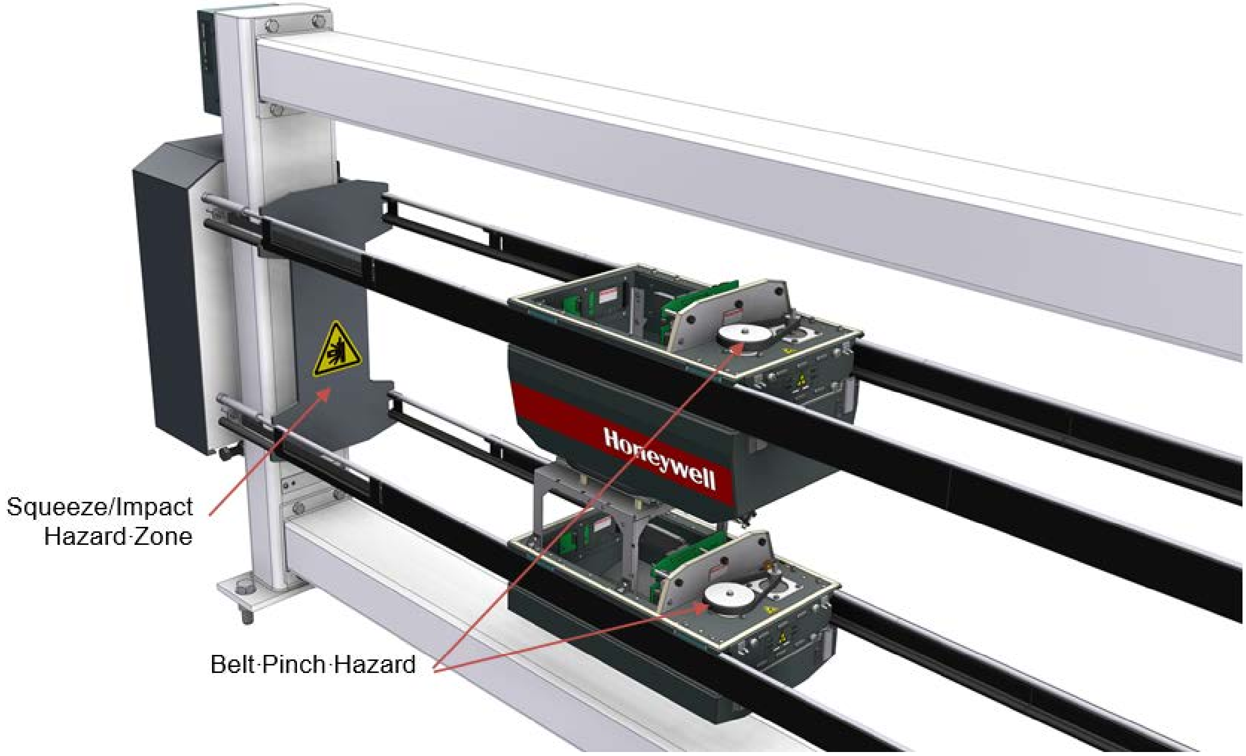


Figure 2-4: Scanner Frame, Mechanical Motion Hazard Zones

Table 2-1: Scanner Frame, Mechanical Motion Precautions

Hazard Type	Warning	Safety Precaution
	Work in this area has pinch points associated with pulleys,and belts which can cause injury.	Users should be aware of moving parts and avoid belt nip areas during operation. Press the stop button on the user control panel to disable the motor drive prior to work in this area
	Work in this area has potential for impact or squeeze hazard from head motion. < 50N [11lbf] for 2 seconds max	Users should be aware of moving heads and placing body parts between the end plate and heads while the scanner heads are powered. Press the stop button on the user control panel to disable the motor drive prior to work in this area

2.2.2. Electrical Safety Hazards

To determine electrical hazards for working on or near the scanner review the following sections.

2.2.2.1. Voltage Zones

Electrical systems extend throughout the scanner system and exist at multiple voltage levels including:

- 120-240VAC
- 24VDC and lower

Multiple levels of electrical protection exist and include:

- Key lock cabinet enclosures
- Circuit breaker and fuse protection
- Protected earth grounding of enclosure
- Voltage level grouping
- Recessed terminal contacts

See **Figure 2-5** and **Table 2-2**. They illustrate the electrical hazards on the scanner and appropriate safety precautions.

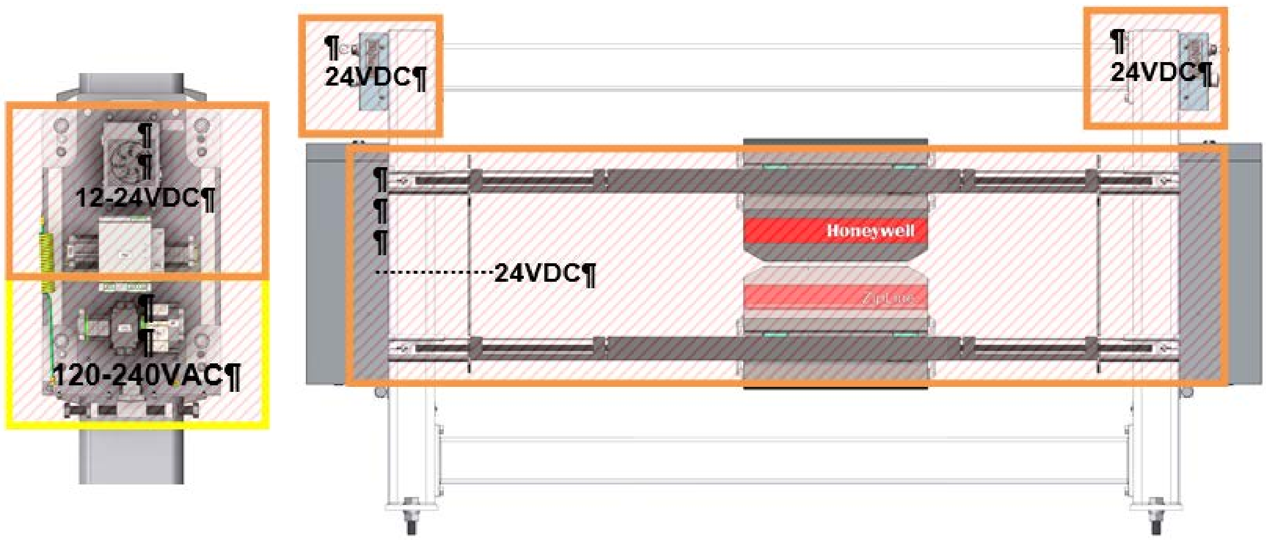


Figure 2-5: Scanner Voltage Zones

Table 2-2: Electrical Hazard Voltage Precautions

Hazard Type	Warning	Safety Precaution
120-240VAC	Work in this area exposes the worker to high voltage and current levels that can cause serious/fatal injury.	Work on wiring or components on the input power rail requires de-energizing power through LOTO of the mill circuit breaker upstream of scanner.
24VDC	Work in this area may expose worker to arcing or mild shock hazards.	Work on wiring and components in this area requires at minimum de-energizing the sub-circuit through the cable end breaker or preferably powering down scanner AC.

2.2.2.2. Static Discharge

Some mill processes generate static electricity. Be aware of the risk of shock from static discharge when working close to mill processes.

2.2.2.3. Electric Shock

Within the endbells, some terminations are not completely covered by access shields or insulation. At these locations you could come into contact with AC power at 120-240VAC levels and DC power at 24VDC.

Electrical shock warning labels (see **Figure 2-6**) have been placed in locations where bare terminations, such as power rail fittings, pose electrical shock hazards (see **Figure 2-7**). Be careful with tools, hands and fingers in areas marked with this label without first properly disabling power.

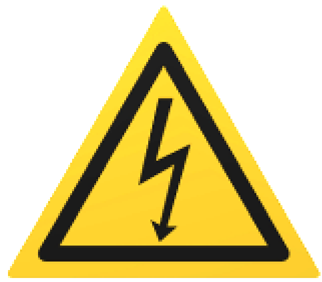


Figure 2-6: Electric shock warning label

Figure 2-7: End bell electrical warning for exposed 24 VDC power rail fittings

2.2.3. Radiation Safety Hazards

Many scanners include sensors that take measurements by directing nuclear particles or X-rays at the process. The scanner design includes rigorous safety features to:

- Inform the worker through shutter status indicators of dangerous, open nuclear and X-ray radiation sources.

- Monitor system mechanical, electrical and software states through interlocks to prevent opening source shutters or discharge of laser sources in an unsafe manner, for example, when heads are split, receivers not in place, sources not in place, control software not running, shutter safety lights not operational, and so on

Subsection **2.2.3.1** describes the nuclear safety hazard conditions.

Subsection **2.2.3.2** describes general radiation safety precautions to be taken when working around a scanner.

Review these sections with special care and note any questions to be answered by Honeywell authorized personnel.

2.2.3.1. Nuclear Radiation

The measurement modules on the scanner typically have a radioactive source with shielding casing materials and aperture opening controlled by a shutter system. The shutter design limits the radiation exposure direction to the receiver system and when closed, allows the radiation source to be blocked completely enabling a safe working environment for maintenance work on the sensors, head, and scanner.

Nuclear Radiation Hazard Zone

When a radiation sensor is operating, the shutter is open but the opposing head limits all but a small amount of radiation that may make its way through the narrow gap between the heads. A radiation survey involves taking measurements of radiation levels surrounding the measurement module. The measurements are used to ensure that all sensors satisfy regulatory and license limits that apply to the user/customer. The measurements are also used to provide information to people who work near the gauges. The small amount of residual radiation that does exist infers radiation hazard zone 1m (3ft) around the scanner heads when shutters are open.

Shutter Status Indicators

Shutter status indicators, the red and green lights on the heads and red lights on the user panels, reflect radiation sensor shutter open or closed states. The red and green indicators are mounted to the upper heads only (see **Figure 2-8**), and face both CD directions. The user control panels indicates the red warning light only. See **Figure 2-9**.

- An illuminated red light indicates *any single* shutter being commanded open by the system.

- An illuminated green light indicates that all shutters are physically sensed closed by the system.

The smaller red indicators in the top row of the user panel indicate specific sensors with shutters commanded open. This allows you to distinguish between a nuclear basis weight and an X-ray ash sensor causing a red light condition.

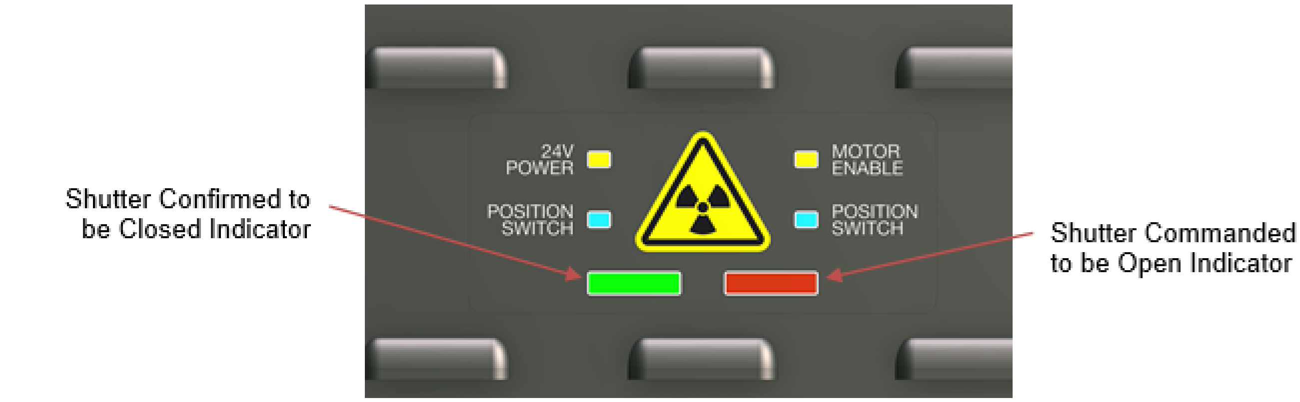


Figure 2-8: Radiation shutter status indicator (red and green) on upper measurement module only

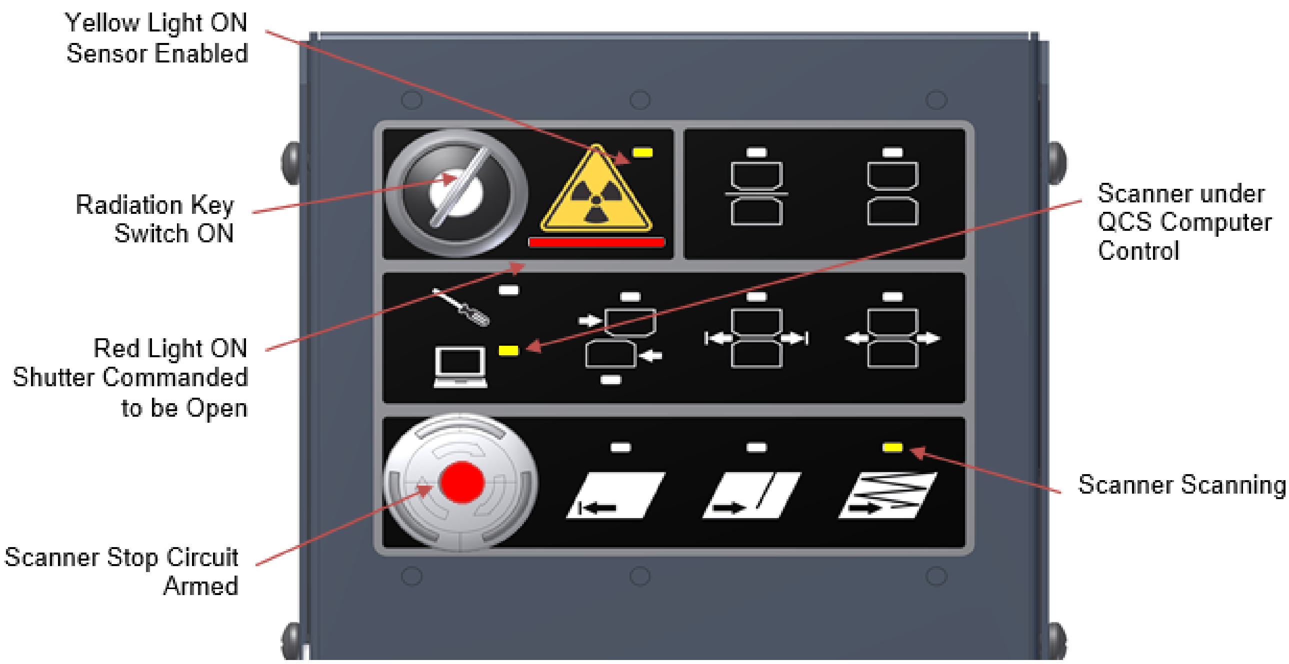


Figure 2-9: Typical user control panel during scanning operation, red light shutter open radiation status on

In this example:

- The radiation sensor interlock switch is in the ON position

- The radiation sensor has been enabled, as indicated by the yellow light above and to the right of trefoil symbol/button
- The shutter was commanded open, as indicated by the large red light bar below the trefoil symbol/button

The following figure shows a safe working condition indicated by the user panel radiation status lights. In this case the green shutter closed indicator is ON at the upper head and the red shutter indicators are all OFF at the user control panel and head.

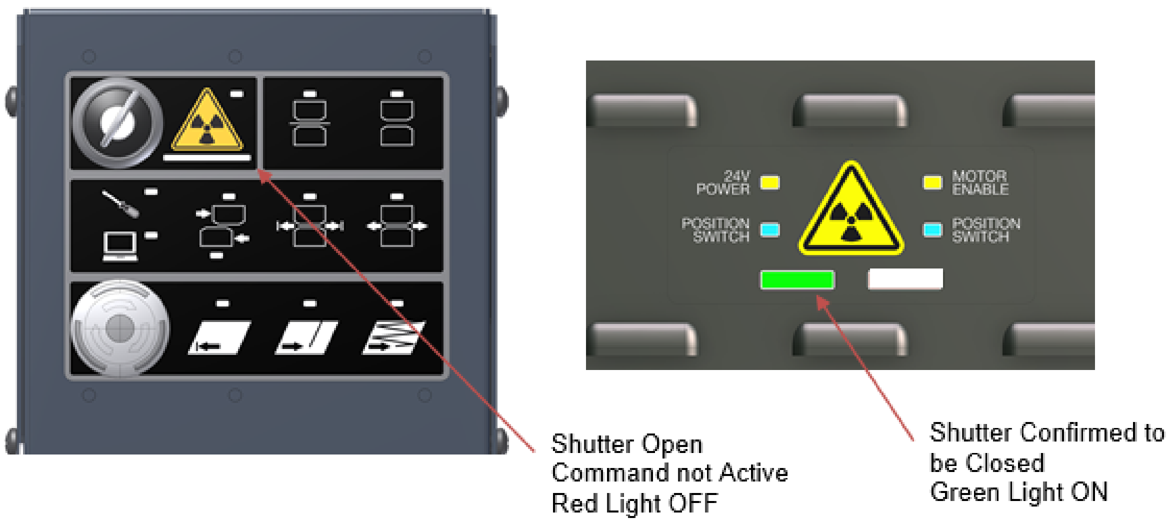
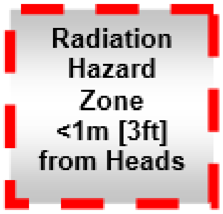
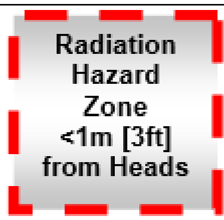
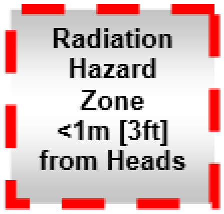
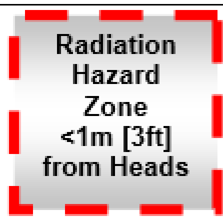


Figure 2-10: Safe user panel radiation shutter status, green light on

Table 2-3 summarizes nuclear and X-ray radiation hazards, warnings, and safety precautions to be used in systems with a nuclear or X-ray-based sensor.

Table 2-3: Nuclear and X-ray Radiation Hazard Precautions

Hazard Type	Warning	Safety Precaution
 Green Indicator **OFF** Red Indicator **ON**	Green Indicator **OFF** indicates that a radiation shutter switch is open. Red Indicator **ON** indicates radiation shutter commanded open. Work in the area <1m from head exposes the worker to trace amounts of radiation from sensors while heads are aligned.	Work in this area (<1m from head) requires closing all shutters first. Do not look into or insert body parts into gap.
 Green Indicator **ON** Red Indicator **OFF** Interlock key **REMOVED**	Green Indicator **ON** indicates that all shutters are closed. Red Indicator **OFF** indicates radiation shutter commanded closed. No nuclear radiation exposure hazard.	Normal maintenance work may be performed on the scanner, measurement modules, and sensors in this area. The highest level of safety control when the interlock key is removed by the person doing maintenance work.

Hazard Type	Warning	Safety Precaution
 Green Indicator **ON** Red Indicator **ON**	Not a normal operating mode when persistent. May occur briefly during shutter open sequence, or if a shutter cannot open, for example, due to lack of air pressure. Green Indicator **ON** indicates all shutters are closed. Red Indicator **ON** indicates a shutter open command is active. No nuclear radiation exposure hazard.	No nuclear radiation exposure hazard. Troubleshoot radiation warning system if state is persistent.
 Green Indicator **OFF** Red Indicator **OFF**	Not a normal operating mode. May occur if a shutter is stuck open, power is off, or if green light circuit is not functioning properly. Green Indicator **OFF** indicates shutter may be open. Red Indicator **OFF** indicates no active shutter open command. Nuclear radiation exposure hazard may be present.	Assume nuclear radiation exposure hazard may be present. Do not split measurement modules. Troubleshoot radiation warning system.

2.2.3.2. General Radiation Safety Precautions

The Honeywell system has been designed with built-in safety interlocks to handle anticipated hazards. However, there are a few additional common sense rules of safety that must be followed. All personnel working in the area around the measurement modules must become familiar with a few basic precautions regarding these types of devices.

- Even though the external radiation field is minimal, personnel should not linger near the measurement modules. Only authorized and qualified personnel with direct business near the measurement modules are permitted in this area.
- Do not open or dismantle the measurement modules. Only authorized and qualified individuals are permitted access to the internal head assembly. Do not insert hands, fingers or other parts of your body in front of the beam exit window. Avoid any direct body exposure between the sensor heads.
- Do not look directly into the space between the heads if the shutter is open.
- Before approaching the sensor head, determine the status of the source shutter by observing the shutter status lights. The Red light is ON when the shutter is commanded open and radiation is being emitted. The Green light is ON when the shutter is closed and no radiation is being emitted.
- If the head becomes damaged or misaligned, turn the main scanner power off to ensure the source shutter is closed. Authorized personnel must examine the equipment before returning it to service.
- A site survey must be performed whenever damage to the scanner is suspected.
- In the event of a fire near the scanner, turn the equipment off and put extinguish the fire. Extinguishing the fire is the highest priority. Authorized and qualified service personnel must examine the equipment before returning it to service.
- For systems that have been installed with a radiation gate, the shutter closes and the heads move offsheet each time the radiation gate is opened. Any failure must be reported to the authorized and qualified service personnel.
- Authorized and qualified personnel must verify the shutter mechanism and interlocks for proper operation every six months.

- A site survey must be performed whenever changes are made to the gauge operating parameters that might affect the radiation field around the sensor.

2.3. Scanner Safety Features

To ensure safe operation a number of features have been developed around the mechanical, electrical and sensor radiation subsystems. This section provides an overview of these safety systems to ensure understanding by the user and continued proper operation.

2.3.1. Mechanical safety features

The description of mechanical safety features are in the following sections.

2.3.1.1. End Cabinet Covers

Description

Electrical equipment is housed in two cabinets at either end of the scanner. These cabinets are accessible through the cabinet doors locked with two square key latches at the top to prevent unauthorized access. See **Figure 2-11**. A warning label indicates that the user should consult the manual prior to opening the enclosure.

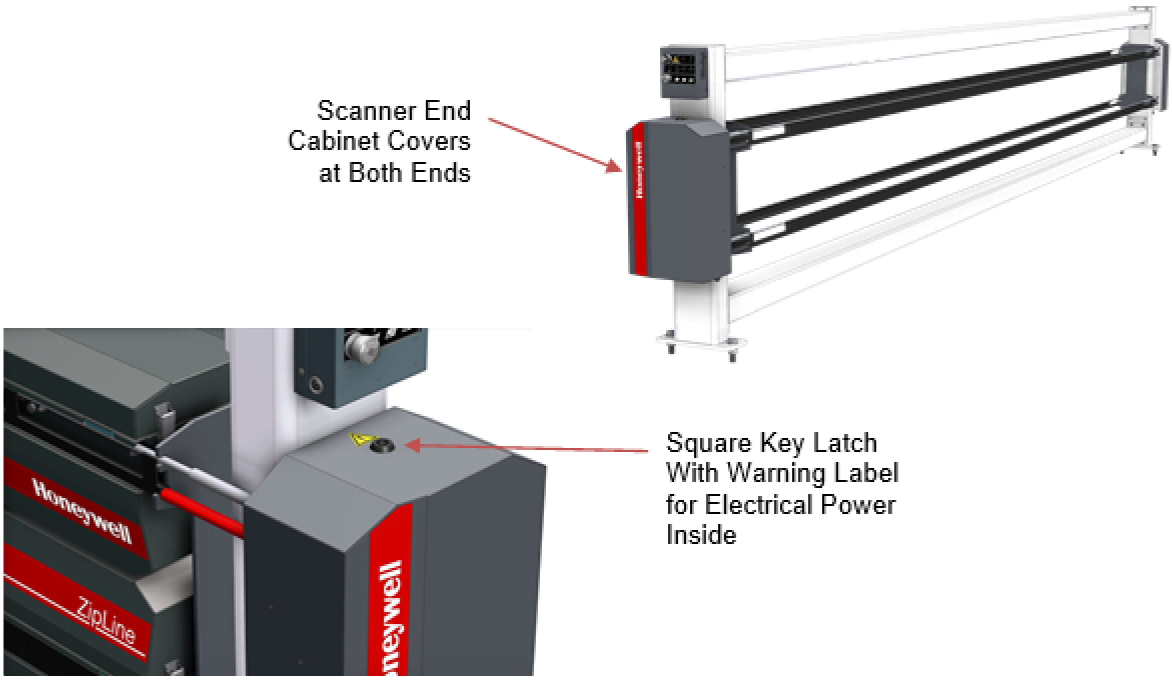


Figure 2-11: Scanner Cabinet Door

Purpose

The enclosure at one end contains the AC termination rail, 12VDC and 24VDC power supplies, circuit protection breakers and fuses, and the MSS computer. This end of the scanner is called the termination end or cable end.

The other end protects exposed power rail fittings and EMI filters. Voltage levels at this end are at or below 24VDC.

2.3.1.2. Scanner stop button

Description

The scanner stop button is a grey push button located on the user control panel. See **Figure 2-12**.

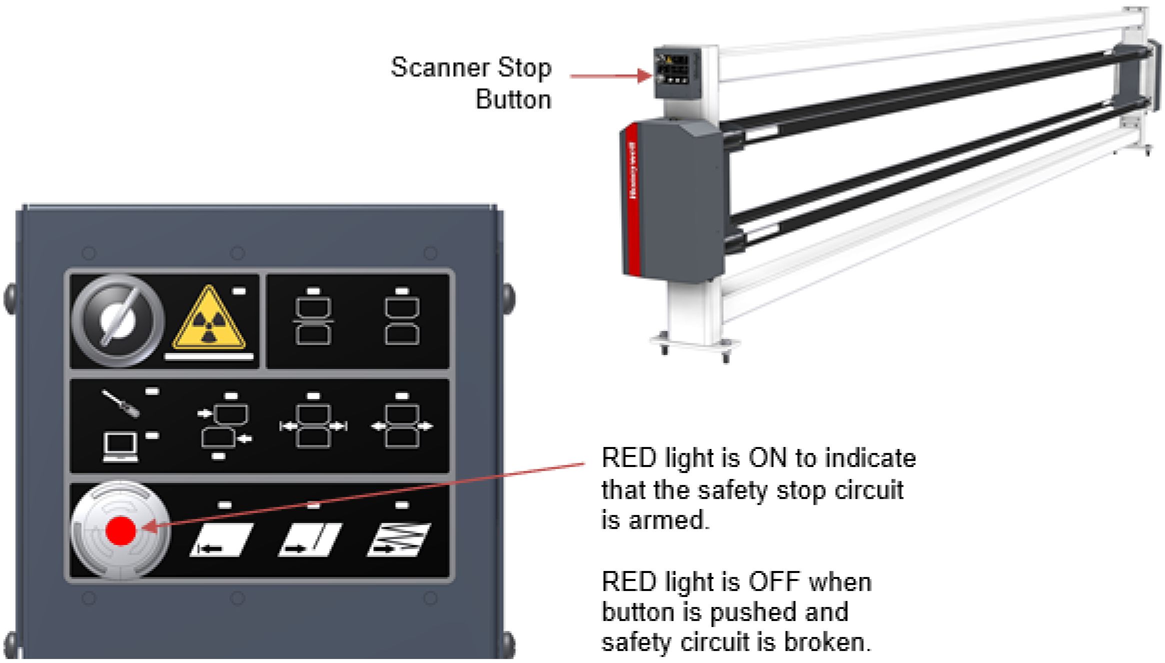


Figure 2-12: Scanner Stop Button

Pushing this button on either end of the scanner electrically disables the enable signal to the motor drive and provides alarm information to the system computer.

Twist and pull button back out to re-arm the stop circuit.

A red LED is ON when the button pulled out to indicate that the stop circuit is armed and the scanner motor can be enabled.

The red LED is OFF when the button is pushed in to indicate that the safety stop circuit is broken and the motor drive is no longer enabled.

When two user control panels have been installed and two stop buttons are in the system, the first button that is pushed in will turn off its red indicator light. The second button that is not pushed in will BLINK red to indicate that the circuit is disarmed by the first button.

Purpose

Push this button to quickly stop scanner motion in an emergency, or ensure that the scanner heads do not move unexpectedly while working in the area around the heads. For example, cleaning covers, inspecting rails and motor belt adjustments.

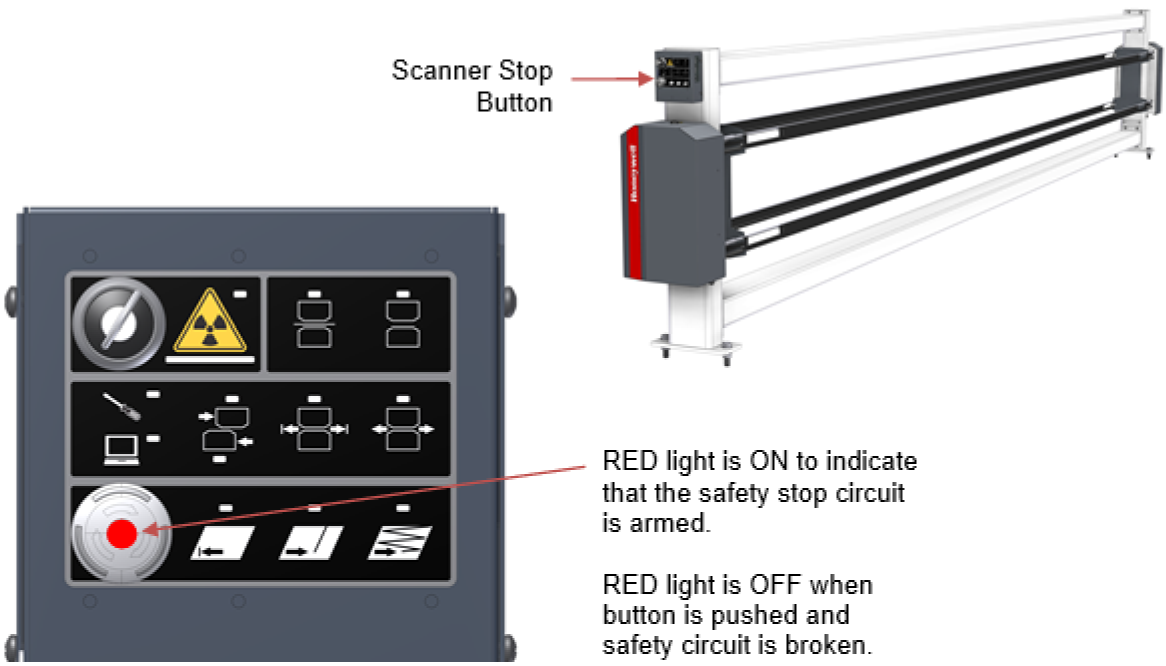


Figure 2-13: Scanner Stop Button

2.3.1.3. Head stop cushion

Description

The scanner frame contains head stop cushions at each end for each of the upper and lower heads.

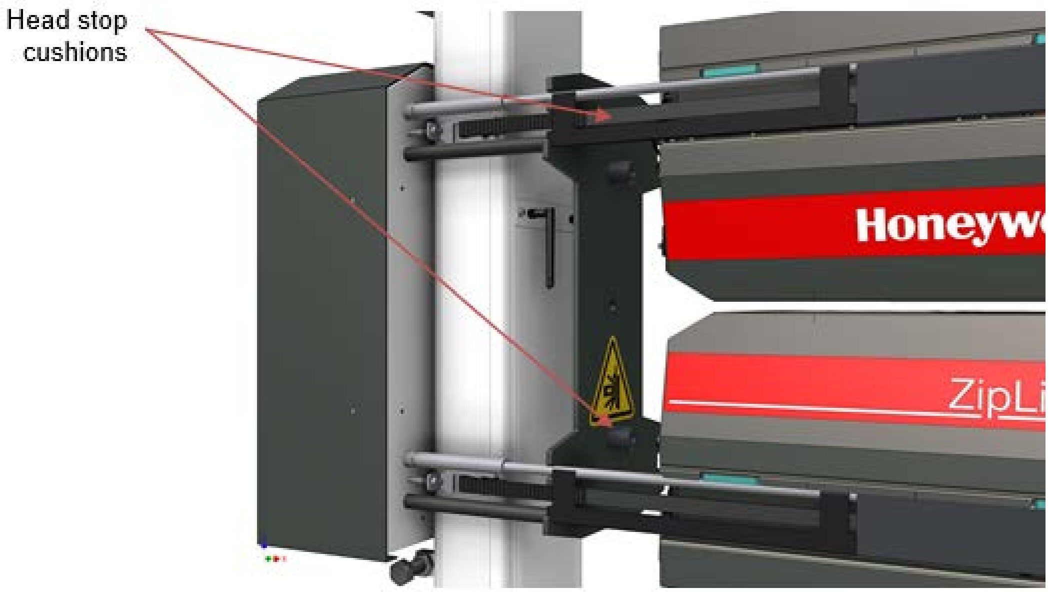


Figure 2-14: Head stop cushions

Purpose

The head stop cushion is used to gently arrest the horizontal motion of the head in the event that the scanner fails to stop at its configured software scan position limit. Impact with the end plates may happen during initial startup if the heads are located outside the boundaries of the magnetic crash position markers.

2.3.2. Electrical safety features

2.3.2.1. ON/OFF main power switch

Description

Scanner power can be turned off without opening the endbell enclosure by using the scanner power switch located on the bottom of the cabinet. See **Figure 2-15**.

Since certain mill regulations only permit entry to electrical cabinets by certified electrical personel, this permits scanner power control by a larger group of users.

WARNING

Mill-supplied AC power terminates inside the cable end cabinet. Even though the scanner power switch is in the OFF position, AC power is still provided to the scanner input circuitry: Cables, EMI filter, and power switch (see OVERALL POWER SCHEMATIC – 80801938AS03)

To fully disconnect the power from the input circuitry and scanner AC cables, deactivate the circuit breaker at the power distribution room located outside the scanner (that is, mill/site circuit breaker panel).

Figure 2-15: Main power switch

2.3.2.2. Mill main power breaker

Description

This is the safest level of protection as it cuts all power feeding the scanner and permits work on the main power connections.

Purpose

Electrical Lockout/Tagout allows for power control of a system or subsystem by workers, in accordance with mill rules and safety regulations.

2.3.2.3. Motor drive interlock

Description

The scanner motor drive interlock is an armed software circuit that disables the motor drive power supply when voltage is broken by either faulty wiring or either of the scanner stop operator buttons at the user control panel. See **Figure 2-16**.

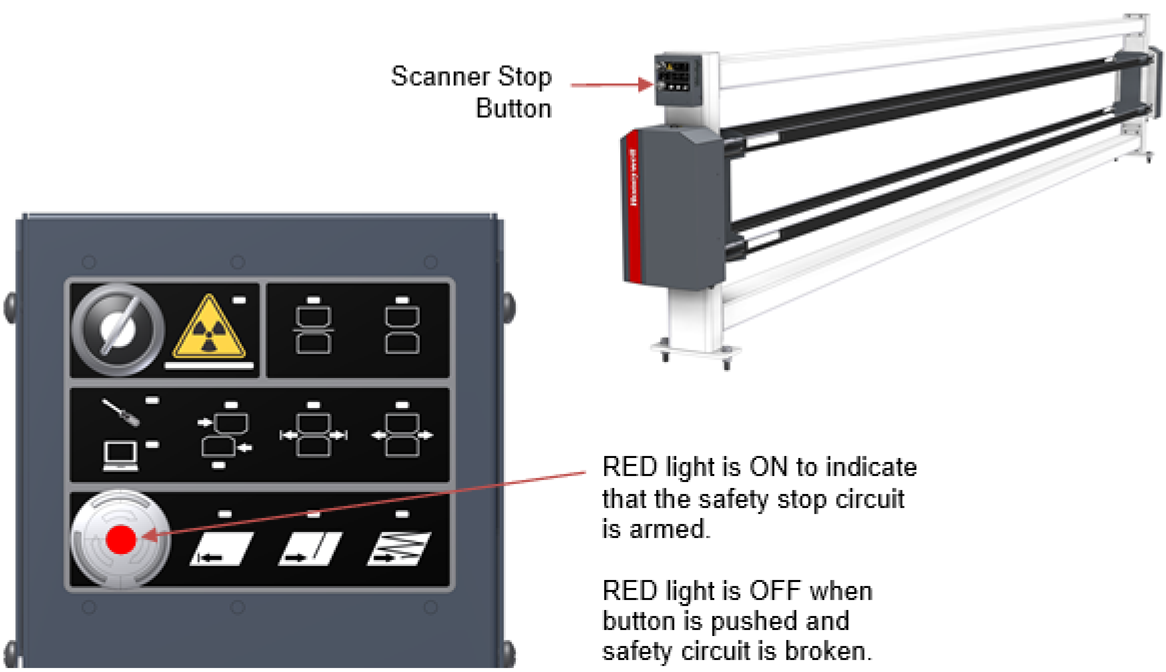


Figure 2-16: Scanner stop button

Purpose

This circuit prevents the motor drive from being powered, to allow safe maintenance work to be done on and around the heads.

2.3.2.4. Heads aligned interlock

Description

A magnetic reed switch mounted into the lower head sheetguide, triggered by a magnet in the upper sheetguide. The signal is armed when the heads are together and is reported to the lower head alley EDAQ. Moving the heads apart breaks the interlock. See **Figure 2-17**.

Figure 2-17: Heads aligned magnet switch

Purpose

The head split interlock is checked by a number of scanner subsystems including:

- Radiation (X-ray, nuclear, and laser) based sensor software to ensure that the opposing hardware is in place to capture potentially dangerous radiation beams that would otherwise propagate in an unsafe manner.

- Frame control software to ensure that both heads properly aligned prior to scanning. May also indicate that a head or belt has become disconnected from the drive system.

2.3.2.5. Green, shutter closed, indicator interlock

Description

The green shutter closed indicator is driven by a simple hardwired (not computer-based) circuit serially routed through each radiation sensor in the upper head only.

Sensors with nuclear or X-ray radiation based shutter controlled sources route the signal through micro-switches attached to the shutter closed positions.

Empty sensor positions or sensors without radiation hazards use a jumper in the wiring harness to complete the circuit.

The green light circuit does not extend to the user control panel due to the wireless head communication architecture.

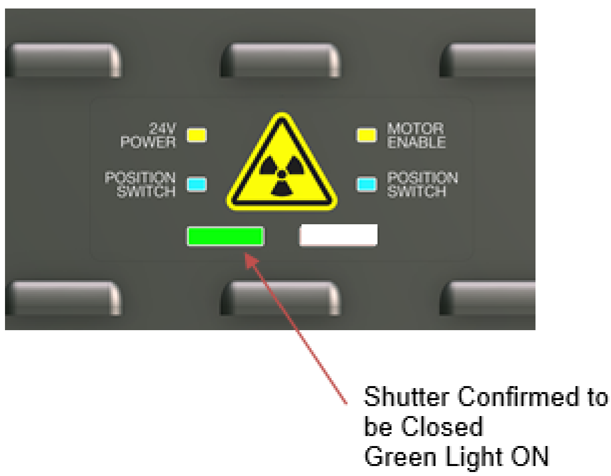


Figure 2-18: Green shutter closed indicator on upper head

Purpose

The green light is used by personnel to ensure that radiation sensor shutters are safely closed before working on the scanner heads.

Heads cannot be split with the user control panel buttons without a green light showing all shutters closed.

2.3.2.6. Circuit protection

Description

Electrical wiring is protected from overloading through the use of current protection devices including:

- Fuses
- Positive temperature coefficient (PTC) auto resetting fuses
- Breakers
- Surge protection

Purpose

These devices limit the current through wiring and limit the damage caused by overload conditions due to wiring or circuit board faults.

2.3.3. Radiation Safety Features

2.3.3.1. Radiation safety warning indicators, Red and Green lights

Description

Red and green radiation shutter status indicators are mounted to the upper head (see **Figure 2-19**), and integrated into the user control panel at the end of the scanner (red light only). A radiation warning label is in close proximity to these indicators.

All indicators use redundant PCB mounted LEDs with feedback to allow confirmation of proper operation back to the supervisory system for diagnostic alarms.

Indicators on the head are not sensor specific. The green indicator will be lit only when *all* sensor shutters are closed, see **Figure 2-19**, and the red indicator will be lit when any sensor shutter is commanded to open (see **Figure 2-19** and **Figure 2-20**.

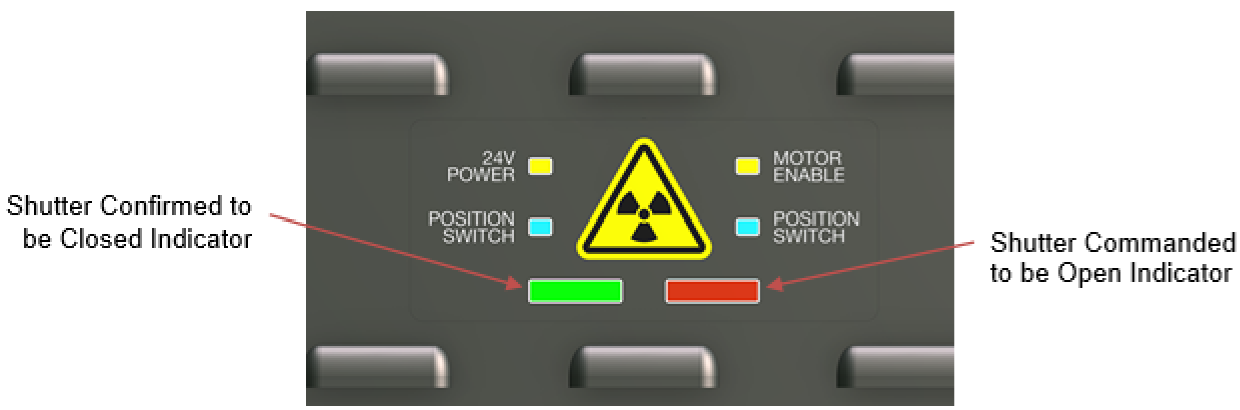


Figure 2-19: Green and red radiation shutter status indicators on head

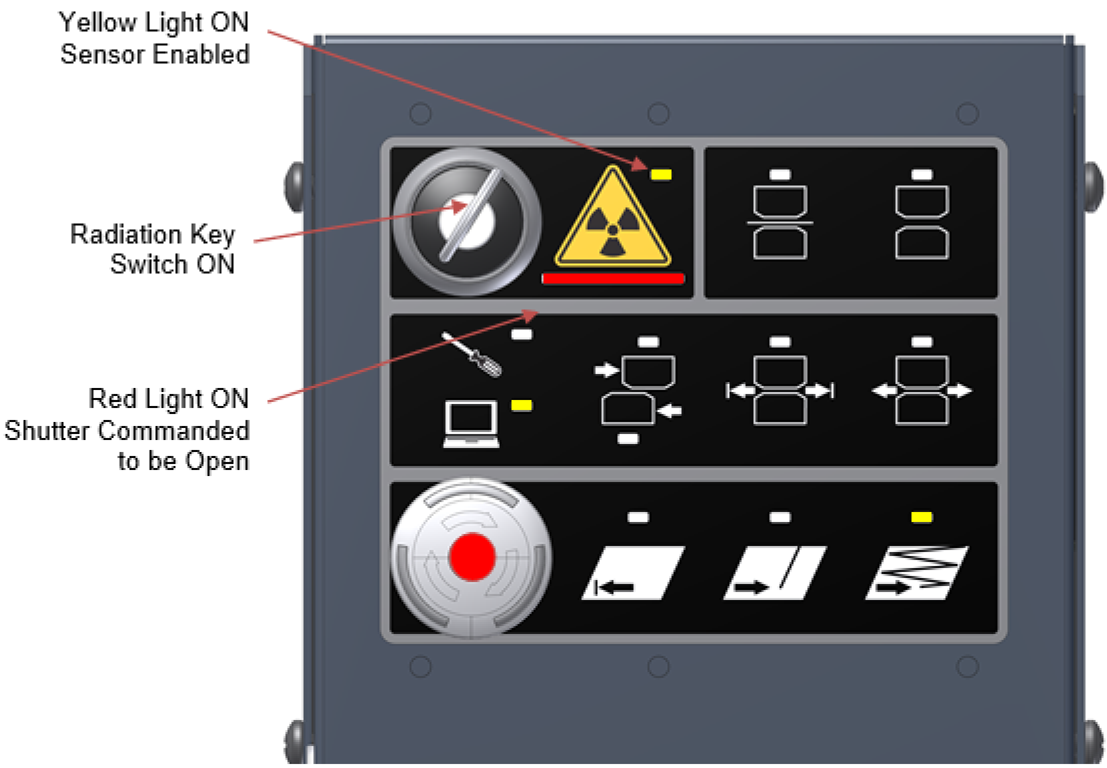


Figure 2-20: Red shutter status indicator on user panel

A yellow indicator above the **Radiation Sensor Enable Trefoil** button indicates whether the sensor has been enabled, **Figure 2-20.**

Purpose

The red and green indicators on the user panel and heads indicate the shutter status of radiation, X-ray or nuclear, sensors. They determine if sensor heads are safe to be approached within the 1m (3ft) radiation hazard zone. See **Table 2-4**.

Table 2-4: Red green shutter status indicator safety summary

Indicator	Shutter Safety Condition
Green Only	All microswitches activated by sensor shutters are in a safe closed position. It is safe to work around the scanner head.
Red Only	A command to open a shutter has been issued by the control system and a shutter is open (green light off). Stay back 1m (3ft) from heads.
Green & Red	A command to open a shutter has been issued, but the sensor shutter has not physically opened for some reason. This is a safe condition but not a normal operating mode. The system may need repairs.
No Green or Red	The green light circuit has been opened by either a sensor shutter switch or incorrect wiring. No shutter open command is active. This is not a normal operating mode, assume that a radiation shutter may be stuck open and troubleshoot system.

The green light also provides an interlock control to ensure safe operation of the head split mechanism. The head split command from the user control panel will be ignored if the green indicator is not ON.

The shutter status safety indicators on the measuring heads provide a second, indicator set if you are working inside the scanner frame and cannot see the endbell user control panel status lights. If the indicators are glowing green, the shutters are closed and it is safe to approach the heads. If they are glowing red, a shutter is open and the measuring heads should not be approached. See **Figure 2-21**.

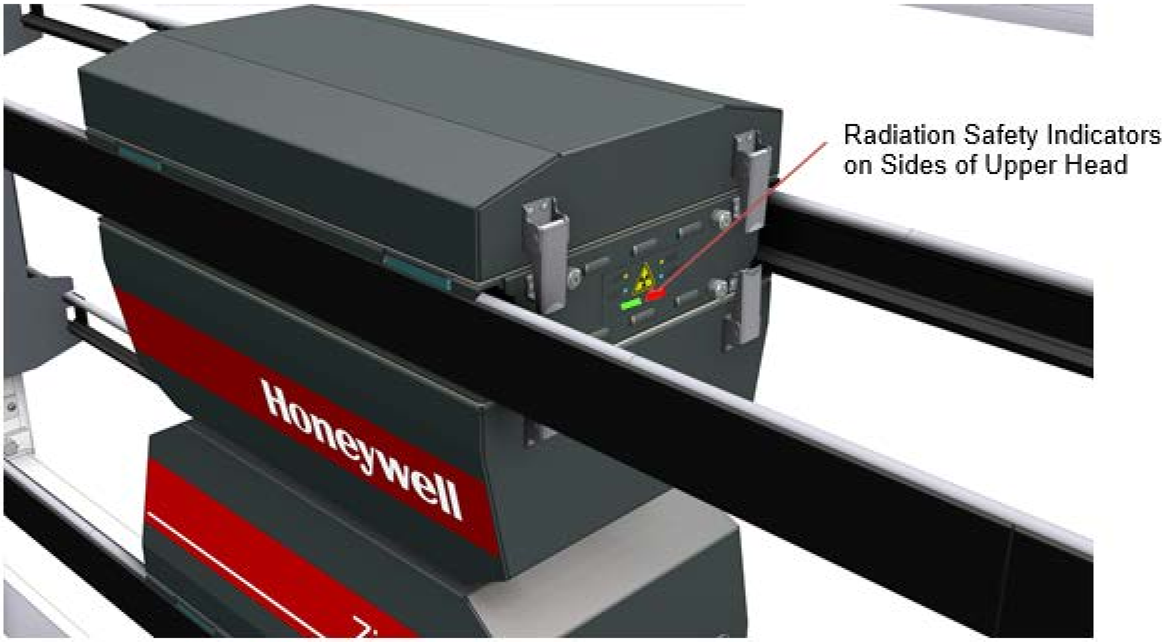


Figure 2-21: Radiation safeyty indicators on upper head

2.3.3.2. Radiation key switch

Description

Sensors associated with safety hazards feature a lockout key switch on the user control panel.

When the key switch is activated, radiation sensors can be enabled for operation by pressing the trefoil radiation enable button. The radiation symbol will then show as being enabled with a yellow indicator light. See **Figure 2-22.**

When the key switch is turned off, the yellow indicator is not lit and sensors will not be enabled when the trefoil icon/button is pressed.

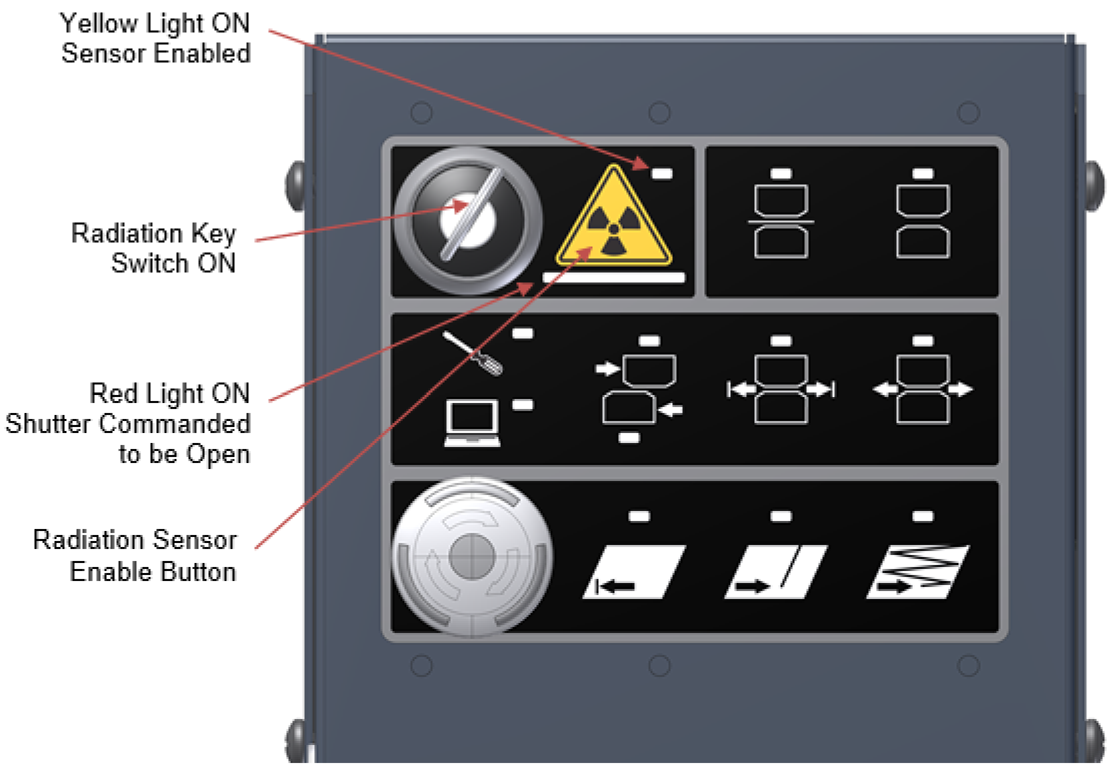


Figure 2-22: Radiation key switch

Purpose

The sensor key lock allows for lockout/tagout of sensors enabling safe work to be conducted near the scanner head and sensors, in accordance with safety regulations.

Since the worker has control of the key, a coworker cannot inadvertently re-enable hazardous sensors.

2.3.3.3. Head alignment interlock (head split switch)

Description

To ensure that the upper and lower head are in rough alignment proximity, a magnet and limit switch arrangement is employed in the opposing sheetguide assemblies so the limit switch will open if one head is moved further than 25mm (1in) from the other. The switch output is connected to a digital input on an EDAQ PCB and is reported to the rest of the control system for interlocking purposes.

Purpose

If the upper head does not completely cover the lower head, radiation from sources are not properly captured and poses a hazard.

As a result when heads are split apart, all sensors lose their interlock permissions, source shutters are closed and lasers are turned off. No shutter can be opened while heads are split due to lack of interlock permission.

Scanner drive motion functions are disabled when the heads are split.

2.3.3.4. Sensor In Place Interlock

Description

A switch on the radiation sensors ensures that they are mounted to the head platform. The switch is connected to a digital input on the sensor EDAQ boards.

Purpose

This switch ensures that there is an appropriate capture device facing a source to limit radiation leakage. A sensor shutter will not open if the sensor in place interlock is not satisfied.

2.3.3.5. Shutter closed signal level

Description

A software algorithm that monitors signal levels from receivers opposite from radiation sources.

Purpose

The algorithm checks for signal levels below a threshold level to ensure that the shutters are properly closing.

2.3.3.6. Failsafe shutter power interlock

Description

An interlock circuit on the power distribution board that controls access to shutter power.

Purpose

The interlock circuit uses a watchdog output from the sensor EDAQ to ensure that the EDAQ hardware and software are operating properly prior to enabling power to shutter mechanisms. This failsafe prevents unintended opening or failure to close source shutters due to latched digital outputs, software program freezes, or incorrect sensor type software connected to radiation sources.

2.3.3.7. Source to receiver communication pairing

Description

A software algorithm that detects communication failure between electronic devices in the radiation safety chain.

Purpose

Due to the distributed scanner EDAQ architecture, radiation safety tasks are controlled by separate EDAQ boards. If one or more of the EDAQ boards are not communicating with the others then tasks may not be completed or safety status information may not be passed to other devices.

If the communication chain between devices in the upper and lower heads and cable end electronics is disrupted, shutters will fail closed, heads will be sent offsheet and a safety alarm will need to be cleared before scanning can resume.

2.3.3.8. Sensor position mapping

Description

A coded resistance value at each sensor power port on the head that is read by each sensor EDAQ board at power up to determine its location in the upper and lower heads.

Purpose

The mapping of sensor locations allows for a software check to ensure that appropriate sources and receivers are properly positioned and matched as a pair.

2.3.3.9. Source locks and tamper proof screws

Description

Locks on radiation sources that secure source assemblies to head platforms.

Tamper proof screws on radiation source platform secure sensor modules to head assembly.

Purpose

These screws and locks restrict removal of radiation sources to authorized persons only.

3. Site Preparation

This chapter contains information on providing the proper environment for the installation of the Q3090 scanner.

This chapter includes a site preparation checklist (see **Table 3-1**) and describes activities such as:

- Providing electrical power, grounding connections, and field IO signal wiring to the scanner.
- Protecting the scanner from process operations.
- Ensuring radiation safety.
- Scheduling installation personnel, including contacts for setup of installation parameters.

Table 3-1: Site Preparation Checklist

Customer Name	
System Number	
Ship Date	
Start Date	

	Item	Reference Section
☐	Obtain the current baseline set of installation drawings	3.1
☐	Choose a scanner location	3.2
☐	Complete the system description form and submit to the Honeywell factory order manager	
☐	Obtain production release and validate against system description	
☐	Build mounting pedestals	3.3
☐	Obtain lifting equipment	3.4
☐	Install cabling	3.5
☐	Install interlock and external signal wiring	3.6
☐	Plan radiation safety	3.7
☐	Schedule installation personnel	3.8

3.1. Obtain the current baseline set of installation drawings

The first step in installing the scanner is to obtain the most recent version of the installation drawings, Honeywell p/n 6509309000IN. These drawings include the most recent dimensions and specifications for the scanner installation and should be used when preparing the site for installation.

Several drawings make up the drawing set, including:

- Scanner dimensions
- Scanner electrical supply specifications
- Pedestal mounting design
- Scanner mounting details
- Scanner cabling and wiring details

The latest set of drawings is shipped with the system.

All Honeywell field project managers have direct internet access to drawing storage sites. Drawings can also be obtained from your Technical Assistance Center (TAC).

3.2. Choose a scanner location

Before selecting the installation location for the scanner, remember that the selected location must satisfy *all* of the following requirements:

- The safety of personnel working around the scanner, including operators and service personnel.
- The appropriate location on the machine to measure the desired parameters for observation and successful control.
- Ensuring adequate space for the scanner frame, passage of the sensor heads, sensor calibration access, cover removal, end access and unhindered access to service the scanner.

- Suitable temperature, humidity and contaminants within the scanner environment.
- Suitable cabling, conduit and cable tray routes.

Location safety

When selecting a scanner location, the first consideration must be given to the safe operation of the scanner. Observe the locations and other equipment on the machine that operators must access. This is especially true during threading of the machine.

Some scanner locations may require moving or modifying existing threading rope-runs or belts, or the addition of threading conveyors to safely thread the machine after the addition of the scanner.

Interlock permissions may need to be planned for if sheet threading conveyors are to operate in the same space as the scanner.

Space constraints

The location chosen must provide enough space for:

- The scanner mechanical support strutcure
- Measurement module scanning movement
- Mounting pedestals
- Servicing of scanner components: head and end enclosures
- Servicing of other nearby equipment

Environment considerations

The scanner environment must also be considered when locating a scanner.

Where possible, avoid locating the scanner in very hot or humid environments. Cool and dry locations are better for service personnel maintaining the scanner and better for maximizing the life of the scanner. Scanner length may be increased to allow the heads to scan clear of the hottest temperatures near the machine.

Avoid the splatter of other machine equipment like water, hydraulic oil, grease, coatings, etc. Erect shields if necessary to protect the scanner from sources of splatter as well as sources of strong heat.

For certain applications, consider protecting the scanner from high-potential static electricity. Typically, this is required for applications exceeding 20kV.

Cabling considerations

Consider how cabling will be run to the scanner. Conduit routing is best run from below, and will likely come up through the floor adjacent to the scanner pedestal.

For communication cables, consider the maximum allowable lengths. This may dictate the media selected (100BASE-T vs. fiber-optic).

3.2.1. Allocate space

Factors to be considered when allocating space for the scanner include its dimensions and weight, as well as the operations required to install and service the scanner. They are described in Subsection **3.2.1.1** through Subsection **3.2.1.3**.

3.2.1.1. Scanner dimensions

Mounting pedestals raise the scanner to achieve the correct passline height (see **Figure 3-1**).

The Inside Scanner length “T”, see **Figure 3-2** is measured between the inside of the rail alignment end plates and is site-dependent.

The scanner length at a particular site is a function of web or sheet trim width, head and sensor configuration, process and environment conditions, and site specific spatial contraints.

In the installation drawings, see sheet 1 duplicated in Figure 3-2 it is also important to note *J* and *K*, and the minimum distance to the sensor center line. These dimensions are important because they indicate the required distance to stop and reverse the head direction while scanning. For more information, refer to the full set of scanner installation drawings.

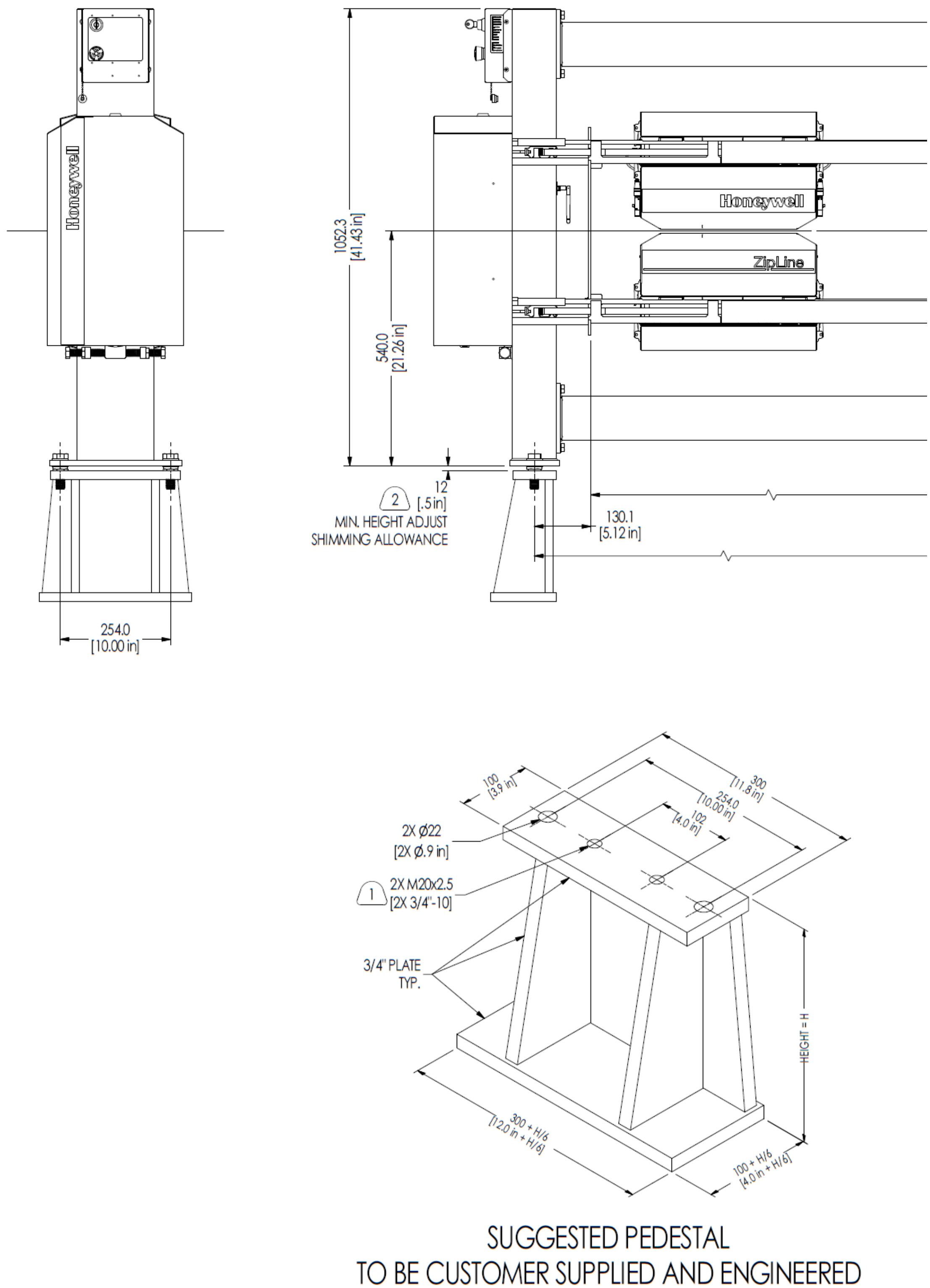


Figure 3-1: **Pedestal Dimensions, see drawing 09309000IN**

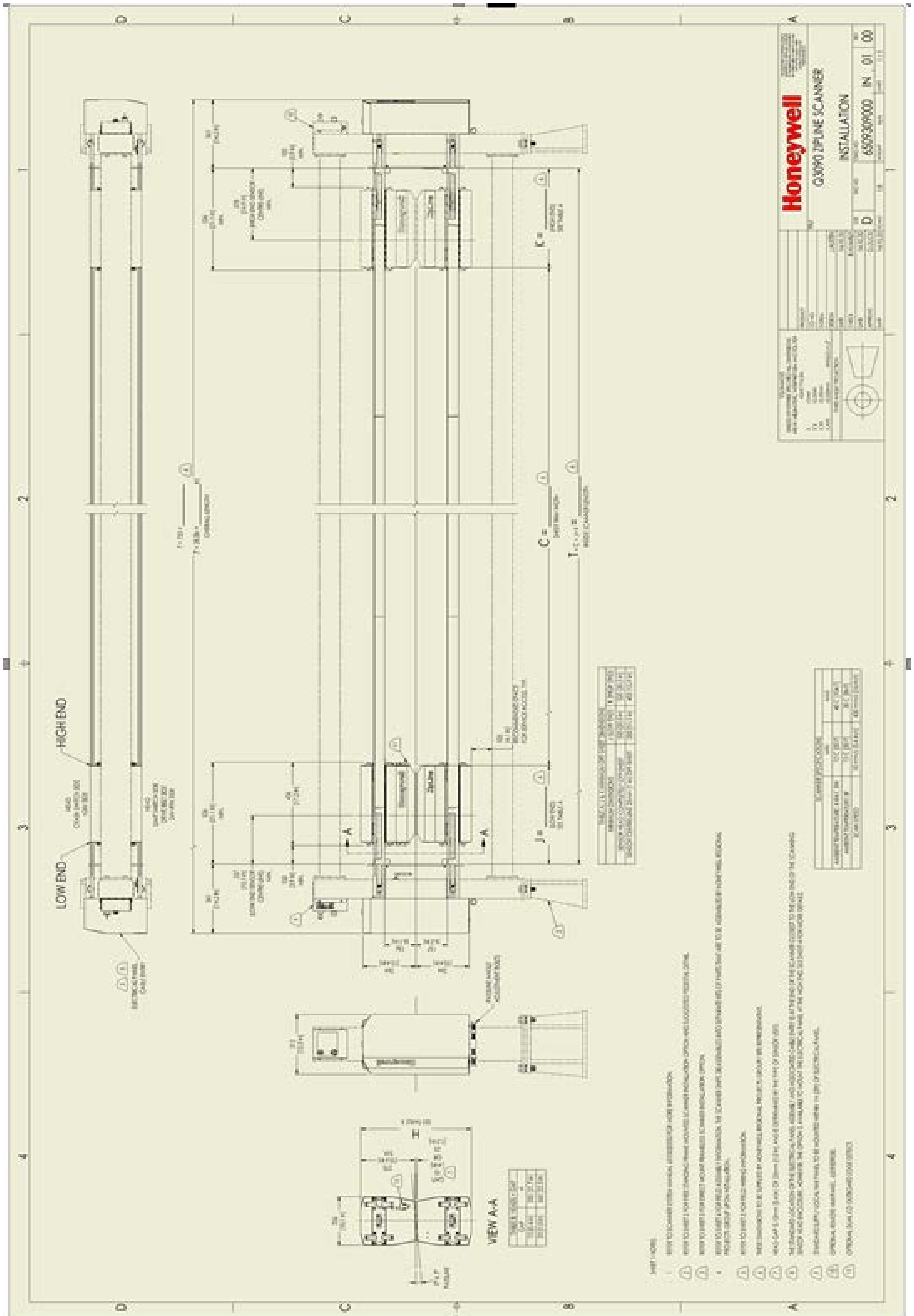


Figure 3-2: Scanner Dimensions, see drawing 6509309000IN

3.2.1.2. Head dimensions

The installation drawings show the scanner and head. See **Figure 3-3**.

The scanner supports pass angles up to ±5 degrees from horizontal.

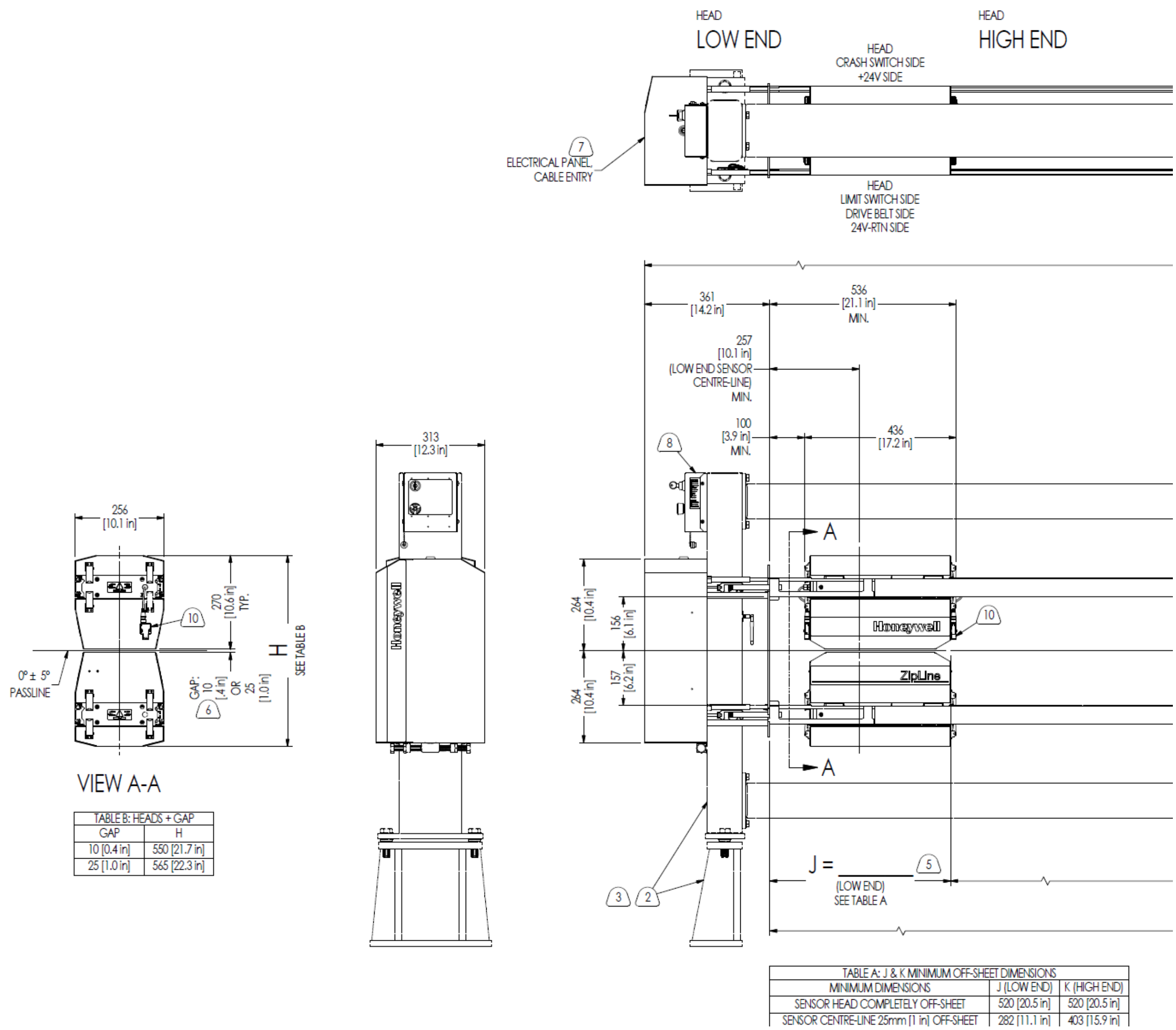


Figure 3-3: **Head Dimensions, see drawing 09309000IN**

3.2.1.3. Clearance requirements

Various types of clearance space must be provided, including:

- Cover removal at both ends of the scanner
- Head access for maintenance and calibration
- Service access for the scanner and adjacent equipment
- Roll removal and retract paths for adjacent rolls
- Rope runs or belts
- Threading conveyors

Space must be provided at the side of the scanner to allow inspection of the cables, extrusion and for inspection/change of the belts.

Space must be provided not only for the scanner and servicing the scanner, but also for equipment, and servicing the equipment around the scanner. This includes servicing and removal of rolls near the scanner.

Threading rope-runs, belts, or conveyors often create challenges for locating scanners. Often, rope-runs must be rerouted or retracted to allow space for scanners. Conveyor retraction must be checked for interference with scanner beams and heads. In cases of potential interference, hand-shake interlocking is required to ensure that the heads do not scan until the conveyors are retracted, and that the conveyors are not advanced until the heads are parked. Similar methods may be used for rope retraction systems.

3.3. Build mounting pedestals

The standard factory supply *does not* include the pedestals. Pedestals must be manufactured locally, or Honeywell can supply special order custom designs if required. Two mounting pedestals must be built for the scanner end supports in order to raise the scanner to the height required by the sheet passline.

The passline height and head angle depend on the height and angle of the adjacent rolls. These passline measurements can be determined by stretching a length of twine tightly over the rolls, and measuring the height dimension *A* to the floor at the center of where the scanner is to be located (see **Figure 3-1**).

The fixed distance at the center of the air gap between the heads is 540mm (21.3in.) to the bottom of the scanner mounting plates. Mounting pedestals should allow for a gap of 12mm (0.5in.).

The height of the pedestal required is:

$$A - 540\text{mm } (21.3\text{in.}) - 12.0 \text{ mm } (0.5\text{in.}) = H$$

Where:

H = pedestal height

ATTENTION

Mount the pedestals directly to the machine floor to avoid potential vibration concerns. *Do not* mount the pedestals to the machine frame.

3.4. Obtain lifting equipment

Scanner components are delivered for assembly on pallets, enabling it to be easily moved to the installation location with pallet jacks or tow motors. Lifting equipment may need to be required to lift heavy or long components for assembly on machine, particularly when scanner lengths are long and/or at elevated locations.

During site preparation, it is important to work with experienced millwrights to identify the appropriate equipment for safely lifting the scanner and maneuvering it onto the mounting pedestals. Arrangements must be made in advance to have the necessary lifting equipment available for installation.

In general, lifting a scanner requires equipment such as a crane, cables, and slings. The equipment required to lift a particular scanner depends on the following factors:

- Scanner weight and length
- Ease of access and elevation of mounting pedestals:

The scanner weighs 36.4kg/m (24.4lb/ft) of beam length (dim *T*) plus 85kg (187lb). This weight is approximate and may vary depending on the head configuration.

3.5. Install cabling

Site preparation includes installing power, LAN (Ethernet), and process I/O cables. Select conduits and trays for cables in accordance with local regulations.

All cables should be continuous and without splices, and identified or labeled at both ends. Additional cable should be pulled to allow routing within the enclosure to the designated termination point.

The maximum length of the LAN cable between the scanner cable end and the QCS server is dependent on the type of Ethernet cable used.

Refer to your Installation drawings for details.

3.6. Install interlock and external signal wiring

Site preparation should also include the assessment and installation of interlocking signals and field IO signals.

If remote scanner control is targeted, for example, interlocks for gate access, provisions for wiring conduits should be planned. Signal voltage and in-rush currents should be evaluated and cable separation and/or specific insulation and shielding should be implemented.

Signal conditioning may be required for mill signals.

WARNING

Do not connect additional AC power cables to the scanner other than what is documented in the production release files. Safety UL/CSA/CE certification may be voided by the addition of any non-documented wiring.

Also, removal and/or bypassing of any safety features, for example, grounding connections, potentially impacts product safety certification. Consult with engineering before any site-specific design changes.

Failure to strictly observe all of these guidelines could result in *serious injury* or *death*.

3.7. Plan radiation safety

Consider what is required to plan the shipment and installation of any radioactive sensors:

- Site licensing: determine if there are any applicable local laws.
- Has the customer identified a radiation safety officer? Has this person been trained?
- Radioactive source shipping arrangements: applies to sensors with radioactive sources, such as a basis weight sensor.
- Site resources to install and test: Who will install the sensor source into the head? Who will perform the installation radiation safety tests, and forward the results to Honeywell radiological operations?

See Section **2.1.2**. for more information.

3.8. Schedule installation personnel

Ensure that you have considered and arranged for the necessary resources for the installation. These resources may include Honeywell personnel, customer or OEM personnel, and contractors. Consider the following resources:

- Resources such as a crane operator and millwrights to physically install the scanner, and shim and align the heads to the process.
- Licensed radioactive resource to install the radioactive source and perform the necessary checks.
- Electrical resources to terminate power and discrete signals.
- Communications resource to terminate and test the Ethernet cable from the scanner to the QCS server.
- Software resources to test communications with the QCS server.

4. Installation

This chapter provides an installation checklist and describes installation procedures, including:

- Inspect the scanner components on receipt
- Receive radioactive sources
- Radiation safety
- Installation of Scanner on OEM Machine Frame
- Standalone Scanner Frame Installation
- Install Scanner Rails
- Level and align the scanner
- Cable the scanner

4.1. Checklist

Table 4-1: Installation Checklist

Customer Name	
System Number	
Ship Date	
Start Date	

	Item	Reference
☐	Scanner parts shipment inspected for damage (pictures to be taken if possible) then unpacked, ensure all parts are present	Section 4.2
☐	Scanner Installation: Verify Pedestals are manufactured as per Installation drawings, install in the correct location. Assemble scanner frame in-place on pedestals	Section 4.3.1
☐	Rail Retainer Plates mounted	Section 4.4
☐	Head support rails and Power transmission rails installed and tensioned to prescribed levels	Section 4.4
☐	Heads placed on rails and centred on passline	Section 4.4
☐	Install head drive belts	Section 4.4
☐	Install Electronics panel	Section 4.4
☐	Mount the HMI Panel	Section 4.4
☐	All covers installed.	Section 4.4
☐	AC power connected.	Section 4.5.1
☐	LAN connected.	Section 4.5.2
☐	Customer inputs connected.	Section 4.5.3

4.2. Inspect the scanner on receipt

4.2.1. Initial inspection

The Honeywell Q3090 CWS Scanners are thoroughly tested and inspected, then carefully packed for shipment. Scanner frame elements are shipped separated into individual sub-assemblies. All parts should be unpacked with the care afforded to any precision instrument.

Before any item of hardware is unpacked, conduct an initial visual inspection and inventory of the shipment as it was received. If there is any evidence of damage, leave the damaged items in the original shipping container and take photos if possible.

WARNING

Do not remove damaged equipment from the shipping container. Leave it *as received*, and contact the factory and shipping company. Take photos if possible.

After all of the parts are unpacked, take an inventory of the items to ensure all required parts are present.

4.2.2. Receive radioactive sources

Additional information on radioactive and X-ray sources and safety is available in the *Radiation Safety Training Manual* (p/n 6510020199).

If licensed personnel have not been scheduled to perform the installation procedures and tests that involve radioactive sources, make arrangements for such personnel immediately.

WARNING

Failure to follow radiation safety procedures *might* cause exposure to hazardous levels of radiation.

If the sensor heads contain a radioactive source (as indicated by labels on the heads), various radiation safety precautions and regulatory restrictions must be observed during installation.

WARNING

The basis weight sensor contains a radioactive source (KR-85, SR-90, AM-241, or PM-147) and/or an X-ray source. OEMs or end users who conduct basis weight sensor installation, required safety tests, repairs, and so on, are required to obtain a radioactive materials license or permit for X-ray sensor servicing, which explicitly authorizes the operations to be conducted and names the individuals who may do so. Otherwise, such operations must be performed by authorized Honeywell employees or other appropriately licensed individuals.

Shipping containers containing basis weight assemblies with radioactive sources are clearly labeled to identify the contents. Scanner heads are not certified containers for transportation of radioactive sources. The scanner and radioactive source are shipped separately. Radiation safety regulations require that only a specifically licensed individual may mount the basis weight assembly into the scanner heads.

WARNING

Do not move or handle a damaged shipping container or sensor head that is labeled as containing a radioactive source until you have discussed the situation with a member of the Honeywell radiation safety staff.

If a container or sensor head marked as containing a radioactive source is seriously damaged, contact Honeywell Radiological Operations. The main contact numbers for Radiological Operations are

ACS Global Radiological Operations in **Duluth**:

- ACS Global Radiological Operations in Duluth: Phone: +1 770-689-0500. group e-mail address: DLACSGlobalRadOps@Honeywell.com

4.2.3. Remove safety shields

In a standard shipment, a safety shield covers any radioactive source. As part of the installation procedure, the shield must be removed by an individual who is specifically authorized to do so under the terms of a radioactive materials license.

ATTENTION

All shields must be removed from radioactive sources before power to the scanner is turned on.

4.3. Frame Installation

4.3.1. Verify and Install Scanner Pedestals

Verify that the pedestals were manufactured to the correct height as per the specific installation and that they meet the required dimensional specifications as per the scanner Installation Drawing (Honeywell p/n 6509309000IN).

Mount the pedestals to the machine floor, and use the jacking nuts on the threaded rod embedded into the floor, or a similar method, to adjust the pedestal height and level.

Do not grout under the mounting pedestals until the scanner height has been adjusted relative to a stringline to ensure that the scanner will not need to be lowered more than the initial 25mm (1in.) gap allowance.

4.3.2. Assemble Scanner Frame

If the scanner was shipped fully assembled, skip to section **4.5**. If the scanner did not ship fully assembled, it would have shipped in four separate sub-assemblies that are to be assembled in-place on the scanner pedestals:

- Qty 2: Frame End Support Weldment
- Qty 2: Frame Spreader Beam Weldment

The assembled scanner frame will look as shown in **Figure 4-1** below.

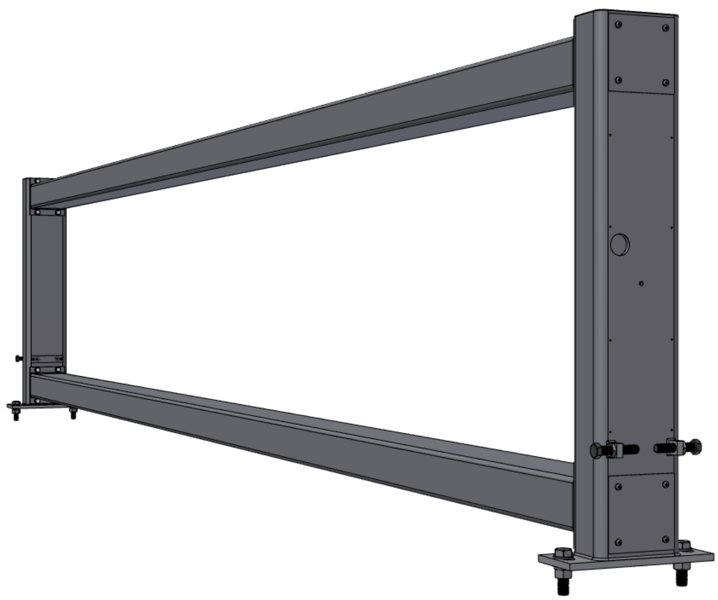


Figure 4-1: **Assembled Scanner Frame**

For further instructions pertaining to assembling the scanner frame, please refer to the Scanner Installation drawing set.

4.4. Scanner Installation

The remaining components of the scanner installation is shipped broken down into the following sub-assemblies and components:

- Qty 2: Rail Retainer Plates
- Qty 4: Head support rails
- Qty 4: Power Transmission rails
- Qty 2: Rail alignment Plates
- Qty 1: Upper/Lower Sensor Head Pair
- Qty 1: Electronics Panel Assembly
- Qty 1: HMI Panel Assembly
- Qty 1: Rail Cover Extrusion Set
- Qty 1: External Sheet Metal Cover Set

The completed Scanner, assembled onto the Scanner frame, will look as shown in **Figure 4-2** below.

Figure 4-2: **Completed Scanner Assembly**

Detailed instructions and assembly steps required in order to complete the scanner assembly are found in the Scanner Installation drawing set (Honeywell p/n 6509309000IN).

4.5. Cable the scanner

All cabling to the scanner is routed through the bottom of the cable end enclosure. For details, refer to the installation drawings.

To provide cables with the best mechanical protection, run them in steel or aluminum conduit (never plastic). If cable trays are used, provide conduit from the cable trays to the scanner. Use cable trays only for types of cable approved for tray installation.

The termination area for hooking up the scanner AC power (110–240V AC) 50/60Hz is located at the bottom of the cable end enclosure.

The terminal blocks to terminate the field wiring are located inside the HMI Panel enclosure

Connect the Ethernet LAN cable from the scanner to the server, see **Figure 4-3**. If a different media for the LAN Ethernet is preferred, a converter must be provided. When the scanner is first connected and communicating with the server, the scanner polls the network and downloads operating parameters from the server. Refer to the scanner installation drawings.

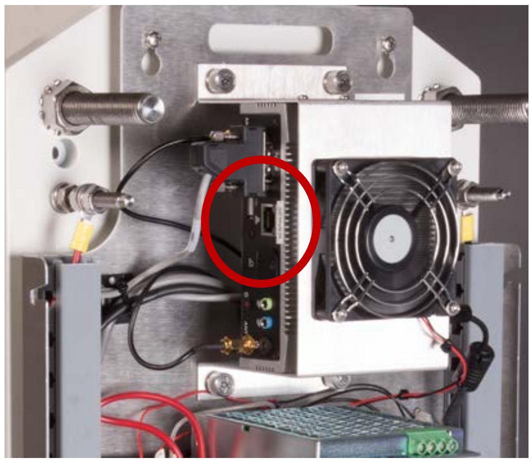


Figure 4-3: LAN connection on MSS side

4.5.1. Hook up AC power

The scanner requires 750VA, 50/60Hz, 110 – 240V AC, single-phase power at the cable end. A double pole circuit breaker (16A) is provided at the cable end at the input of the supply line. A dedicated mill circuit breaker in the main power distribution panel is required for the scanner power.

Applicable local electrical safety and workmanship codes should be followed and performed by certified personnel.

WARNING

All shields and head shipping strapping must be removed from radioactive sources before the power is turned on to the scanner.

To connect AC power and communications cabling to the scanner:

- Run the conduit and a three-conductor cable from a dedicated 20A (maximum 25A) plant circuit breaker to the circuit breaker in the cable end enclosure. Use a short run of flex conduit to complete the connection of the rigid conduit to the scanner. This will facilitate future service and provide for scanner movement.

- A blank aluminum plate is provided on the bottom of the cable end enclosure to allow the customer to drill holes to suit their conduit fittings.
- Terminate the line (L1), neutral (or L2), and safety ground on the provided terminals of CB1 (L1 to CB1-1, L2 to CB1-2) and grounding studs (ground to the protective earth ground stud).

WARNING

Release the line filter terminals protection cover after work completion.

Failure to strictly observe all of these guidelines could result in *serious injury* or *death*.

4.5.2. Hook up LAN network

The scanner communicates with the QCS server over an Ethernet network. The scanner supports 100BaseT Ethernet. If a different media for the LAN is preferred, a converter must be provided. When the scanner is first connected and communicating with the QCS server, the scanner polls the network and downloads operating parameters from the server.

- Terminate the Ethernet cables to the MSS computer LAN1 port in the cable end enclosure (MSS mounted to the door or remotely).
- Power up the scanner (see Section 8.1.10). After powering up the scanner, confirm communications by monitoring the blinking *receive* and *transmit* lights on the MSS network interface card (NIC) (see Section **8.6.11**).
- Refer to the scanner installation drawings.

4.5.3. Hook up field I/O

Signals often need to pass between the scanner and external sources, including:

- Heads parked
- Scan enable
- Sheet break
- Offsheet
- Onsheet

- Reel turnup
- Line speed tachometer inputs

These field wiring signals are to be terminated within the HMI panel enclosure box. Refer to the scanner installation drawings for further details.

5. System setup and verification

Once the full frame, electronics panel, scanner heads and HMI assembly are integrated according to Section 4, proceed with system setup and verification as described in this chapter.

5.1. Confirm scanner standalone mode operation

Ensure the heads are located between the crash switches.

Power on scanner via the power button on the underside of the electronics panel cabinet. The MSS will got through its boot procedure which takes the order of two to three minutes to complete. Wait for this operation to complete and confirm the heads independently move towards the low end, tag the crash switch and advance forward to settle at the limit switch position. The MSS will conclude its initiation in “Auto” mode.

Verify the scanner stop functionality. Press the scanner stop mushroom button on the user control panel. Verify that the upper and lower head motor controllers are disabled as a consequence. The motor controller enabled is indicated by both a head LED indication and direct indication on the motor controller itself. See **Figure 5-1** and **Figure 5-2** for expected indicator light behaviour. Verify this on both heads.

Release the scanner stop button and verify a successful reset. The expected behaviour is that both heads will reverse to the lower crash switch and advance to the lower limit switch and stop.

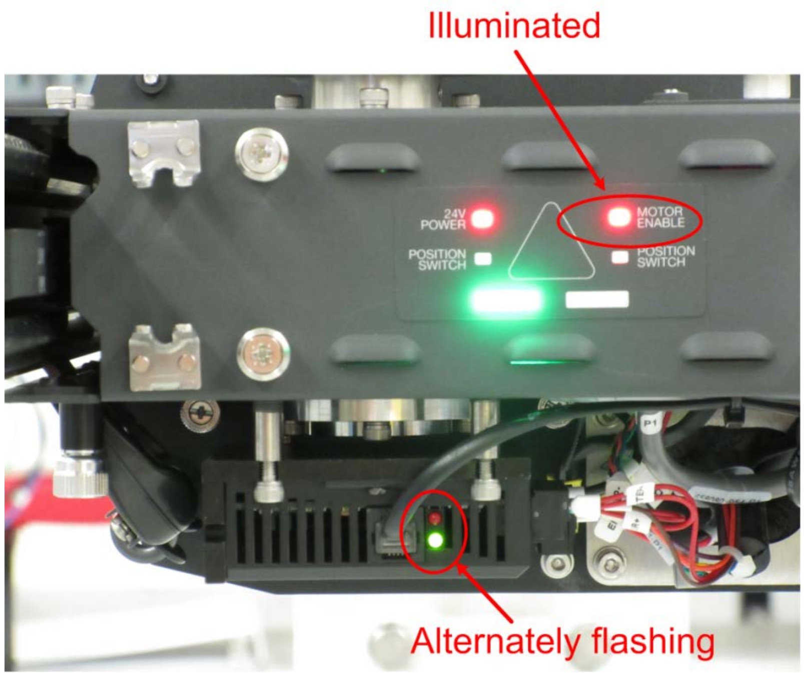


Figure 5-1: Motor controller enabled

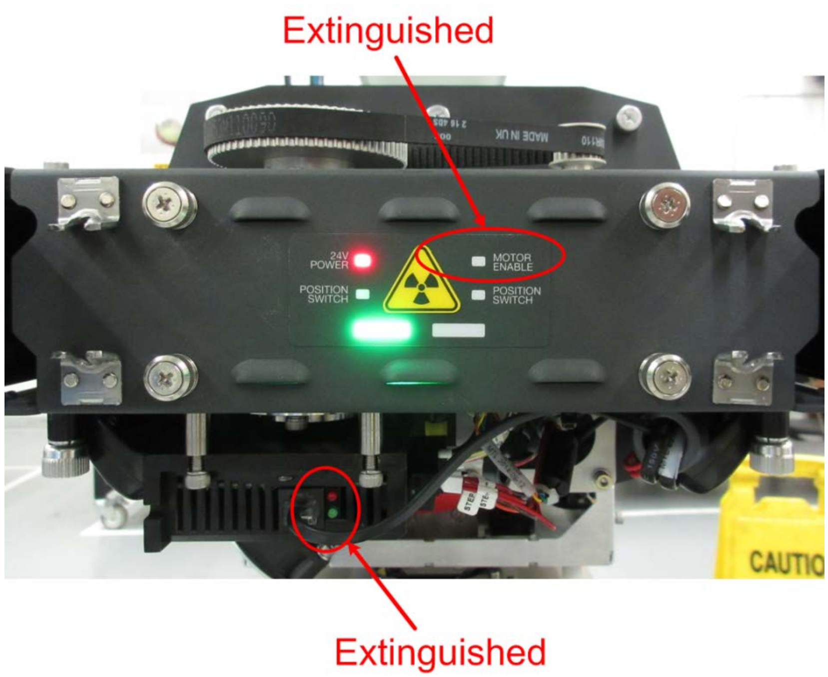


Figure 5-2: Motor controller disabled.

Enter local mode by pressing the “Local” mode button on the HMI panel for three seconds. See **Figure 5-3**.

Figure 5-3: Enter local mode

Confirm the system entered local mode by observing only the head movement indicator and the local mode indicators are on. All other indicator LEDs are extinguished. See **Figure 5-4**.

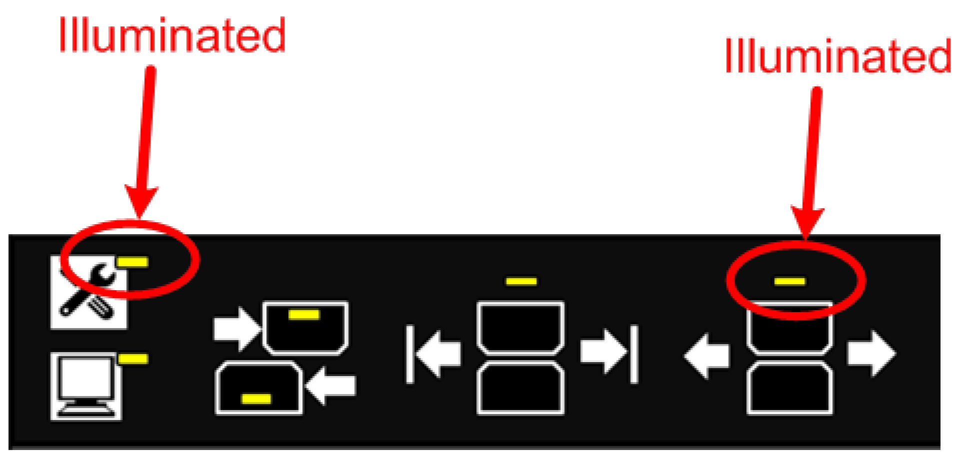


Figure 5-4: Confirm local mode.

Verify individual head movements back and forth. Press the head split button and observe the upper head indicator illuminate first. This indicates the upper head is under individual control. Press the scan button to move it towards the high end and use the offsheet button to move it towards the low end. Confirm it moves in both directions.

Select the lower head by pressing the head split button and verifying the lower head indicator is illuminated. With the lower head under control, move it back and forth in the same manner as the above instruction and verify it moves as commanded.

Press the head align button and verify the heads come together.

Finally, press the scan button and verify the heads scan together continuously.

This completes the standalone mode scanner checkout.

5.2. Confirm scanner operation in auto (RAE) mode

Connect the MSS to RAE and proceed to verify the operation with the platform software.

5.2.1. ZipLine head I/O presence

Verify the following I/O in the MSS Card Point I/O monitor page.

5.2.1.1. Frame controller job set I/O

- There are no analog inputs or outputs to verify in the frame controller job set.

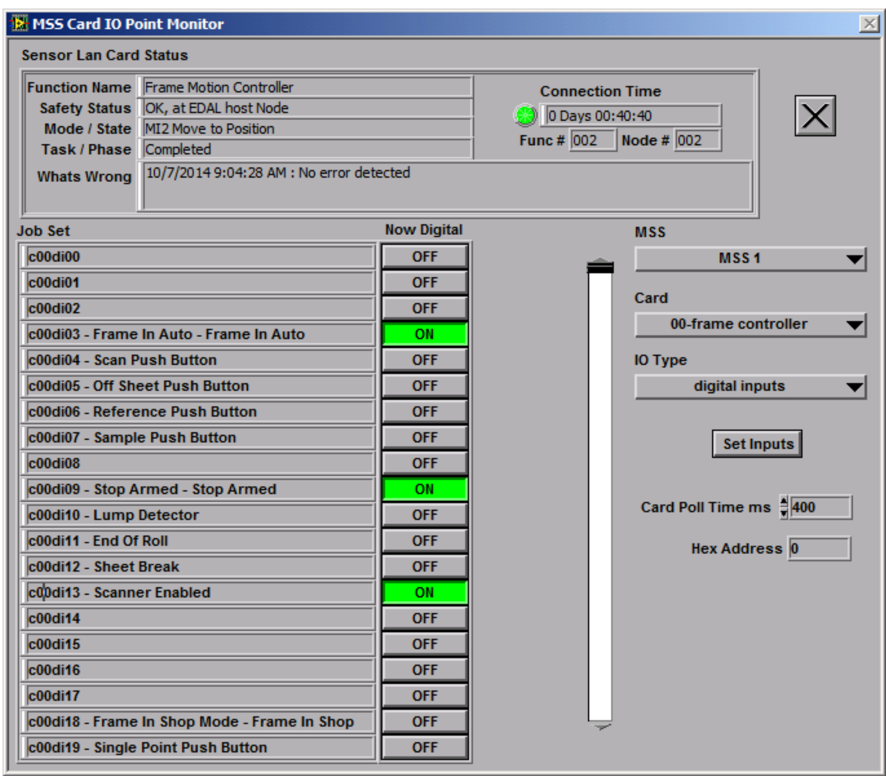


Figure 5-5: MSS frame controller digital inputs

- See **Figure 5-5** for the family of frame controller digital inputs. These do not required one-by-one testing. The I/O states will toggle with routine scanner operations.

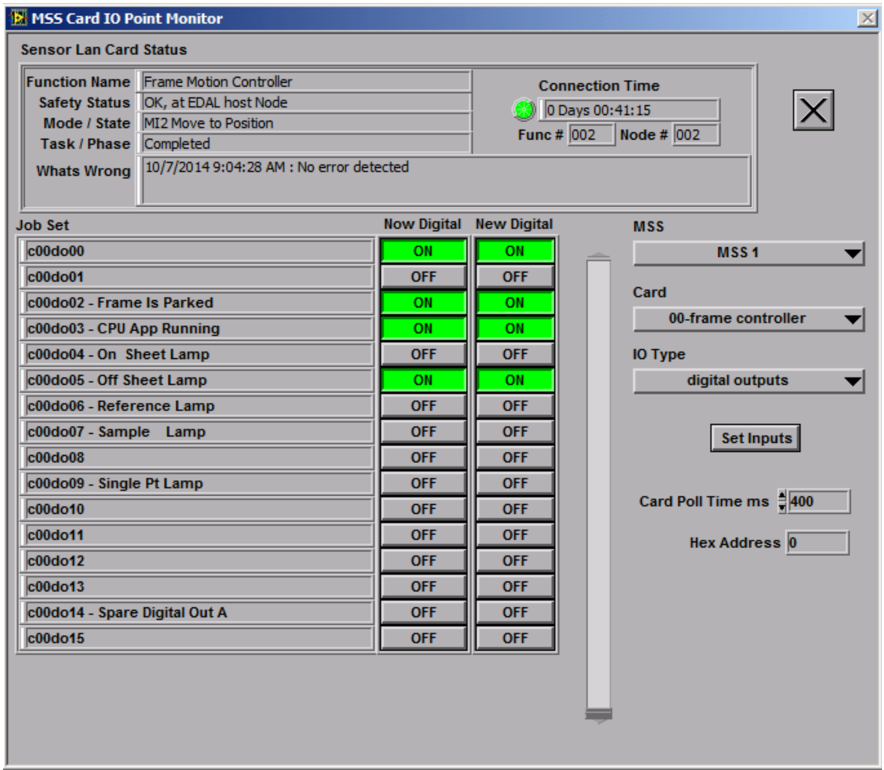


Figure 5-6: MSS frame controller digital outputs.

- See **Figure 5-6** for the family of frame controller digital outputs. These do not required one-by-one testing. This image is for reference.

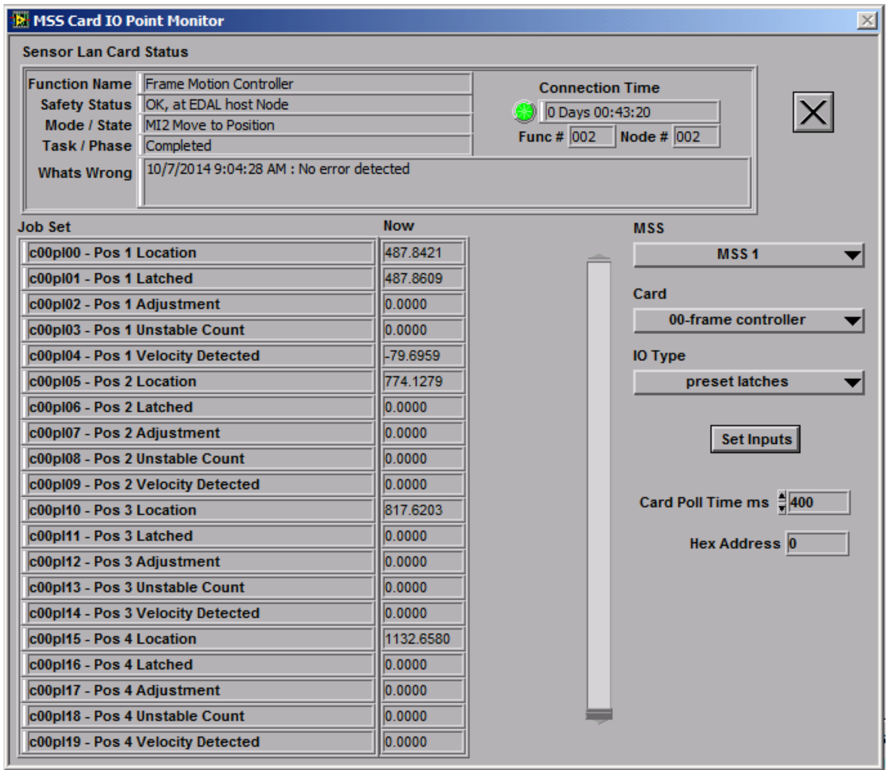


Figure 5-7: MSS frame controller preset latches.

- **Figure 5-7** shows the frame controller set of preset latches. There is no test for this data. For reference, after the scanner is calibrated, the speeds and latch positions can be monitored here.

5.2.2. Top performance job set I/O

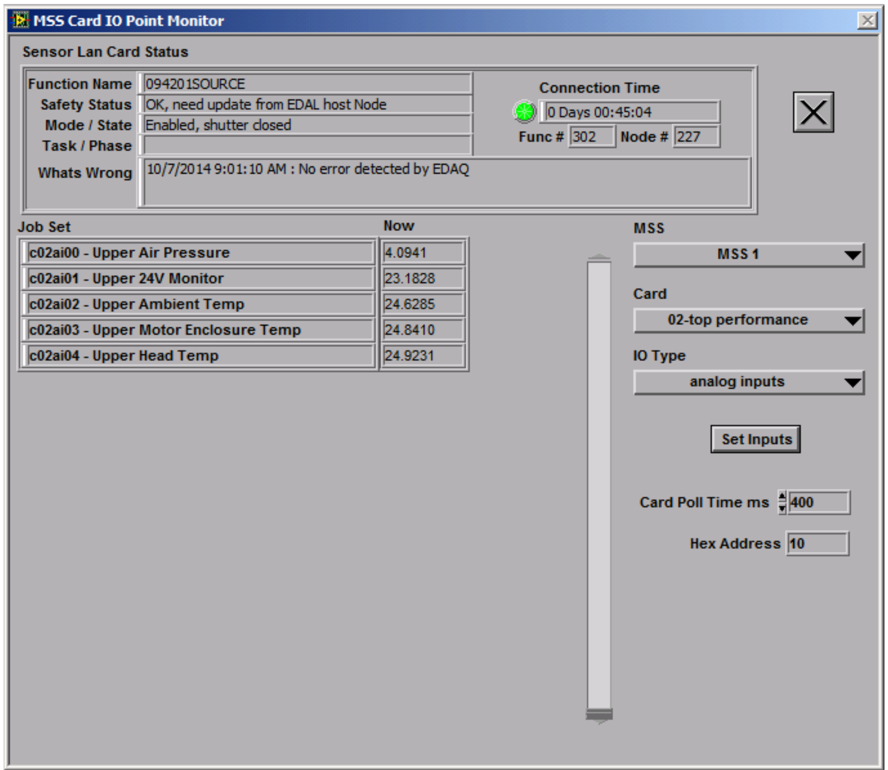


Figure 5-8: MSS top performance analog inputs

- **Figure 5-8** shows the family of analog inputs associated with the top performance job set.

- The “upper air pressure” signal is used when there is a compressor in the scanner head. This is the voltage sensed on the PDB pressure nipple to monitor the pressure available to actuate shutters and flags. The compressor is present for weight and x-ray sensors but not needed for IR gauges. The signal in volts is related to pressure, P, in units of psi (gauge), in the following:

  $$P = 7.5 * V - 3.75$$

  Where:

  V is the signal reported by the upper air pressure.

  A signal of 0.5V indicates that there is no pressure on the PDB pressure sensing chip.

Verify that the a signal larger than 3.85V is present. If this is not the case, verify that the parameter **compressor_on_volts** in the upper EDAQ ID file is 3.85V. See **Figure 5-9**.

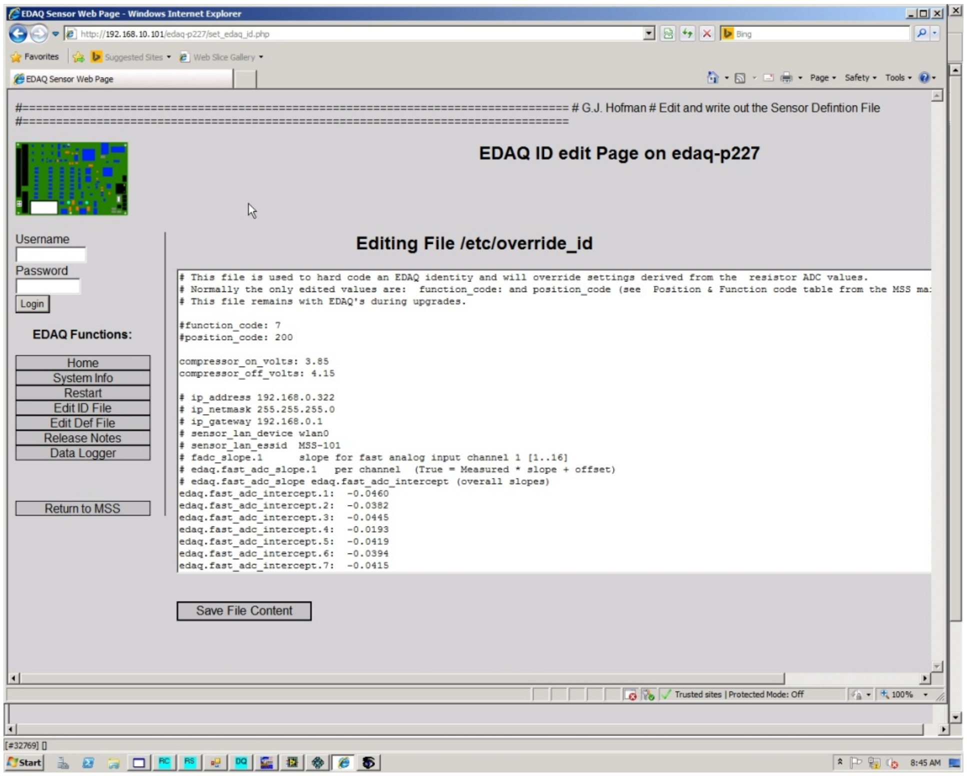


Figure 5-9: Set pressure limits on upper EDAQ ID file

- The 24V monitor reports the power supply potential to the upper head. Verify that this value does not drop to less than 22V.
- The upper ambient, motor enclosure and head temperatures report various temperatures pertaining to the head. Verify they are reporting reasonable values in ^{o}C.

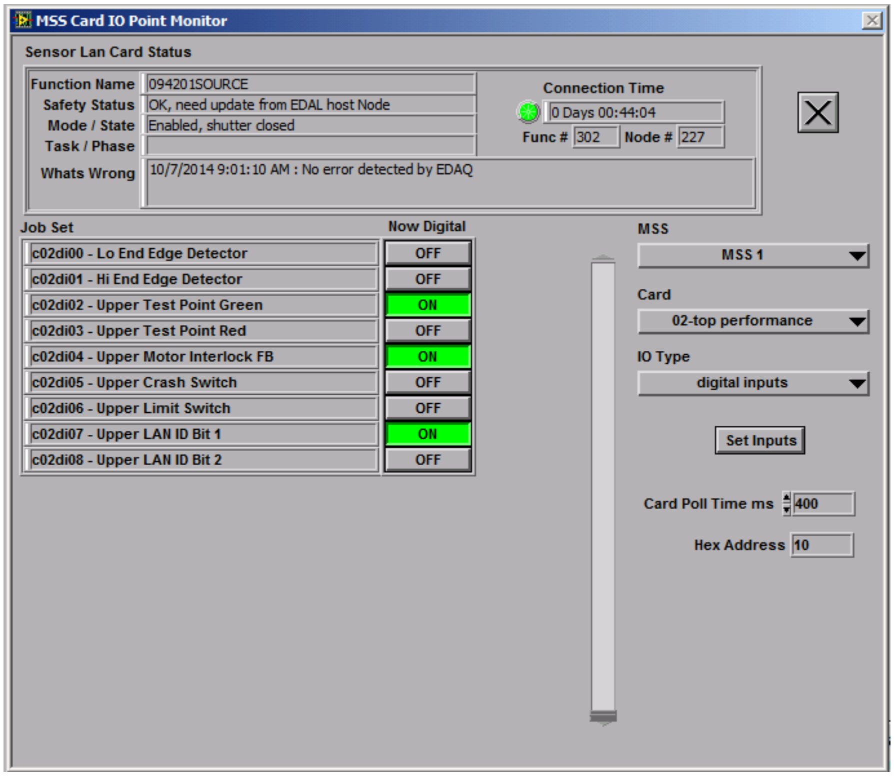


Figure 5-10: MSS top performance digital inputs

- **Figure 5-10** shows the family of digital inputs associated with the top performance job set. There is no test required on this group, the figure is for reference.

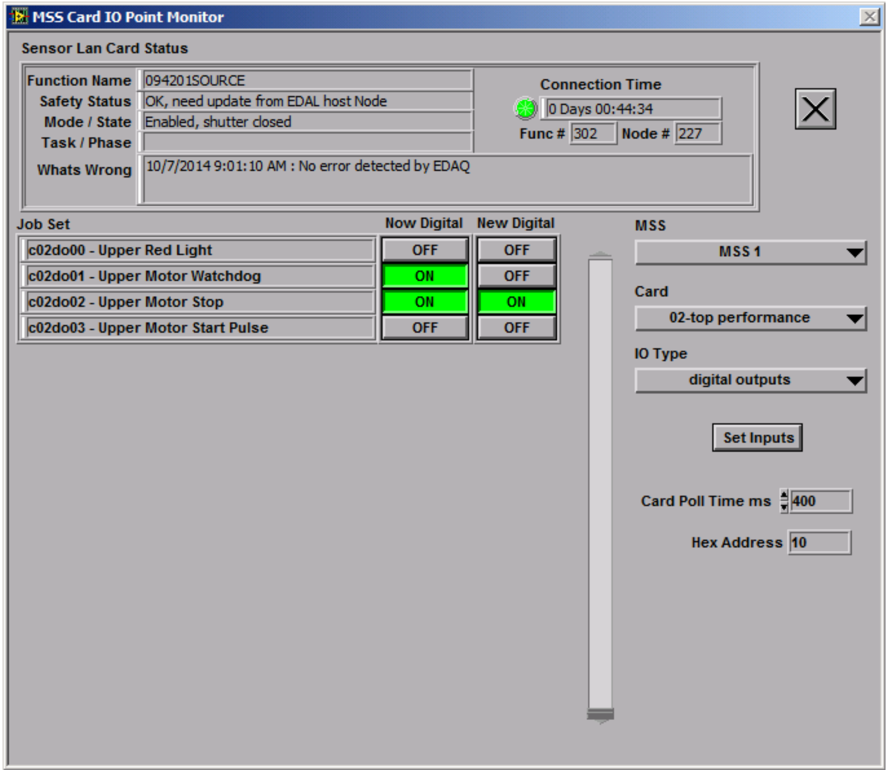


Figure 5-11: MSS top performance digital outputs.

- **Figure 5-11** shows the top performance digital I/O job set data. Verify that the "upper motor watchdog" is toggling when the motor is enabled. This output will not toggle when the motor is disabled. For example, if the scanner stop button is pressed.

5.2.3. Lower performance job set I/O

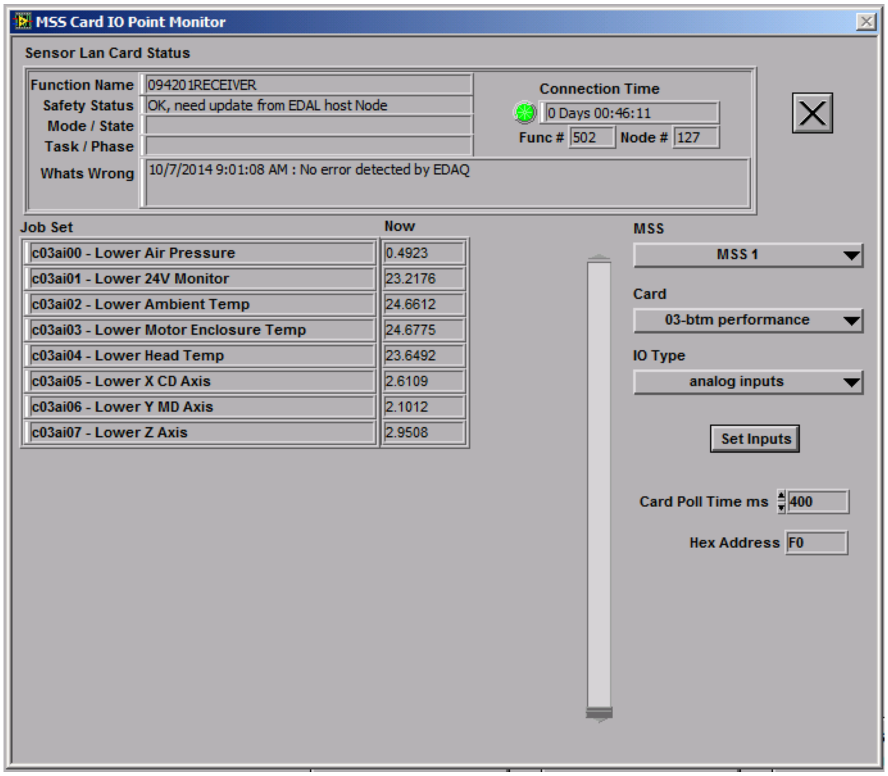


Figure 5-12: MSS bottom performance analog inputs.

- **Figure 5-12** shows the analog inputs associated with the lower head performance job set.
- The lower air pressure should be near 0.5V as these is no compressor in this head.
- The 24V monitor reports the power supply potential to the upper head. Verify that this value does not drop to less than 22V.
- The upper ambient, motor enclosure and head temperatures report various temperatures pertaining to the head. Verify they are reporting reasonable values in °C.
- The X, Y and Z provide signals representing the physical alignment of the heads. Verify these data are present and updating. Gently push one of the heads laterally and see that they respond. The formal XYZ evaluation will be done in Section **5.4**.

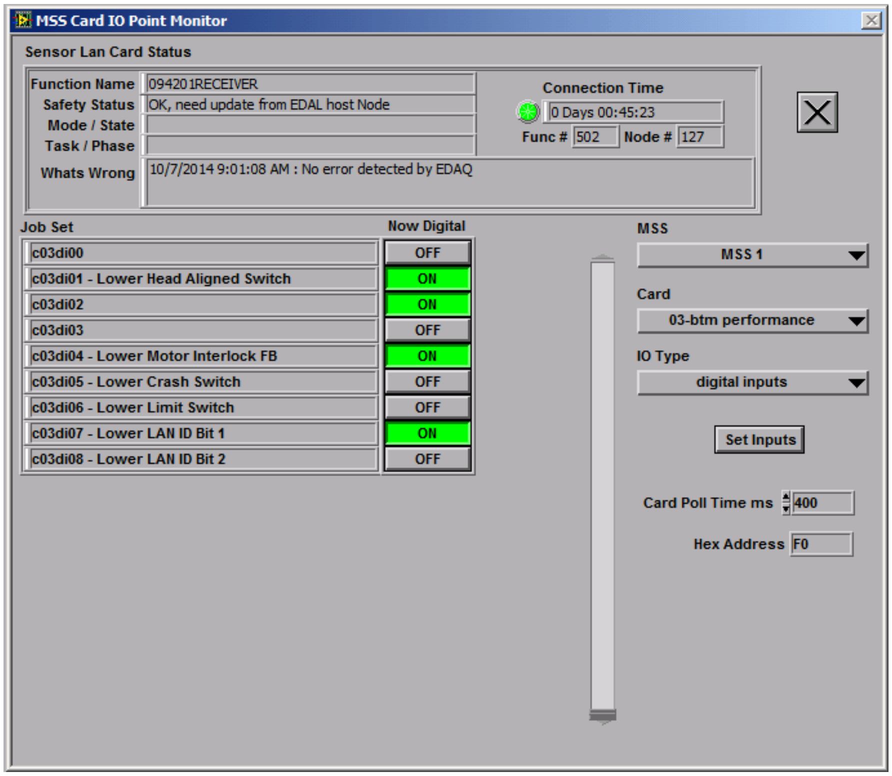


Figure 5-13: MSS bottom performance job set digital inputs.

- Figure 5-13 shows the MSS bottom performance job sets.
- The **Lower Head Alignment Switch** is a physical switch located in the lower head. Disable the motor controllers by pressing the scanner stop button and slide one head manually to separate the heads by approximately one inch. Verify this input toggles.

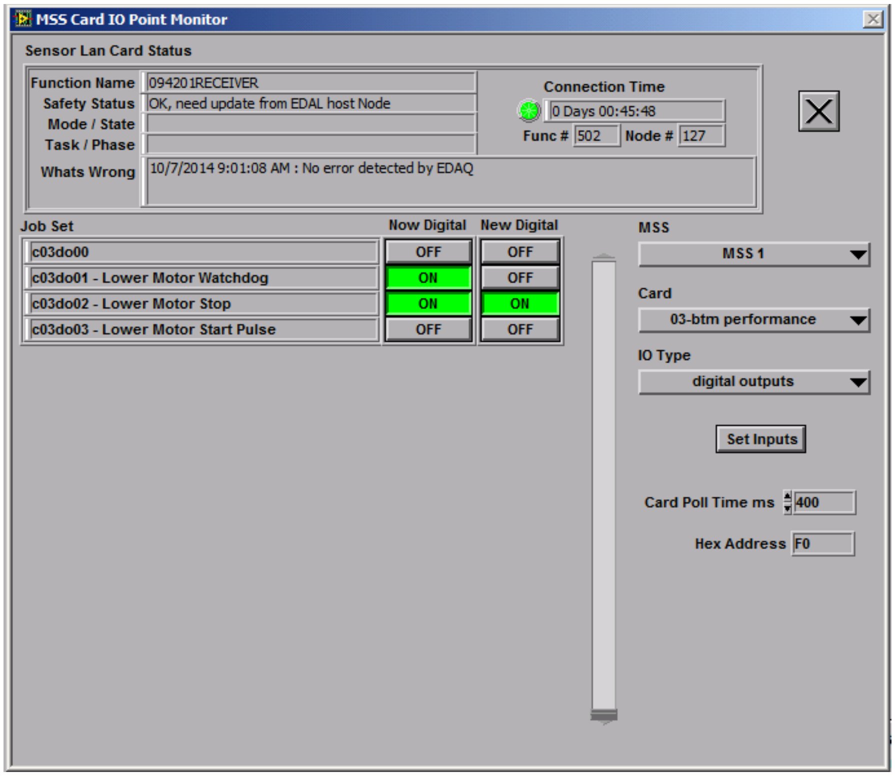


Figure 5-14: MSS bottom performance job set digital outputs.

- **Figure 5-14** shows the top performance digital I/O job set data. Verify that the **upper motor watchdog** is toggling when the motor is enabled. This output will not toggle when the motor is disabled (for example if the scanner stop button is pressed.)

5.3. Scanner limit calibration

Scanner calibration should follow the standard scanner calibration procedure (i.e. common to the Q4000) from the scanner calibration display. The use of the outside of the inner alignment plates is recommended location for the low and high end references (so that one can hook the end of tape measure over them). See **Figure 5-15** for the physical positions of limit switches on the frame relative to the alignment plates.

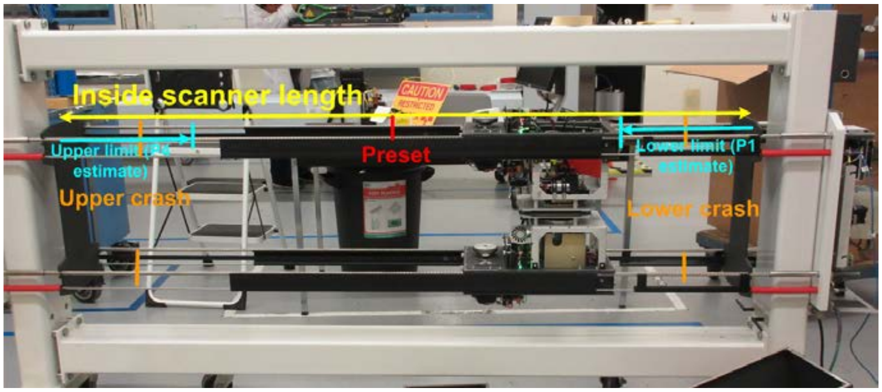


Figure 5-15: Position of limit magnets on the frame

5.4. Scanner XYZ calibration & verification

The X, Y, and Z sensors in the ZipLine head require a baselining adjustment to compensate for things like the ambient magnetic field, typically emanating from the structural steel in the scanner's environment. This operation is required on all scanners. If the system was provided by the factory fully assembled, skip to Section **5.4.4**.

5.4.1. Determine and enter X, Y, and Z baseline profile correctors

To do this the heads need to move together with a known alignment to capture the influence of the external magnetic fields. Do this by mechanically locking the heads together and driving the pair of heads with the upper head motor. Do the following steps to set up the system mechanically for this assessment:

1. Remove all head covers and set them aside for the balance of the test.
2. Remove the lower motor belt from the motor pulley and set it aside. See **Figure 5-16**.

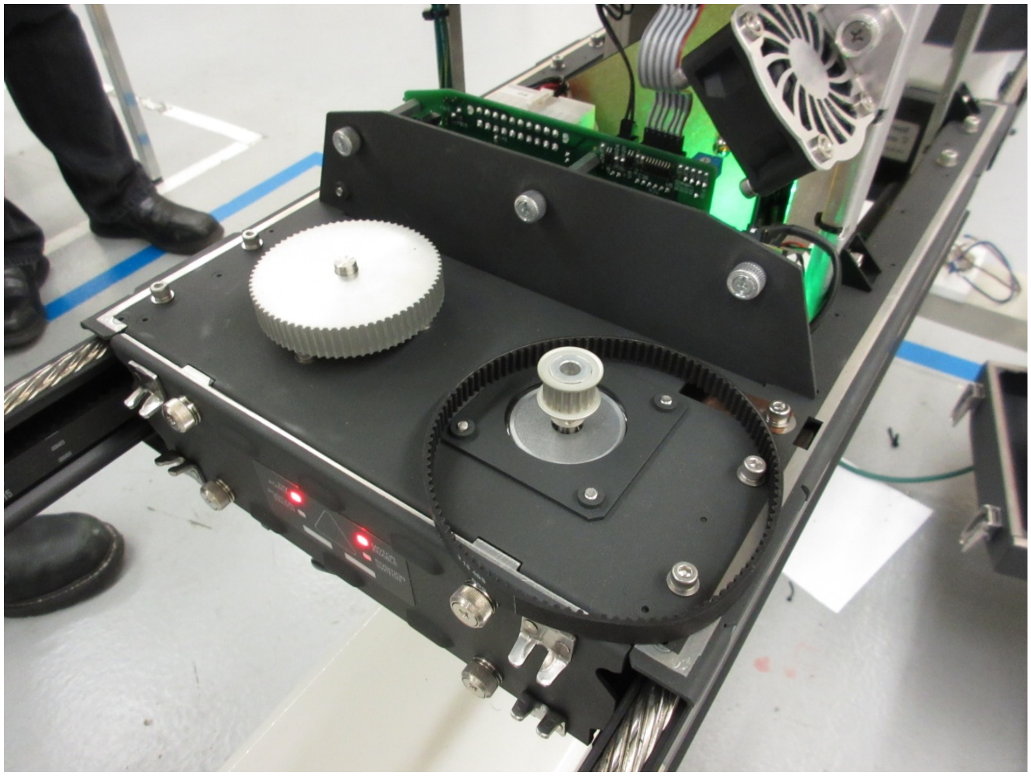


Figure 5-16: Remove lower head motor belt from head drive system

3. Lock the lower head to the upper head using four gap spacers. Insert a gap spacer into the slotted cutout on each corner of the sheet guide. Keep the washers outside the sheet guides. See **Figure 5-17**.

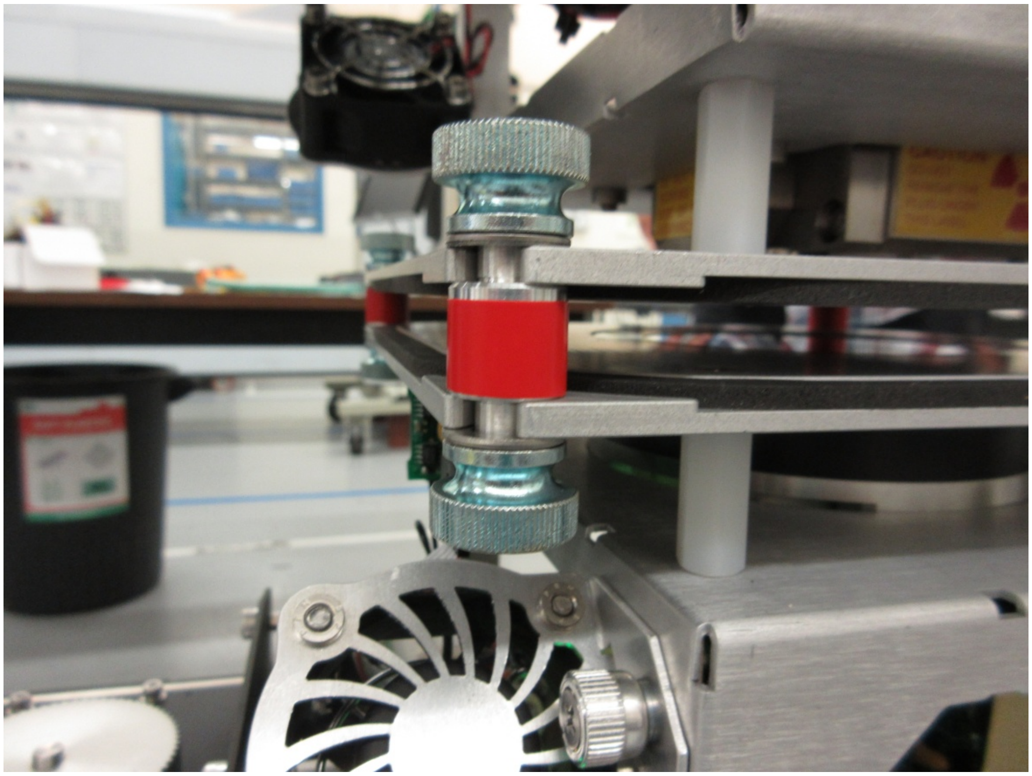


Figure 5-17: Gap spacers maintain an exact 10mm alignment between heads

The bucketized sheet width needs to include an area of the frame where the sensor standardize, background, sample, and reference operations will be performed since X, Y, and Z baseline correctors are applied during these operations as well as during scanning.

- Navigate to the profile correction display from the scanner/sensor tab, see **Figure 5-18**.
- On this display, there are written instructions on the left upper area of the screen, see **Figure 5-19**.

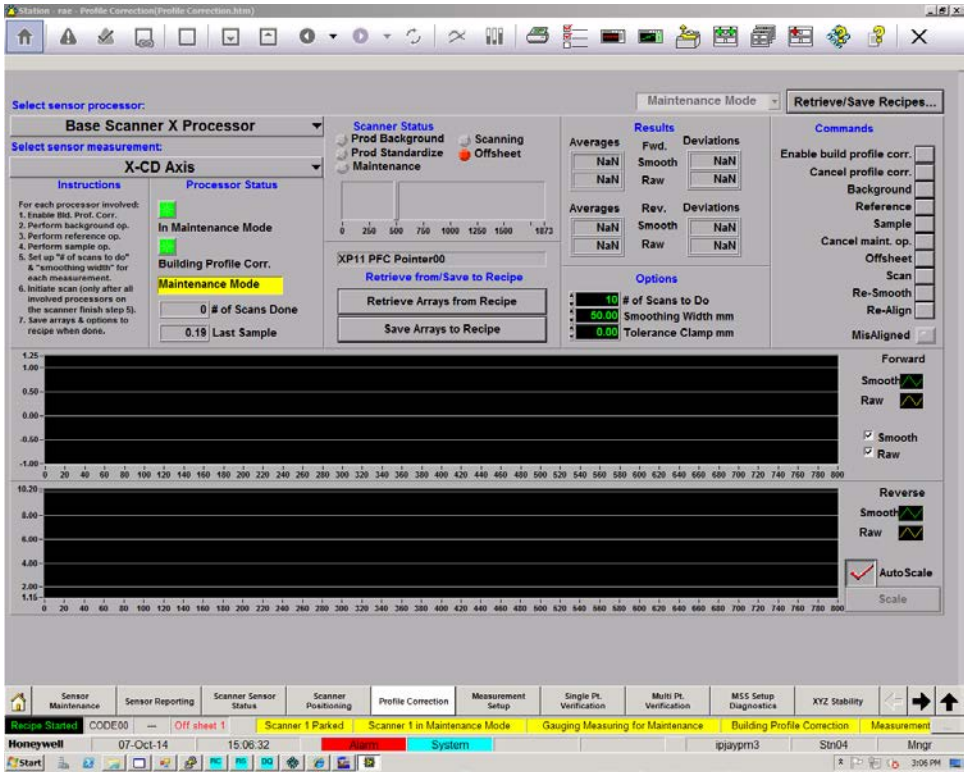


Figure 5-18: Profile correction display

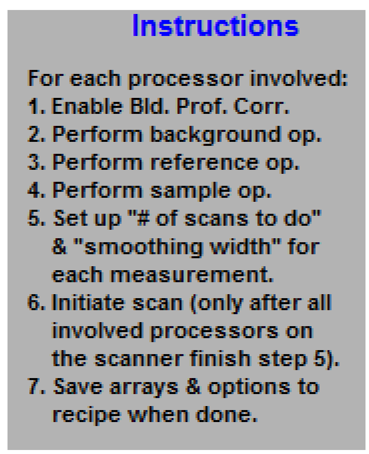


Figure 5-19: Generic profile correction instruction on the Profile Correction screen

1. Load the recipe by selecting  on the top horizontal dispatcher.

2. Place the system in maintenance mode, from the profile correction display.

3. Select **Base Scanner X Processor** as the processor and **X-CD Axis** as the sensor measurement. Do step 1 and 5 (see Figure 5-19) of the on-screen instructions for X. The green indicator **Building Profile Corr.** should illuminate. Select 10 scans, a smoothing width of 50mm and a tolerance clamp of 1mm.

4. Select **Base Scanner Y Processor** as the processor and **Y-MD Axis** as the sensor measurement. Do step 1 and 5 (see Figure 5-19) of the on-screen instructions for Y. Select 10 scans, a smoothing width of 50mm and a tolerance clamp of 1mm.

5. Select **Base Scanner Z Processor** as the processor and **Z Axis** as the sensor measurement. Do step 1, 2, 3, 4 and 5 (see Figure 5-19) of the on-screen instructions for Z. Select 10 scans, a smoothing width of 50mm and a tolerance clamp of 1mm.

6. Re-verify that scanning limits include the standardize position on the "scanner positioning." The standardize position must be captured inside the span swept out by the profile correction procedure.

7. Standardize setup can be found in MSS Standardize Setup under MSS Setup Diagnostics in the Scanner/Sensor menu.

8. Do step 6 (see **Figure 5-19**). This will scan the scanner with the heads locked together. The number of scans executed will count up on the "# of scans done" indicator. Ensure the full scanning width is being executed while the profile correction is being captured.

9. The individual X, Y, and Z correctors need to be saved individually. Do step 7 (see Figure 5-19) for X. Save the profile corrector to all grades – this is a geometrical corrector and applies to all grades.

10. Do step 7 for Y (see **Figure 5-19**).

11. Do step 7 for Z.

12. Return the system to production mode from the profile correction display.

13. The recipe has now been modified with the most recent X, Y, and Z baselines. Re-load using the pop-up bar icon.

14. In the sensor maintenance screen, select the options for the X, Y, and Z sensor processors by selecting "Base scanner performance processor" then "supporting sensors".

15. Verify selected correctors, for X select options as in **Figure 5-20**.

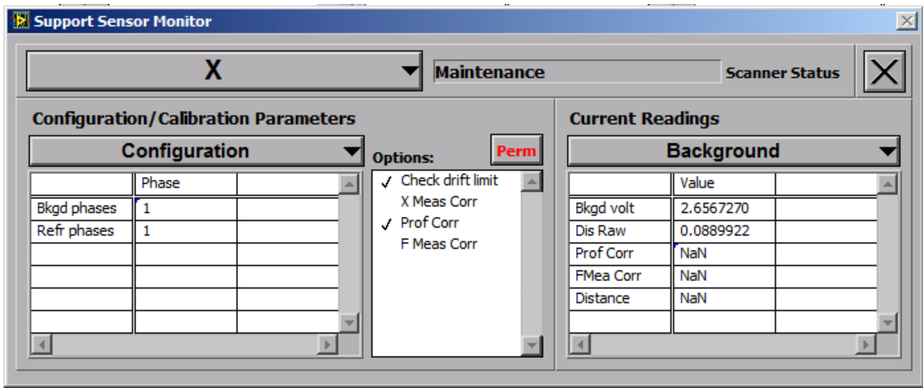


Figure 5-20: X profile correction settings for measurement

- For Y select options as in **Figure 5-21**.

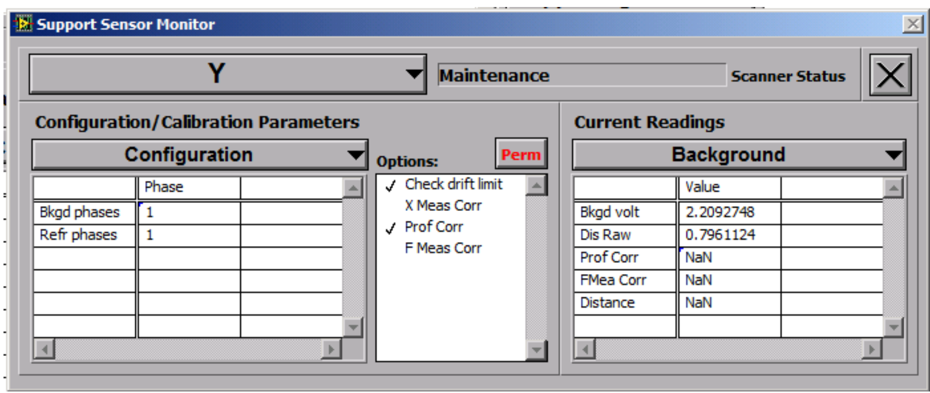


Figure 5-21: Y profile correction settings for measurement

- For Z select options as in **Figure 5-22**.

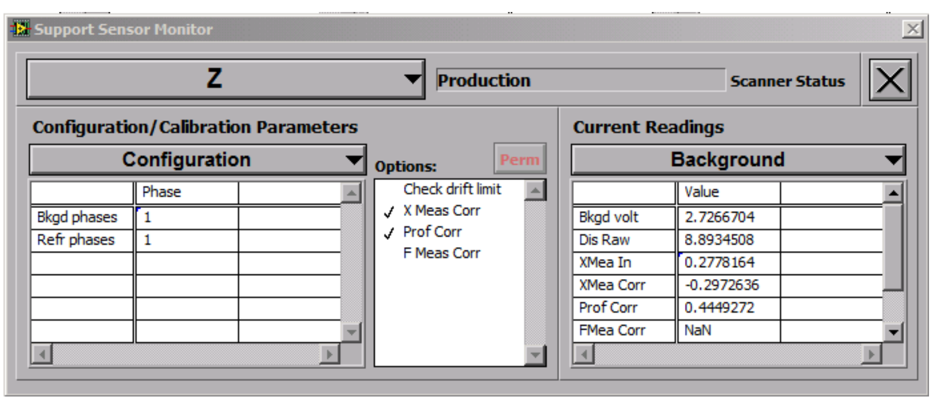


Figure 5-22: Z profile correction settings for measurement

- Keep the heads locked together and scan in production mode. The scanner passes this item if for X, Y, and Z the profile ranges are less than 0.05mm for each item. See **Figure 5-23** for a passing example.

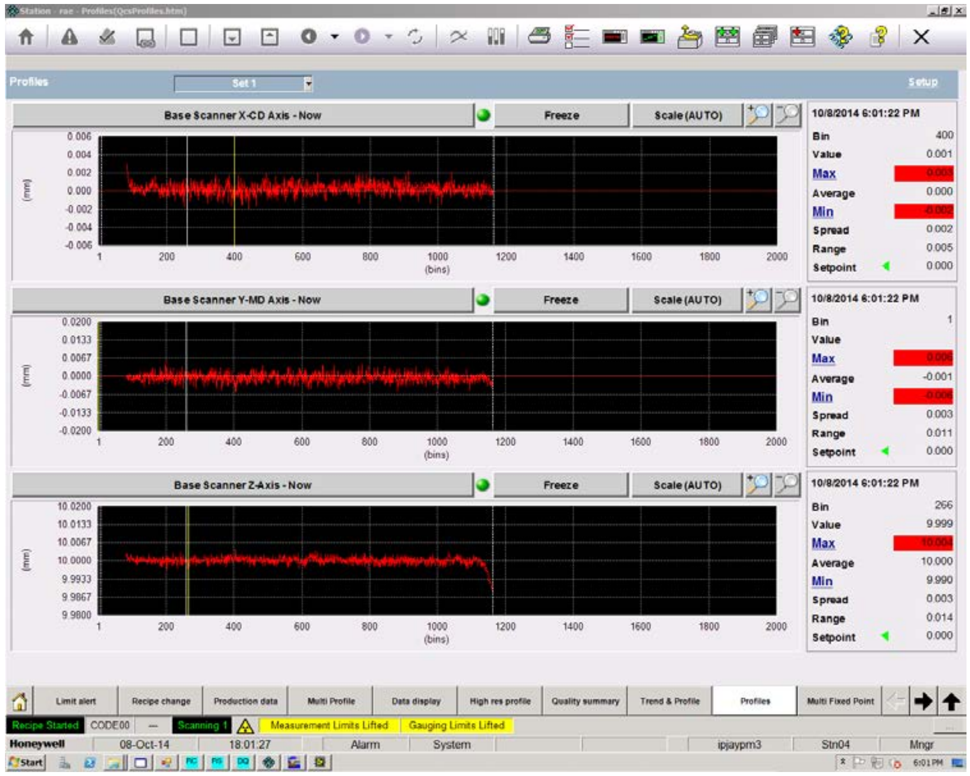


Figure 5-23: X, Y and Z profiles with heads locked together and profile correctors applied

5.4.2. Determine and set x-sensor signal corresponding to ideal head alignment

- While the scanner is scanning with the heads locked together, also verify the x-sensor signal that the MSS is seeing. This value is needed to define the target voltage for the x-sensor to ensure head alignment when the heads are operated in master/follower mode. Go to MSS Scan Voltages and select **ss1 performance** as the **sensor set** and **x axis** as the channel. See **Figure 5-24**.

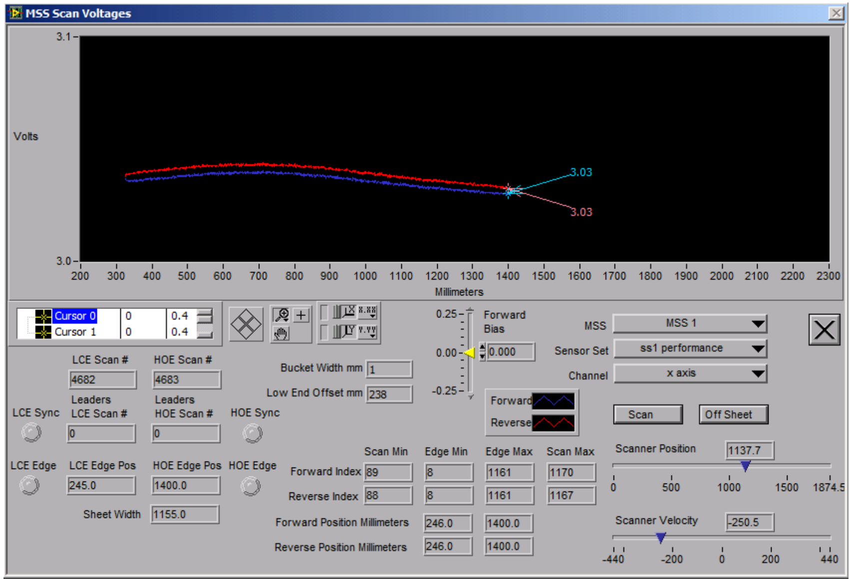


Figure 5-24: MSS scan voltage showing x-signal when heads are aligned

- Note the average signal value of the x-axis sensor when the heads are locked. In the example above, it is approximately 3.0V. The scaling factor between signal and distance is approximately 2mm/V. For the example above, 3.0V is the estimated voltage the x-sensor should report when the heads are nominally aligned. Estimating within 50mV is acceptable. Call this signal level V_x^o.

- The target x-sensor signal is related to the calibration of the x-sensor. The following formula relates relative head displacement, X, (mm) to the x signal, V_x (in volts), the slope of the displacement/signal relationship, dX/dV_x (mm/V) and a displacement offset, X_o (mm):

$$X = \frac{dX}{dV_x} V_x + X_o.$$

The goal of this step is to adjust X_o so that the aligned x-sensor voltage corresponds to an X displacement of zero millimeters. Execute this computation as follows:

$$X_o = -\frac{dX}{dV_x} V_x^o$$

Where (dx/dVx) is 2.08 mm/V (default in RAE) and V_x^o is the value recorded from Figure 5-24. In the example in this document, the computation is realized as:

$$X_o = -\left(2.08\frac{mm}{V}\right)(3.0V) = -6.24mm$$

- Enter this value by navigating to the **Scanner/Sensor Maintenance** tab and enter maintenance mode. The X-sensor is a supporting sensor of the performance processor. Select its pop-up and select the C**onstants** list. See **Figure 5-25**.

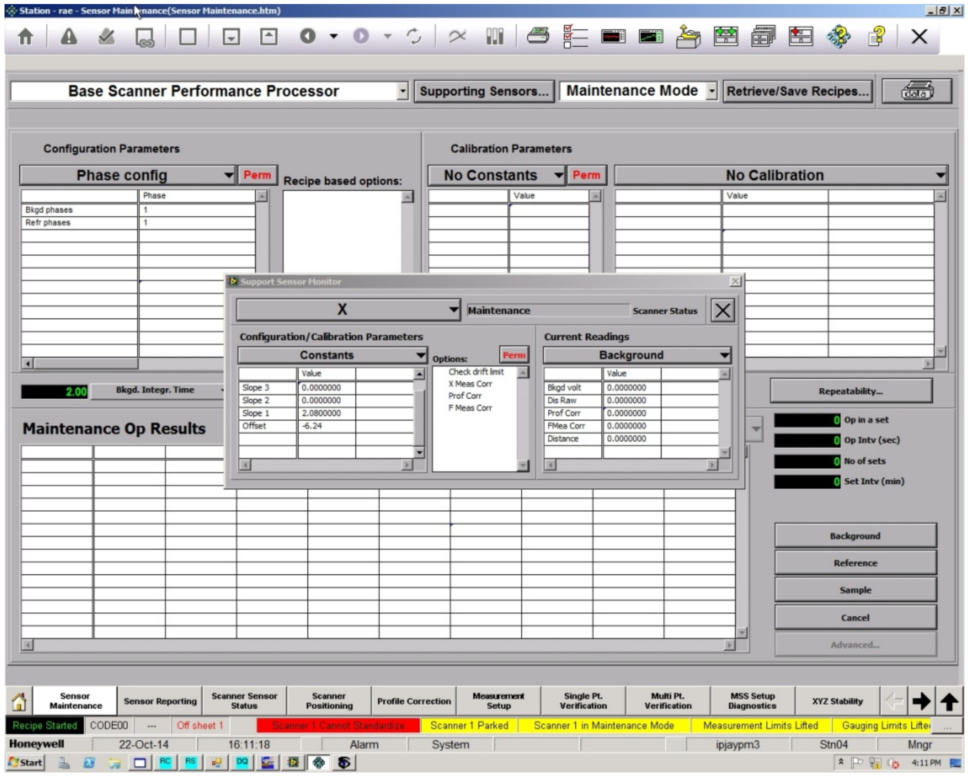


Figure 5-25: Access X-sensor constants

- In the offset field, enter the value computed for X_o, which is 6.24V in this example.

5.4.3. Validate Z profile calibrations

- Validate the Z calibration by adding a washer's width to each gap spacer thus expanding the gap by the width of a washer. See **Figure 5-26**. Scan again.

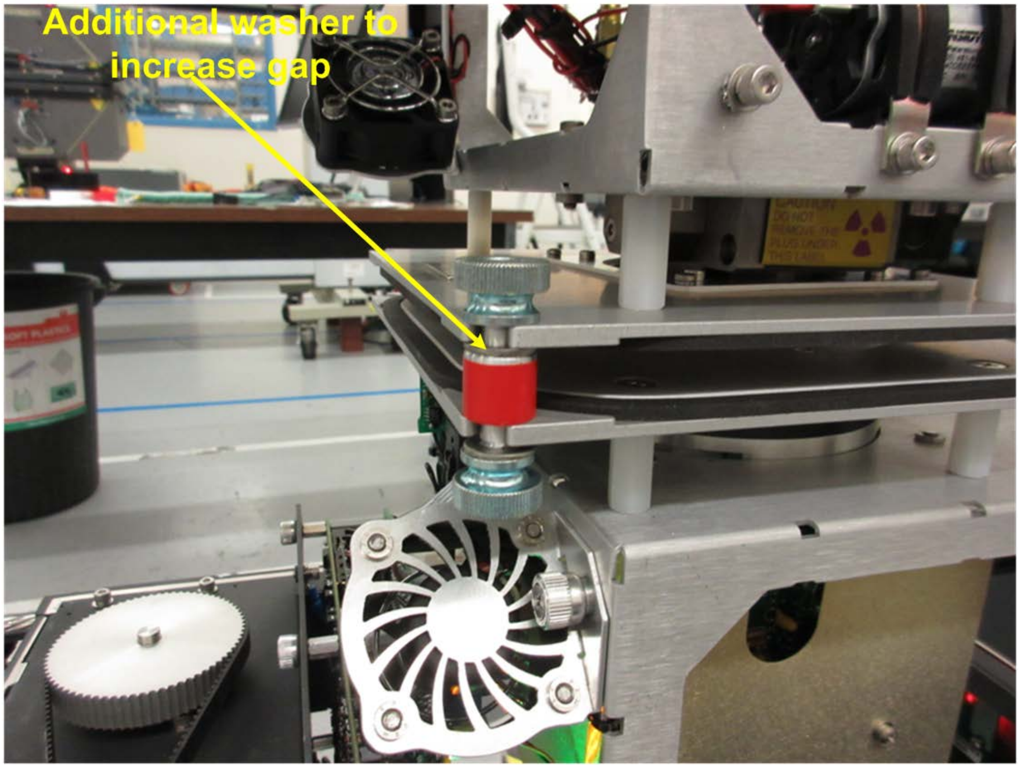


Figure 5-26: Add additional washer in gap to further separate heads

- The scanner passes this item if the following conditions are achieved:
  - X, Y, and Z ranges are less than 0.05mm.
  - The Z-profile average measures the washer to within +/-0.1mm.
- See **Figure 5-27** and **Figure 5-28** for additional detail. In this example, the washer measures 1.46mm using a digital Vernier caliper. When this washer is added to the scanner gap, the Z-profile now reports an average of 11.41mm, meaning the 10mm gap has been increased by 1.41mm. This is within +/-0.1mm of the washer thickness, thus a pass.

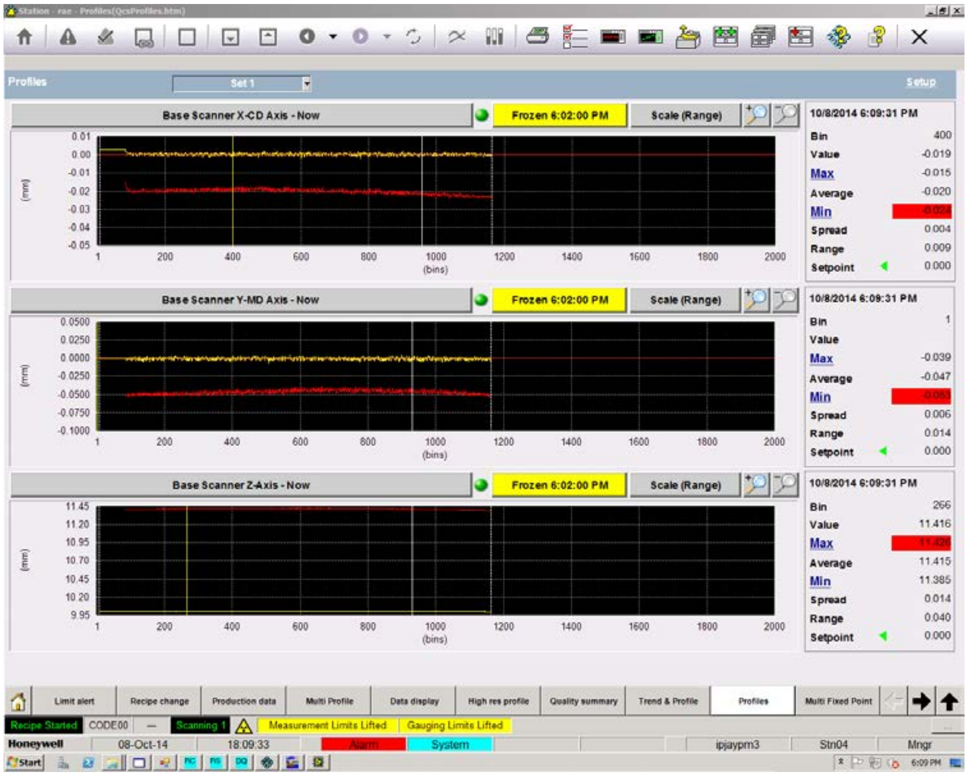


Figure 5-27: Z sensor measures the additional space after calibration

Figure 5-28: Physical measurement of additional spacing washer

- The X, Y, and Z measurement operation is now confirmed.
- Remove the gap spacers and replace the lower head motor belt.

5.4.4. Verify scanner geometric alignment

With the X, Y, and Z measurements set up, validate the scanner geometry itself.

- Scan the heads normally in master/follower mode and confirm X, Y, Z ranges are inside the factory specifications of:
  - o X average is between -0.2mm and 0.2mm.
  - o X range is less than 2mm.
  - o Y range less than 2mm.
  - o Z average is between 9.5mm and 10.5mm.
  - o Z range less than 0.8mm.
- **Figure 5-29** displays a passing example.

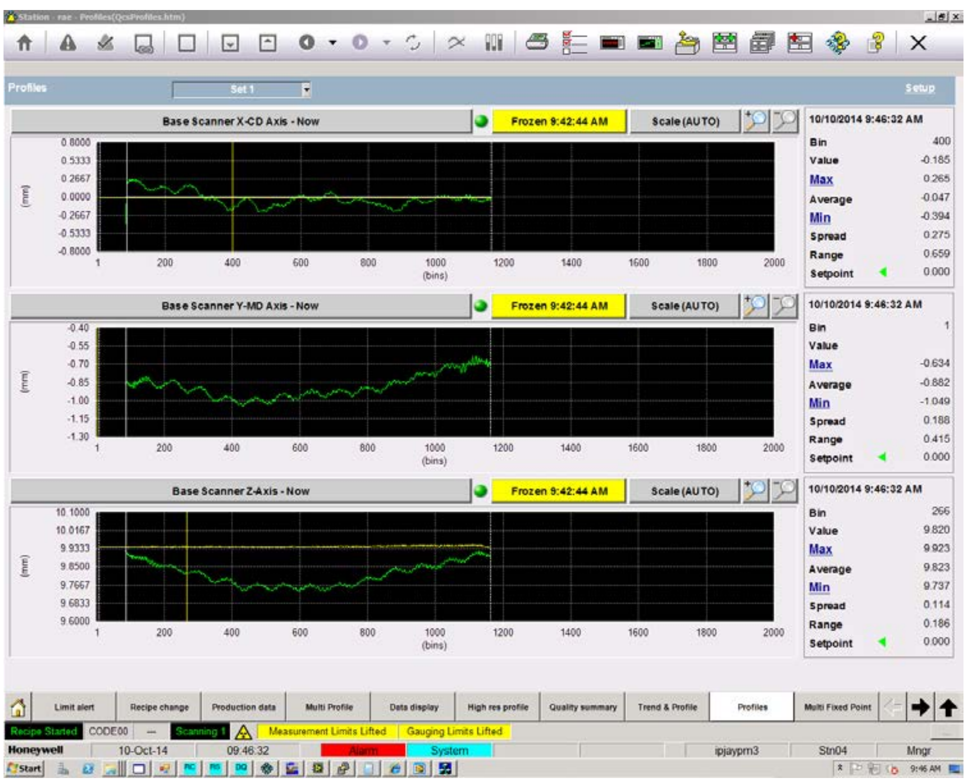


Figure 5-29: Representative X, Y, and Z passing ZipLine alignment

- This concludes the Q3090 scanner setup/test. The balance of these tests verify sensor integration into the head.

5.5. Sensor integration

Execute the sensor integration steps corresponding to the sensor(s) on the specific system under test. The detailed example in the next section is for source 9 basis weight sensor. Refer to the appropriate sensor manual for sensor specific instructions.

5.6. Source 9 integration

5.6.1. Verify compressed air provisioning

Source 9 basis weight sensors require air actuation to open the shutter. Compressed air is provided by a mini-compressor integrated in the upper head. The I/O pertaining to the compressor operation is shared between the top performance job set and the sensor source job set. Section **5.2.2** indicated how to establish the pressure limit behaviour in the EDAQ. This test will verify that adequate pressure is being supplied over time.

- Set up a trend variable to monitor the sensor pressure.
- Allow the scanner to scan limit to limit with a standardize cycle of thirty minutes for several hours.
- Verify that the pressure trend is maintained between the upper and lower thresholds entered in the EDAQ in section **5.2.2**. We expect to see the pressure signal slowly decay from the upper threshold to the lower threshold and then be “pumped-up” abruptly as the compressor engages. The decay rate of the pressure signal should be less than 1.8V/hour when the scanner is in offsheet position and the shutter is not being actuated. See **Figure 5-30** for a passing example. If this is not achieved, check the plumbing arrangement for leaks.

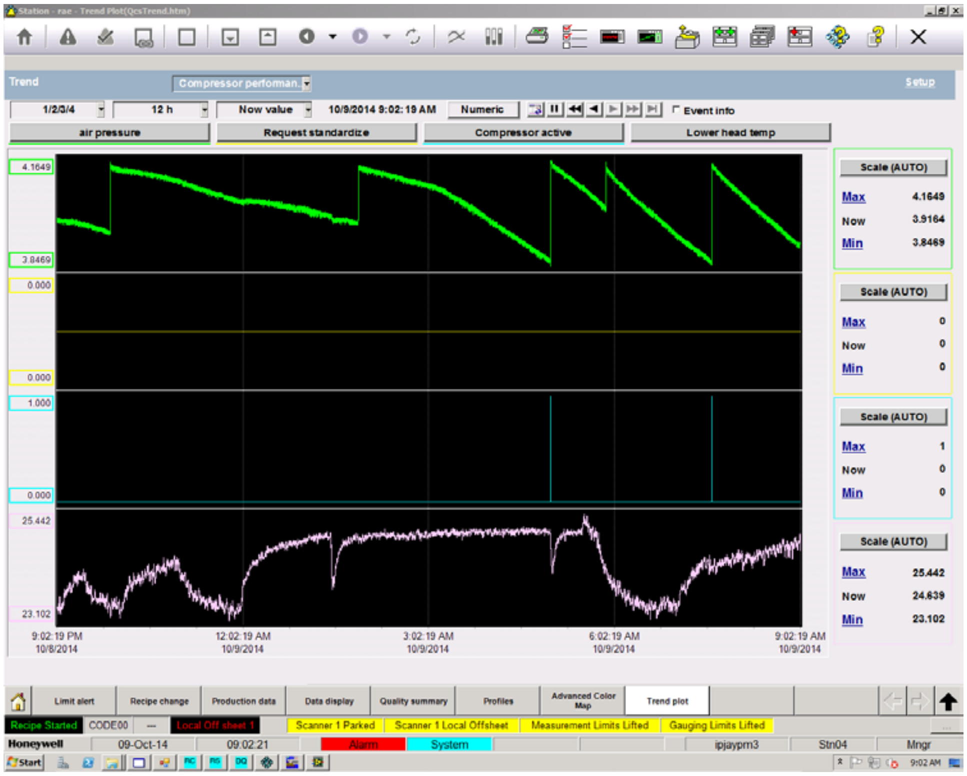


Figure 5-30: Compressor validation

5.6.2. Sensor stability verification

- Check sensor stability in the standard manner. Execute repeated references in the offsheet position and validate that the flag-to-air ratio is less than 0.0002. Execute five sets. See **Figure 5-31** for a passing example.

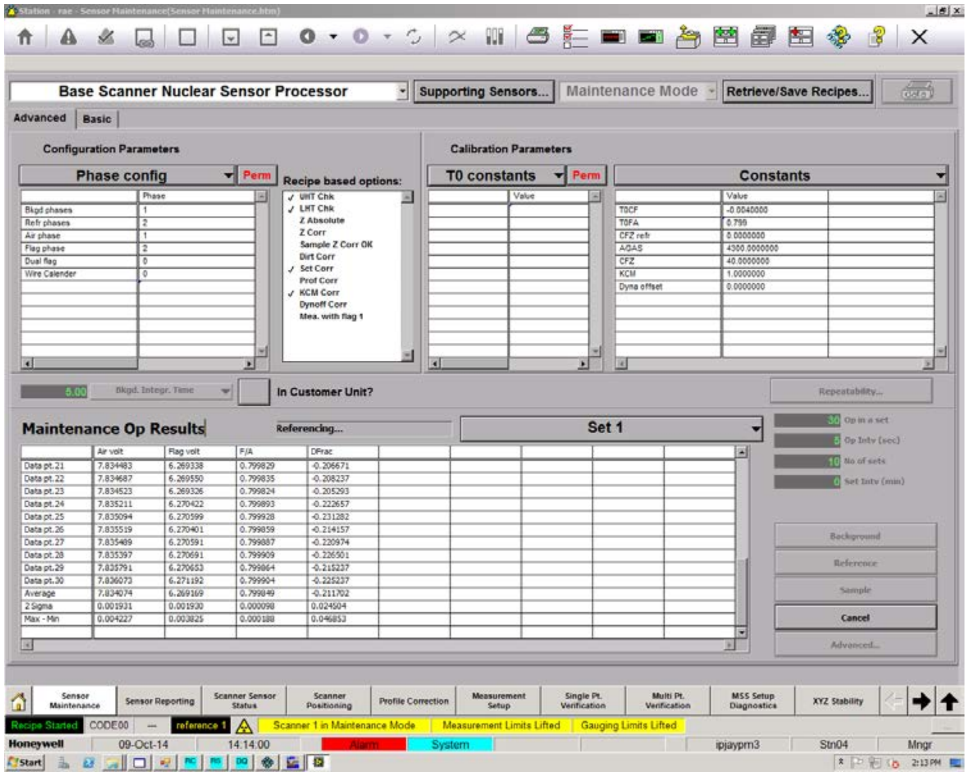


Figure 5-31: Sensor maintenance display - capture repeated references

6. Detailed System Description

The Q3090 scanner can be divided into the following major subsystems:

- Freestanding cable-support structure and rail system
- Scanner power distribution panel
- Upper and lower measurement modules
- User control panel (HMI)
- Sample holder

An overview of these systems is provided in the following sections. Further details regarding troubleshooting and task procedures can be found in the troubleshooting and tasks sections of this manual.

6.1. Freestanding Cable-Support and Rail System

The Q3090 scanner structural system consists of a tensioned rail system mounted to a free standing cable-support structure, see **Figure 6-1**.

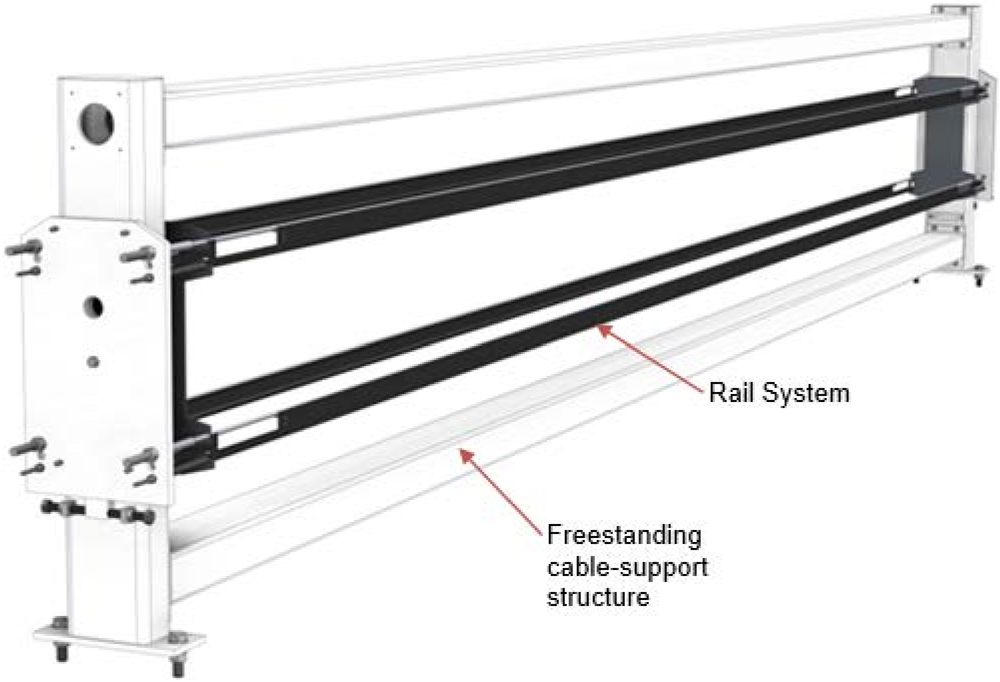


Figure 6-1: Scanner Structural System

6.1.1. Freestanding Cable-Support Structure

The freestanding cable-support structure manages the tension loads of the rail system needed to guide the measurement modules. See **Figure 6-2**.

Tension loads on the vertical supports from rail cables are internal to the structure and are not transmitted to the scanner mounting plates. This allows the structure to be easily mounted to pedestals, or machine frames as required.

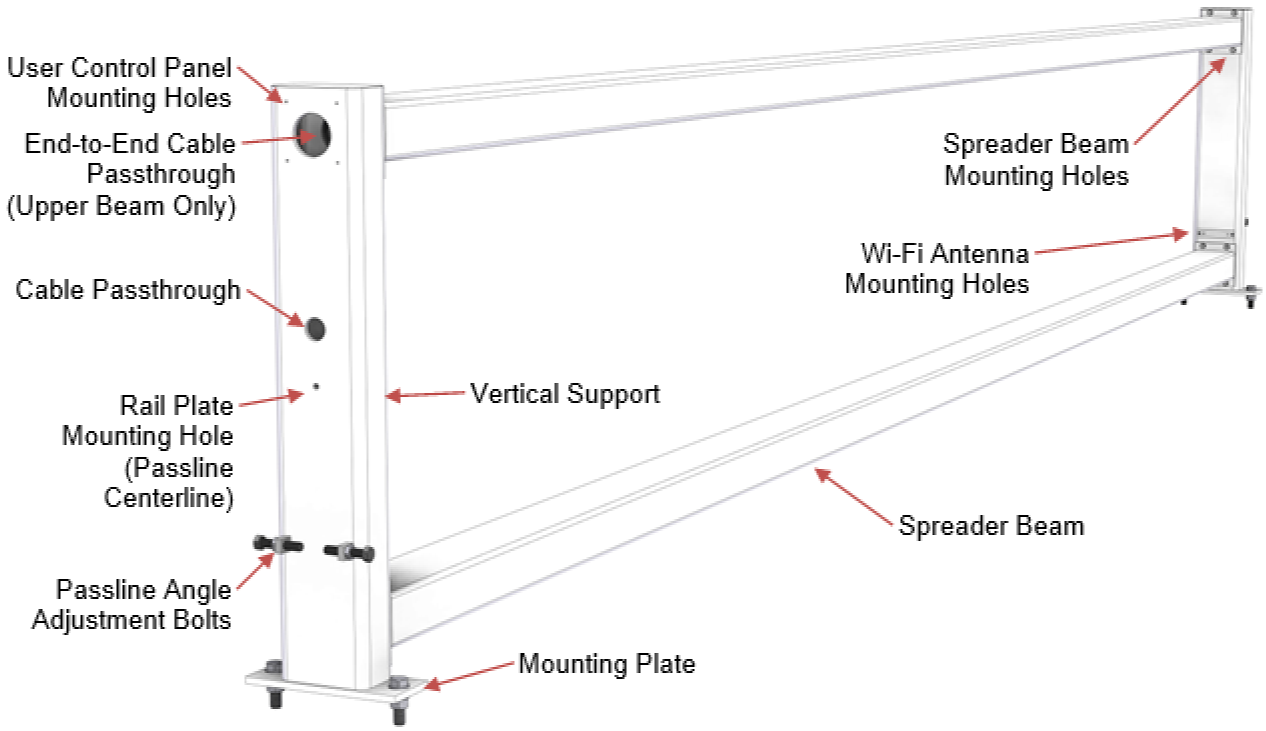


Figure 6-2: Compression Frame Assembly

The painted steel compression frame is assembled from identical upper and lower spreader beams and identical vertical end supports.

Assembled on site, end supports are typically mounted in vertical alignment on customer supplied pedestals with spreader beams bolted between them during installation.

6.1.1.1. Passline Adjustment Features

Customer supplied shim plates, or jacking bolts in the pedestal design allows for proper vertical placement and future adjustment of the scanner to match the process passline height. The rail plate mounting hole marks the approximate passline height.

Passline angle can be easily adjusted and locked with passline adjustment bolts on each end of the frame. Fine angle adjustments can be made after the system is fully assembled to match true process angles. See **Figure 6-2**.

6.1.1.2. Cable Routing Features

Access holes in vertical supports allow cable harnesses to be routed to Wi-Fi antennas and user control panels.

Access holes also exist in spreader beam end plates and end supports to allow cables to be routed from one end of the scanner to the other without requiring expensive cross machine conduit runs. Note this option is for the upper beam only.

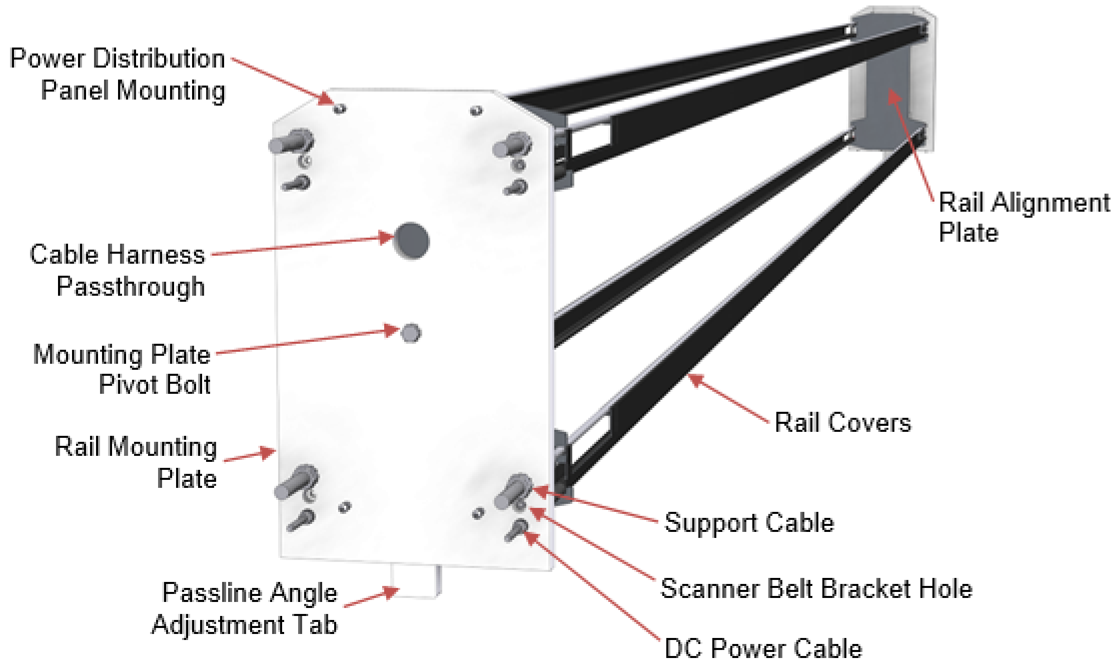
See **Figure 6-2**.

Typical uses for the internal cable routing are:

- Scanner user control panel(s)
- Wi-Fi Antenna
- Field I/O wiring
- Operator devices
- Power delivery
- Pneumatics

6.1.2. Rail System

The rail system is a composite structure of stainless cables, PVC covers, timing belt, and positioning magnets mounted to end plates attached to the vertical supports. See **Figure 6-3**.



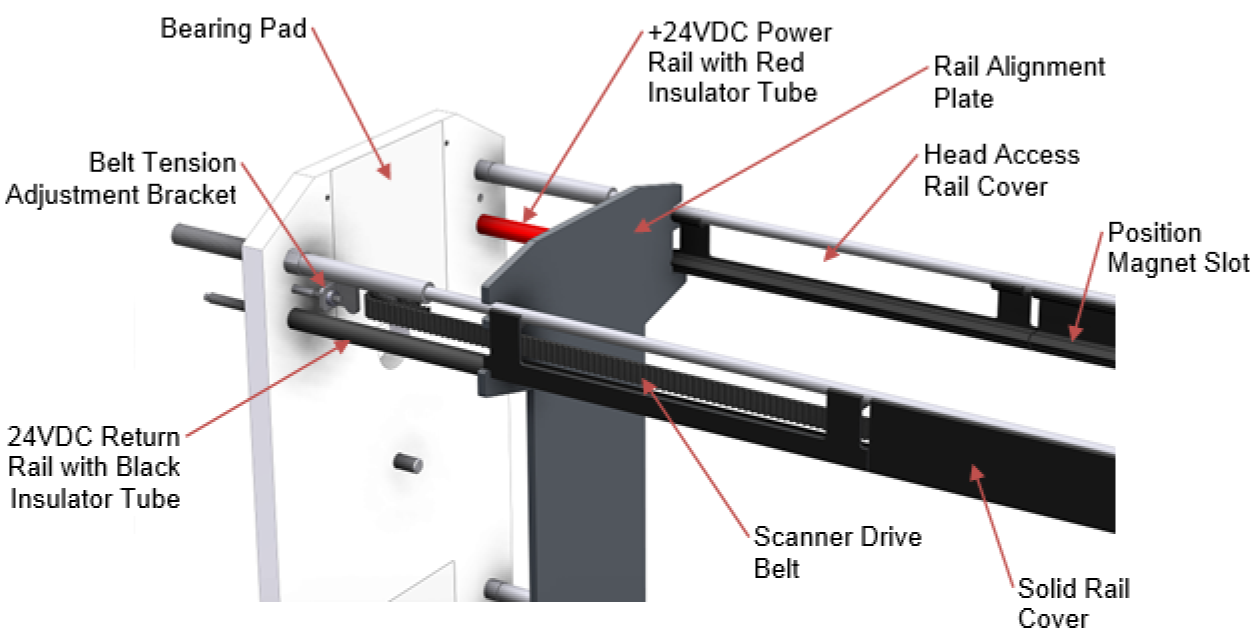


Figure 6-3: Rail System Overview

6.1.2.1. Rail Mounting Plates

Rail mounting plates are attached to the compression vertical end supports to provide a mounting structure for rails, belts and the power distribution panel. See **Figure 6-3**.

A pivot bolt allows for ±5° of passline angle adjustment of the rail system. A set of bearing plates and jacking bolts allow fine passline angle adjustment of the heads, even after the rail system is tensioned and the scanner is operating.

Rail support and power cables are bolted to the four corners of the rail mouting plate.

The scanner belt bracket attaches to a hole between the support and power cables. Belt attachment holes are located on both sides to allow easy field assembly and head orientation configuration.

The mounting plates also support the power distribution panel and end covers which can be mounted at either end of the frame.

6.1.2.2. Support Cables

10mm diameter cables provide the main support functionality for the scanner heads. The cables are manufactured from marine grade stainless steel with a dieform finish. This provides a long lasting, smooth and consistent surface for the the scanner heads to traverse on. See **Figure 6-3**.

Support cables are stretched as a group with hydraulic bolt tensioners to set sufficient operating tension during installation. Recommended cable tension is 40KN (9000lbf) maximum. See installation procedure for tensioning and white paper on cable tension safety details.

Support cables should be kept clean to reduce running friction from head bearing components. Grease and oil deposited on rails from nearby equipment can collect dirt and result in a sticky abrasive paste. Shields may need to be installed if running difficulties develop.

Under normal operation, it is expected that the cables will last the life of the scanner installation.

6.1.2.3. Power Cables

The 5mm diameter power cables provide 24VDC power to the scanner heads. Cables are manufactured from marine grade stainless steel with a dieform finish. This provides a long lasting, smooth and consistent surface for the the scanner head current collectors (copper/carbon brushes) to contact during scanning motion. See **Figure 6-3**.

Power cables are tensioned to approximately10KN (900lbf) maximum during installation. This tension operation is done by hand with wrenches as opposed to hydraulic tensioners. See installation procedure for tensioning and white paper on cable tension safety details.

Power cables are installed after the support cables. Proper cable tension can be set by setting the gap between bare power and bare support cables at center span to 37.5mm.

Power cables should be kept clean to maintain good electrical contact performance at the heads. Grease and oil deposited on rails from nearby equipment can collect dirt and result in a sticky abrasive paste. Shields may need to be installed if running difficulties develop.

Under normal operation, it is expected that the cables will last the life of the scanner installation.

6.1.2.4. Power Rail Insulator Tubes

Insulating tubes cover the exposed power cables between alignment plates and rail mounting plates. A red tube is used on the +24VDC rail side to provide easy visual indication for technicians working on the scanner. A black tube indicates the power return rail.

See **Figure 6-3**.

6.1.2.5. Cable Covers

The cable or rail covers provide protection to the +24VDC power rail against accidental shorting to ground. See **Figure 6-3.**

1m extruded PVC cover segments snap onto both the support and power cables after they are tensioned.

End cover sections are detailed with cutouts to provide access for drive belt installation and sensor mounting screws.

6.1.2.6. Scanner Drive Belt

The scanner head utilizes an omega drive arrangement for the drive system in both the upper and lower heads. In this arrangement the belts are fixed to each end of the scanner and the motor is situated in the scanner head. At the head, the belt is guided by two idler pulleys to an offset toothed drive pulley forming an 'Ω' shaped belt path in the head. See **Figure 6-4**.

Belt installation should be done at a head rail access cover, see **Figure 6-4**. Positioning the head at the high end will align the cover opening with the drive system. Belts can only be threaded through the head from the low end as shown in **Figure 6-4**. Remove motor end head cover to allow access for belt threading around drive pulley.

Belt tension adjustment screws are provided at each end of the scanner. Belt tension should be adjusted to 125-150 N (28-33 lbs). The appropriate belt tension will depend on the scanner length, longer scanner needing higher tension. It is generally appropriate to adjust the tension so that the belt in the middle of the scanner stays well within the extrusion.

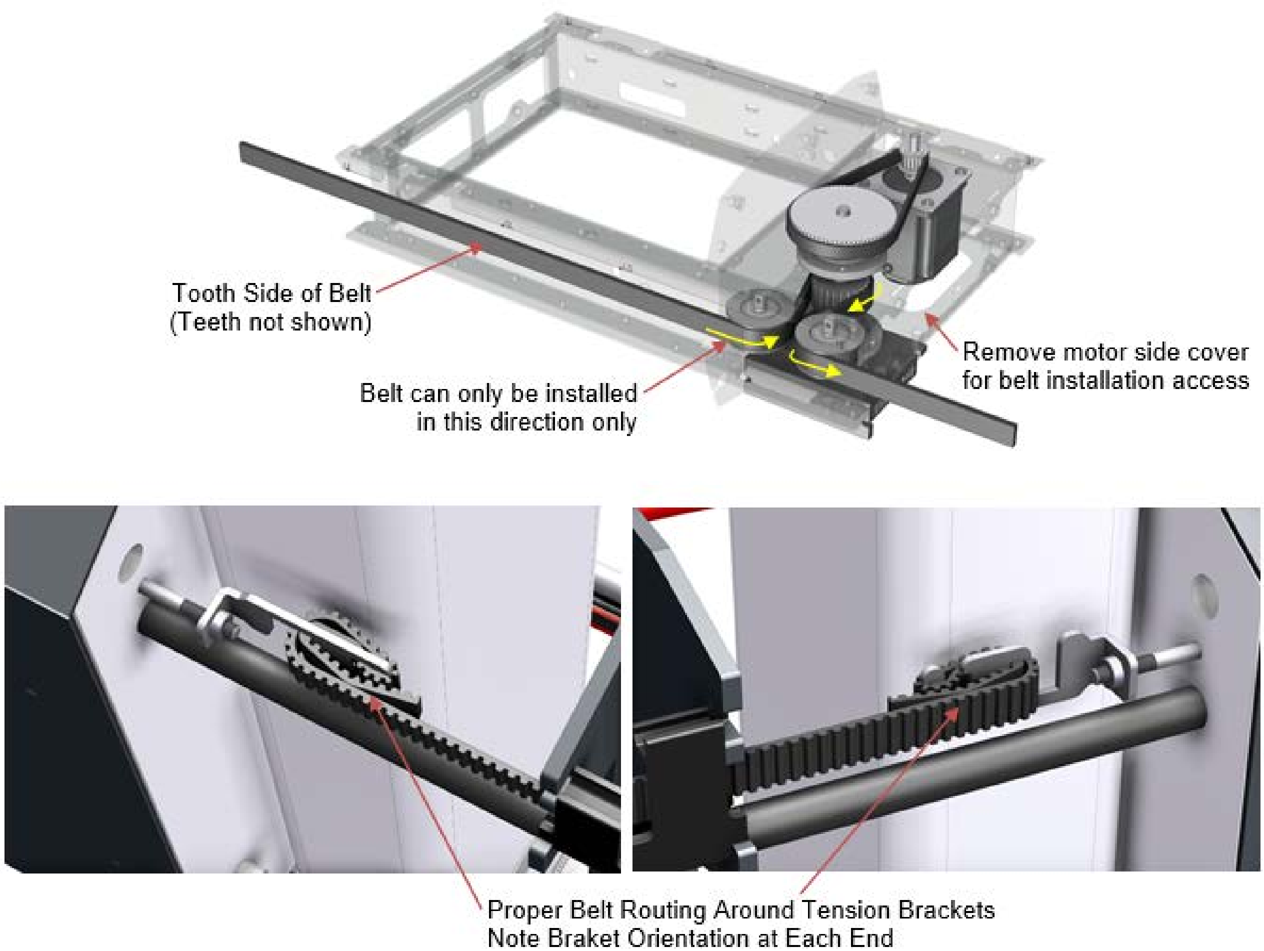


Figure 6-4: Scanner Belt Routing Through Head and Tension Brackets

6.1.2.7. Scanner End Covers

Covers on the rail mounting plates at each end protect the rail anchors and power distribution panel.

A square key latch on the top of the cover provides entry protection due to AC power electrical hazard.

Opening the latch will allow the cover to be lifted slightly (J-slot) and pulled away from the scanner end for removal, see

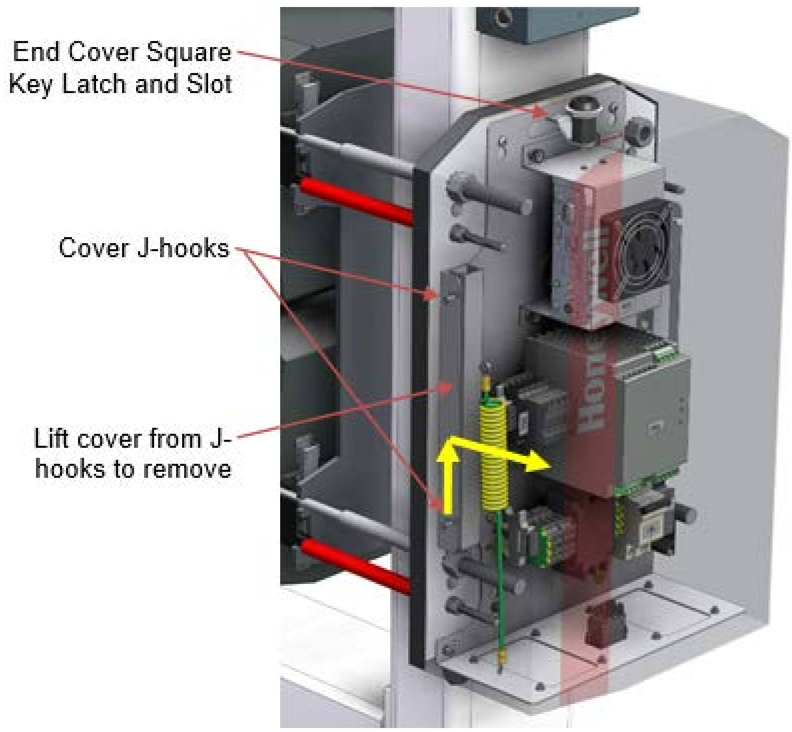


Figure 6-5: Scanner End Cover Latch and Removal

6.1.3. Position Magnets: Crash, Limit, Preset

Absolute position referencing, scan limits and crash signaling for scanner head motion is accomplished with position marking magnets attached to the rail system covers.

Magnet locations are sensed by two magnet switches located on each side of the upper and lower heads. Switch events that occur on the side of the head marked CS are considered crash signals, while events captured by the switch on the LS side are considered either limit or preset signals, see **Figure 6-6**. Crash magnet markers are located on both the upper and lower rails. Limit and preset magnet markers are only located on the upper rail since the upper head controls all coordinated head motion.

A software feature allows the head to further distinguish individual magnets from each other by measuring the activation length as the head moves past. By convention, three different magnet lengths are used in the scanner depending on location:

- Low End 13mm (1/2in)
- High End 19mm (3/4in)
- Middle Preset 25mm (1in)

Note that low and high ends of the scanner are determined by head orientation, irrespective of end bell cable entry configuration, **Figure 6-6** illustrates how to determine scanner high and low end based on head orientation. Note that the motor determines the high side of the scanner head and the limit/preset magnet locations are always on the belt side of the rail system. Additionally, the sheetmetal of the heads above the support rail, see **Figure 6-7,** is marked for reference as follows:

- LE: Low-End
- CL: Centerline of primary sensor
- CS or LS: Crash Switch or Limit Switch Location
- HE: High-End

Magnet location and function details are summarized in **Table 6-1**.

Table 6-1: Crash, Limit and Preset Magnet Summary

Magnet type	**Magnet Length**	**Location**	**Head Action**
Crash	Low End 13mm (1/2in) High End 19mm (3/4in)	40cm inboard of each end of upper and lower rails Crash switch side of the heads (no drive belt side)	Stop motion in current direction. Reverse out of magnet zone.
Limit	Low End 13mm (1/2in) High End 19mm (3/4in)	Each end of upper rail only >10cm inboard of crash magnet locations Limit switch side of the head (drive belt side)	Signals limits to scanning length. Head will not scan past this zone regardless of QCS scanner configuration.
Preset	25mm (1in)	Middle of upper rail only. Limit switch side of the head (drive belt side)	Trigger location event for head encoder position monitoring.

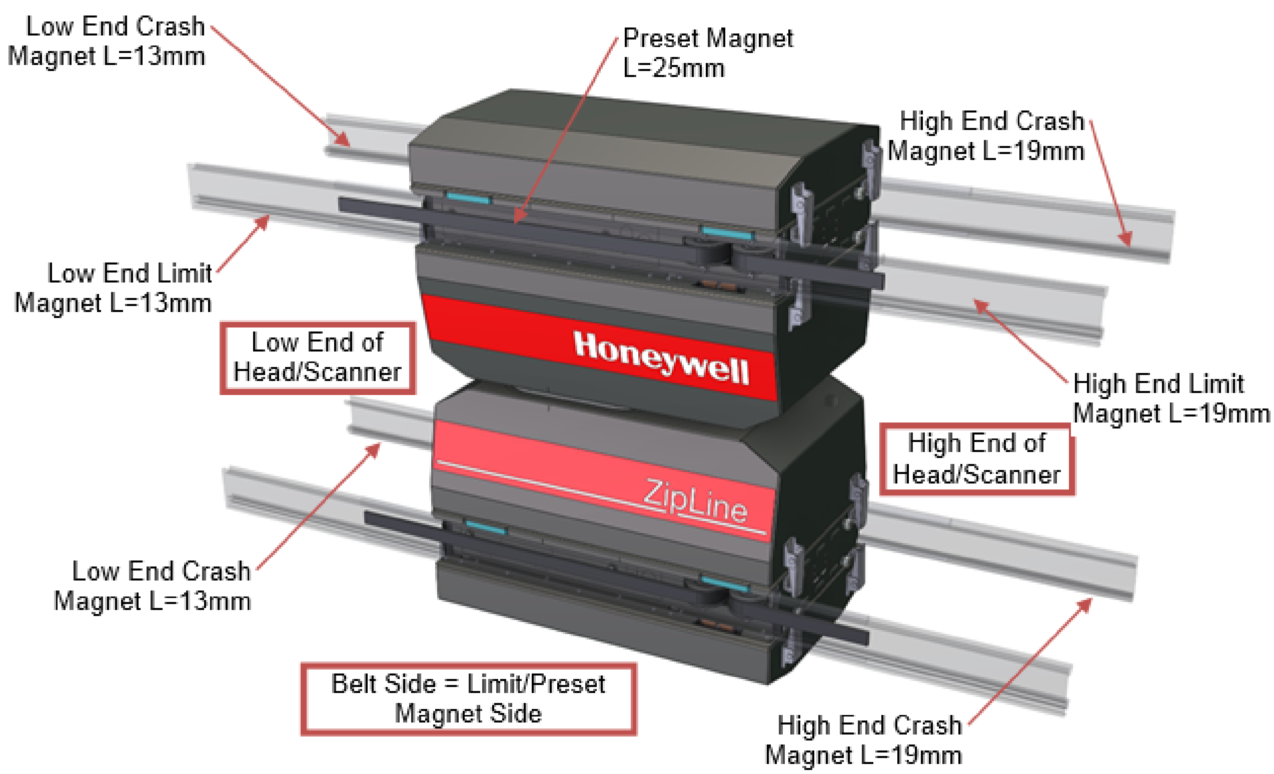


Figure 6-6: Position Magnet Locations Relative to Head Orientation

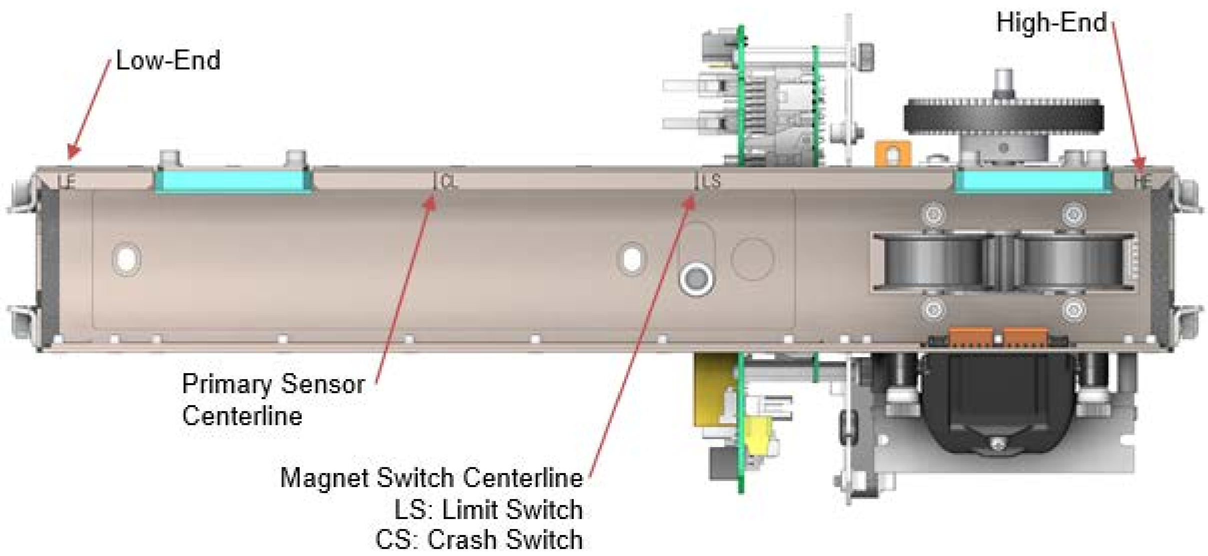


Figure 6-7: Head Markings: Switch Location, Centerline, High End, Low End

6.2. Scanner Power Distribution Panel

Electrical power distribution for the scanner is controlled by the power distribution panel, see **Figure 6-8**. The panel can be mounted to either end of the scanner frame during installation without factory pre-configuration.

The panel contains the 24VDC and 12VDC power supplies, breaker and fuse circuit protection devices and the measurement sub-system (MSS) computer.

All power used by the scanner heads is supplied by the 24VDC supply power via the scanner rails. A 12VDC supply is used for the MSS computer.

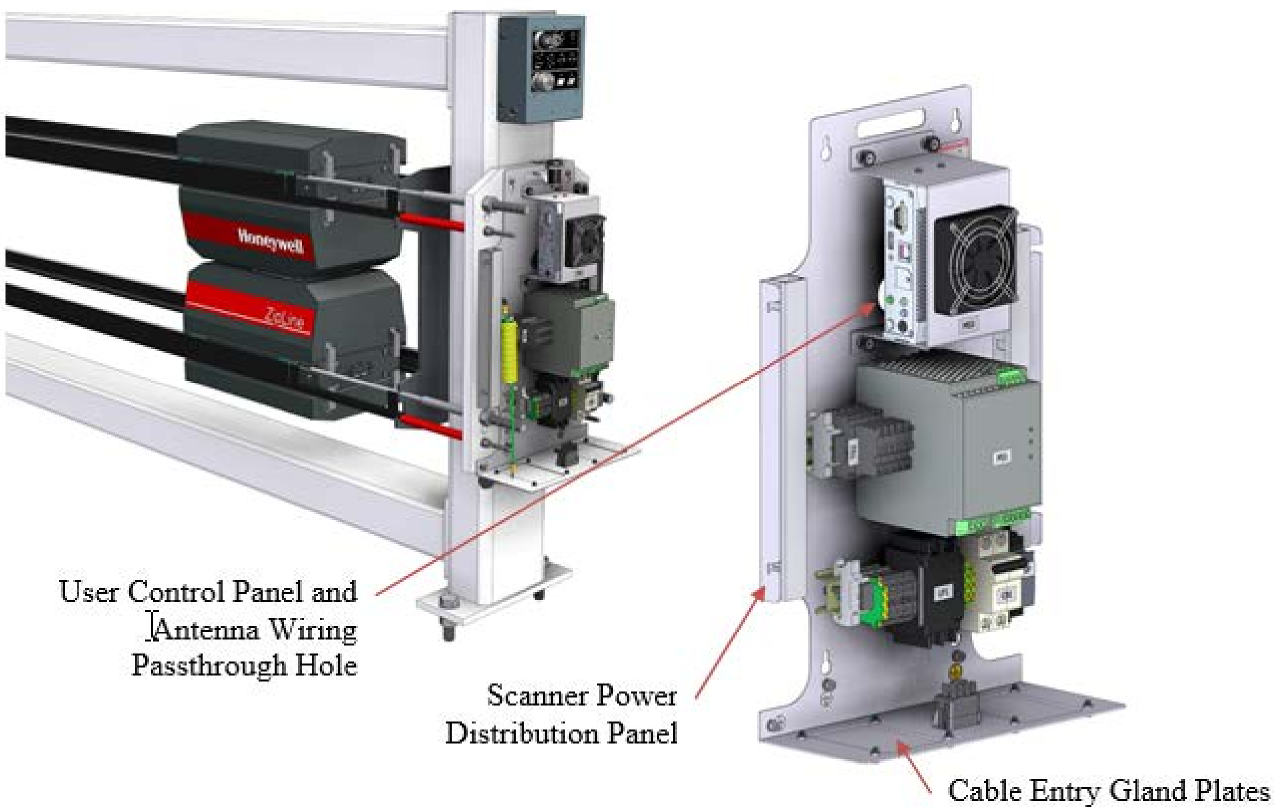


Figure 6-8: Scanner Power Distribution Panel

6.2.1. Schematic

The electrical schematic for the scanner power distribution panel can be found in drawing 6580801938.

6.2.2. Installation Wiring

Cable entry for AC power, communications, and field I/O is accommodated by two gland plates on the bottom flange of the panel, see **Figure 6-8**. Strain relief fittings for field cable should be installed in these plates.

See Section 4 for wiring details.

6.2.3. Rail Wiring Connections

DC power is supplied to the scanner power rail end fittings from 24VDC red and black lugged leads provided on the panel. Connection of leads should be done after proper tension is applied to cables and rail covers have been installed. Lug attachment to the M8 cable fittings are made between a pair of jam nuts as shown in **Figure 6-9.**

Figure 6-9: Rail Wiring Connections

The polarity of the connection is dependent on head orientation. The belt side of the head is the 24VDC return side for both upper and lower heads. Scanner head polarity can be confirmed by the connection markings on the head power distribution board, see **Figure 6-9**. In addition, rail connections should match the red and black insulation tube markings on the power rails, see **Figure 6-10**.

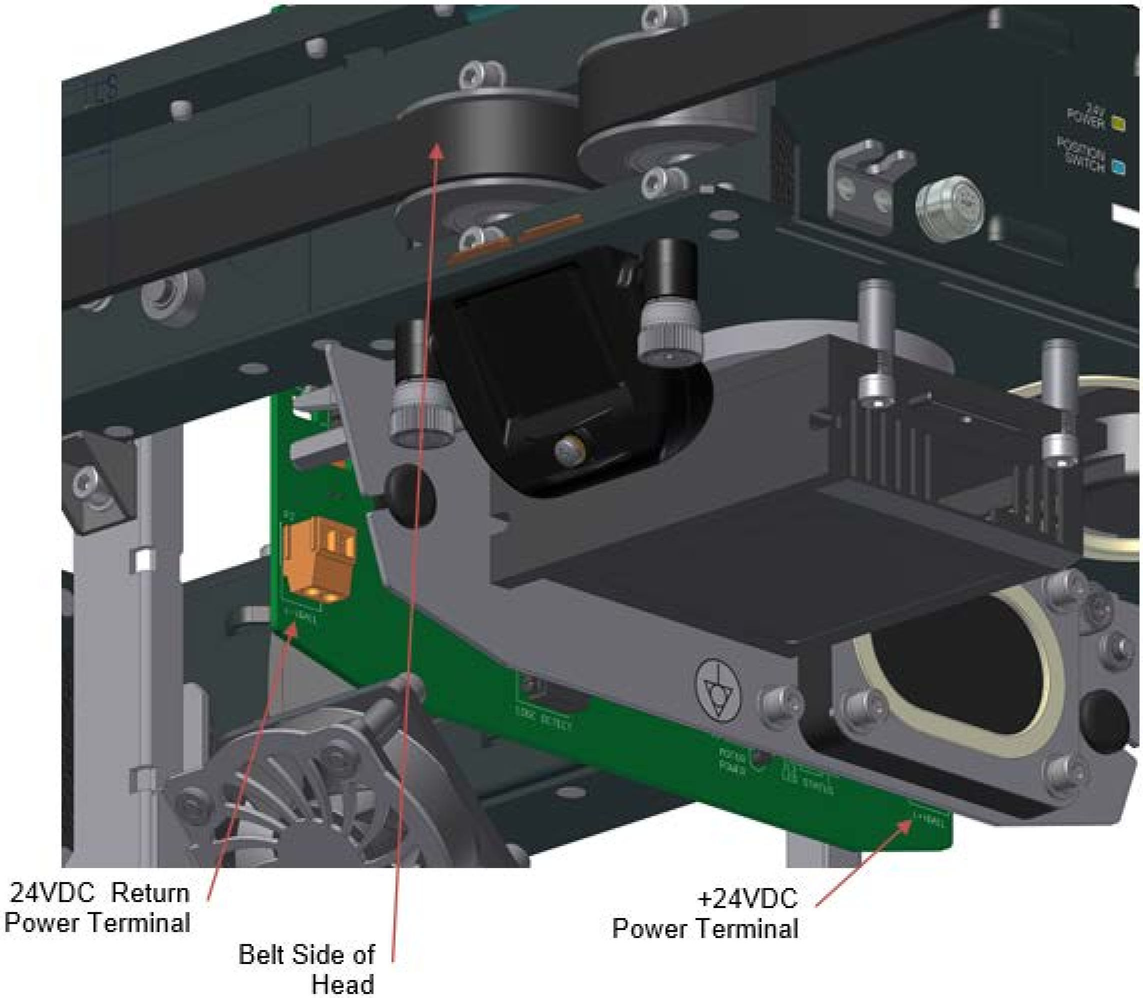


Figure 6-10: Head Polarity Markings

6.2.4. Electrical Protection Systems

Scanner AC power is protected by the surge protector, main breaker and line filter. Individual DC circuits are protected by fuses. See **Figure 6-11**.

An external system power switch is located on the bottom of the scanner to allow the system power to be turned on or off without needing to remove the panel cover.

Live AC wiring may pose hazard restrictions for cover removal in certain mill environments.

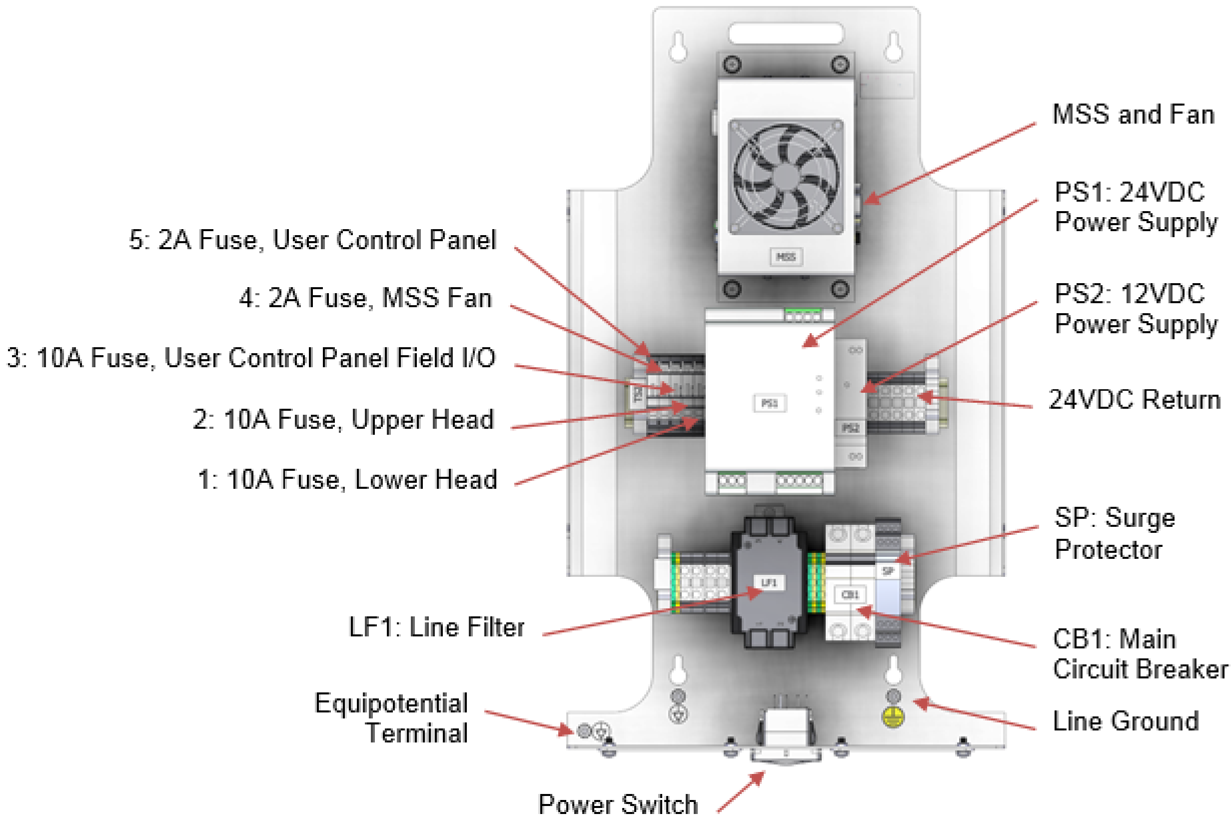


Figure 6-11: Electrical Circuit Protection Devices

6.2.5. Panel Installation and Removal

The power distribution panel can easily be installed or removed by loosening the four mounting screws and using the keyhole panel cutouts as shown in **Figure 6-12**.

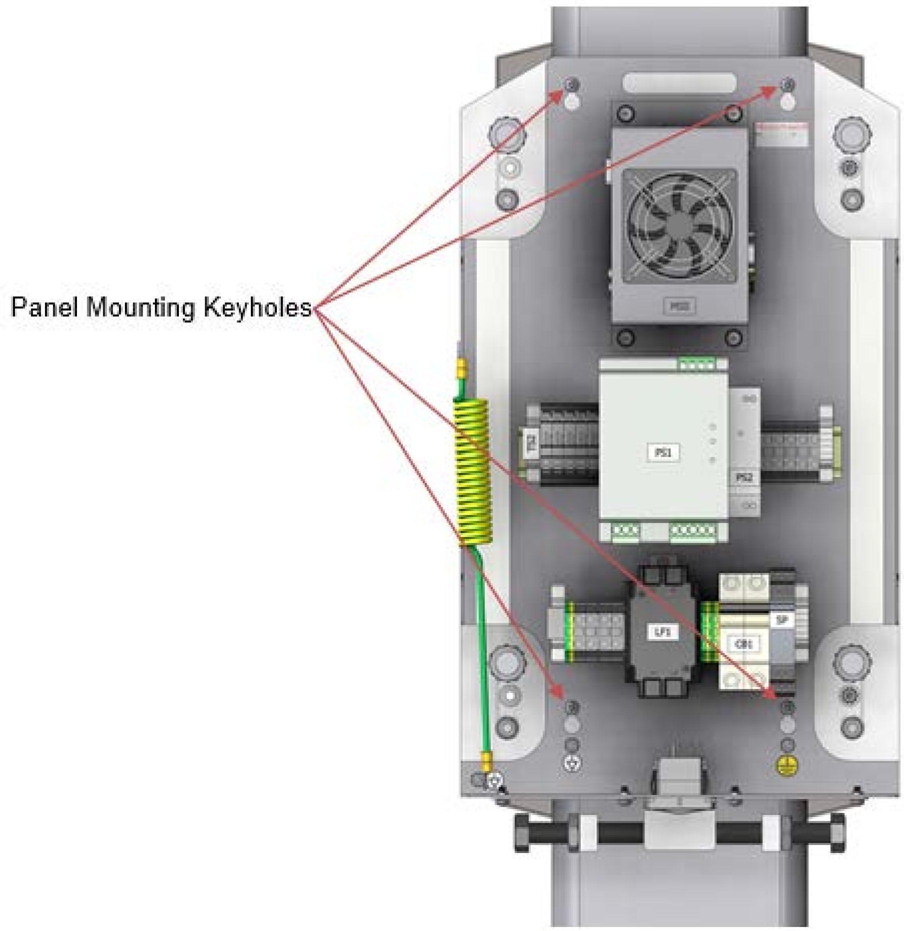


Figure 6-12: Power Distribution Panel Mounting

6.3. Measurement Modules

The heads of the Q3090 scanning system consolidate functionality traditionally associated with a scanner frame into the head assembly. This approach results in an autonomous device that contains all the elements required for:

- Motive power
- Positioning
- Head-to-head alignment

- Sensing
- Data acquisition
- Pneumatic power
- Wireless communication
- Information processing

Many tradional scanner subsystems are simplified in the Q3090, such as drive assemblies, while others are eliminated such as powertracks.

The Q3090 scanner heads can be broken into two main assemblies: the head chassis and the sensor frame, see **Figure 6-13**. These assemblies are detailed in the following sections.

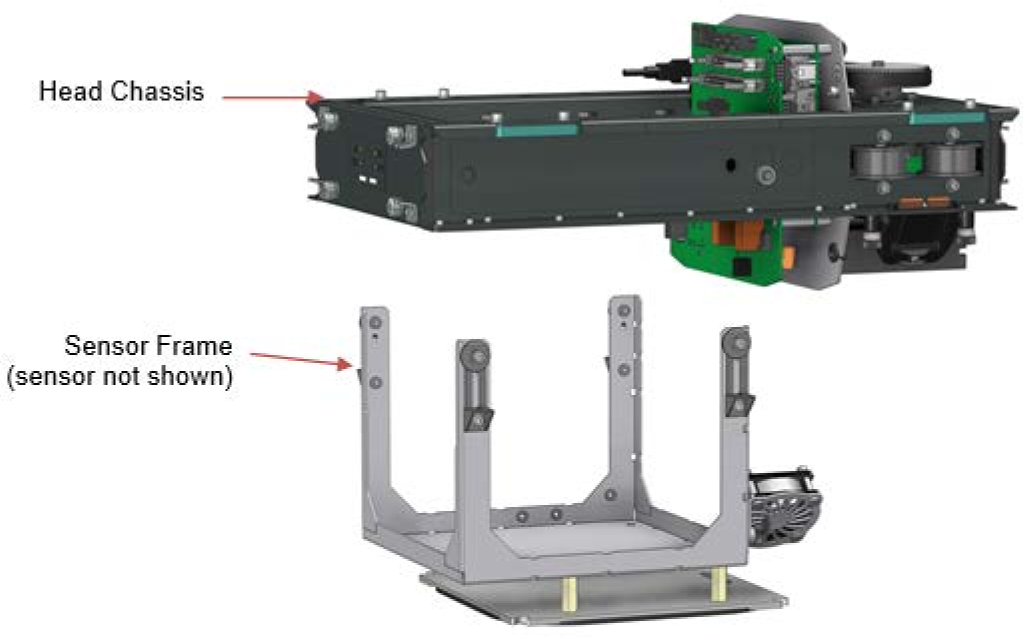


Figure 6-13: Head Chassis and Sensor Frame

6.3.1. Head Chassis

The chassis assembly, **Figure 6-13**, provides the base level of functionality required for mounting sensors, driving motion, acquiring sensor data, and communicationing with the MSS and QCS system.

The head chassis assembly design and parts are common to both the upper and lower heads. Automatic software configuration and selector switches on the head power distribution board configure specific upper and lower head functionality. This includes:

- Defining the upper head as the master for motion control and the lower head as the follower.
- Assigning the I/O for XYZ alignment sensors and head alignment limit switch in lower head.
- Network configuration.
- Radiation green light source and receiver jumpers.

The main components of the chassis assembly are detailed in the following sections.

6.3.1.1. Head Frame

The head frame is an aluminum sheetmetal assembly designed to fixture all head drive and sensor components.

The frame is a riveted sheetmetal assembly that cannot be taken apart, see **Figure 6-14**. Most of the frame is powder coated except for the vertical centre piece. This part acts as the chassis ground. There are also text indicators along the edge of the frame that indicate orientation and location as follows:

HE – High-End

LE – Low-End

CL – Sensor Centre Line

CS – Crash Switch

LS – Limit Switch

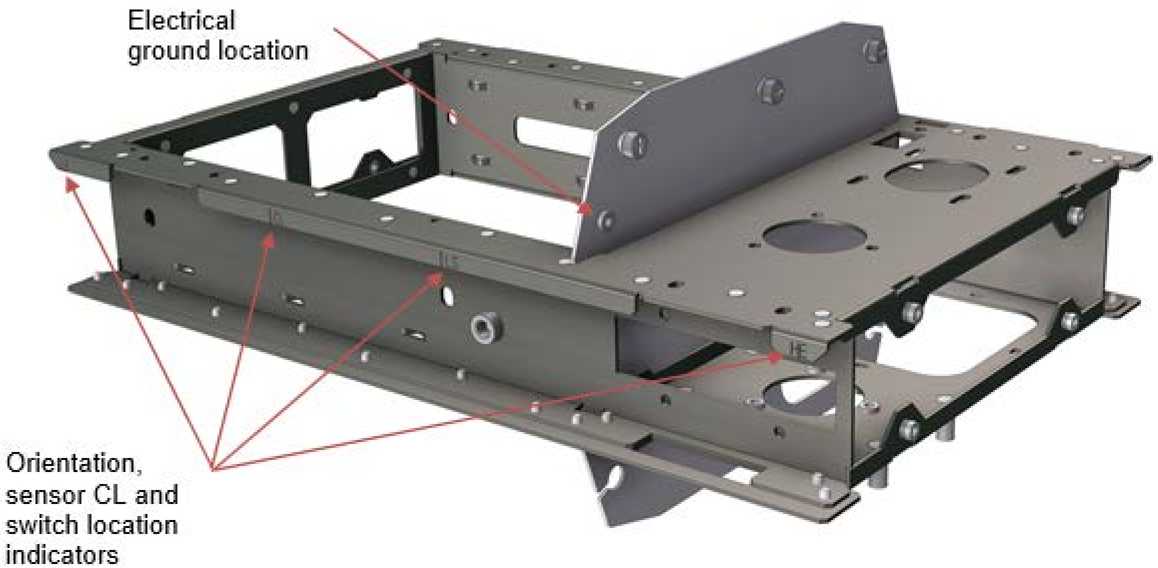


Figure 6-14: Head Frame

6.3.1.2. Power Distribution Board (PDB) PCBA

Power and signal distribution throughout the chassis assembly is done by the power distribution board. The power distribution board in the head is coupled directly with the EDAQ controller to reduce cable connections, see **Figure 6-15**.

The power distribution board in the heads perform the following functions:

- Distribution and conditioning of 24VDC power from the rail current collectors to sensors and chassis components.
- Circuit power protection with fuses and PTC devices.
- Direct routing of analog and digital signals from the head EDAQ to chassis components.
- Interlock watchdog relay control for motor drive power and radiation sources.

- Network configuration.
- Upper and lower head configuration.
- Air compressor pressure monitoring.
- Troubleshooting indicators and test points.

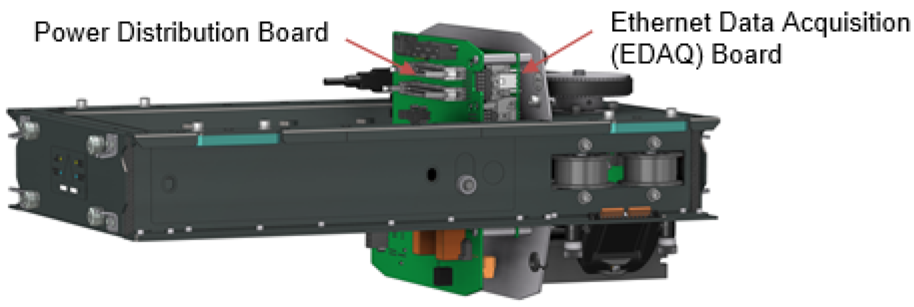


Figure 6-15: Power Distribution Board

6.3.1.2.1. Connections Schematic

All component connections to the power distribution board are summarized in drawing 6580801915 sheet 3.

6.3.1.2.2. Configuration

The same power distribution board part is installed in both upper and lower heads. The board contains two switches to allow easy configuration of the PCBA for upper or lower head placement, see **Figure 6-15**.

- SW1 selector switch configures different LAN setups. Normally the switch is set to 2 for a single scanner system and wireless system defaults. During initial network setup of an EDAQ, the card will need to be connected to the MSS via LAN cable directly. To enable the Ethernet port, the switch should be set to position 1. Position 3 is used for non-default wireless communication settings and position 4 is reserved.
- SW2 enables the XYZ sensor I/O to be routed to the EDAQ.
- SW3 configures auto-location resistors to upper or lower head values for proper sensor software configuration.

- W1 and W2 allow the serial green light circuit to be bypassed when no sensor which requires interlocking is present in the primary or secondary sensor locations. W2 is always installed in a single sensor head.
- W3 is installed in order to test the interlock circuits. When inserted, W3 allows a test interlock signal to be generated and is used to validate correct operation of the interlock circuits. W3 must be removed in normal operation.

WARNING Do not operate the system with W3 installed. This will override essential safety interlocks and could lead to serious injury. The interlock test circuit should only be utilized by qualified personnel.

Typical head switch and jumper configurations are shown in Table 6-2.

Table 6-2: Power Distribution Board Switch and Jumper Settings

Selector	Setting	Typical Upper Head	Typical Lower Head
SW1 LAN Bit:	1 2 3 4	1: Wired Ethernet setup connection. 2: Single scanner system default Wi-Fi setup. 3: Additional scanner wireless communication settings. 4: Reserved	1: Wired Ethernet setup connection. 2: Single scanner system default Wi-Fi setup. 3: Additional scanner wireless communication settings. 4: Reserved
SW2: Upper/Lower Head Switch	Up Down	Up	Down
SW3: Upper/Lower Head Switch	Up Down	Up	Down
W1: Green Light Jumper	In Out	**In**: Primary sensor which does not use interlocking (e.g. MXIR). **Out**: Primary sensor which uses interlocking. For example, nuclear gauge.	**N/A**: Green light circuitry is only active on the upper head.
W2: Green Light Jumper	In Out	**In**: Single sensor head.	**In**: Single sensor head.

		In: Secondary sensor which does not use interlocking (e.g. MXIR). **Out**: Secondary sensor which uses interlocking. For example, nuclear gauge.	**In**: Secondary sensor which does not use interlocking (e.g. MXIR). **Out**: Secondary sensor which uses interlocking. For example, nuclear gauge.
W3: Interlock Test Circuits	In Out	**Out**: Normal operation **In**: Interlock override, do not use.	**Out**: Normal operation **In**: Interlock override, do not use.

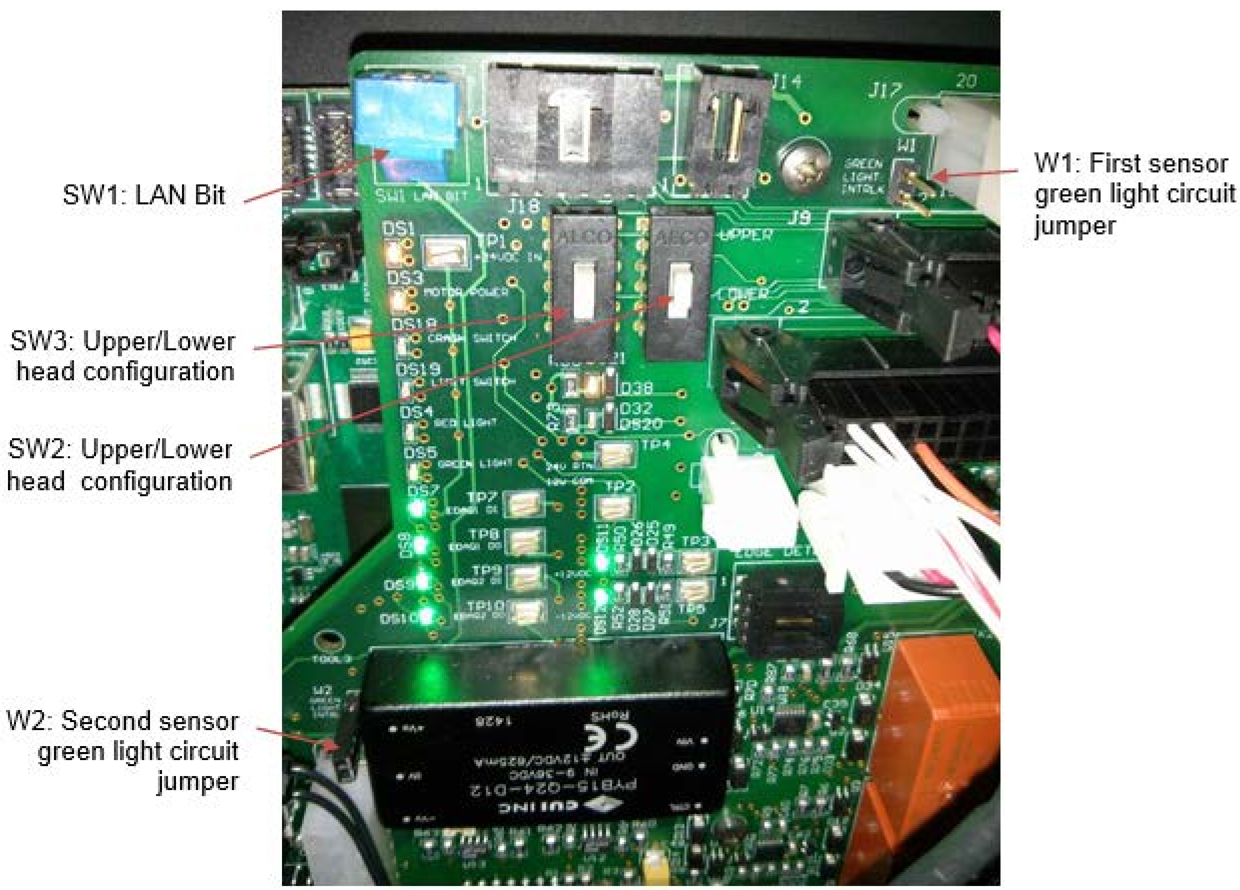


Figure 6-16: Power Distribution Board Jumper and Switch Configurations

6.3.1.2.3. Head Power Fuse

A 6.3A fuse protects the 24VDC power circuits in the head as shown in **Figure 6-17**. A spare fuse is located in a holder to the left as shown.

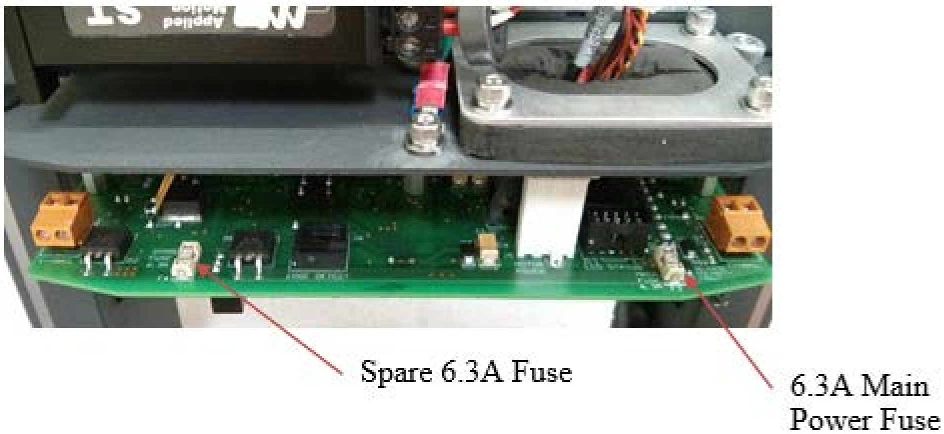


Figure 6-17: Power Distribution Board Fuse Location

6.3.1.2.4. Power Distribution Board Indicator LED’s

Indicator LED’s have been included on the power distribution board for troubleshooting assistance. See **Figure 6-18** for location details.

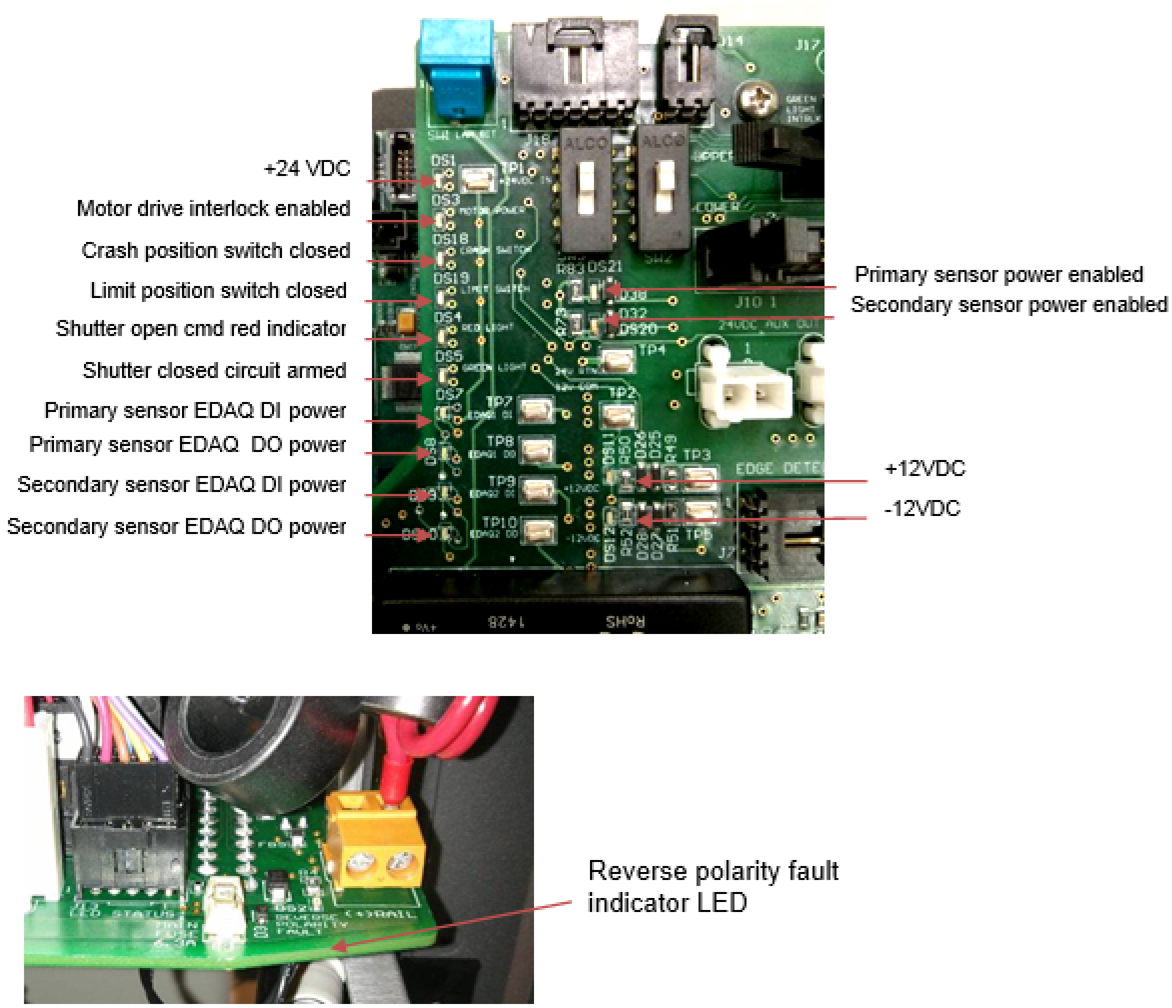


Figure 6-18: Power Distribution Board Indicator LEDs

6.3.1.2.5. Primary and Secondary Sensor Harness Connections

Single sensor head configurations use the three primary sensor connectors as shown in **Figure 6-19**.

Secondary sensors are connected directly to a second EDAQ for analog and digital I/O and to the secondary sensor power connector on the power distribution board as shown in **Figure 6-20**.

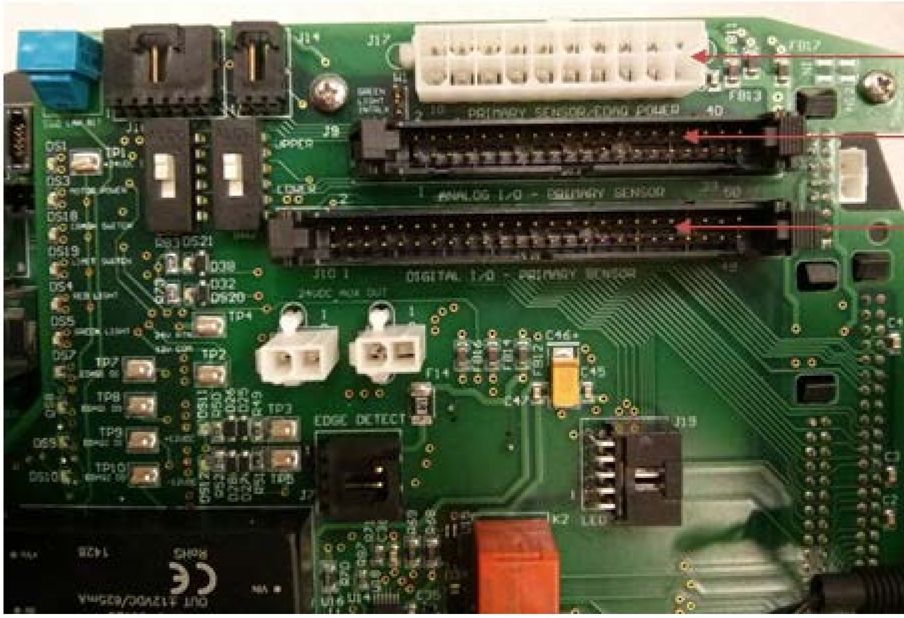


Figure 6-19: Primary Sensor Harness Connections

Figure 6-20: Secondary Sensor Harness Power Connection

6.3.1.2.6. Removal and Installation

Removal of the power distribution board and EDAQ is done by removing all harness connectors and disconnecting the source compressor air tube at the quick connection fitting.

Warning do not attempt to remove the tubing from the air pressure sensor barb fitting. This will break the fitting. If the tubing needs to be replaced, cut the tubing close to the fitting and then slit the tubing along the barb.

Undo the six thumbscrews holding the power distribution board and EDAQ to the head frame.

Lower the pair of boards down and out of the heads. The power distribution board will interfere with magnet switch components if it is pulled upwards.

Installation is reverse of removal. Check all connection points, jumpers and switch settings for proper configuration.

6.3.1.3. Ethernet Data Acquisition (EDAQ) Board

The Ethernet data acquisition (EDAQ) board handles all motion control and I/O activities for each head.

EDAQ boards are generic and self-configuring based on position and sensor type resistors that are measured during startup.

6.3.1.3.1. Connections Schematic

The motor drive serial communication cable, head temperature sensors, and Wi-Fi adaptor are all connected directly to the EDAQ. See drawings 6580801915 sheet 3 and 6581500030AS for connection details.

6.3.1.4. Wireless Ethernet Adapter

The 5Ghz wireless Ethernet adapter plugs in the USB port on the EDAQ via extension cable. A RF transparent window near the mounting port ensures communication through head covers.

In some installations the wireless channel may need to be adjusted from default values due to RF interference. Refer to the wireless channel setup in the MSS EDAQ Manual for instructions on changing these settings.

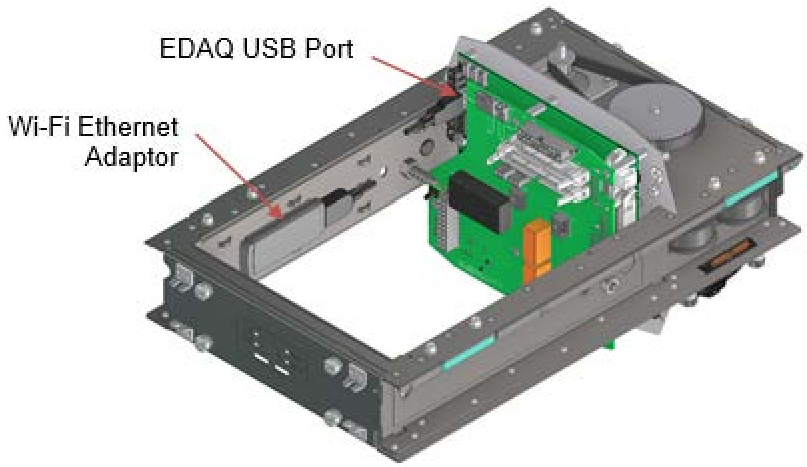


Figure 6-21: Wi-Fi Ethernet Adapter

6.3.1.5. Temperature Sensors

There are four temperature inputs available via the EDAQ in the scanner heads. Three of these are used for environmental measurements by the upper and lower heads. Thermistor sensors are positioned to take readings from the following locations:

- External ambient air, connected to EDAQ port J4
- Internal motor enclosure, connected to EDAQ port J5
- Internal sensor enclosure, connected to EDAQ port J6

See drawing 6580801915 sheet 3 for connector locations.

Compatible thermistor sensors are 100K NTC only.

6.3.1.6. Linear Bearings

The scanner heads travel on PTFE composite self-lubricating bearing blocks. Bearings should be periodically checked for wear and replaced as required. Wear can be monitored by inspecting the gap between the chassis lip and rail extrusion.

Figure 6-22: Linear Bearing

The bearing block alignment is set in the factory using a jig to provide accurate alignment between upper and lower heads. Bearings can be adjusted in the machine direction if needed but new systems should not require it. Note that this can affect machine direction head to head alignment. Refer to alignment instructions in the bearing block replacement procedure for proper adjustment.

Bearing material is designed to run in a dry condition. Oils applied to scanner rails may collect dust debris and thicken over time leading to higher running friction levels. It is normal to have particles embed themselves into the bearing material during use. It is also normal for some of this debris to collect in the valleys between stands of the support cables. Debris build up should be monitored periodically to ensure it does not fall onto the sheet.

6.3.1.7. Drive System

The scanner drive system is comprised of the following:

- Stepper motor drive
- Stepper motor with encoder
- Speed reduction pulley/belt and idlers

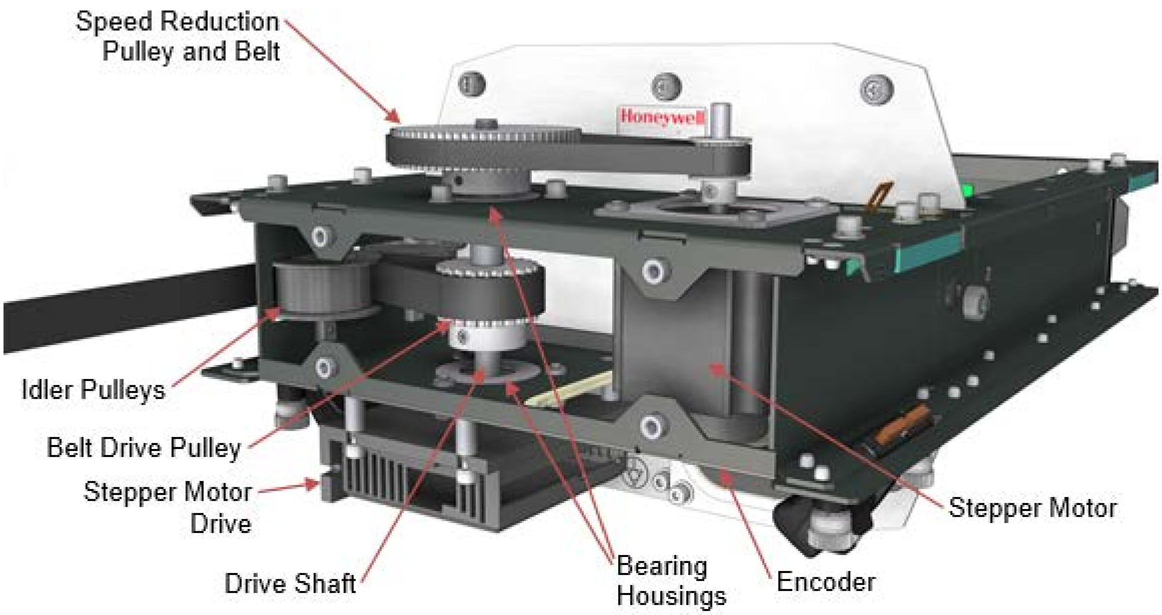


Figure 6-23: Drive Components and Belt Access (End Cover Removed)

6.3.1.7.1. Stepper Motor Drive

The stepper motor drive is controlled by the head EDAQ via serial communications. The serial cable is plugged into the EDAQ RS232 port and interfaces with the RJ14 port on the stepper motor drive.

The motor contains additional control wiring for enable, direction, and start/stop.

Power to the stepper motor drive is delivered by the motor power harness which is connected to the head power distribution board through the cable pass through.

6.3.1.7.2. Stepper Motor and Encoder

The scanner heads are individually driven by stepper motors. Stepper motors feature: no reduction gears, high torque at low speeds, holding torque when stopped, extremely fine motion increment resolution, absolute postioning, extremely high speed turn down ratio and compact size.

Encoders attached to the motor output shafts allow motion control software to track absolute head position after the initial startup limit switch homing routine is completed.

The motor and encoder assembly can be easily removed from the chassis frame by removing the four mouting screws accessible through the motor access hole on the bottom side of the chassis.

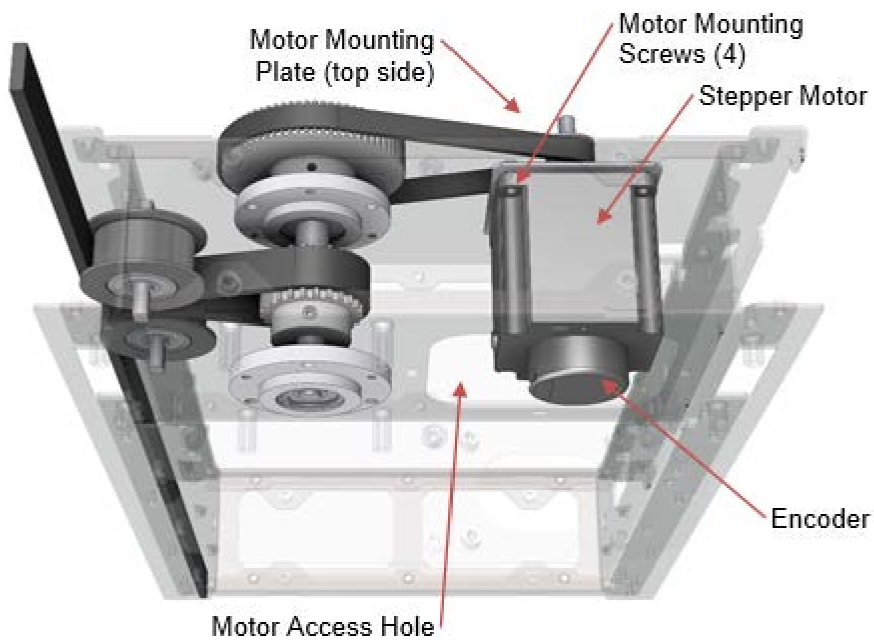


Figure 6-24: Belt Routing

6.3.1.7.3. Pulleys and Belt

Power from the stepper motor is transmitted through a reduction pulley set. This allows the motor shaft to be isolated from the high side loads generated by the tension in the scanner belt. It also allows speed and torque to be more closely matched to the drive application.

In certain circumstances it is useful to remove the motor drive belt to disconnect the motor from the head. This can be accomplished by sliding the belt up and off the large speed reduction pulley. The motor belt tension is also set by removing the belt and setting the distance between motor shaft and drive shaft.

Toothed pulleys are set to axles with setscrews and should be checked periodically to ensure that they are properly fixed in place. Loose pulleys will cause head to head misalignment and may damage shafts if left unchecked.

The main drive shaft is supported by two shielded bearings set in housings attached to the chassis frame.

Idler pulleys are mounted to the inside channel of the chassis frame.

Shaft and idler pulley bearings should be checked periodically for proper operation.

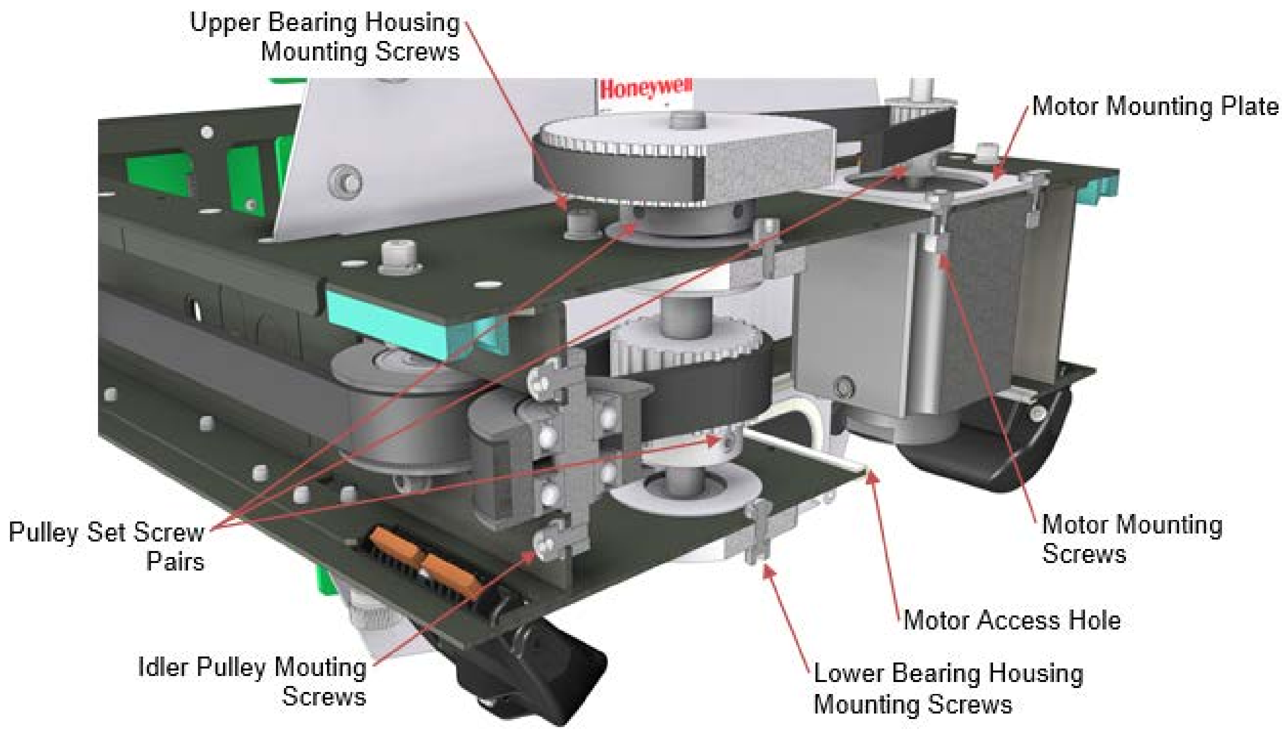


Figure 6-25: Drive System Mounting Details

6.3.1.8. Current Collector (Copper Graphite Brushes)

Each head is equipped with two current collector assemblies with dual copper graphite composite brushes, see **Figure 6-26**. Brush composition was chosen for long wear life, low dust, and low resistance.

For convenience, current collectors should be replaced as complete assemblies at end of life. Wear indicators are present on the brushes in the form of lines

The current collector assemblies are mounted to the chassis frame with pivoting mounts to allow the brushes to maintain contact with the rail system over moderate angles of misalignment. Under extreme displacement or twisting of the rail system, bushes may pop out of the rail slot. Scanner power should be disabled while brushes are reseated in rail slots.

Electrical connection from each brush is made at the connection binding post and is terminated to each side of the head power distribution board, see **Figure 6-26**. When electrically connecting a head, confirm the DC power polarity of the rails with head power distribution board connection points.

Current collectors must be removed before the heads can be removed from the rails or reinstalled to avoid breaking the current collector housing or brushes.

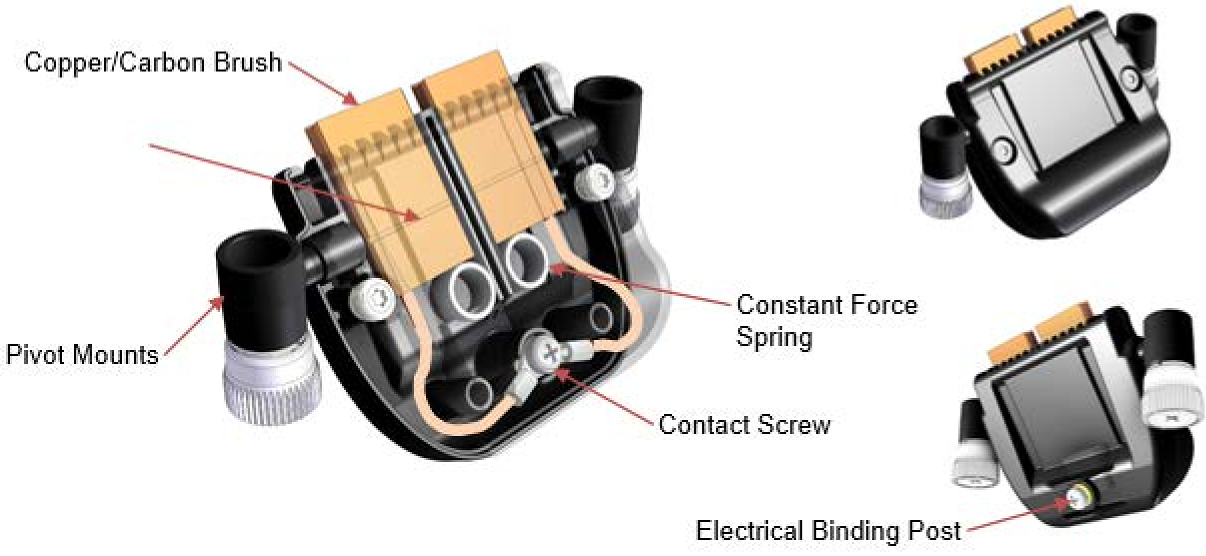


Figure 6-26: Current Collector Assembly

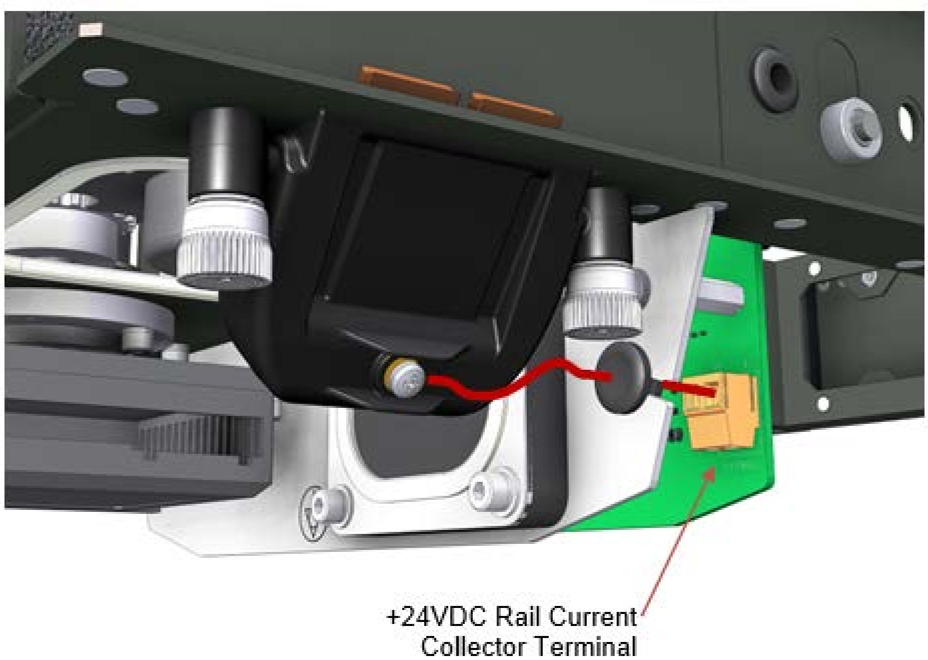


Figure 6-27: Current Wiring Detail

6.3.1.9. Scan Position Magnet Switches

Each head contains two barrel-type position magnet switches mounted to each side of the the chassis frame, see **Figure 6-28**. Switches on the belt side of the head relate to limit and preset trigger events. Switches on the side opposite the belt relate to crash switch events.

Switch operation can be easily monitored by with the head status panels on each side of the heads. Triggering switches are indicated with blue lamps. Left and right indication lamps correspond to switches on respective sides of the head.

Switches are connected to 1x2 connectors on each side of the power distribution board, see **Figure 6-28**.

Switches should not extend outwards more than 8mm from the side of the chassis to avoid rubbing on scanner belt.

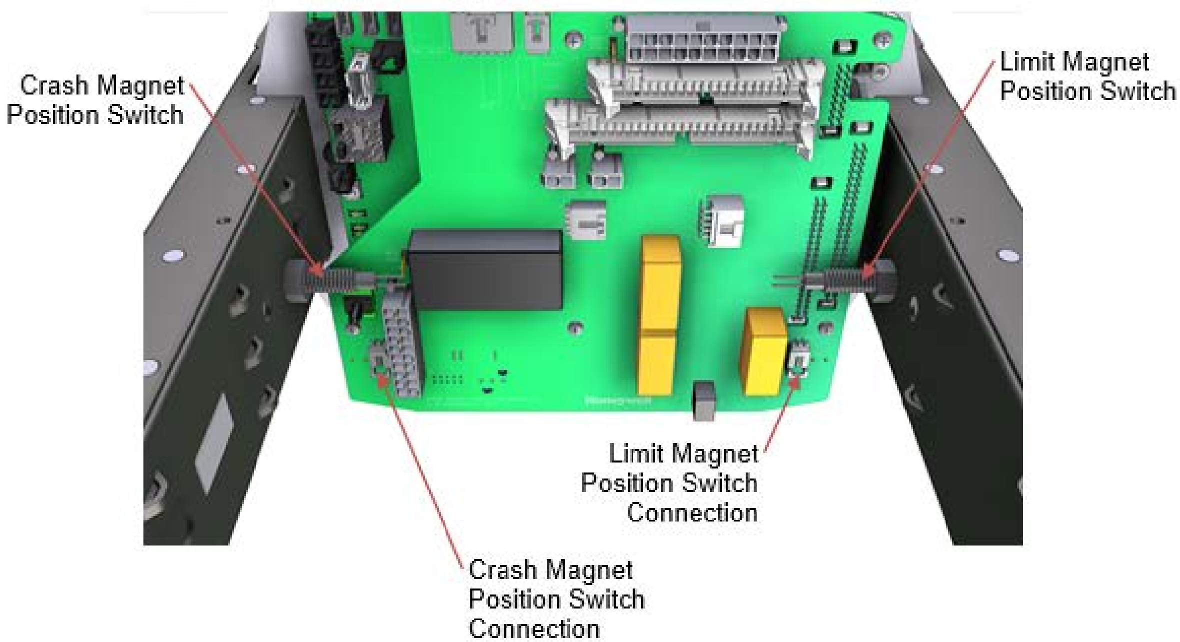


Figure 6-28: Position Magnet Switches

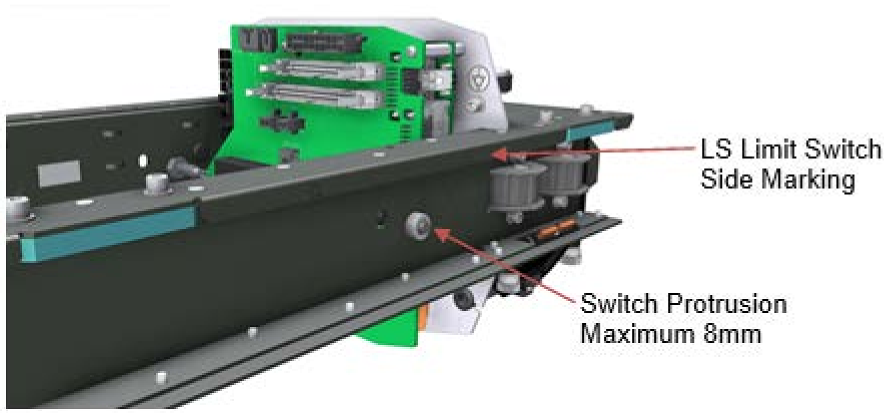


Figure 6-29: Magnet Position Switch Protrusion Length

6.3.1.10. Head Status Panels

Indication lamps have been included at each cross direction end of the scanner heads to provide operational status of the scanner heads.

Only the upper head displays radiation shutter status information since it is the only one that houses radiation sources, see **Figure 6-30**.

Both the upper and lower heads relay 24VDC power, magnet position switch operation, and motor enable status for their respective assemblies.

Refer to **Table 6-3** for detailed indicator meanings.

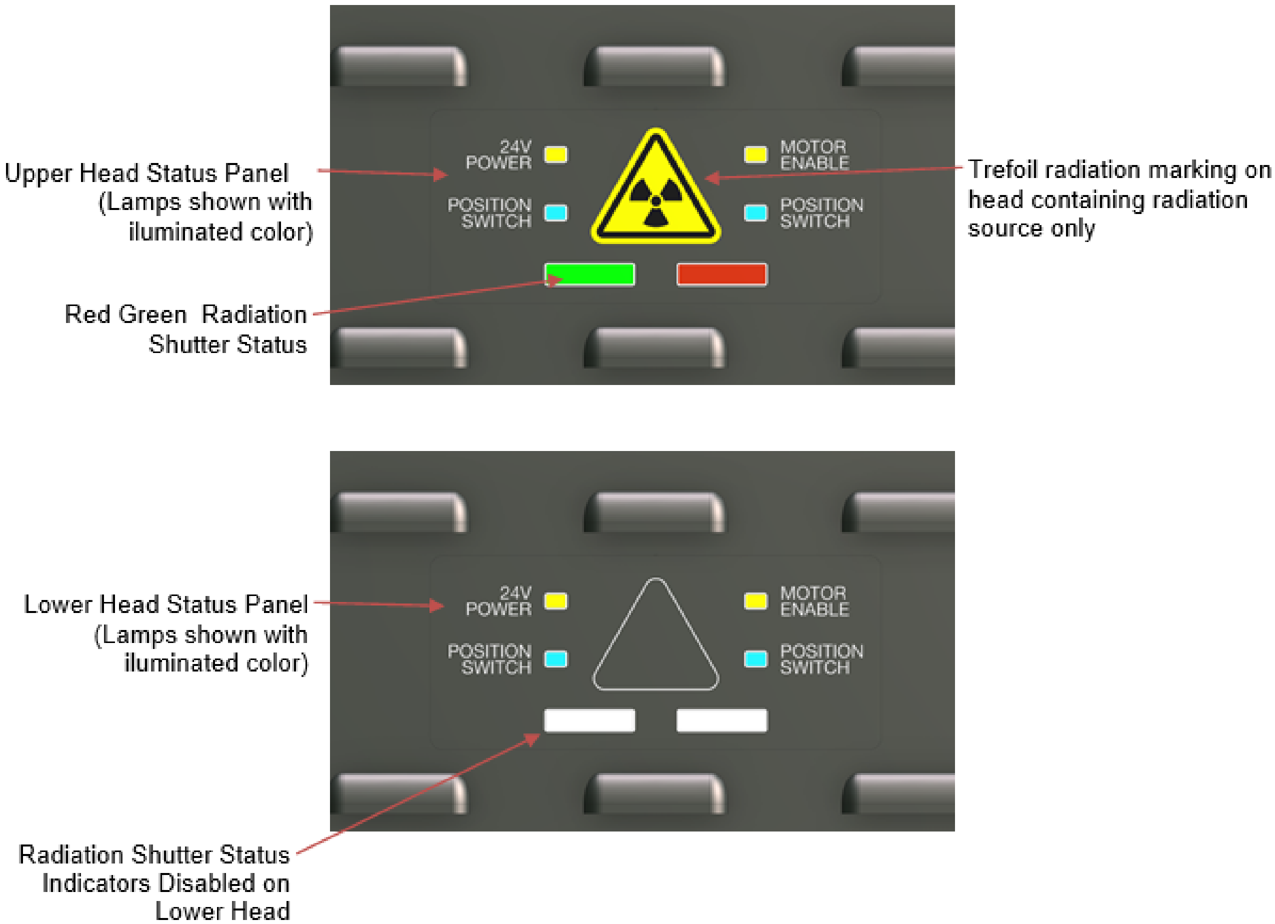


Figure 6-30: Head Status Panels

Table 6-3: Head Status Indicator Guide

Indicator Lamp	When Lit
24VDC Power	Indicates that 24VDC power is properly connected to the head and the head power distribution board is operating
Motor Enable	Indicates that the motor drive has been enabled by the EDAQ Implies that the EDAQ hardware and software are operating
Position Switch	Indicates that a magnet position switch has been activated
Red Radiation Shutter (Upper Head Only)	Indicates that a software command has been sent to open the source shutter
Green Radiation Shutter (Upper head Only)	Indicates that the switch monitoring the physical shutter state is closed.

Status panels are connected to the head power distribution board. See **Figure 6-31** for details.

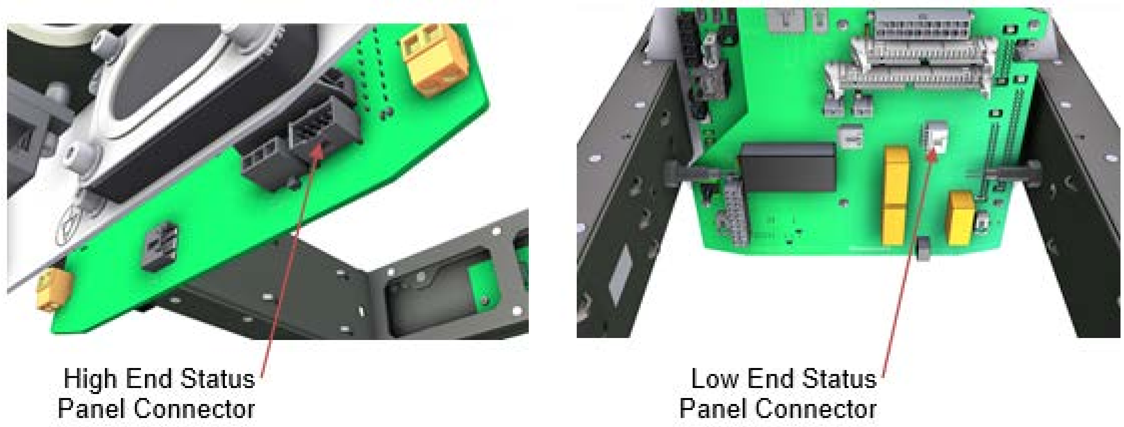


Figure 6-31: Head Status Panel Connection Locations

6.3.2. Sensor Frame

The sensor frame assembly provides a mounting system for primary sensor assemblies and auxiliary sensor devices described in the following sections.

When the primary sensor devices are bolted into the frame assembly the entire frame can be easily removed from the chassis with four mounting screws accessible on the sides of the chassis. Alignment cleats, set at the factory, allows the frame to be reinstalled in a repeatable manner. Alignment cleats should not normally be adjusted in the field.

6.3.2.1. X, Y, Z Head Alignment Sensor

Head-to-head alignment is measured with a three axis magnetic displacement sensor attached to the lower sheetguide. The sensors monitor the direction of magnetic field lines generated from a rectangular magnetic mounted in the sheetguide of the upper head, see **Figure 6-32**.

Due to residual magnetic fields in the hollow steel sections used in the compression frame, the displacement sensor system needs to be baselined after assembly to remove ambient magnetic field distortions.

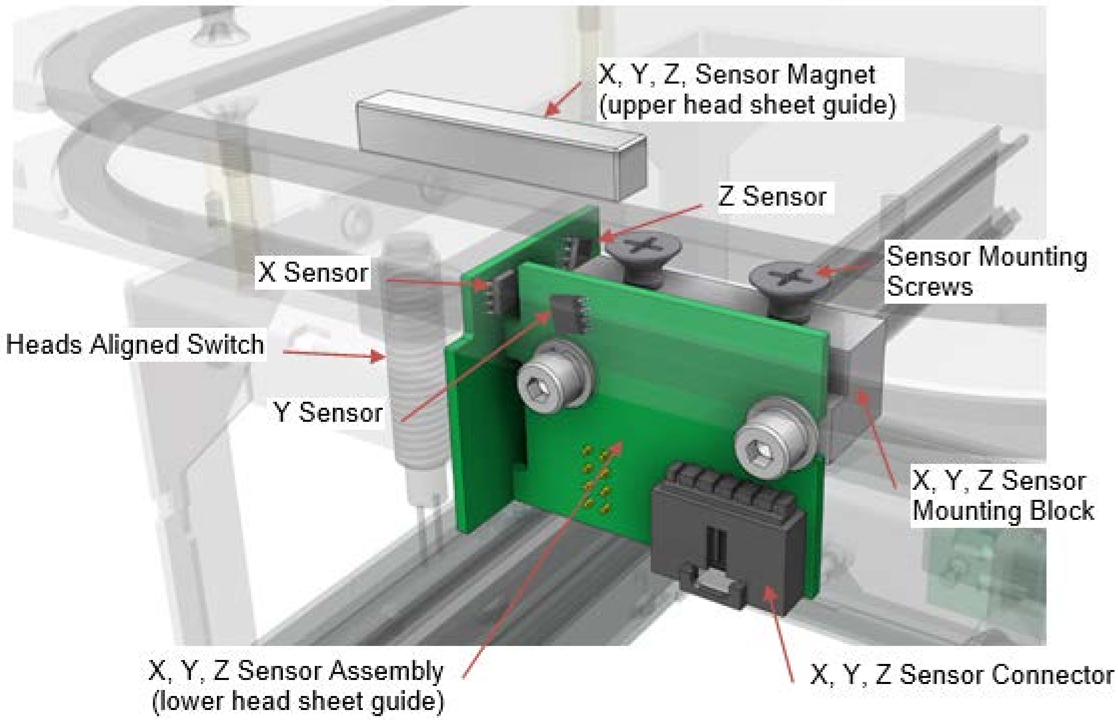


Figure 6-32: X, Y, Z Sensor and Magnet

6.3.2.2. Air Compressor

Compressed air is commonly used by primary sensors for actuation of flags and shutters. A micro air compressor is mounted where required to provide a local source of compressed air up to 2.4bar (35psig).

Air pressure at the compressor output is monitored by a pressure sensor on the head power distribution board. The head EDAQ automatically turns on the compressor as required in order to maintain pressure. If there are no leaks in the air system, typical duty cycle is less than 5%.

The pressure sensor may be damaged by pulling on the tube attached to the sensor barb fitting. The airline should be disconnected at the push to connect union prior to sensor frame separation from the chassis.

6.3.2.3. Heads Aligned Switch

Radiation safety interlocks require that upper and lower heads are in substantial alignment prior to opening shutters. A magnetic limit switch is mounted in the lower head beside the X, Y, Z sensor to monitor upper head to lower head alignment.

This switch utilizes the same magnet as the X, Y, Z alignment sensor for operation, see **Figure 6-32**.

6.3.3. Head Covers

Environmental protection of the head internals is provided by covers attached to the sensor heads.

Large covers attach to the upper and lower halves of the heads and are latched on the cross direction ends of the heads. The latches are adjustable and should be inspected for proper operation and adjusted as required.

Smaller plate covers are removable with thumb screws on each cross direction end of the head. These covers allow for access to the motor cavity for inspection and belt threading and additional access to the sensor cavity when required.

6.4. User Control Panel (HMI)

Local control of the scanner is accomplished with the user control panel. The device also serves as a power connection point for the sample holder and field I/O termination.

Panels are preconfigured for mounting top of the scanner vertical supports with a mounting bracket, see . If required, the mounting bracket can be moved to an adjacent location to improve installation access.

A single control panel is standard system supply. A second optional panel can be mounted to the opposite end of the scanner for both operator and technician convenience.

Figure 6-33: User Control Panel Scanner Mounting

6.4.1. Button Layout and Operation

The control panel allows for four main types of operation detailed in the following sections.

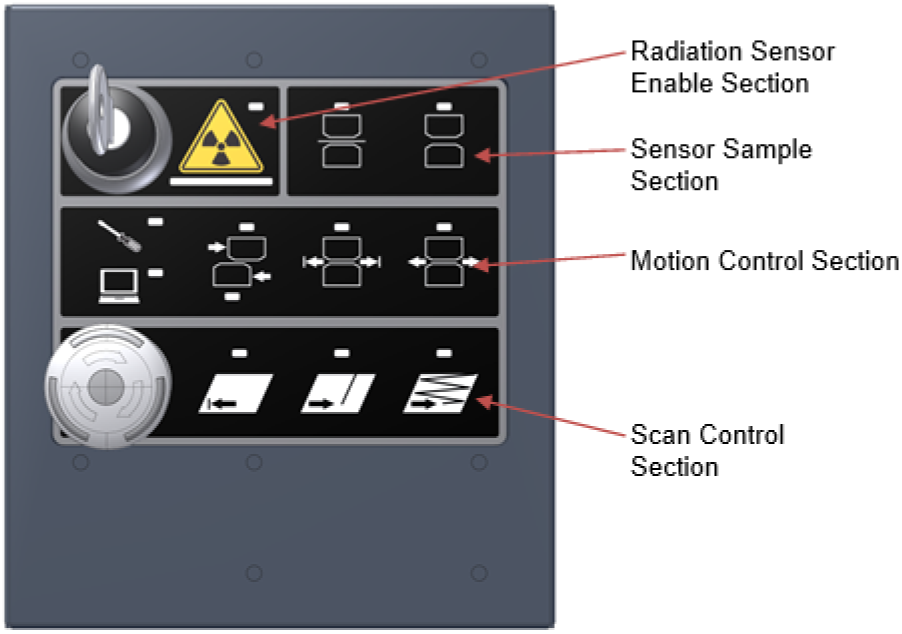


Figure 6-34: User Control Panel Layout

6.4.1.1. Radiation Sensor Enable

The radiation sensor enable section of the user control panel provides safety controls for radiation sources found in nuclear and x-ray sensors.

The key switch can be removed for lockout purposes and must be inserted and turned on before radiation sources can be enabled

The radiation source is enabled by pressing the trefoil radiation button. A yellow light appears to the upper right of the trefoil symbol to indicate that the sensor is enabled for automated control of shutters by the QCS system.

The indicator bar below the trefoil will turn red when the shutter is commanded to be opened. When the shutter is not commanded to be open, this indicator will not be lit.

WARNING

There is no hardwired (software independent) green light indicator available at the user panel due to the wireless communication architecture to the sensor heads. Before any work is preformed on the sensor heads, shutter closed confirmation should be obtained from the green radiation status light on the upper head. This is the only location where the hardwired serial circuit exists in the scanner system.

6.4.1.2. Local Motion Control Mode

The motion control section of the control panel allow the heads to be manually driven to avoid the need to push the heads. This section is used in conjuction with the onsheet and offsheet buttons to start motor power and control directionality.

Local motion control mode is entered by holding the screwdriver symbol button for three seconds. This will light the local mode indicator and turn off the QCS computer control or auto mode indicator.

This mode is canceled by pressing the computer icon to return the scanner to QCS computer control or auto mode. The local mode indicator will turn off and the auto mode indicator will light up.

When in local motion control mode, the heads may be moved in one of three ways by pressing the corresponding icon detailed in **Table 6-4**.

Table 6-4: Button functions in local motion control mode

Local Mode Option	Description
Head split mode	Pressing this button will allow selection of either upper or lower head. Subsequent pressing of the onsheet or offsheet buttons will allow manual motion of selected head for as long as the selected button is pressed.
Shop mode	Pressing this button will allow the heads to be cycled between limit switch magnets. Subsequent pressing of the onsheet or offsheet buttons will start or cancel this motion.
Manual mode	Pressing this button will allow the heads to be manually moved

	together as a pair. Subsequent pressing of the onsheet or offsheet buttons will move the heads for as long as the selected button is pressed

6.4.1.3.
Scan Control

The scan control section of the control panel is also used in the QCS computer control mode or auto mode to control head motion commands.

The following table describes the button functions.

Table 6-5: Scan control button functions

Auto Mode Option	**Description**	**Indicator**
Scanner stop mode	Pressing the scanner stop button will remove the motor power enable signal from the heads and stop motion. The scanner stop button circuit is normally lit red to indicate that it is armed. Turn the button to rearm the circuit. Clear motion alarms with the QCS screen or by holding the offsheet button for 5 seconds	Red light lit when armed – scanner available for motion. No light when circuit is broken – motors are disabled.
Offsheet mode	Pressing the offsheet button will send the heads to the offsheet position. When a scanner alarm has been generated, holding this button down for 5 seconds will clear the alarm and send the heads to the offsheet position. This button is also used in local motion control mode to move the heads in an offsheet direction.	Lit solid when scanner is offsheet. Blinking when scanner is in process of moving to offsheet location. Not lit when QCS control is unavailable.
Single point mode	Pressing this button will send the heads to measure a single bin location on the sheet. This location is configured in the QCS system.	Lit solid when scanner is measuring in single point mode. Blinking when heads are in process of standardize or motion to single point location. Not lit when not in single point mode.
Scan mode	Pressing this button will cause the heads to begin scanning the sheet. This button is also used in local motion	Lit solid when scanner is measuring in scan mode. Blinking when heads are in

	control mode to initiate shop mode and move the heads in an onsheet direction.	the process of standardization. Not lit when not in scan mode.

6.4.1.4. Sampling

The sampling section of the scanner control panel allows local, at the scanner, initiation of sample or reference measurements to be taken. These buttons replicate functionality of the sample and reference buttons in the QCS.

The buttons can be used during scanner and sensor calibration routines to avoid travel to a QCS station.

Indicators will be lit during sample and reference measurement processes to indicate when the process has been completed.

6.4.2. Power and Serial Communication Connection

Power to the user control panel is supplied from two fused 24VDC circuits. One circuit provides power to the panel interface while the other is dedicated to field I/O loops.

Communication between the user control panel and the MSS computer is accomplished with RS232 serial communication. A harness connects a 1x4 header to the DB9 connector serial port of the MSS computer.

6.4.3. Primary and Secondary Panel Setup

A secondary user control panel can be connected in a daisy chain configuration for power and communications to the first panel. Serial communications between the first and second panel are handled with RS485 protocols.

If two control panels are configured in a system, only one panel can contain the radiation sensor interlock switch.

Panel configuration is required in both a software configuration file and jumper on the user control panel communications board.

6.4.4. Field I/O

6.4.4.1. Digital I/O

Connection of signals from field devices is done to termination headers in the user control panel. The system allows for ten digital input signals and four digital output signals.

I/O states are LED indicated and labeled on the side of the control panel, see **Figure 6-35**.

- Input signal levels are +5 to +24VDC.
- Output signal levels are +24VDC.

Figure 6-35: User Control Panel Field Input Indicators

6.4.5. Sample Paddle Port

A 24VDC auxiliary port is located on the left side of the user control panel. This is used to provide power to the sample holder spin motor.

Figure 6-36: User Control Panel Sample Paddle Port

6.5. Sample Holder

The sample holder is designed to allow consistent positioning of samples within the sensor measurement zone during calibration procedures.

To increase the measurement area of the sample, a motor spins the sample while the heads scan from the outside to inside diameter.

Power for the sample holder spin motor is provided by the plug on the side of the user control panel.

The sample holder is mounted to a mounting plate attached to the lower rail. This location is setup in the QCS system to allow the heads to be properly positioned relative to the sample holder.

The sample and reference buttons on the user control panel can be used to initiate the measurement process. Indicator LED’s indicate when the measurement process is completed and a new sample can be inserted.

7. Preventive maintenance

Preventive maintenance, when performed on a periodic basis, can prevent many failures, and catch minor problems before they become major ones. The frequency of preventive maintenance procedures might need to be adjusted depending on the operating environment.

7.1. Preventive maintenance schedule

Table 7-1 provides a preventive maintenance checklist.

Table 7-1: Preventive maintenance checklist

Task	Daily	Weekly	Monthly	Years		
				1	3	5
Clean & inspect the carbon brush assemblies			X			
Monitor internal head temperature for stability		X				
Verify sensor air pressure (if equipped)		X				
Clean external surfaces			X			
Clean support & power rail surfaces			X			
Inspect and replace air filter (fan cooling option only)		X				
Inspect the drive belts			X			
Inspect the rail sliders			X			
Verify head alignment			X			
Replace the carbon brush assemblies				X		

Replace the motor drive belt					X	
Replace head drive belts					X	
Replace the rail sliders					X	
Replace the final drive assembly						X
Replace the idler pulleys						X
Replace the drive motor & encoder						X

8. Procedures

8.1. User control panel

8.1.1. Enable Radiation Sensor (HMI Panel)

Activity Number:	Q3090-00-ACT-001	**Applicable Models:**	Q3090-00
Type of Procedure:	Support	**Expertise Level:**	Operator
Priority Level:	Low	**Cautions:**	None
Availability Required:	None	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	1 minute	**# of People Required:**	1
Prerequisite Procedures:	None	**Post Procedures:**	
Required Parts:	Part Number	Quantity	Lead Time
	• N/A		
Required Tools:	Part Number	Quantity	Lead Time
	• N/A		

1. Insert the key in the keyswitch located in the Radiation Enable Section and turn clockwise see **Figure 8-1** and **Figure 8-2**.

    a. The key can be removed at other times to lockout the system.

    b. The key cannot be removed from the keyswitch when in the enable position.

Figure 8-1: HMI panel mounting

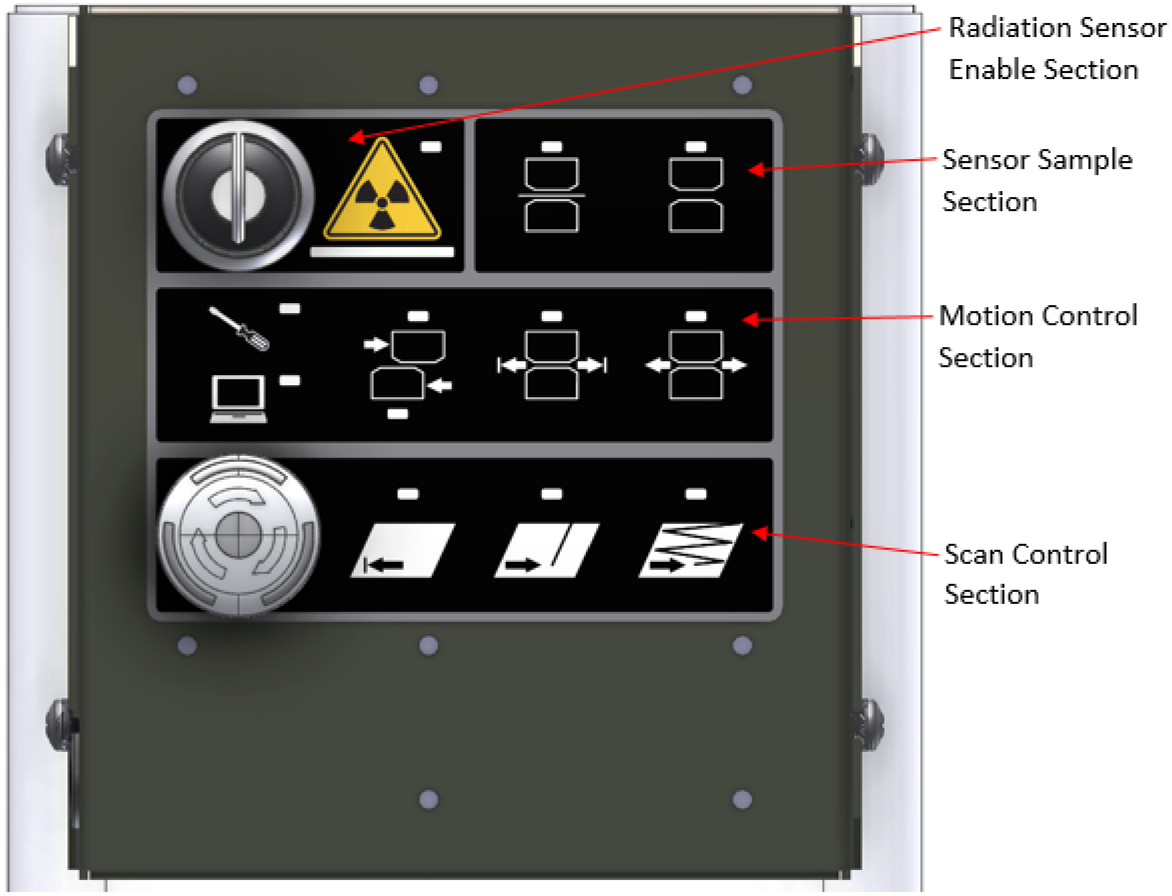


Figure 8-2: HMI panel function groupings

Figure 8-3: Elements of the "Radiation Sensor Enable Section"

2. The radiation source is then enabled by pressing the trefoil symbol Radiation Enable button, see **Figure 8-3**.

   a. A yellow light will illuminate to the upper right of the trefoil symbol indicating that the sensor is enabled for automated control of the shutters by the QCS system, see **Figure 8-3**.

   b. A red indicator bar below the trefoil symbol will illuminate when the shutter is commanded to open. When no shutter open command is issued the red indicator will not be lit, see **Figure 8-3**.

WARNING

There is no hardwired (software independent) green light indicator available at the user panel due to the wireless communication architecture to the sensor heads. Before any work is preformed on the sensor heads, shutter closed confirmation should be obtained from the green radiation status light on the upper head. This is the only location where the hardwired serial circuit exists in the scanner system.

8.1.2. Enter Scanner Auto Mode (HMI Panel)

Activity Number:	Q3090-00-ACT-002	**Applicable Models:**	Q3090-00
Type of Procedure:	Support	**Expertise Level:**	Operator
Priority Level:	Low	**Cautions:**	None
Availability Required:	None	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	1 minute	**# of People Required:**	1
Prerequisite Procedures:	None	**Post Procedures:**	Choose an item.
Required Parts:	Part Number	Quantity	Lead Time
	• N/A		
Required Tools:	Part Number	Quantity	Lead Time
	• N/A		

1. To enter Auto Mode, the mode in which QCS computer control is involved in scanner activities, locate the user panel (HMI Panel) as shown **Figure 8-4** and **Figure 8-5**

Figure 8-4: HMI panel mounting

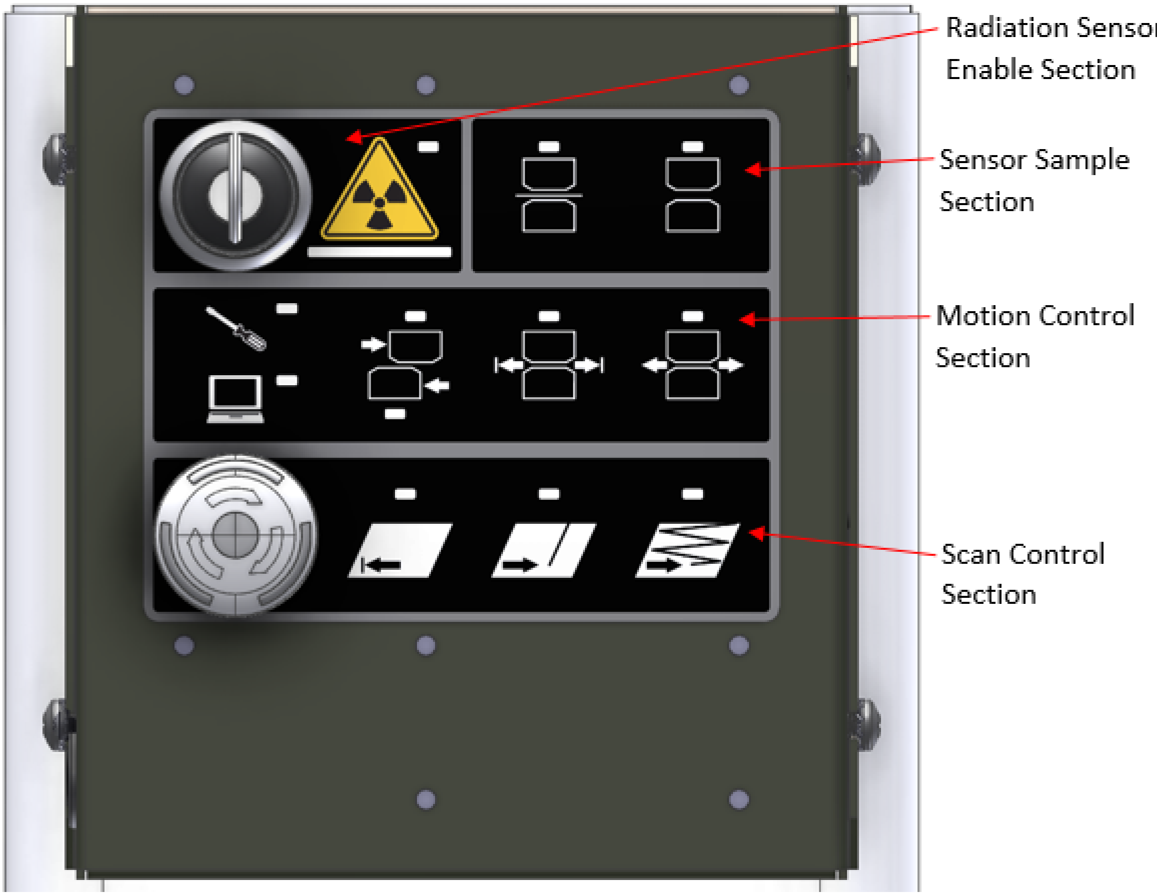


Figure 8-5: HMI panel function groupings

2. Press the computer symbol Auto Mode button (**Figure 8-6**)

    a. The yellow indicator LED at the upper right corner of the computer symbol will illuminate indicating that the system is in auto mode

ATTENTION

Upon entering Auto Mode, the heads will perform a homing procedure where they will return to the offsheet position and self-align. Be aware of this movement before changing modes.

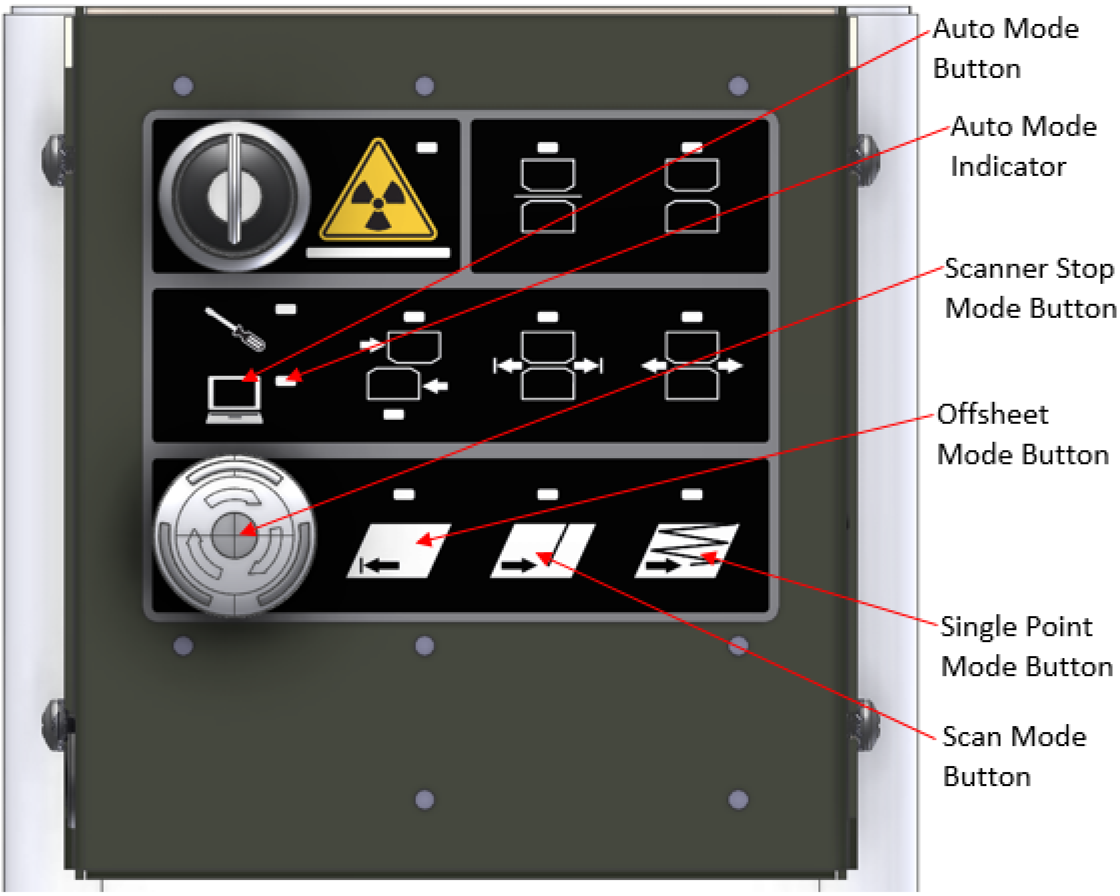


Figure 8-6: Scanner Auto Mode indicators and actuation button layout

3. The buttons in the "Scan Control Section **Figure 8-5** of the panel can then be used according to the call-outs of **Figure 8-6**.

Table 1: Summary of available motion control commands when in Auto Mode

Auto Mode Option	**Description**	**Indicator**
Scanner stop mode	Pressing the scanner stop button will remove the motor power enable signal from the heads and stop motion. The scanner stop button circuit is normally lit red to indicate that it is armed. Turn the button to rearm the circuit. Clear motion alarms with the QCS screen or by holding the offsheet button for 5 seconds	Red light lit when armed – scanner available for motion. No light when circuit is broken – motors are disabled.

Offsheet mode	Pressing the offsheet button will send the heads to the offsheet position. When a scanner alarm has been generated, holding this button down for 5 seconds will clear the alarm and send the heads to the offsheet position.	Lit solid when scanner is offsheet. Blinking when scanner is in process of moving to offsheet location. Not lit when QCS control is unavailable.
Single point mode	Pressing this button will send the heads to measure a single bin location on the sheet. This location is configured in the QCS system.	Lit solid when scanner is measuring in single point mode. Blinking when heads are in process of standardize or motion to single point location. Not lit when not in single point mode.
Scan mode	Pressing this button will cause the heads to begin scanning the sheet.	Lit solid when scanner is measuring in scan mode. Blinking when heads are in the process of standardization. Not lit when not in scan mode.

8.1.3. Move Aligned Measurement Modules – Manual Mode (HMI Panel)

Activity Number:	Q3090-00-ACT-003	**Applicable Models:**	Q3090-00
Type of Procedure:	Support	**Expertise Level:**	Operator
Priority Level:	Low	**Cautions:**	None
Availability Required:	None	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	

Duration (time period):	1 minute	# of People Required:	1
Prerequisite Procedures:	None	**Post Procedures:**	
Required Parts:	Part Number	Quantity	Lead Time
	• N/A		
Required Tools:	Part Number	Quantity	Lead Time
	• N/A		

1. Locate the Local Motion Control Mode pushbutton in the Motion Control section of the user panel (HMI Panel) identified by the screwdriver symbol (see **Figure 8-7**, **Figure 8-8**, and **Figure 8-9**.)

    a. Press and hold the Local Motion Control Mode button for three seconds until the indicator LED to the upper right side of the screwdriver symbol illuminates

Figure 8-7: HMI panel mounting

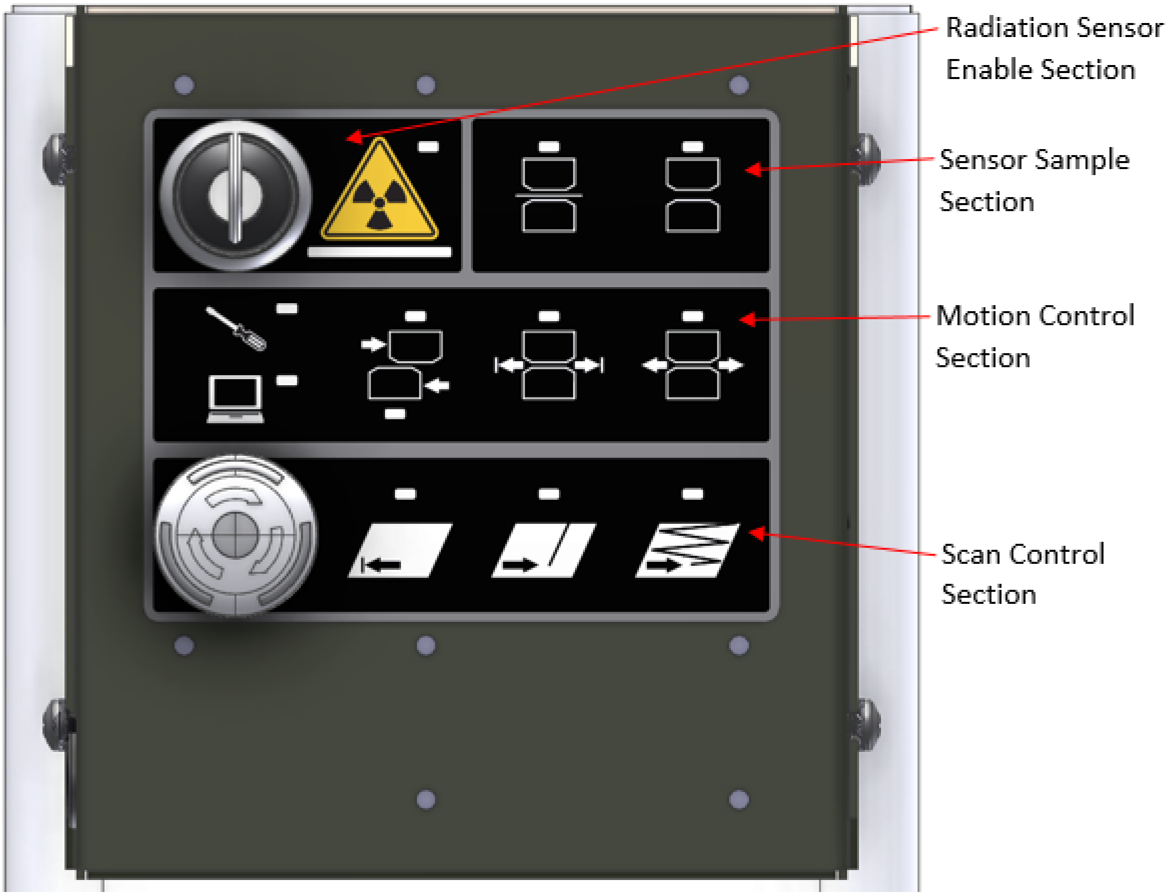


Figure 8-8: HMI panel function groupings

2. Once in Local Motion Control Mode, press the Manual Mode button and ensure the indicator LED above the button illuminates (**Figure 8-9**)

ATTENTION

> In Local Motion Control mode the measurement modules may move to the offsheet location and align during a mode change between Head Split, Shop, and Manual modes. Be aware of this movement when toggling between modes.

3. The measurement modules are now ready to be moved as an aligned pair

   a. The heads will travel toward the high end of the scanner for as long as the Scan button is held (denoted Drive Modules Forward in **Figure 8-9**)

   b. The heads will travel toward the low end of the scanner for as long as the Offsheet button is held (denoted Drive Modules Reverse in **Figure 8-9**)

WARNING	When driven in manual mode there is no provision to halt motion at either end of the scanner's span i.e. crash switches are ignored. Use care to prevent injury (pinch points) or equipment impact damage by releasing the drive command buttons before the measurement modules reach the end of the scanner's span.

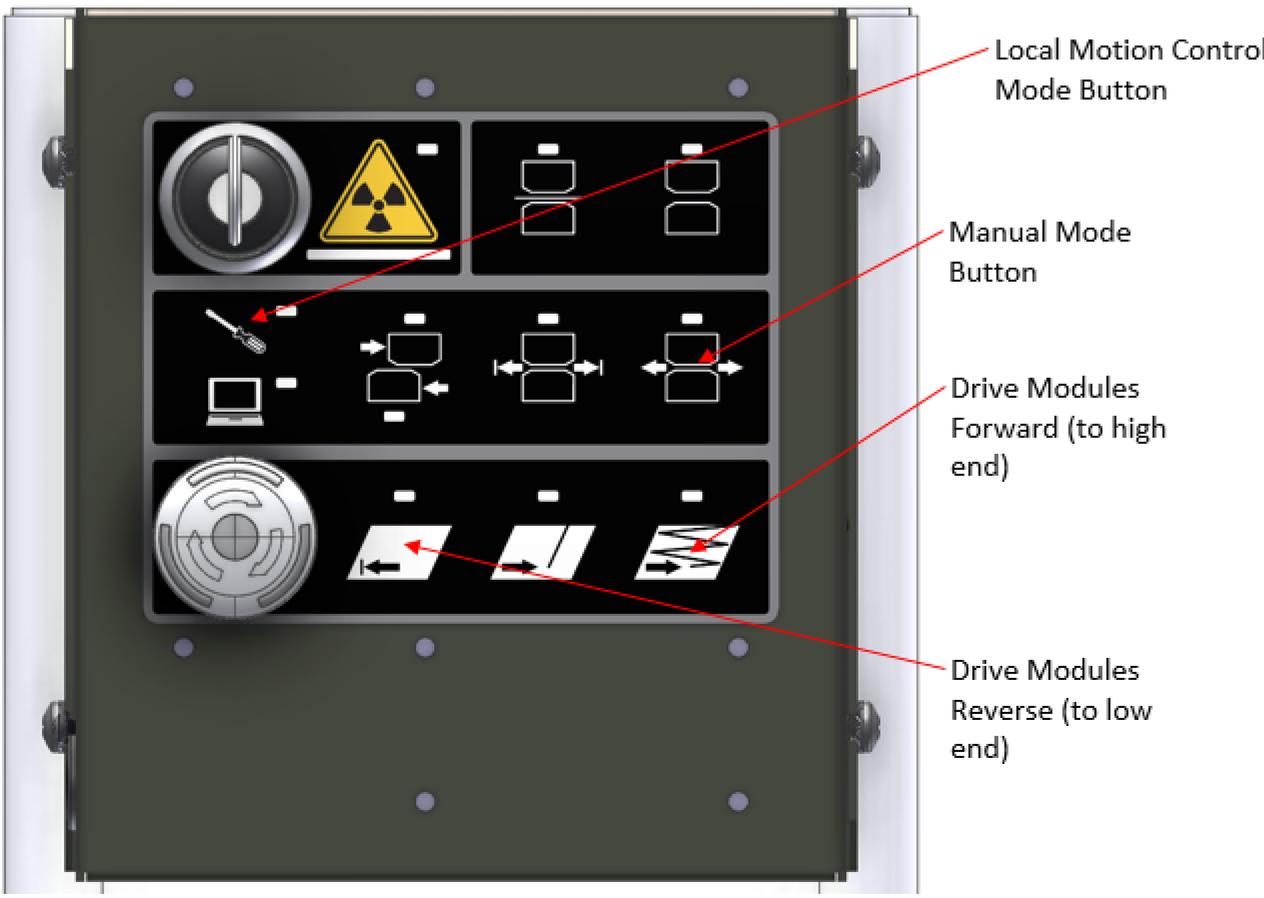


Figure 8-9: Layout of user panel buttons used for Manual Mode control of the measurement modules

8.1.4. Move Heads Between Limit Magnets – Shop Mode (HMI Panel)

Activity Number:	Q3090-00-ACT-004	**Applicable Models:**	Q3090-00
Type of Procedure:	Support	**Expertise Level:**	Operator
Priority Level:	Low	**Cautions:**	None
Availability Required:	None	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	1 minute	**# of People Required:**	1
Prerequisite Procedures:	None	**Post Procedures:**	
Required Parts:	Part Number	Quantity	Lead Time
	• N/A		
Required Tools:	Part Number	Quantity	Lead Time
	• N/A		

1. Locate the Local Motion Control Mode pushbutton in the Motion Control section of the user panel (HMI Panel) identified by the screwdriver symbol. See **Figure 8-10**, **Figure 8-11**, and **Figure 8-12**.

    a. Press and hold the Local Motion Control Mode button for three seconds until the indicator LED to the upper right side of the screwdriver symbol illuminates

Figure 8-10: HMI panel mounting

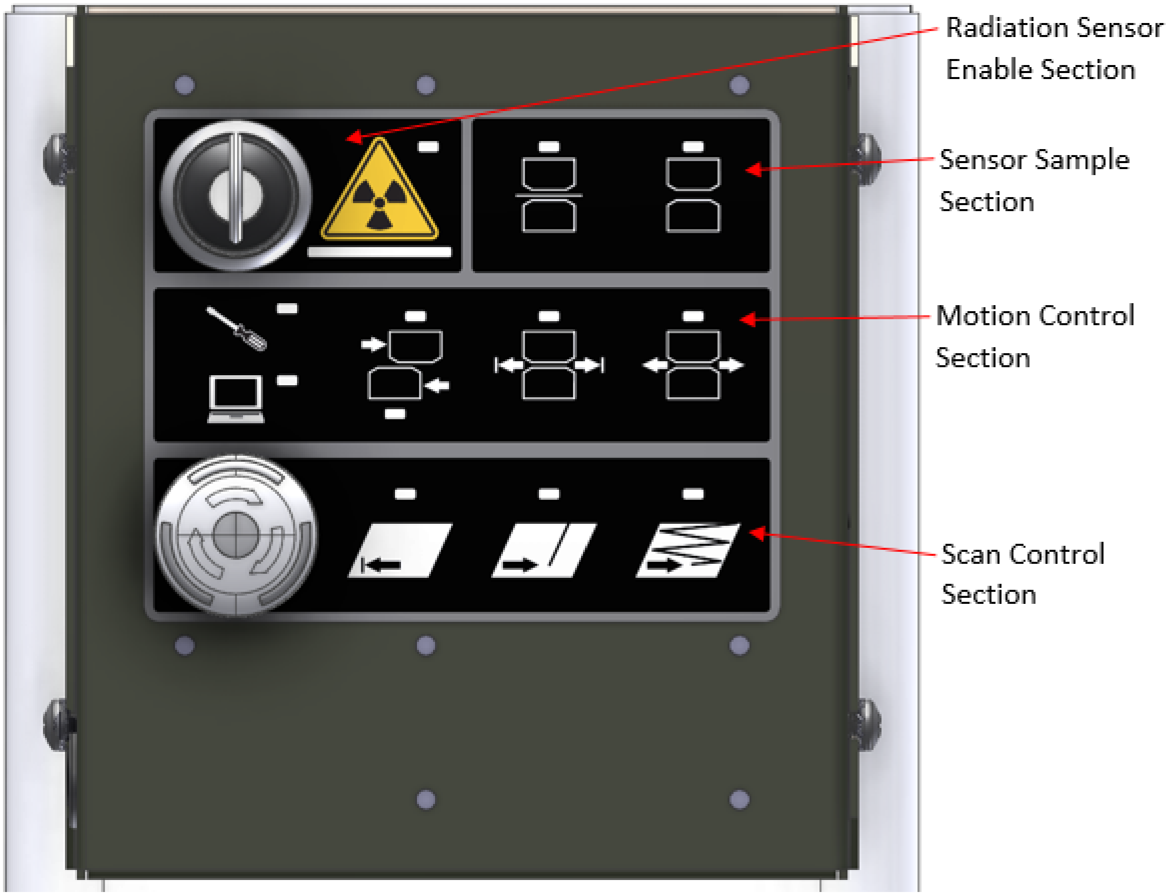


Figure 8-11: HMI panel function groupings

2. Once in Local Motion Control Mode, press the Shop Mode button and ensure the indicator LED above the button illuminates (**Figure 8-12**)

ATTENTION

In Local Motion Control mode the measurement modules may move to the offsheet location and align during a mode change between Head Split, Shop, and Manual modes. Be aware of this movement when toggling between modes.

3. The measurement modules are now ready to traverse the length of the scanner from high end limit switch to low end limit switch continuously until the command is cancelled

   a. Continuous motion is instigated by pressing the Scan button (denoted Start Motion in **Figure 8-12**)

   b. The command is cancelled by pressing the Offsheet button (denoted Canel Motion in **Figure 8-12**)

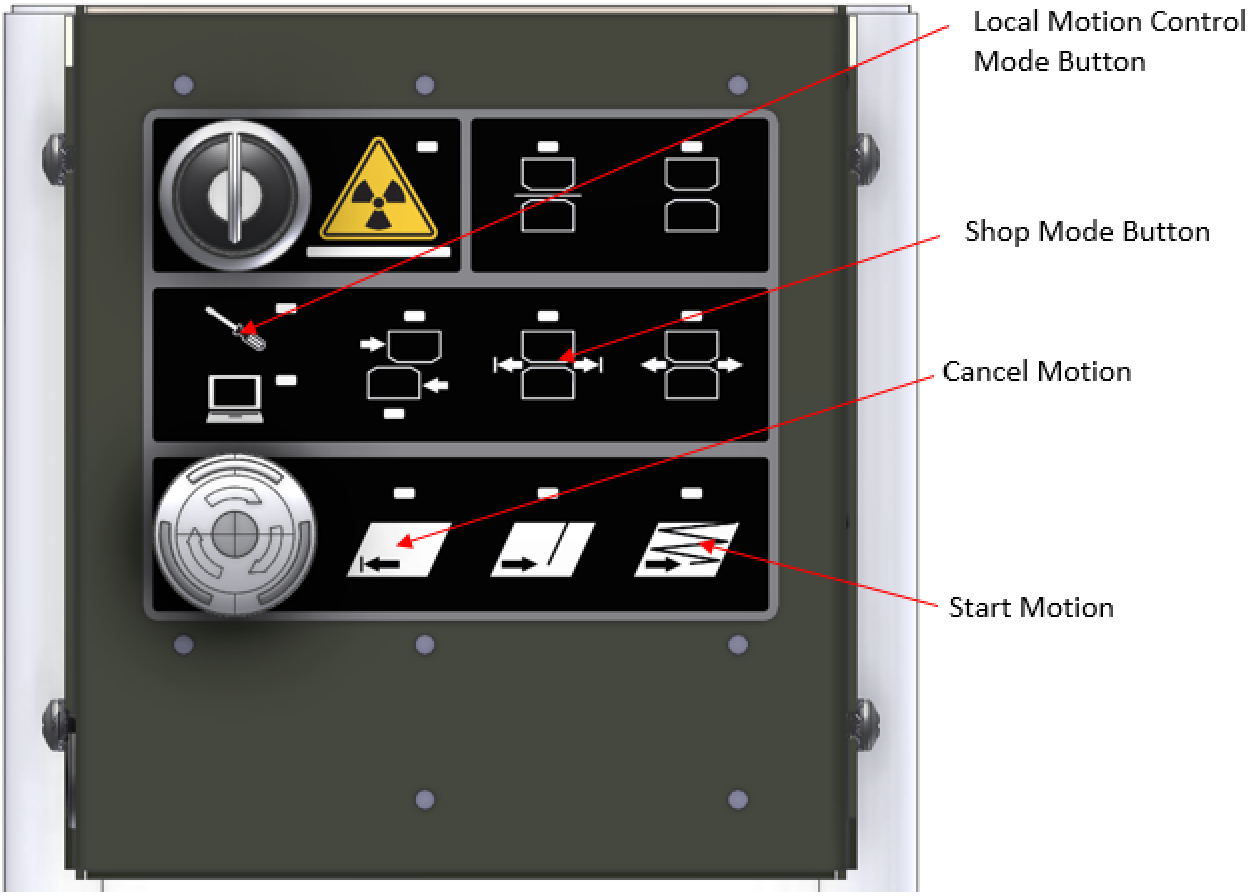


Figure 8-12: Layout of user panel buttons for Shop Mode control of the measurement modules

8.1.5. Sample/Reference Operations (HMI Panel)

Activity Number:	Q3090-00-ACT-005	**Applicable Models:**	Q3090-00
Type of Procedure:	Support	**Expertise Level:**	Operator
Priority Level:	Low	**Cautions:**	None
Availability Required:	None	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	1 minute	**# of People Required:**	1
Prerequisite Procedures:	None	**Post Procedures:**	
Required Parts:	Part Number	Quantity	Lead Time

	• N/A		
Required Tools:	Part Number	Quantity	Lead Time
	• N/A		

The sampling section of the scanner control panel allows local, at the scanner, initiation of sample or reference measurements to be taken. These buttons replicate functionality of the sample and reference buttons in the QCS.

The buttons can be used during scanner and sensor calibration routines to avoid travel to a QCS station.

1. To initiate a sample operation, press the sample button when the scanner is in Auto mode (see **Figure 8-13**)
    a. The LED indicator above the button will be illuminated during the duration of the operation
2. To initiate a reference operation press, the reference button when the scanner is in Auto mode (see **Figure 8-13**)
    a. The LED indicator above the button will be illuminated during the duration of the operation

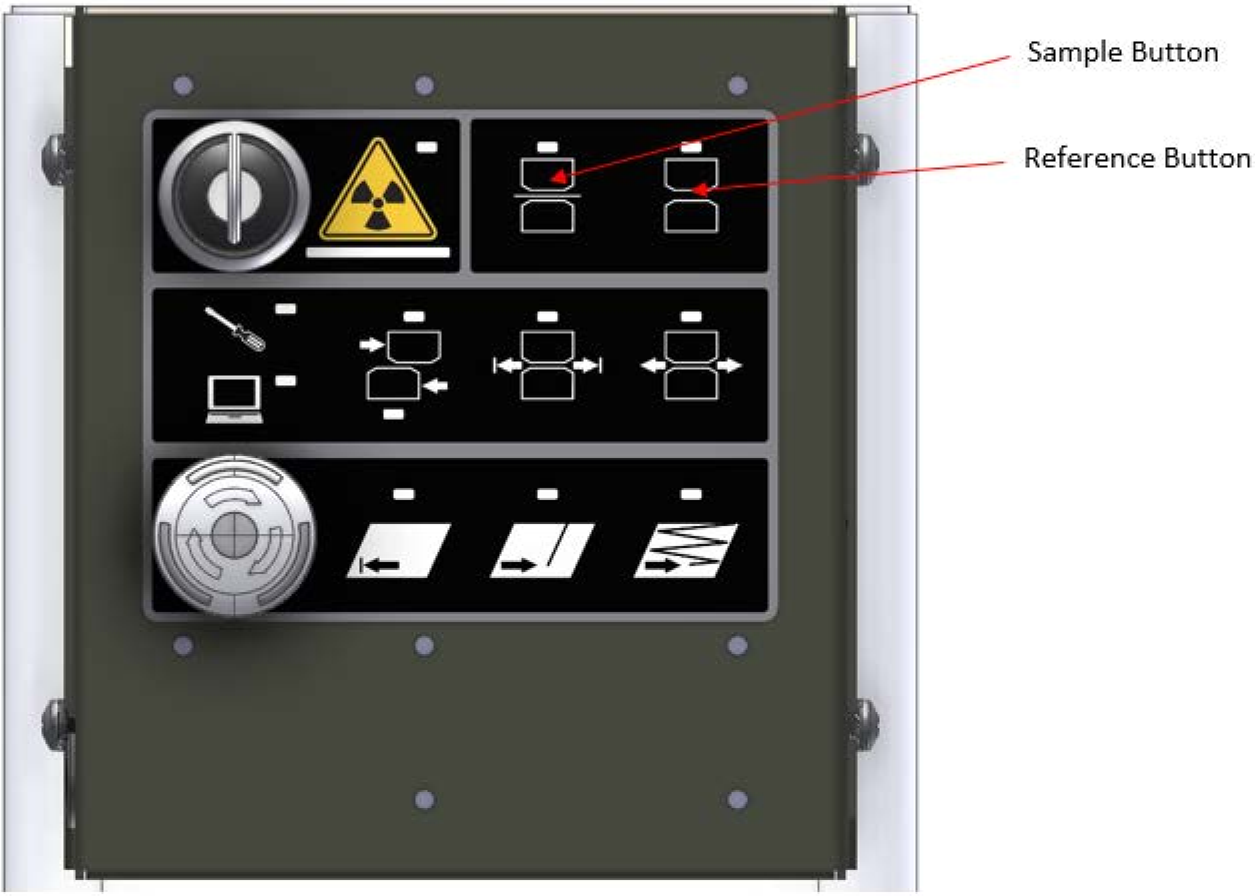


Figure 8-13: Location of sample and reference buttons on the user panel (HMI panel)

8.1.6. Split Sensor Heads (HMI Panel)

Activity Number:	Q3090-00-ACT-006	**Applicable Models:**	Q3090-00
Type of Procedure:	Support	**Expertise Level:**	Operator
Priority Level:	Low	**Cautions:**	None
Availability Required:	None	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	1 minute	**# of People Required:**	1
Prerequisite Procedures:	None	**Post Procedures:**	Choose an item.
Required Parts:	Part Number	Quantity	Lead Time

	• N/A		
Required Tools:	Part Number	Quantity	Lead Time
	• N/A		

1. Locate the Local Motion Control Mode pushbutton in the Motion Control section of the user panel (HMI Panel) identified by the screwdriver symbol (see **Figure 8-14**, **Figure 8-15**, and **Figure 8-16**).

    a. Press and hold the Local Motion Control Mode button for three seconds until the indicator LED to the upper right side of the screwdriver symbol illuminates

Figure 8-14: HMI panel mounting

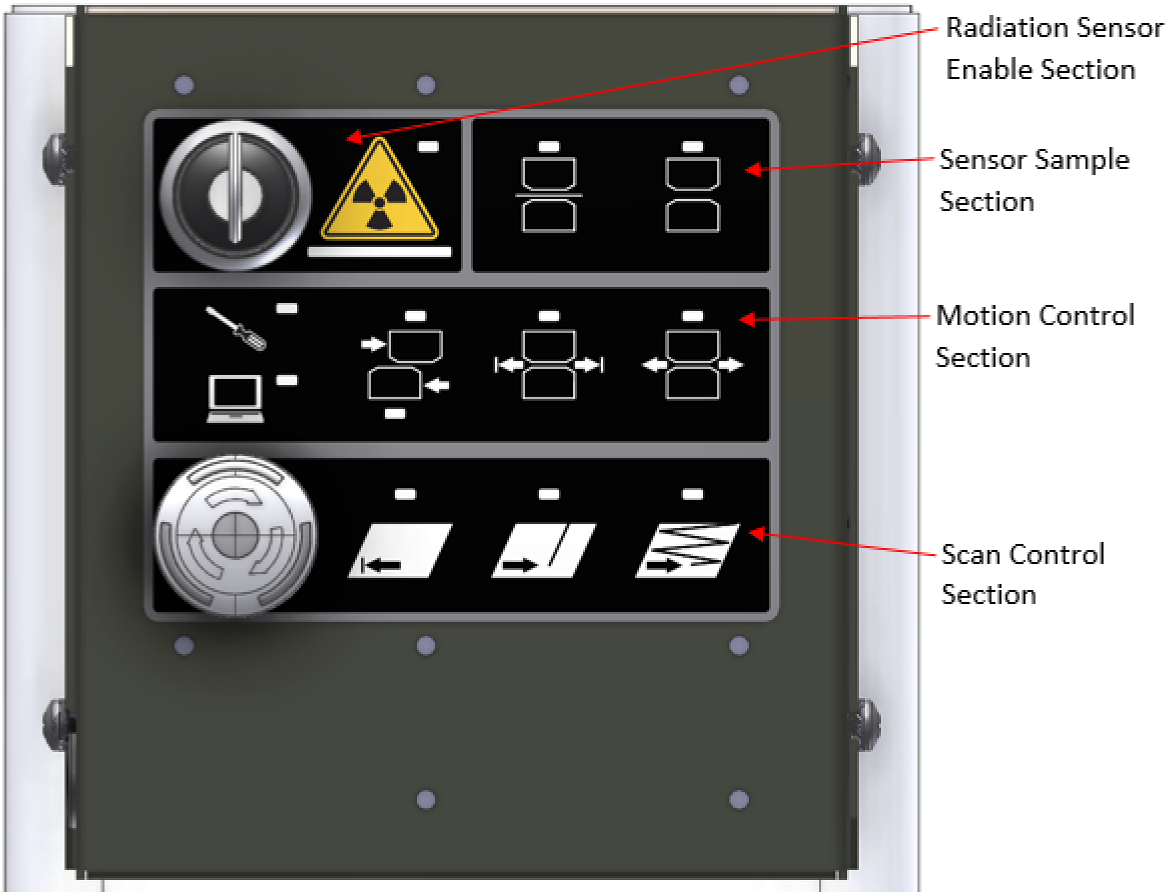


Figure 8-15: HMI panel function groupings

2. Ensure that the scanner stop button is armed by confirming that the scanner stop button is illuminated red

3. To split the sensor heads press the Head Split Mode button (see **Figure 8-16**).

   a. When the LED above the Head Split Mode button is lit the user can control the motion of the upper measurement module by pressing and holding the scan button (denoted Drive Module Forward in **Figure 8-16**) or by pressing and holding the offsheet button (denoted Drive Module Reverse in Figure 8-16). The scan and offsheet buttons are found in the bottom row: the Scan Control Section (see **Figure 8-16**)

   b. When the lower LED is lit the user can control the motion of the lower head in the same manner as above

   c. Continuously pressing the Head Split Mode button toggles between selecting the upper module and lower module for independent drive

d. Pressing the Single Point button (located between the Drive Forward and Drive Reverse buttons see **Figure 8-16**) will realign the measurement modules by driving the lower unit to align with the upper

ATTENTION

In Local Motion Control mode the measurement modules may move to the offsheet location and align during a mode change between Head Split, Shop, and Manual modes. Be aware of this movement when toggling between modes.

WARNING

When driven in head split mode there is no provision to halt motion at either end of the scanner's span i.e. crash switches are ignored.

Use care to prevent injury (pinch points) or equipment impact damage by releasing the drive command buttons before the measurement modules reach the end of the scanner's span

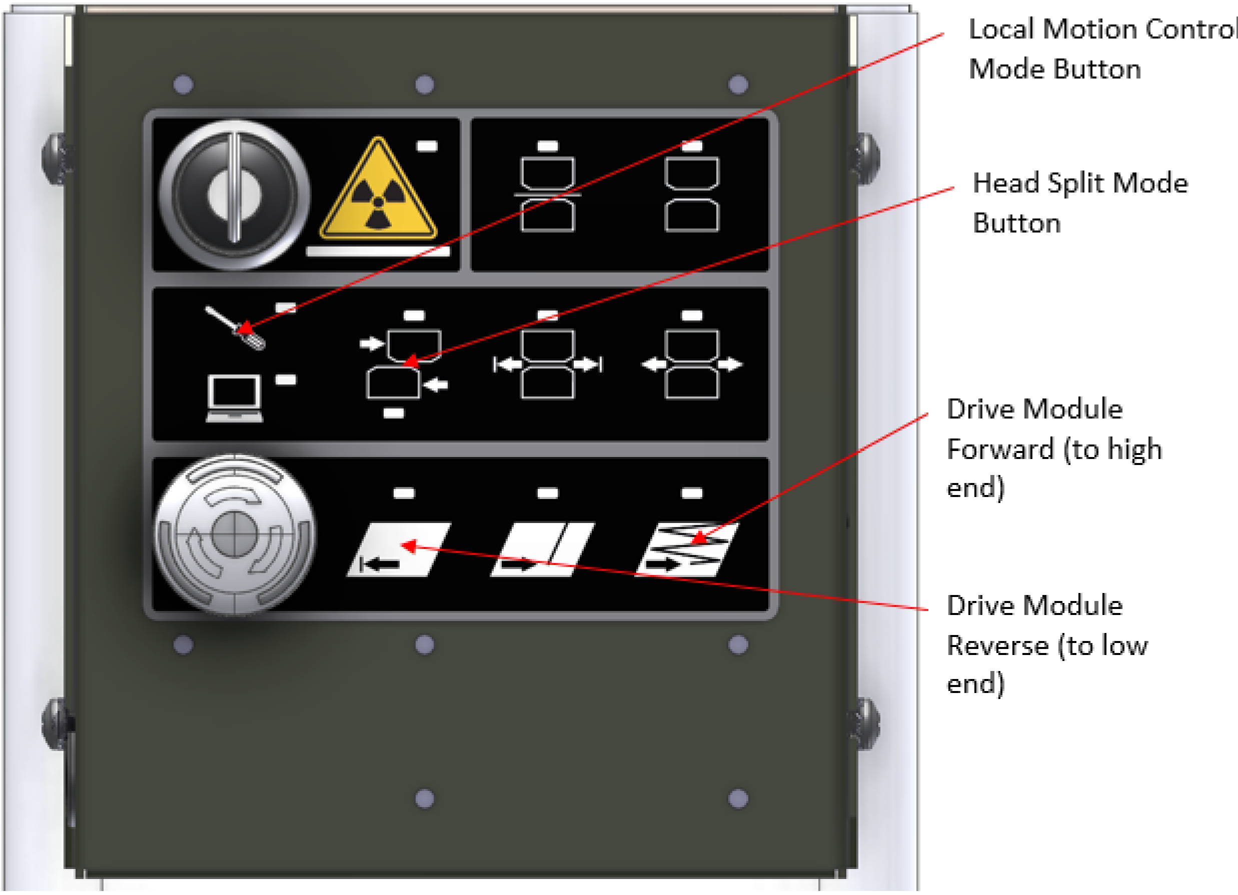


Figure 8-16: Layout of user panel buttons used for Head Split Mode control of the measurement modules

8.2. Electrical panel

8.2.1. Turn Scanner On/Off via Main Power Switch

Activity Number:	Q3090-00-ACT-007	**Applicable Models:**	Q3090-00
Type of Procedure:	Support	**Expertise Level:**	Operator
Priority Level:	Low	**Cautions:**	None
Availability Required:	Scanner offsheet	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	

Duration (time period):	1 minute	**# of People Required:**	1
Prerequisite Procedures:	None	**Post Procedures:**	None
Required Parts:	Part Number	Quantity	Lead Time
	• N/A		
Required Tools:	Part Number	Quantity	Lead Time
	• N/A		

1. Locate the main power switch on the bottom side of the endbell which contains the electronics panel assembly (see **Figure 8-17**). This endbell will have the main power and networking cables running into the scanner from the bottom side adjacent to the main power switch.

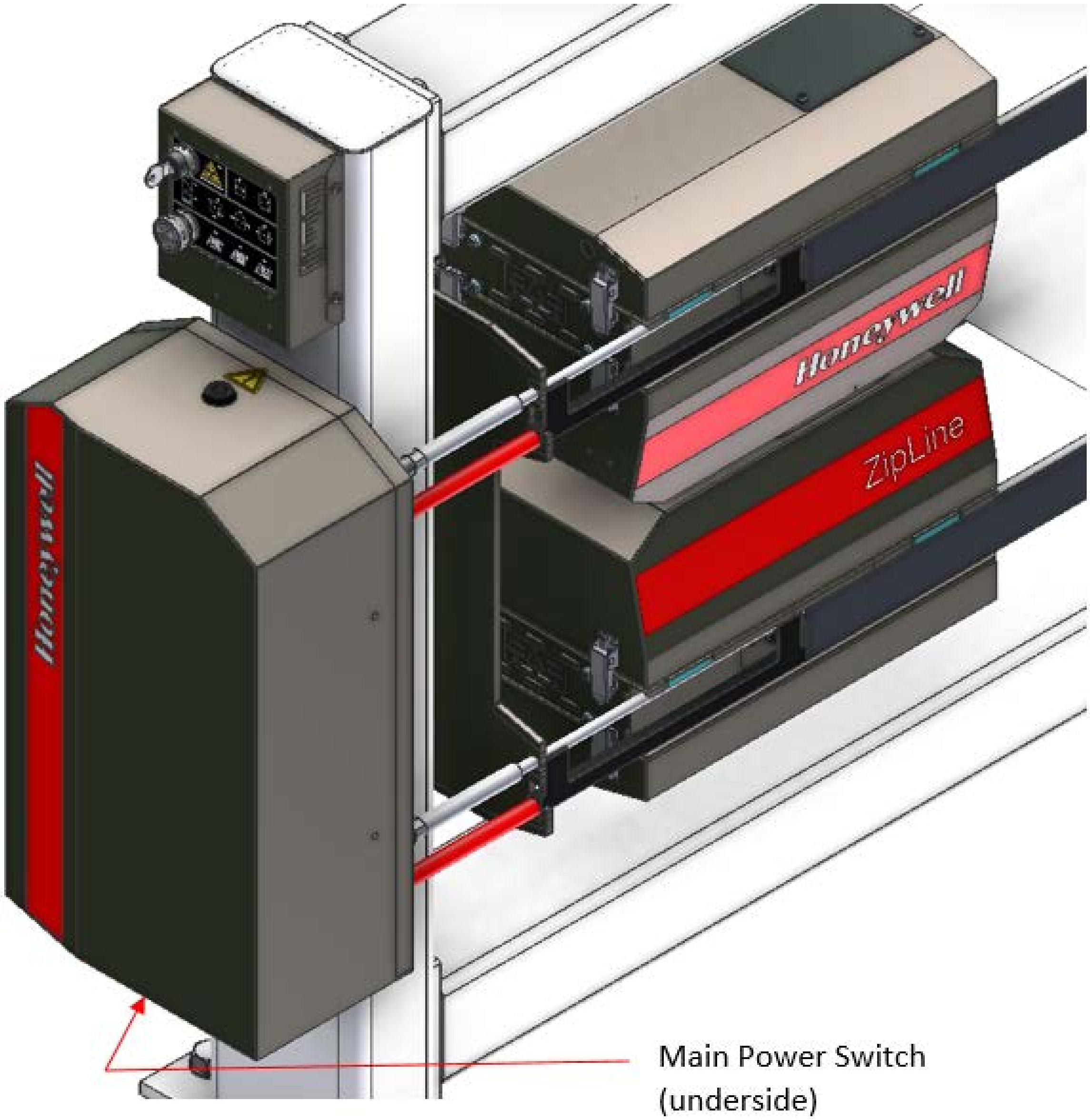


Figure 8-17: Location of main power switch on endbell

2. Toggle the switch to turn the scanner ON or OFF

    a. It is preferable to only toggle scanner power when the measurement modules are in the offsheet position

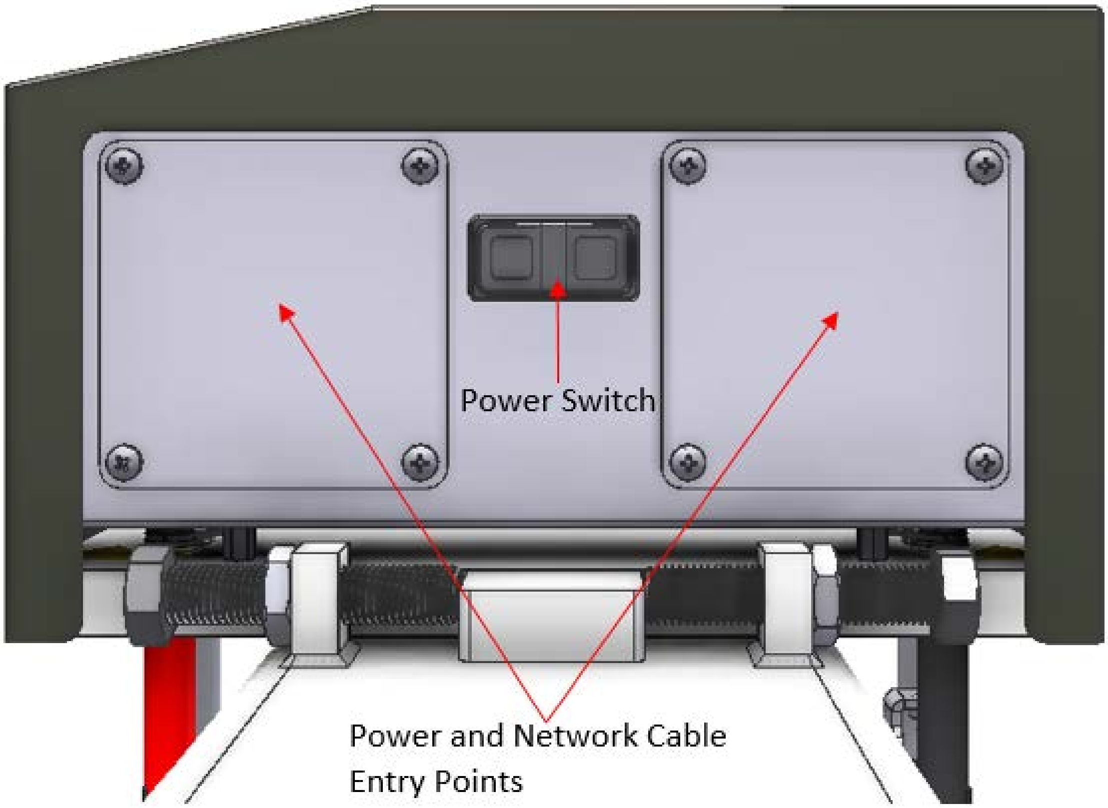


Figure 8-18: Power switch on underside of endbell adjacent to entry points for scanner power and network cables

WARNING	Even when the main power switch is in the OFF position, there are still accessible live wires if the endbell cover is removed. Only qualified personnel should perform work within the endbell assembly and only when the scanner has been disconnected from mains power either by unplugging the scanner entirely or using an appropriate lockout/tagout procedure for scanners which are permanently wired.

8.2.2. Change Branch Fuse in Endbell

Activity Number:	Q3090-00-ACT-008	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician

Priority Level:	High	**Cautions:**	Electric shock
Availability Required:	Scanner Power Off	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	10 minutes	**# of People Required:**	1
Prerequisite Procedures:	Scanner lockout/tagout	**Post Procedures:**	Remove scanner lockout/tagpout
Required Parts:	Part Number	Quantity	Lead Time
	• 2A 250V ¼”x1¼“ fast acting fuse (Honeywell PN 6541230035) OR • 10A 250V ¼”x1¼“ fast acting fuse (Honeywell PN 6541230051)		
Required Tools:	Part Number	Quantity	Lead Time
	• Square key for removing endbell cover • Needle nose pliers		

1. Send the measurement modules to the offsheet position if possible.

2. Remove the cover panel from the endbell containing the electrical panel assembly. This will be the endbell to which mains power and network cabling are run (see **Figure 8-19**).

WARNING

> At this point in the procedure there are live voltages accessible to the technician within the endbell. This step is necessary to identify which branch fuse(s) need replacement. Use extreme caution.

Figure 8-19: Use square key to open cover containing the electrical panel assembly

3. Locate the five DIN-rail mounted black fuse holder blocks to the left of the main power supply (see **Figure 8-20**).

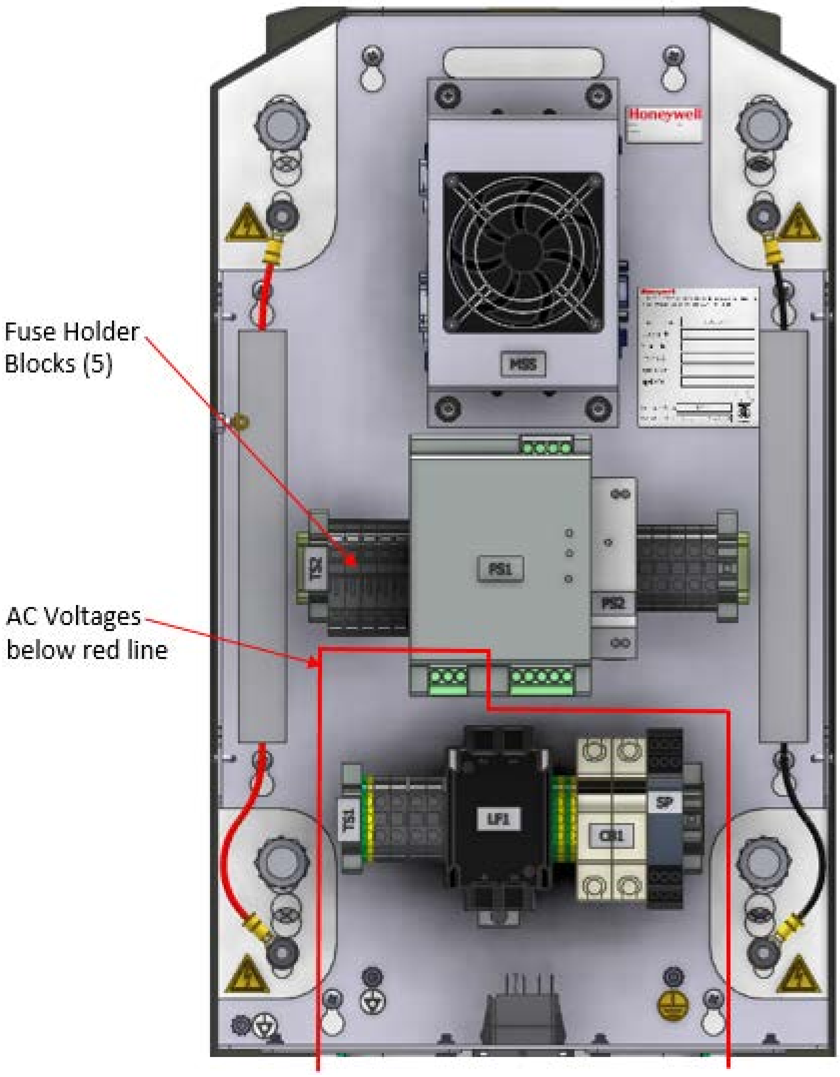


Figure 8-20: Location of the main fuses inside the electrical panel assembly

4. An illuminated red LED on any of these fuse holder blocks indicates an open fuse (see **Figure 8-21**).

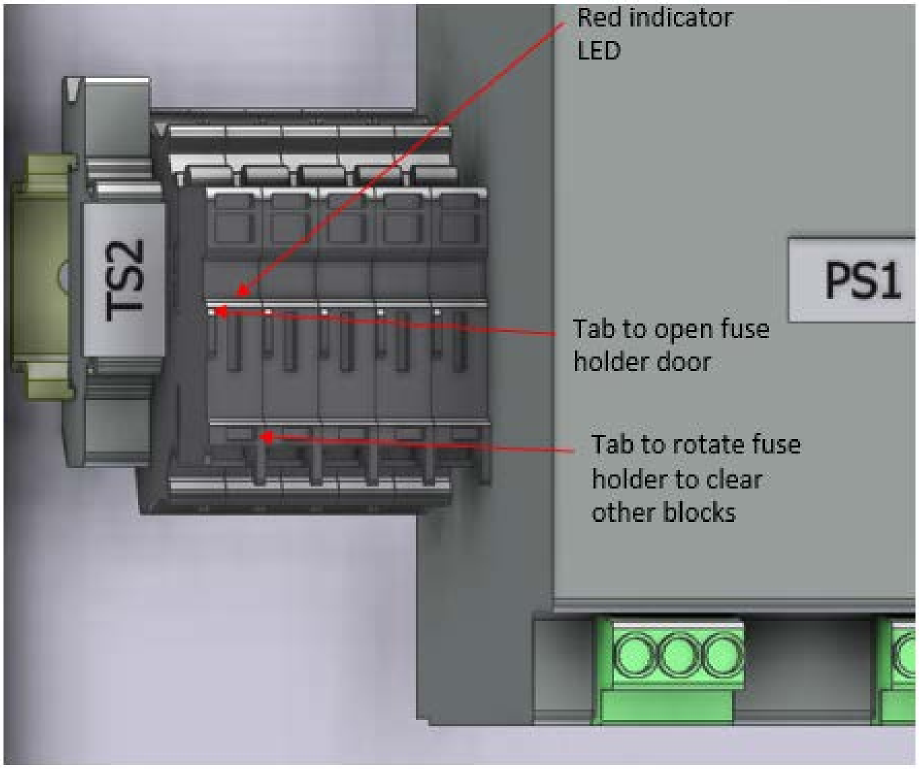


Figure 8-21: Main features of the fuse block holder

5. Note which fuses have opened. Fuse holders are numbered from right to left so in Figure 8-21 above the fuse holder next to the “TS2” stop is TS2-F5, and the fuse holder next to the DC power supply is TS2-F1.
   a. Fuse holders TS2-F1, TS2-F2, and TS2-F3 house 10 A fuses.
   b. Fuse holders TS2-F4 and TS2-F5 house 2 A fuses.
6. Power down the scanner and perform a scanner lockout/tagout procedure.

WARNING

Failure to follow recommended lockout/tagout procedure increases the risk of exposing the technician to hazardous voltages. Only qualified personnel should perform this maintenance procedure.

7. Open any affected fuse holder(s).
   a. Lift the tab on the lower side which allows the holder to rotate up in order to clear interference from the other blocks.
   b. Swing open the fuse holder door by pushing on the tab located on the top surface (see **Figure 8-21** for tab locations).

8. Remove the fuse(s) using needle nose pliers if required.

WARNING

> Use caution if using a tool to remove the fuse especially if the affected fuse is a glass cartridge type. This glass is easily broken.

9. Replace with the same type fuse as was removed.
10. Close the fuse holder door and rotate the assembly back into position.
11. Replace the endbell cover and lock it in place using the square key.
12. Reverse the lockout/tagout procedure and power up the scanner.

8.2.3. Replace HMI panel and/or control boards

Activity Number:	Q3090-00-ACT-009	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician
Priority Level:	Low	**Cautions:**	None
Availability Required:	Scanner Power Off	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	30 minutes	**# of People Required:**	1
Prerequisite Procedures:		**Post Procedures:**	
Required Parts:	Part Number	Quantity	Lead Time
	• 6580500129 PCBA HMI PANEL BOARD and/or • 6580500128 PCBA HMI CONTROLLER BOARD		
Required Tools:	Part Number	Quantity	Lead Time
	• 7mm or 9/32" hex socket driver • Phillips screw driver		

1. Scan the Measurement Modules Offsheet, power down the scanner and follow all appropriate Scanner Lockout/Tagout procedures.

2. Remove the 4 Phillips screws holding the HMI control box to the scanner frame (see **Figure 8-22**).

Figure 8-22: HMI panel on scanner

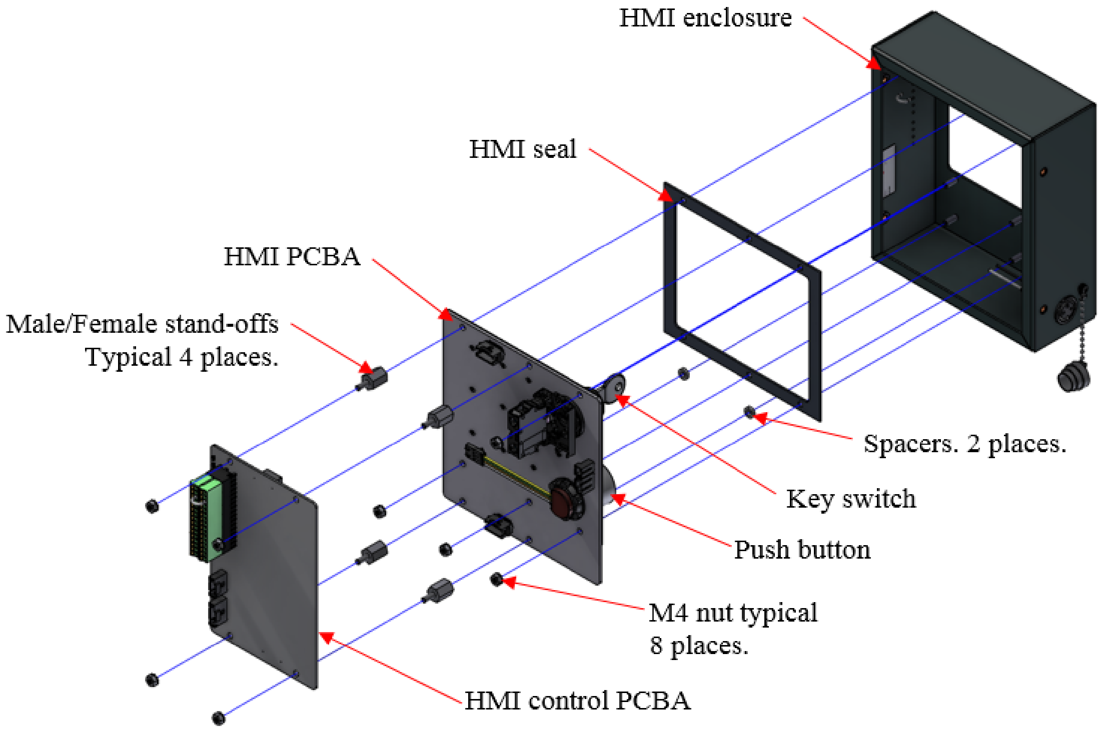


Figure 8-23: HMI Panel exploded view

3. Remove the (4) M4 nuts holding the 6580500128 PCBA Q3090 HMI CONTROLLER BOARD (see **Figure 8-23**).
4. Remove the HMI control board.
5. Remove the 4 male/female stand-offs.
6. Remove the keyswitch contact block by prying on the back tab. This will allow access to the obstructed M4 nut.
7. Remove the remaining M4 nuts. Note the ground lugs under 2 of the M4 nuts.
8. Remove the 658080129 PCBA HMI PANEL BOARD.
9. Re-install the PCBA HMI PANEL BOARD ensuring the board sits flat on the HMI seal and spacers.
10. Install the 2 ground lugs under the M4 nuts.

ATTENTION	Take care not to over tighten the nuts and standoffs holding the PCB.

11. Tighten the 4 M4 nuts and 4 standoffs.
12. Re-install the keyswitch contact block.
13. Install the 6580500128 PCBA Q3090 HMI CONTROLLER BOARD.
14. Tighten the 4 M4 nuts.
15. Remove scanner lock-out/tagout..

8.2.4. Replace power supply

Activity Number:	Q3090-00-ACT-010	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician
Priority Level:	Average	**Cautions:**	Electrical shock
Availability Required:	Scanner Power Off	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	30 minutes	**# of People Required:**	1

Prerequisite Procedures:	None	**Post Procedures:**	None
Required Parts:	Part Number	Quantity	Lead Time
	6541002775 – 24V 20A power supply		
Required Tools:	Part Number	Quantity	Lead Time
	Long narrow flat head screwdriver Jeweler's screw driver flat head		

1. To change the power supply, one must detach the line power from the ZipLine system. Rigorously follow site lock-out/tag-out procedures to prevent energization of the incoming power leads to the ZipLine while this work is being performed.

2. Remove all leads from the existing power supply 6541002775.

3. Access the DIN rail release for the power supply with a long, narrow flat head screwdriver and remove the old component. See **Figure 8-24** for location of DIN rail release tab of power supply.

4. Snap new power supply 6541000755 into place on the DIN rail

5. Re-wire according to drawing 6580801938 – Q3090 electrical panel interconnect.

6. Remove lock-out/tag-out and re-power system.

7. Verify 24V+/-0.1V is provided by power supply, adjust via potentiometer screw on the face of the power supply if required.

8. The replacement is complete.

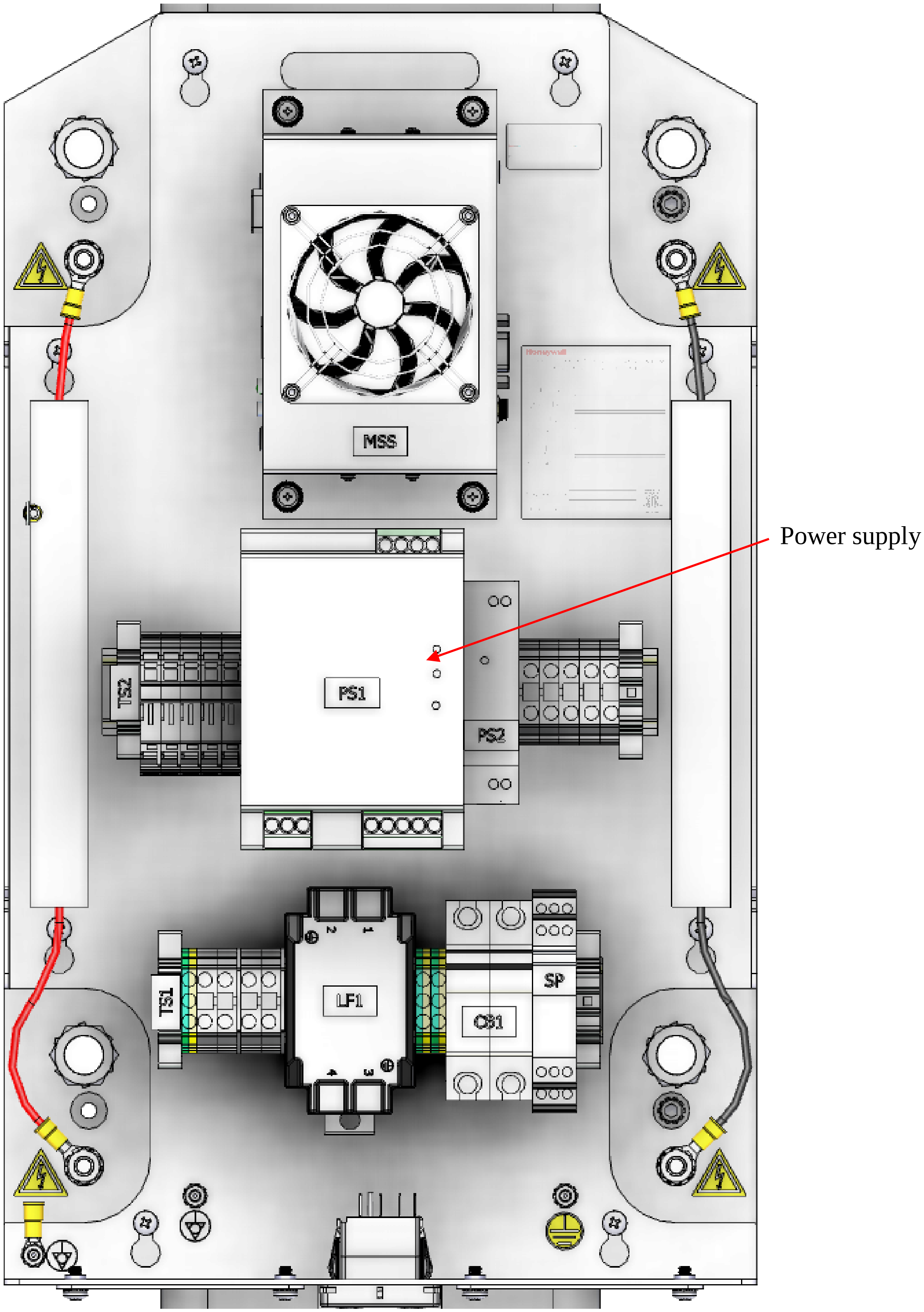


Figure 8-24: Location of Power Supply.

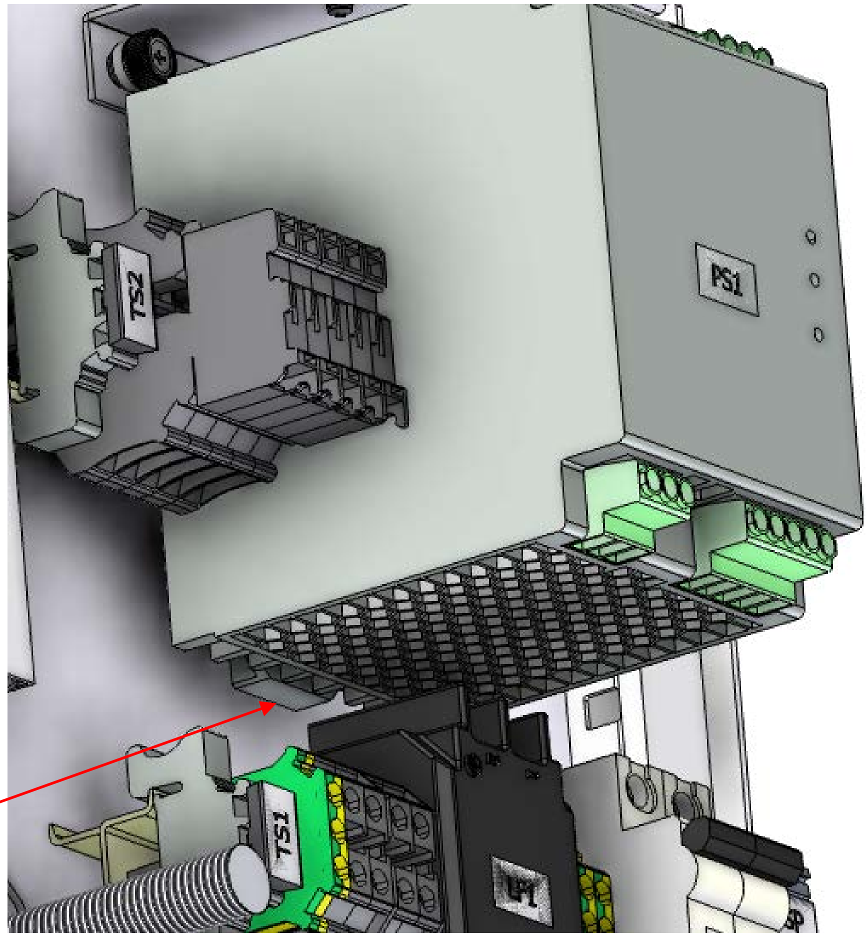


Figure 8-25: Power supply DIN rail release tab

8.2.5. Replace MSS

Activity Number:	Q3090-00-ACT-011	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician
Priority Level:	Low	**Cautions:**	None
Availability Required:	Scanner Power Off	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	15 minutes	**# of People Required:**	1
Prerequisite Procedures:		**Post Procedures:**	
Required Parts:	Part Number	Quantity	Lead Time
	• 6580801967 Q3090 MSS PROGRAMMED ASSY		
Required Tools:	Part Number	Quantity	Lead Time
	• Small Phillips screw driver • Medium Phillips screw driver • 3mm wide flat screw driver		

16. Scan the Measurement Modules Offsheet, power down the scanner and follow all appropriate Scanner Lockout/Tagout safety procedures.

17. Disconnect the connectors from the computer and the positive and negative power from the 24-12VDC converter. Remove the 24VDC fan leads from the terminal blocks. Note the positive terminal block screw for the fan is accessed under the fuse (see **Figure 8-27**).

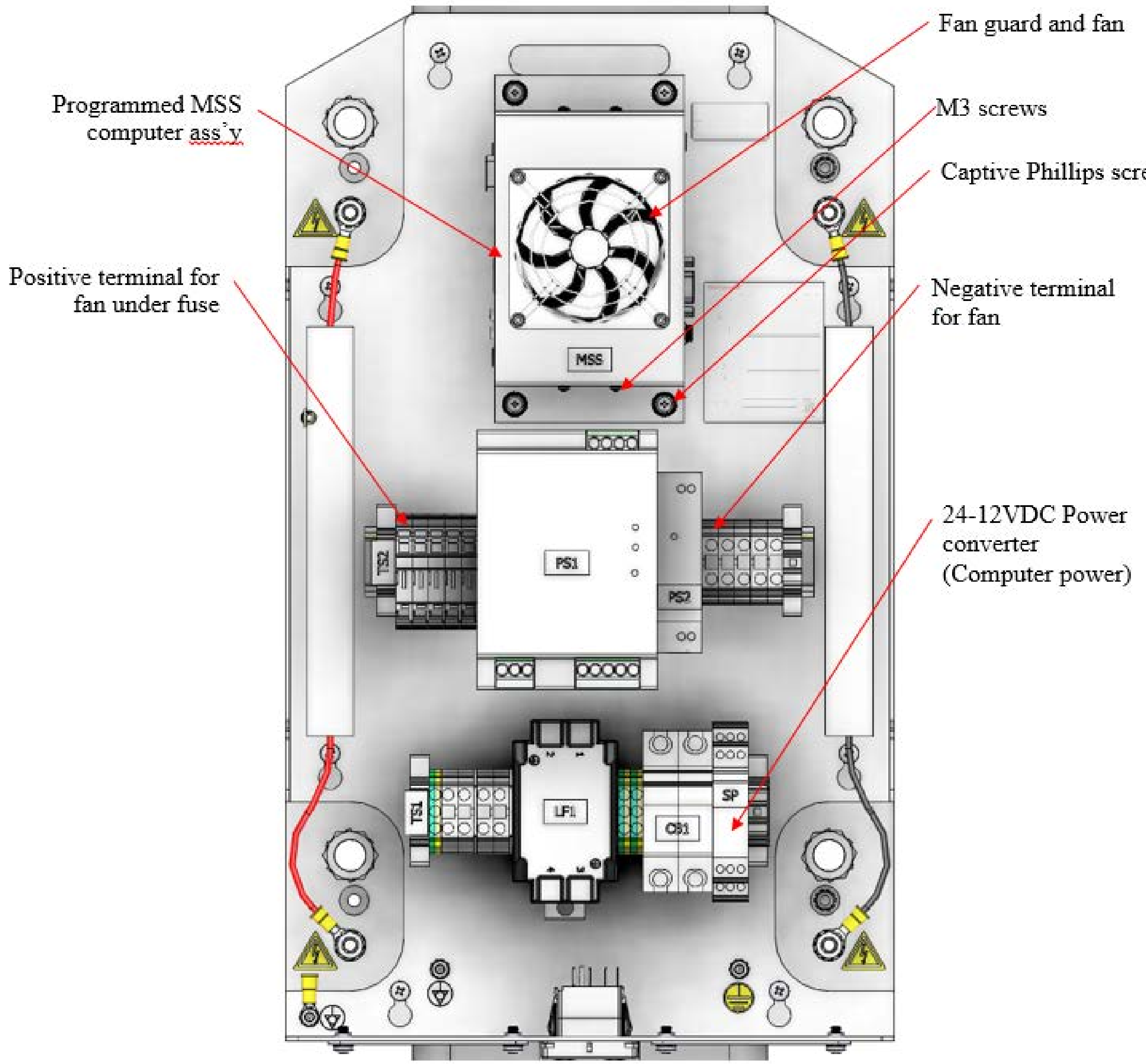


Figure 8-26: Cable End electronics (cover removed)

18. Remove the computer 6580801967 Q3090 MSS PROGRAMMED ASSY from the cable end panel by loosening the captive Phillips screws.

19. Remove the MSS computer from the sheet metal bracket by removing the (4) M3 screws.

20. Install the new computer 6580801967 Q3090 MSS PROGRAMMED ASSY into the bracket.
21. Re-terminate and connect the computer connections.
22. Follow all appropriate Scanner Lockout/Tagout safety procedures.
23. Power on the scanner and ensure the fan is blowing onto the MSS.
24. End procedure.

8.2.6. Replace MSS fan

Activity Number:	Q3090-00-ACT-012	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician
Priority Level:	Low	**Cautions:**	None
Availability Required:	Scanner Power Off	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	30 minutes	**# of People Required:**	1
Prerequisite Procedures:		**Post Procedures:**	
Required Parts:	Part Number	Quantity	Lead Time
	• 6540100028 FAN, 80MM SQ. X15MM, 24VDC, 2 BEARING		
Required Tools:	Part Number	Quantity	Lead Time
	• Set of metric Allen keys • Wire stripper		

25. Scan the Measurement Modules Offsheet, power down the scanner and follow all appropriateScanner Lockout/Tagout procedures.

26. Disconnect the positive and negative fan leads from the terminal blocks. Note the positive terminal block screw is accessed under the fuse. See **Figure 8-27**.

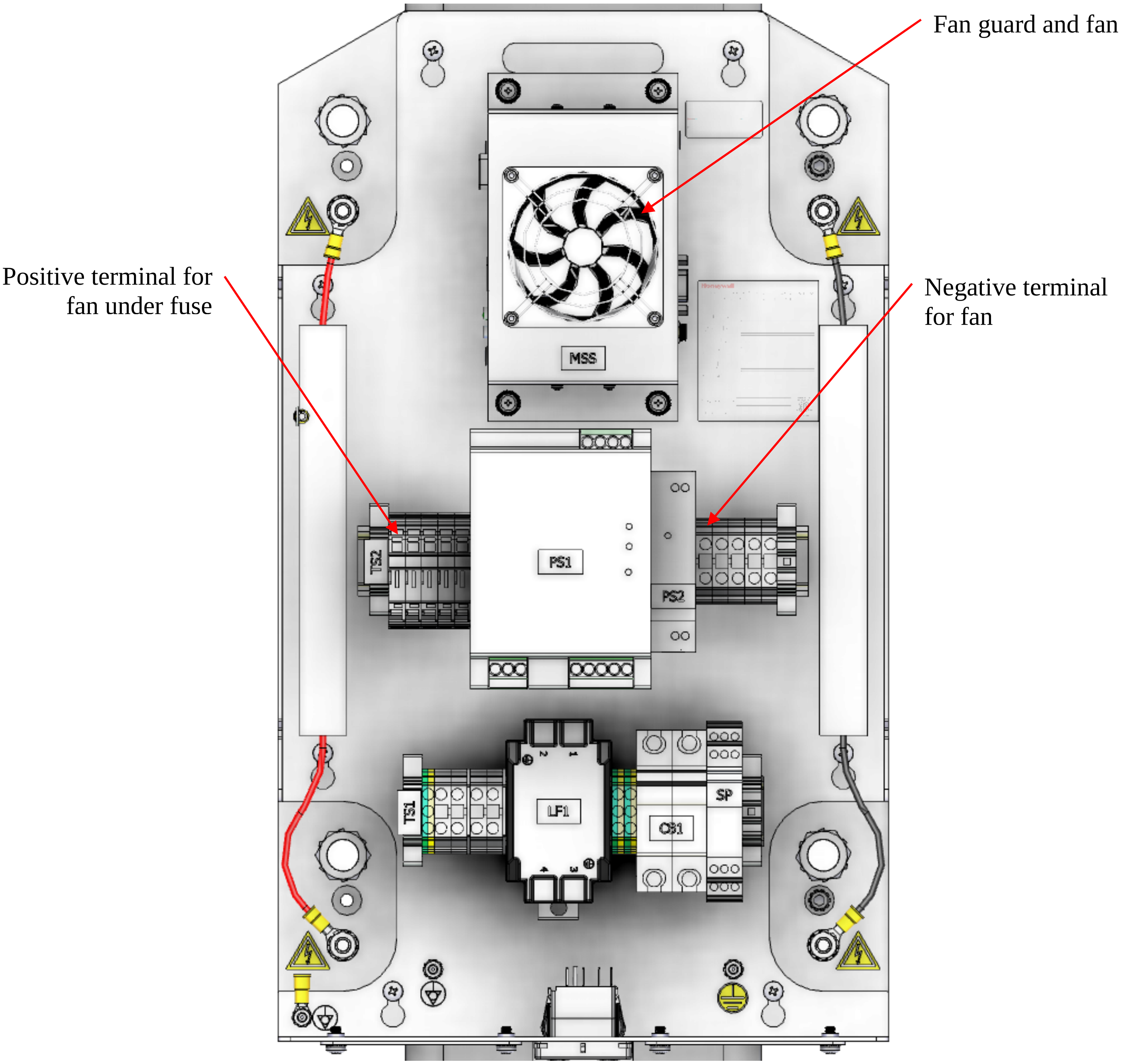


Figure 8-27: Cable End electronics (cover removed)

27. Remove the fan guard and the 6540100028 FAN, 80MM SQ. X15MM, 24VDC, 2 BEARING.

28. Install the new fan and guard.

ATTENTION	Ensure the fan is blowing 'onto' the MSS. Direction arrow should be toward the MSS (away from the fan guard)

29. If required trim the fan wires to the lengths required.
30. Terminate wires to the previously used terminal blocks.
31. Remove the Scanner Lockout/Tagout.
32. Power on the scanner and ensure the fan is blowing onto the MSS.
33. End procedure.

8.3. Measurement modules

8.3.1. Remove/Install Sensor

Activity Number:	Q3090-00-ACT-013	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician
Priority Level:	High	**Cautions:**	None
Availability Required:	Scanner Power Off	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	30 minutes	**# of People Required:**	1
Prerequisite Procedures:		**Post Procedures:**	
Required Parts:	Part Number	Quantity	Lead Time
	• Relevant replacement sensor assembly including wire harnesses		
Required Tools:	Part Number	Quantity	Lead Time
	• Metric Hex Keys • Padlock Key (for nuclear basis weight sources)		

1. Send measurement modules offsheet from either the operator's station or the user panel.
2. Power OFF scanner and perform LOTO procedure.

WARNING

> Follow all radiation safety procedures, specifically the *Radiation Safety Training Manual* (p/n 6510020199), when working near radioactive sources. Failure to follow radiation safety procedures could cause exposure to hazardous levels of radiation.

3. Push measurement modules apart and remove upper and lower covers from each.

4. Disconnect all cables, wire harnesses, and air lines from the sensor.

ATTENTION

> In a Q3090 ZipLine scanner, EDAQ power is provided through the sensor harness. When replacing a sensor the EDAQ will not be powered on as long as the cable assembly is removed.

5. Remove the four screws which mate the sensor to the carriage (most commonly 5 mm hex key). If there is insufficient clearance to remove the sensor modules in this fashion skip ahead to the “Alternate Instructions” at the end of this procedure.

    a. If removing a basis weight nuclear source, a padlock blocks access to one of the screws to prevent unauthorized removal (see **Figure 8-28**). A key should be available to temporarily open this padlock to allow access for sensor maintenance.

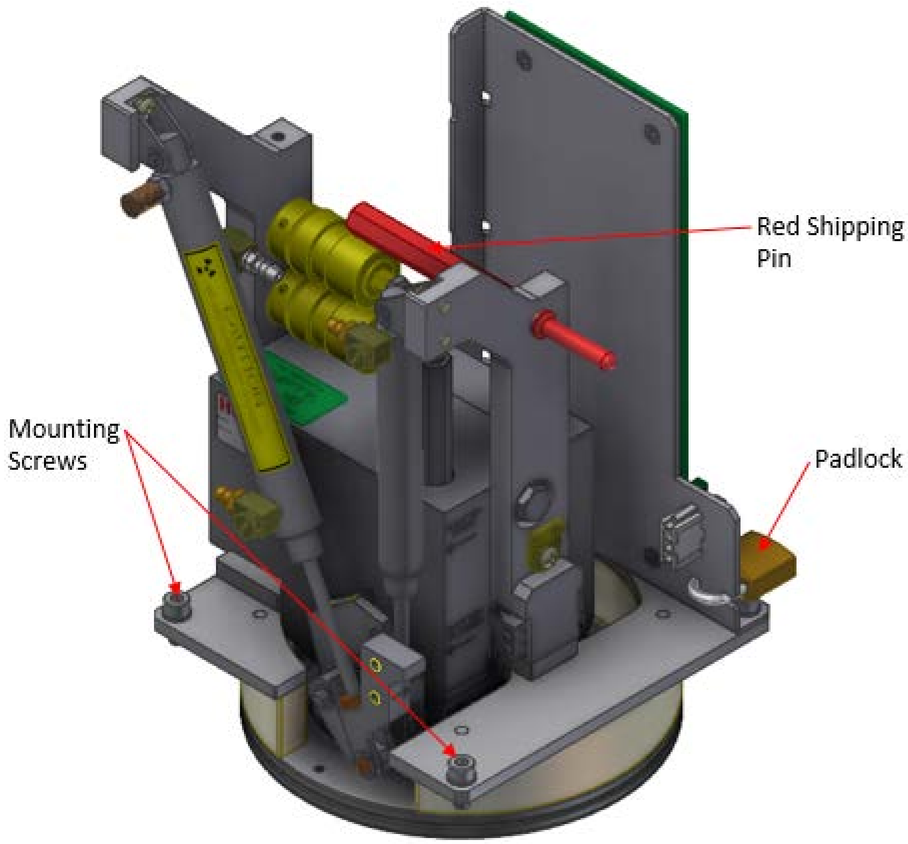


Figure 8-28: SX18 nuclear gauge source side showing mounting screws, padlock, and shipping pin in its storage position

b. On the upper measurement module lift the sensor out of the carriage.

c. On the lower module the sensor must be secured while removing the screws to ensure the unit does not drop.

ATTENTION

Mark orientation of the sensor source/receiver before removing from the carriage.

ATTENTION

Sensors contain sensitive parts that are prone to damage when not installed in an appropriate scanning system or storage mechanism. Take care not to damage the sensor windows when handling sensors outside of the measurement module environment.

WARNING

Nuclear gauges must be locked into an appropriate receptacle when outside of a scanning system and only handled by qualified personnel. Insert the red shipping pin (refer to sensor manual and Figure 8-28) when not installed in a scanner.

6. Install in the reverse order of removal.
7. Remove the scanner LOTO.

Alternate Instructions

In many cases there may be insufficient clearance to remove a sensor module from the head due to interference with the scanner frame. In these cases it is necessary to remove the sensor hanger and remove the sensor module from the other side of the chassis.

1. Remove the four screws which secure the sensor hanger to the measurement module hanger.

ATTENTION

There are eight screws on the sensor hangers – four secure the sensor hanger to the measurement module chassis and four secure the plastic alignment parts. This alignment is set in the factory. Be sure not to remove the plastic alignment parts as improper setup may negatively impact sensor performance.

8.3.2. Replace Power Brushes

Activity Number:	Q3090-00-ACT-014	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician
Priority Level:	Low	**Cautions:**	None
Availability Required:	Scanner Power Off	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	1 year
Duration (time period):	10 minutes	**# of People Required:**	1
Prerequisite Procedures:	Scanner Lockout/Tagout, Remove and Install the Inner and Outer Measurement Module covers	**Post Procedures:**	Scanner Lockout/Tagout, Remove and Install the Inner and Outer Measurement Module covers, Verify Power Brush Tracking
Required Parts:	Part Number	Quantity	Lead Time
	• 6580801920 Q3090 HEAD BRUSH ASSY		
Required Tools:	Part Number	Quantity	Lead Time
	• Phillips Screwdriver		

13. Scan the Measurement Modules Offsheet, power down the scanner and follow all appropriate Scanner Lockout/Tagout safety procedures.
14. Remove the inner and outer covers from the Measurement Modules (see section **8.3.16**).
15. Each measurement module has a power brush mounted on each of the two sides of the chassis. These are located as shown in the following figure.

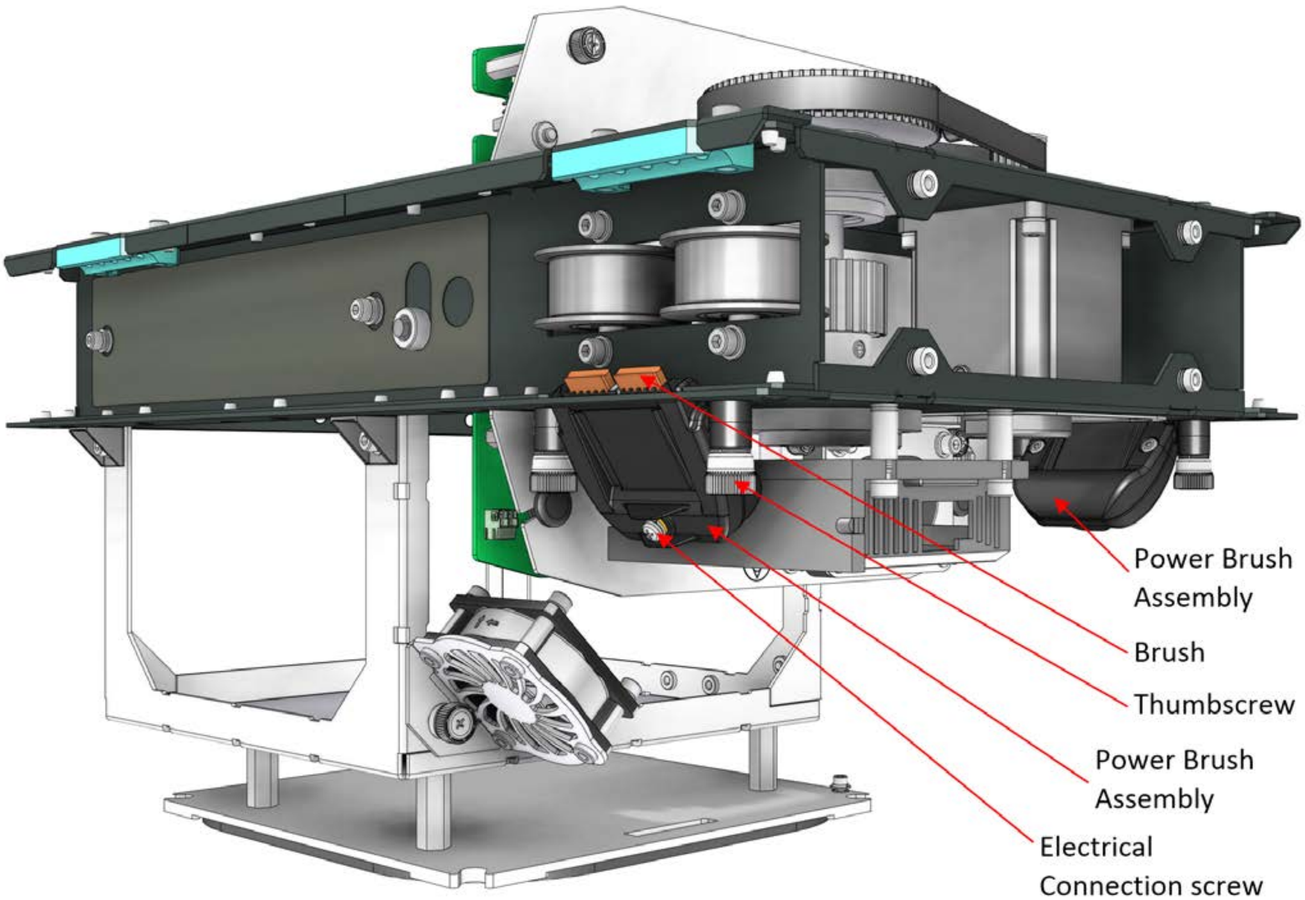


Figure 8-29: Power Brushes

16. In order to remove a power brush assembly, unscrew the thumbscrews and remove. A Phillips screwdriver can also be used to assist in undoing the thumbscrews if necessary.

17. Use a Phillips screwdriver in order to loosen the electrical connection screw terminal on the power brush assembly and remove the electrical connection wire.

18. Before installing a new brush assembly, inspect to ensure the brushes smoothly and easily retract inside the brush assembly body. Do not use the brush assembly if the retraction is difficult, sticks or does not retract at all.

19. Connect the electrical connection wire to the new brush assembly and tighten the electrical connection screw to secure and ensure good electrical contact.

20. Note the orientation of the power brush assembly depicted in **Figure 8-29** in particular that the electrical connection screw should be facing “outward”.

21. Bring the brush assembly in position to mount to the chassis.

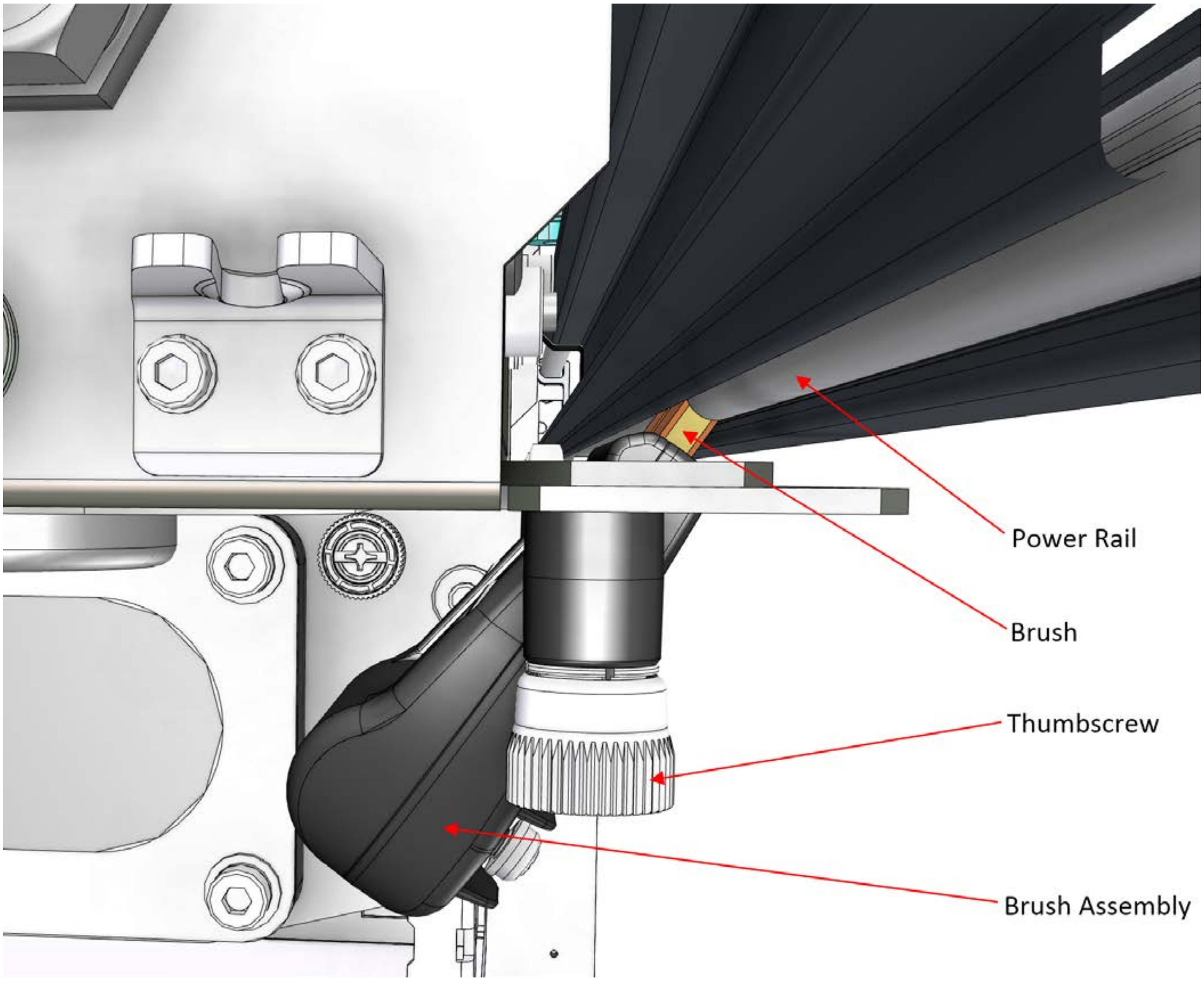


Figure 8-30: Brush Alignment to Power Rail

22. Align the brush such that it is in direct contact with the power rail as shown in **Figure 8-30**. Push the brush assembly up against the power rail in order to retract the brushes inside the brush assembly housing and the thumbscrews align with the mating holes in the chassis. Tighten the thumbscrews and use a Philips screwdriver to ensure fully tightened.

23. Follow section **8.3.4** Verify Power Brush Tracking procedure in order to ensure sufficient brush contact is maintained along the full length of the scan path.

24. Replace all covers that were instructed to be removed at the beginning of this procedure.

25. Remove the Scanner Lockout/Tagout.

8.3.3. Replace Ground Brushes

Activity Number:	Q3090-00-ACT-015	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician
Priority Level:	Low	**Cautions:**	None
Availability Required:	Scanner Power Off	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	1 year
Duration (time period):	10 minutes	**# of People Required:**	1
Prerequisite Procedures:	Scanner Lockout/Tagout, Remove and Install the Inner and Outer Measurement Module covers	**Post Procedures:**	Scanner Lockout/Tagout, Remove and Install the Inner and Outer Measurement Module covers
Required Parts:	Part Number	Quantity	Lead Time
	• 6580200027 Q3090 HEAD GROUND BRUSH		
Required Tools:	Part Number	Quantity	Lead Time
	• M3 hex key wrench		

26. Scan the Measurement Modules Offsheet, power down the scanner and follow all appropriate Scanner Lockout/Tagout safety procedures.

27. Remove the inner and outer covers from the Measurement Modules. See section **8.3.16**.

28. Each measurement module has a ground brush mounted near the side of the chassis. These are located as shown in the following figure.

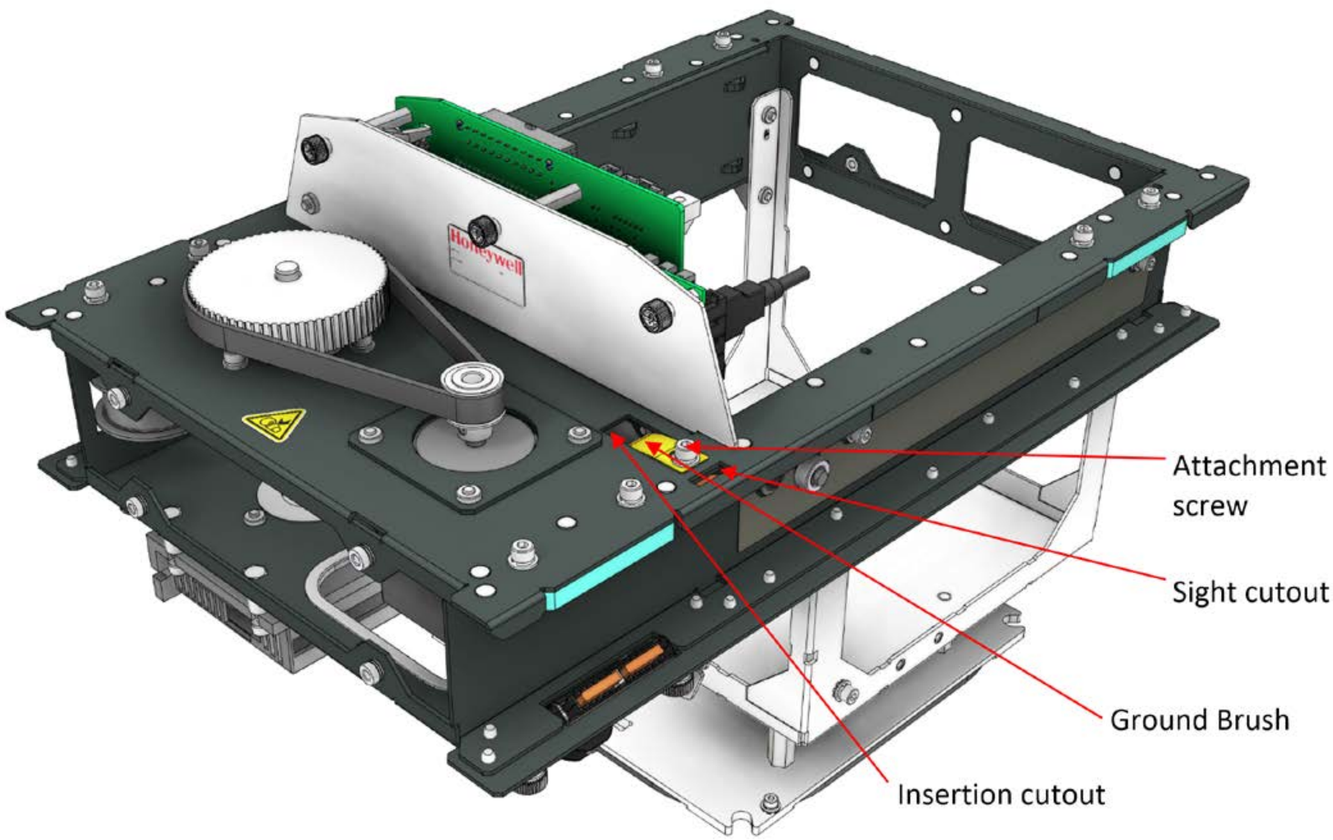


Figure 8-31: Ground Brush

29. In order to remove a ground brush, use an M3 hex key wrench to unscrew the ground brush attachment screw and feed the ground brush out through the insertion cutout.

30. To install a ground brush, feed the ground brush such that the brush element contacts the top of the support rail in order to ground the chassis to the support rail. Refer to **Figure 8-31**. which shows a cross section of how the ground brush is to be oriented.

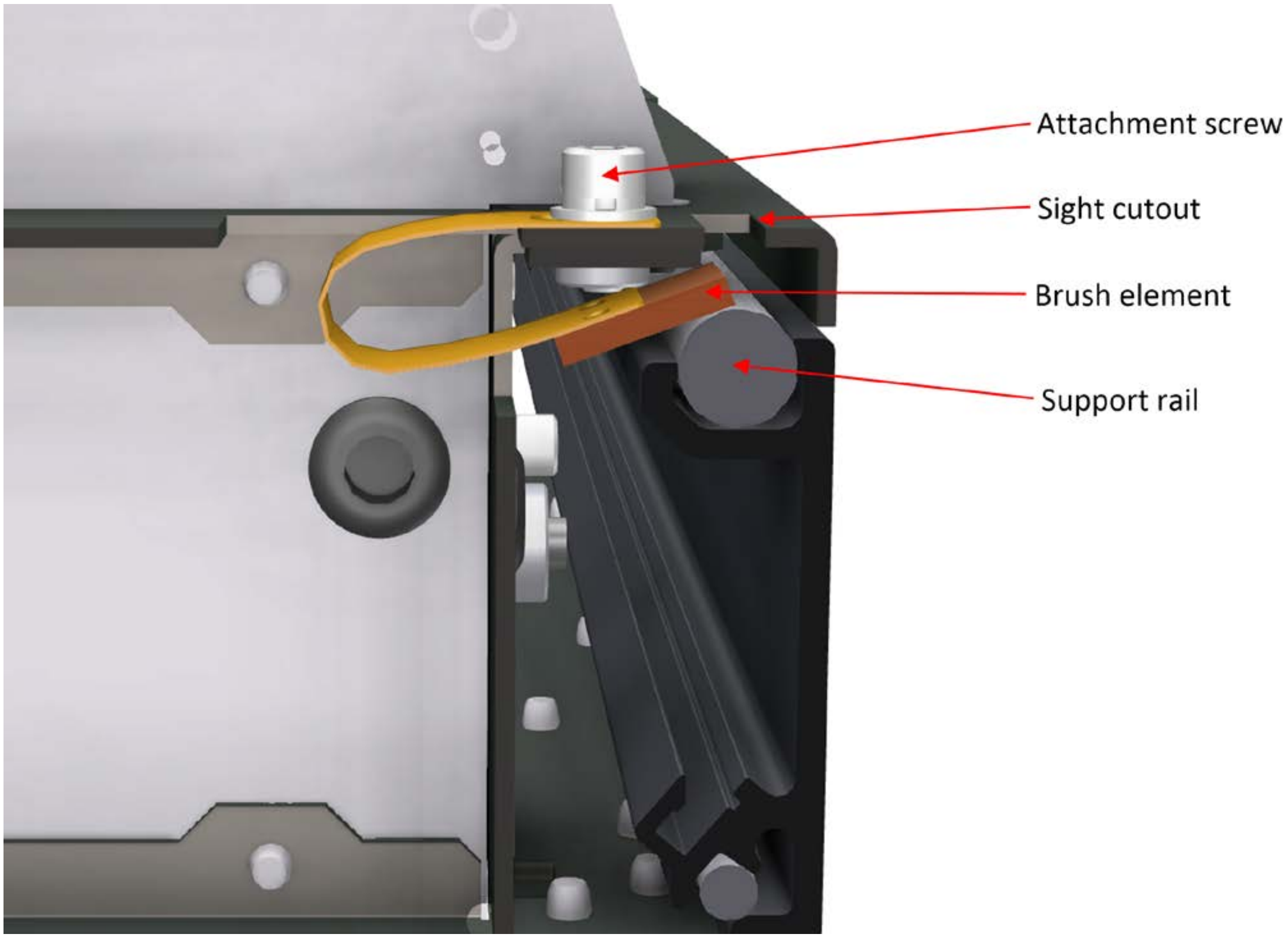


Figure 8-32: Ground Brush Cross Section

31. Look through the sight cutout to confirm that the brush element is in good contact with the support rail and use an M3 hex key wrench to tighten the ground brush attachment screw to lock the ground brush in place.

32. Replace all covers that were instructed to be removed at the beginning of this procedure.

33. Remove the Scanner Lockout/Tagout.

8.3.4. Verify Power Brush Tracking

Activity Number:	Q3090-00-ACT-016	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician
Priority Level:	High	**Cautions:**	None

Availability Required:	Scanner offsheet	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	1 Month
Duration (time period):	3 minutes	**# of People Required:**	1
Prerequisite Procedures:	None	**Post Procedures:**	None
Required Parts:	Part Number	Quantity	Lead Time
	• n/a		
Required Tools:	Part Number	Quantity	Lead Time
	• Straight Edge at least 500mm long (a 2ft level works well)		

34. It is very important to follow this procedure to verify that the power brushes are tracking properly on the power rails. Failure to do so can quite often lead to intermittent power issues which will cause the measurement modules to lose power, stall and stop communicating.

35. Scan the Measurement Modules off sheet.

36. Visually inspect the power brushes to ensure they are in direct contact with the power rails as shown in the following figure.

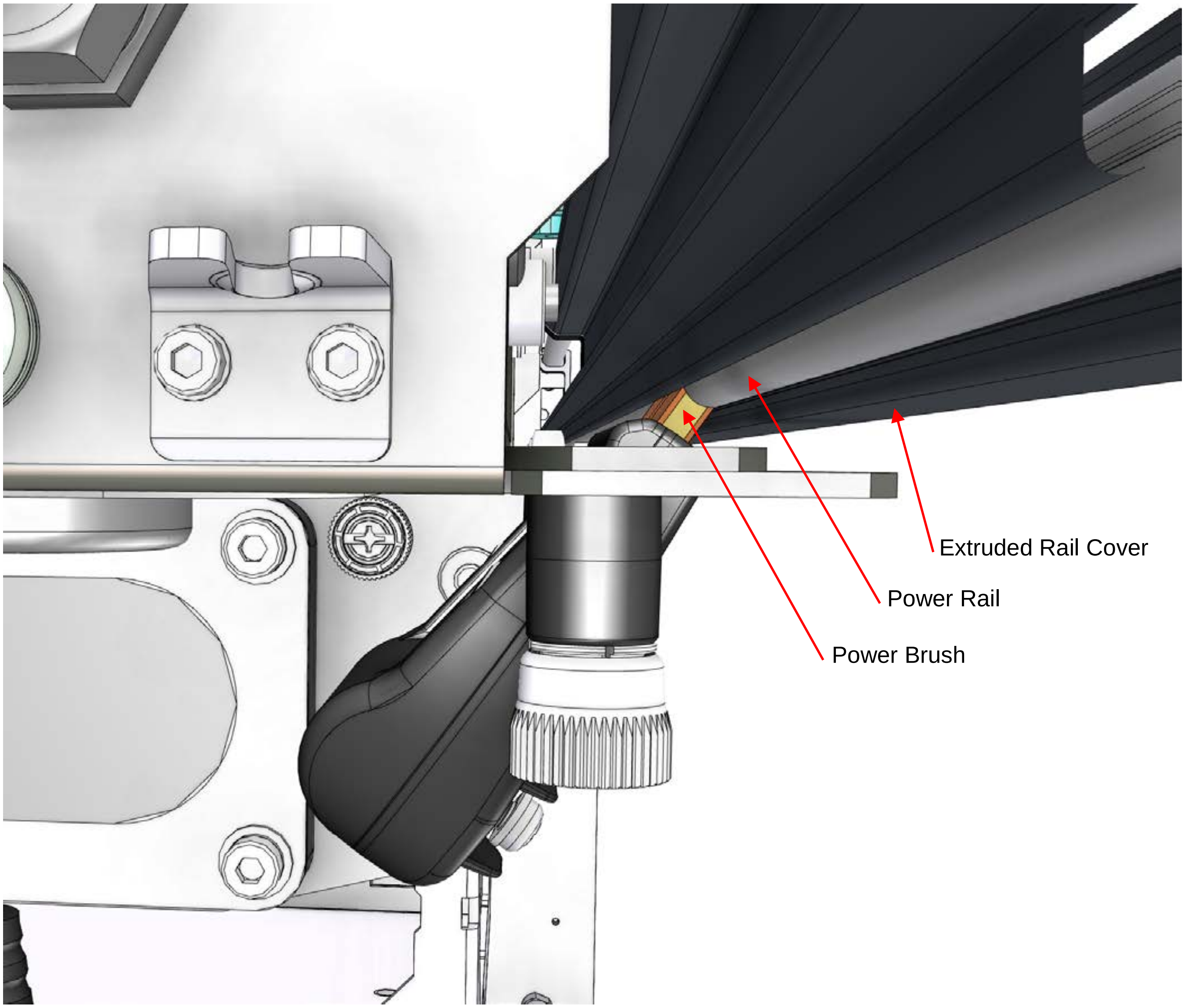


Figure 8-33: Power Brush Alignment

37. Manipulate the brush and/or the extruded rail covers in order to ensure direct contact between the power brush and the power rail if necessary.

38. After ensuring the Power Brushes are in good contact with the power rails while the measurement modules are parked, the next step is to ensure the power rails are straight along the full length of the scan path. Doing this will ensure that the brushes track properly along the power rails while scanning. In order to do this, use a straight edge that is at least 500mm long, such as a 2 foot (or longer) level, hold the straight edge such that it is vertical and press it up against the scanner extruded rail covers such that it contacts both the upper and lower rails. See **Figure 8-33**.

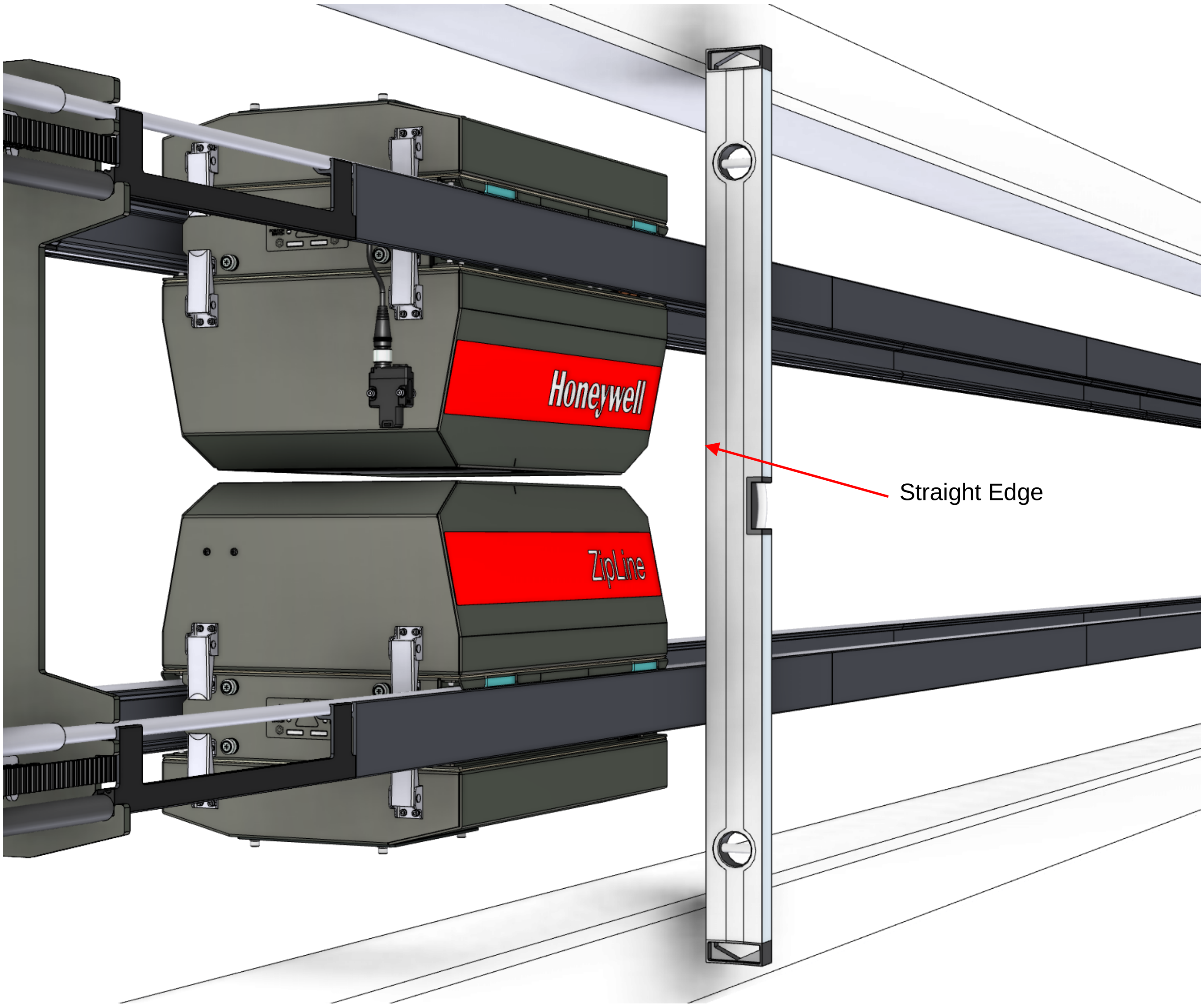


Figure 8-34: Ground Brush Cross Section

39. Both upper and lower extruded rail covers should be in contact with the straight edge along the full vertical height of each rail cover without any significant gaps. If there is a gap, simply grab the rail and twist it in the appropriate direction in order to line it up vertically such that there is no gap between the extruded rail covers and the straight edge.

40. Slide the straight edge a few hundred millimeters (several inches) along the scan direction and repeat the procedure described in the previous step to ensure vertical alignment of the rails. Repeat this procedure along the entire scan length of the scanner, on both upstream and downstream sets of rails.

41. Now the rails should in perfect alignment allowing the measurement modules to scan while maintaining good brush to power rail contact along the full scan path.

8.3.5. Replace Air Compressor

Activity Number:	Q3090-00-ACT-017	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician
Priority Level:	Average	**Cautions:**	None
Availability Required:	Scanner offsheet	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	15 minutes	**# of People Required:**	1
Prerequisite Procedures:	Motor drive lockout/tagout	**Post Procedures:**	Remove motor drive lockout/tagout
Required Parts:	Part Number	Quantity	Lead Time
	• 6540120009 AIR PUMP 28 PSI 24VDC		
Required Tools:	Part Number	Quantity	Lead Time
	• Metric Hex keys • Needle nose pliers		

1. Send the measurement modules to the offsheet position from either the operator's station or the HMI panel.
2. Perform a motor drive LOTO.

WARNING

> Failing to perform a motor LOTO could result in unexpected head movement. When the motor drive is locked out there will still be power delivered to the measurement modules.

3. Disable the radiation sensor from the HMI panel.
4. Separate the measurement modules and remove the lower cover from the upper module (see **Figure 8-35**).

Figure 8-35: Lower cover of the upper measurement module removed. The air compressor is visible

5. Locate the air compressor (see **Figure 8-35**).
6. Using pliers, push sideways on the hose clamp to separate the teeth (see Figure 8-36).
7. Remove the pneumatic hose from the barb on the compressor.
8. Remove the wiring harness from the compressor.

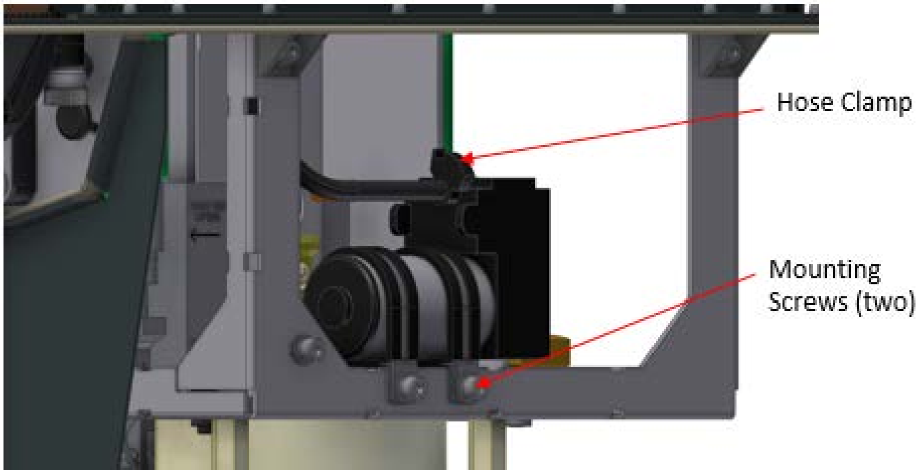


Figure 8-36: Locations of the compressor clamp mounting screws and the hose clamp. Wire harnesses are not shown

9. Use a 4 mm hex key to loosen the screws which hold the compressor clamps (see **Figure 8-36**).

10. Remove the old compressor and install the new one by reversing the steps above.

    a. Polarity for the wiring harnesses is molded into the air compressor.

ATTENTION	Polarity of the power for the air compressor is important. Look at the face of the compressor which has the electrical contacts and note the polarity molded into the plastic housing.

8.3.6. Replace Head Status LED PCBA

Activity Number:	Q3090-00-ACT-018	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician
Priority Level:	High	**Cautions:**	Electric shock, PPE required
Availability Required:	Scanner Power Off	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	15 minutes	**# of People Required:**	1
Prerequisite Procedures:	Motor drive lockout/tagout	**Post Procedures:**	Remove motor drive lockout/tagout
Required Parts:	Part Number	Quantity	Lead Time
	• 6580500130 Q3090 PCBA STATUS LEDS		

Required Tools:	Part Number	Quantity	Lead Time
	• Phillips head screwdriver		

WARNING

> The head status LEDs PCBA is an integral part of the hardwired green light circuit in the upper head. Without a continuous path that lights the green shutter indicator on either side of the head the system will be in an error state.

1. Send the measurement modules to the offsheet position from either the operator’s station or the HMI panel.

2. Perform a motor drive LOTO.

WARNING

> Failing to perform a motor LOTO could result in unexpected head movement. When the motor drive is locked out there will still be power delivered to the measurement modules.

3. Remove the upper and lower head covers from each of the measurement modules that need a replacement PCBA (see **Figure 8-37**).

    a. It is necessary to separate the heads in order to remove the covers. Either perform this operation from the user panel in local motion mode or push them apart by hand once motor power has been disabled.

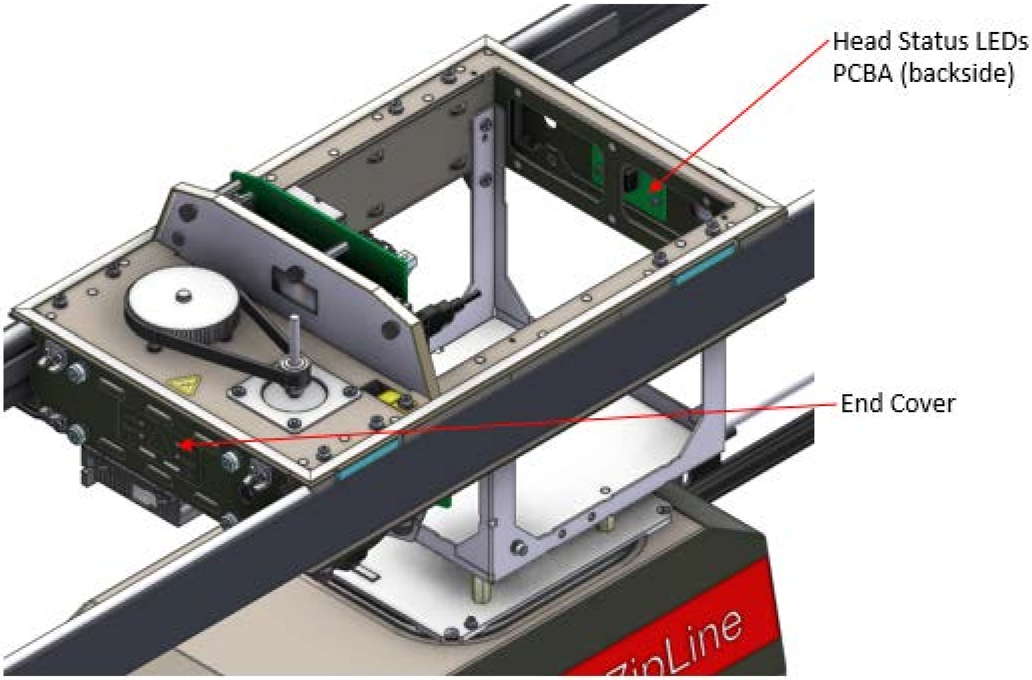


Figure 8-37: Upper measurement module with head covers removed. One of two head status LED PCBAs is visible

4. Loosen the four captive fasteners which hold the affected end cover to the module chassis using a Phillips screwdriver (see **Figure 8-38**).

Figure 8-38: End cover showing the four captive fasteners which mate it to the chassis

5. Gently remove the end plate cover which will be tethered to the chassis by the status LED PCBA's cable harness.

6. Unplug the cable harness.

7. Remove the three screws which hold the status LED PCBA to the end cover using a Phillips screwdriver (see **Figure 8-39**).

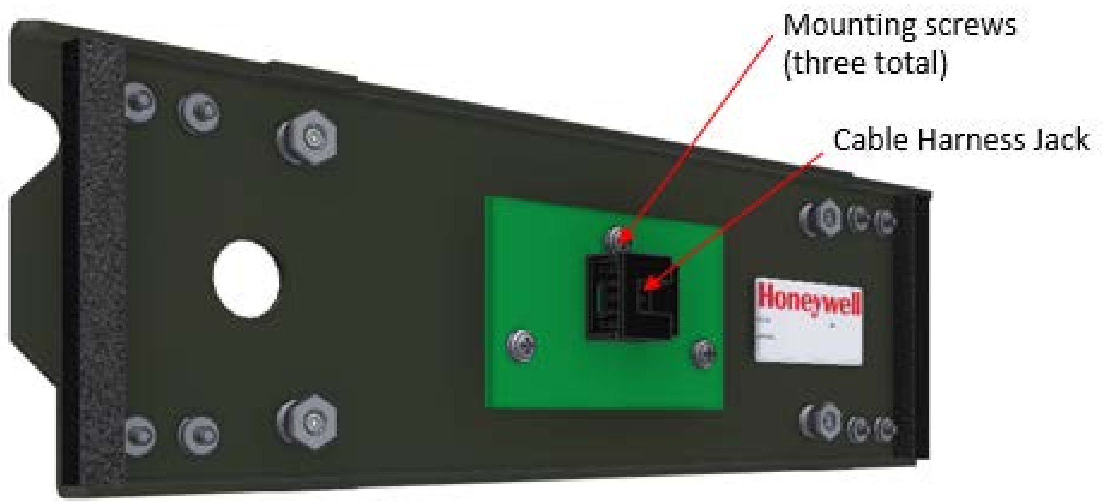


Figure 8-39: Backside of the end plate cover with the backside of the head status LED PCBA visible as well as its three mounting screws

8. Install the new head status LED PCBA in the reverse order.

9. Remove the motor drive LOTO.

8.3.7. Replace Head Split Switch

Activity Number:	Q3090-00-ACT-019	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician
Priority Level:	Low	**Cautions:**	None
Availability Required:	Scanner Power Off	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	5 minutes	**# of People Required:**	1
Prerequisite Procedures:	Scanner Lockout/Tagout, Remove and Install the Inner and Outer Measurement Module covers	**Post Procedures:**	Scanner Lockout/Tagout, Remove and Install the Inner and Outer Measurement Module covers
Required Parts:	Part Number	Quantity	Lead Time
	• 6541320029 SWITCH REED NO 200V 0.5A 10W M8 BARREL		

Required Tools:	Part Number	Quantity	Lead Time
	• ½" wrench		

42. Scan the Measurement Modules Offsheet, power down the scanner and follow all appropriate Scanner Lockout/Tagout safety procedures.

43. Remove the outer lower cover from the Measurement Module. See section **8.3.16**.

44. The lower measurement module has a magnet position switch mounted into the lower sensor (see **Figure 8-40**).

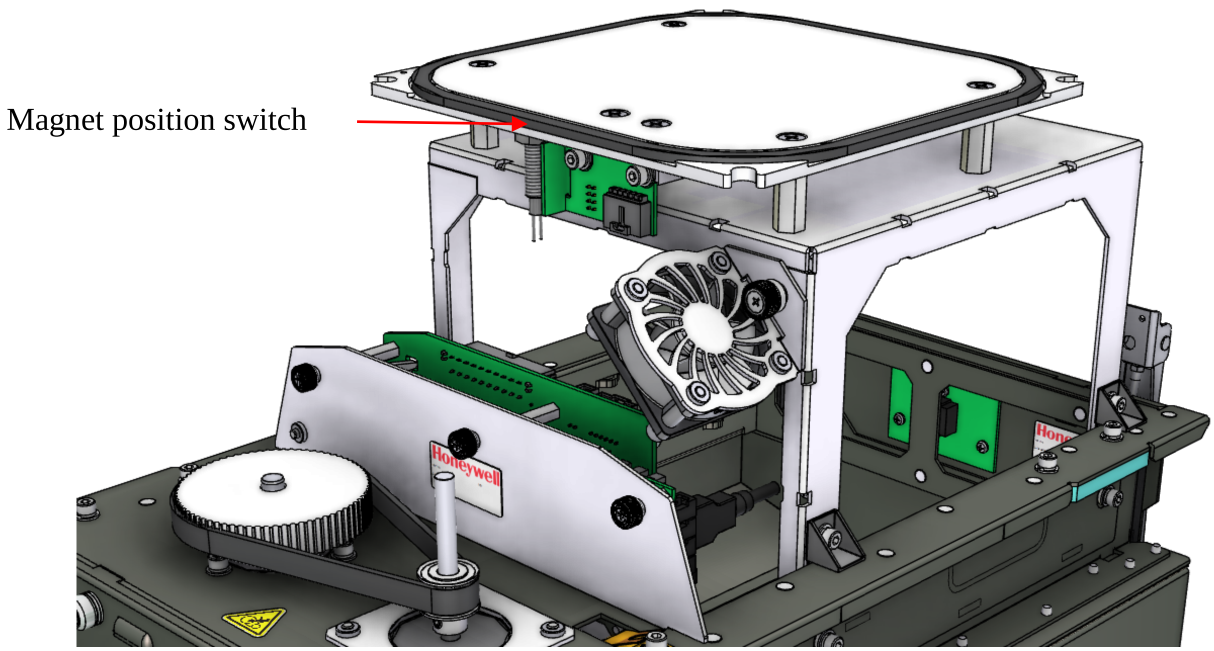


Figure 8-40: Lower measurement module head split switch

45. In order to remove a magnet position switch, first carefully unplug its connector from the Power Distribution Board.

46. Loosen the locknut on the inside of the chassis.

47. Remove the switch by unscrewing the entire assembly, switch body, wires and all.

48. Install the new switch by threading back into the same threaded hole until it bottoms out. Tighten the locknut in order to lock in position.

49. Plug the connector into the Power Distribution Board.

50. Replace the cover.

51. Remove the Scanner Lockout/Tagout.

8.3.8. Replace Wireless Adapter

Activity Number:	Q3090-00-ACT-020	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician
Priority Level:	High	**Cautions:**	None
Availability Required:	Scanner offsheet	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	15 minutes	**# of People Required:**	1
Prerequisite Procedures:		**Post Procedures:**	
Required Parts:	Part Number	Quantity	Lead Time
	• 6543100084 WIRELESS N DUAL BAND USB ADAPTER • Small cable ties		
Required Tools:	Part Number	Quantity	Lead Time
	• Side cutters		

1. Send the measurement modules to the offsheet position from either the operator's station or the HMI panel.

2. Perform a motor drive LOTO.

WARNING

> Failing to perform a motor LOTO could result in unexpected head movement. When the motor drive is locked out there will still be power delivered to the measurement modules.

3. Remove the smaller measurement module cover on the measurement module which will have its wireless adapter replaced. No need to separate the measurement modules for this procedure (see **Figure 8-41**).

   a. This is the uppermost cover for the upper measurement module.

   b. This is the lowermost cover for the lower measurement module.

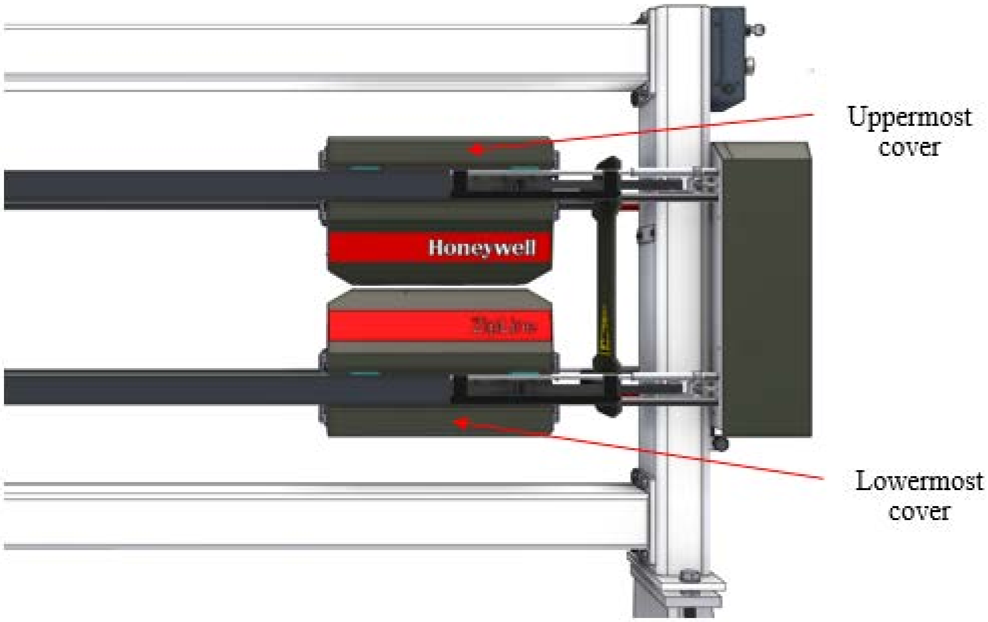


Figure 8-41: Only need to remove one cover to replace the wireless adapter

4. Remove any cable ties that may be in place holding the wireless adapter to the chassis (see **Figure 8-42**).

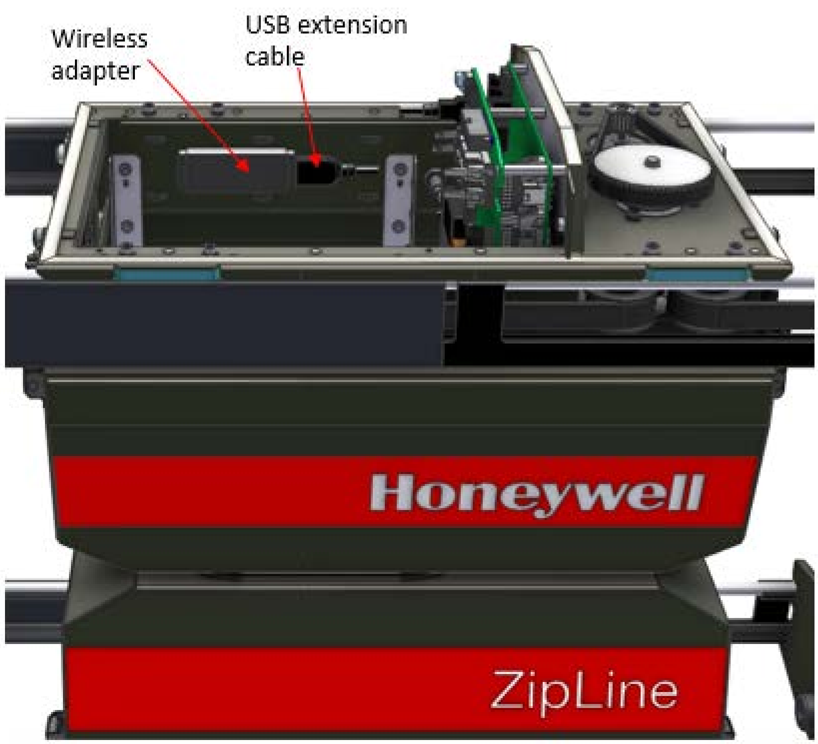


Figure 8-42: Location of wireless adapter in the upper measurement module

Figure 8-42 is similar for the lower module.

5. Unplug the old wireless adapter from the USB extension cable.
6. Plug in the new wireless adapter into the USB extension cable and ensure that the extension cable is well seated in the EDAQ's USB port.
7. Cable tie the new wireless adapter in place.
8. Replace head covers and remove motor drive LOTO.

8.3.9. Change Power Distribution PCBA Fuse

Activity Number:	Q3090-00-ACT-021	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician
Priority Level:	High	**Cautions:**	Electric shock
Availability Required:	Scanner Power Off	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	15 minutes	**# of People Required:**	1
Prerequisite Procedures:	Scanner lockout/tagout	**Post Procedures:**	Remove scanner lockout/tagpout
Required Parts:	Part Number	Quantity	Lead Time
	• 6.3 A fast-acting fuse (Honeywell PN 6541239004)		
Required Tools:	Part Number	Quantity	Lead Time
	• Needle nose pliers		

1. There is only one replaceable fuse on the power distribution PCBA (PN 6580500127). It is located on the backside of the PCBA adjacent to the bulkhead which separates the measurement module into motor drive and sensor compartments (see **Figure 8-43**).

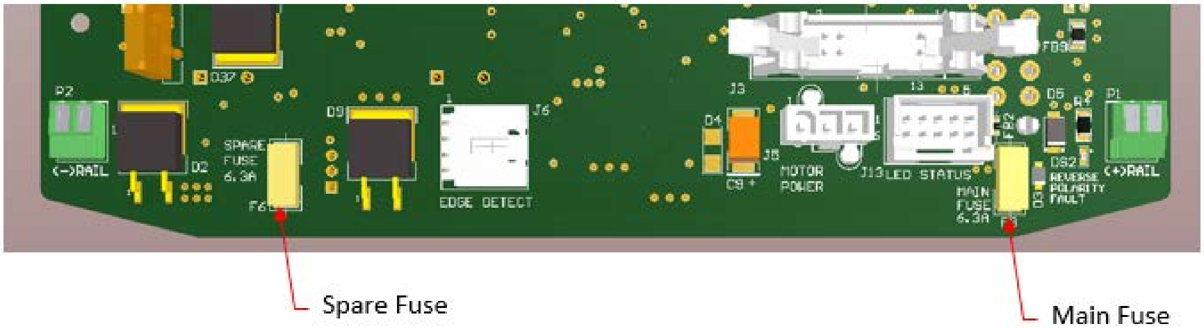


Figure 8-43: Locations of the main power fuse and the spare fuse on the backside of the head power distribution PCBA

2. An unintentional short can cause this fuse to open with the symptom of scanner power being on, the endbell electronics are on, but there appears to be no power in the measurement modules. This is especially obvious if one of the two measurement modules is powered on but the other is not. Look for the absence of illumination on yellow LED DS1 (see **Figure 8-44** and **Figure 8-45**).

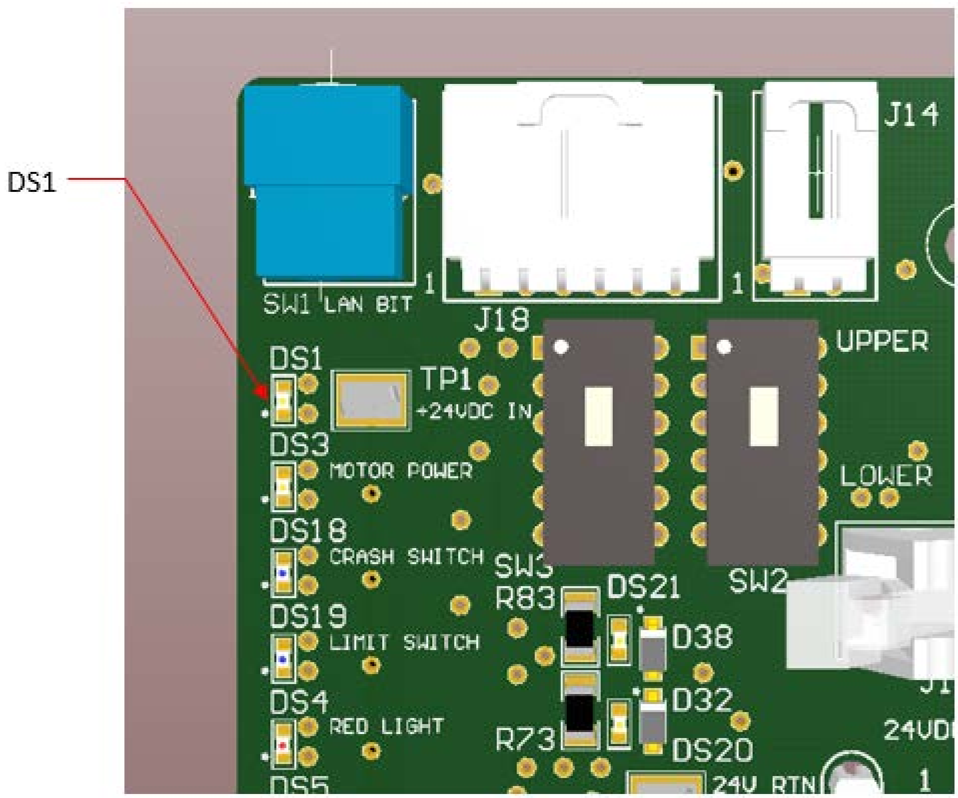


Figure 8-44: Location of DS1 on the top left hand corner of the head power distribution PCBA on the front side

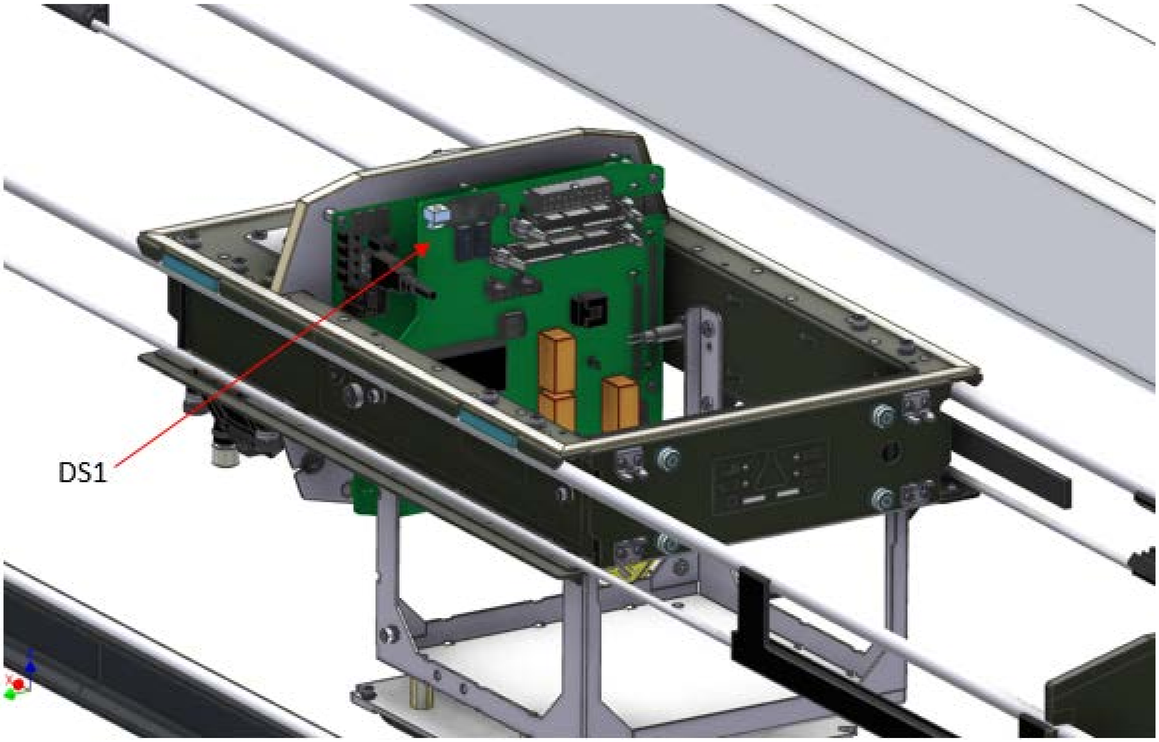


Figure 8-45: Approximate location of yellow LED DS1 within the measurement module (depicted with covers removed)

3. After powering down the scanner and performing a scanner lockout/tagout, remove the lower cover of the affected measurement module(s) (see **Figure 8-46**), separating the heads by hand if necessary.

WARNING

Failure to follow recommended lockout/tagout procedure could result in exposing technicians to live voltages.

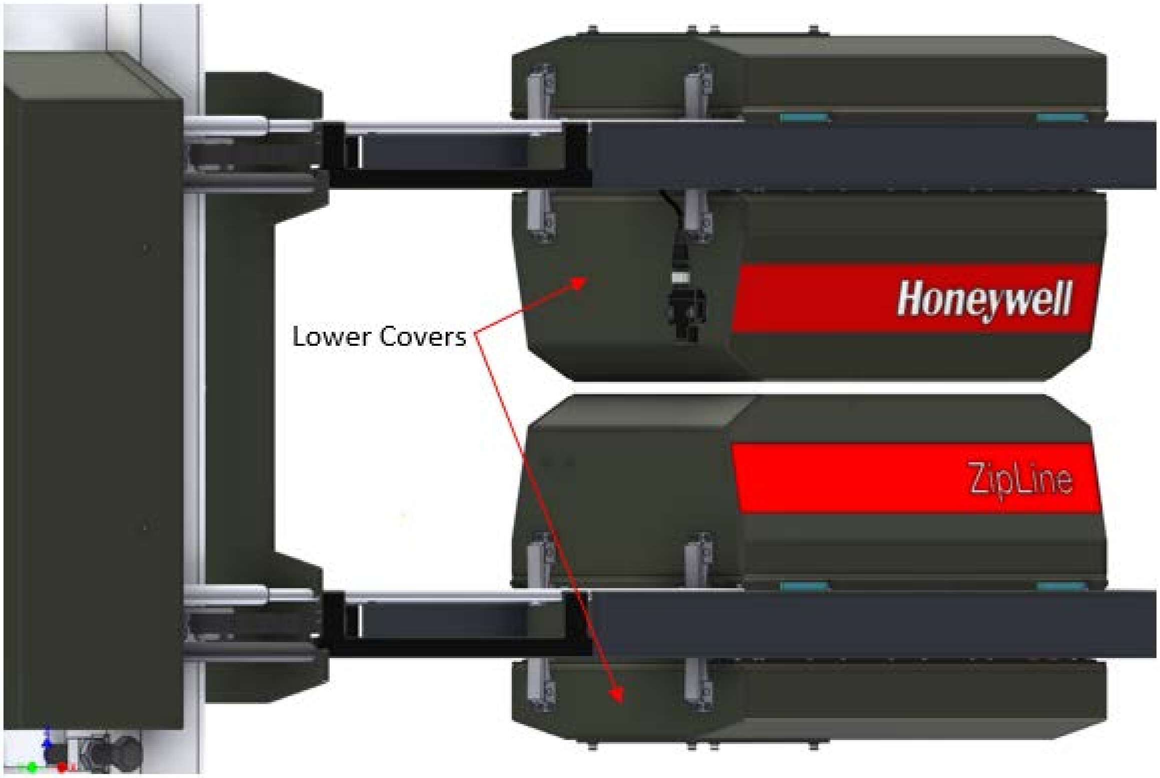


Figure 8-46: Upper and lower measurement modules with lower covers indicated

4. The fuses are located on the backside of the power distribution PCBA along the lower edge (see **Figure 8-47**).

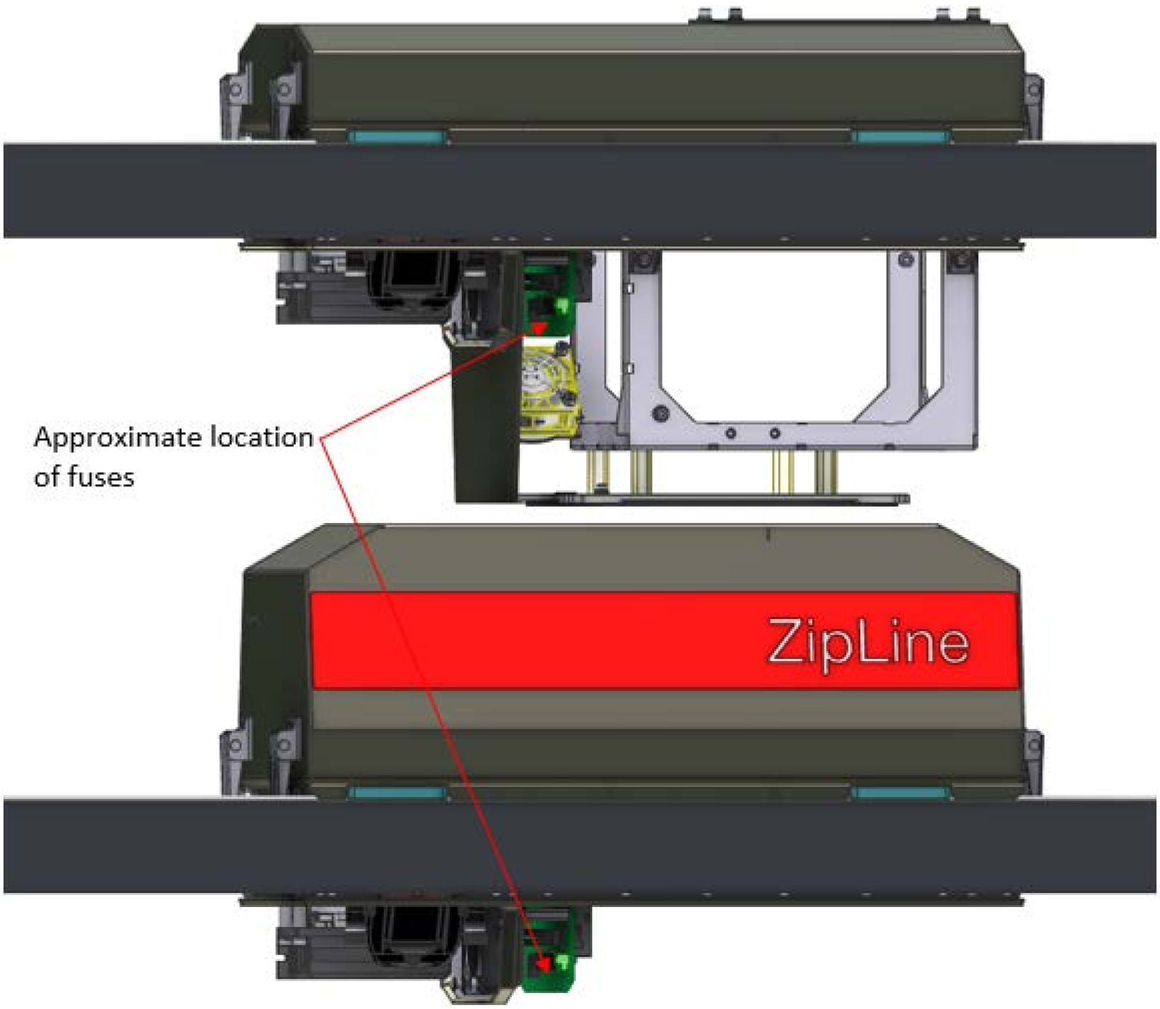


Figure 8-47: Main power fuses and spare fuses are located on the backside of the power distribution PCBAs near the bottom edge

5. Locate the main fuse (see **Figure 8-43** and **Figure 8-47**) and remove it from its holder by pulling straight out with a pair of needle nose pliers. There are no latches.

    a. You can confirm the fuse has opened by measuring across its terminals using a multimeter and registering a high resistance.

6. Locate the spare fuse and remove it from its block in the same manner, then insert it into the main fuse holder block.

7. If you have used your spare fuse, contact Honeywell about part number 6541239004

8.3.10. Replace XYZ Sensor Assembly

Activity Number:	Q3090-00-ACT-022	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician
Priority Level:	High	**Cautions:**	None
Availability Required:	Scanner Power Off	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	15 minutes	**# of People Required:**	1
Prerequisite Procedures:		**Post Procedures:**	
Required Parts:	Part Number	Quantity	Lead Time
	• 6580801948 Q3090 HEAD XYZ SENSOR ASSY		
Required Tools:	Part Number	Quantity	Lead Time
	• Phillips screwdriver		

1. Send the measurement modules to the offsheet position either from the operator's station or from the HMI panel.

2. Perform a motor drive LOTO.

WARNING

Failing to perform a motor LOTO could result in unexpected head movement. When the motor drive is locked out there will still be power delivered to the measurement modules.

3. Remove the upper cover from the lower measurement module.

   a. It is necessary to separate the modules in order to remove the cover. Either perform this operation from the user panel in local motion mode or push them apart by hand once motor power has been disabled.

4. Locate the XYZ sensor assembly on the bottom side of the sensor platform (see **Figure 8-48** and **Figure 8-49**).

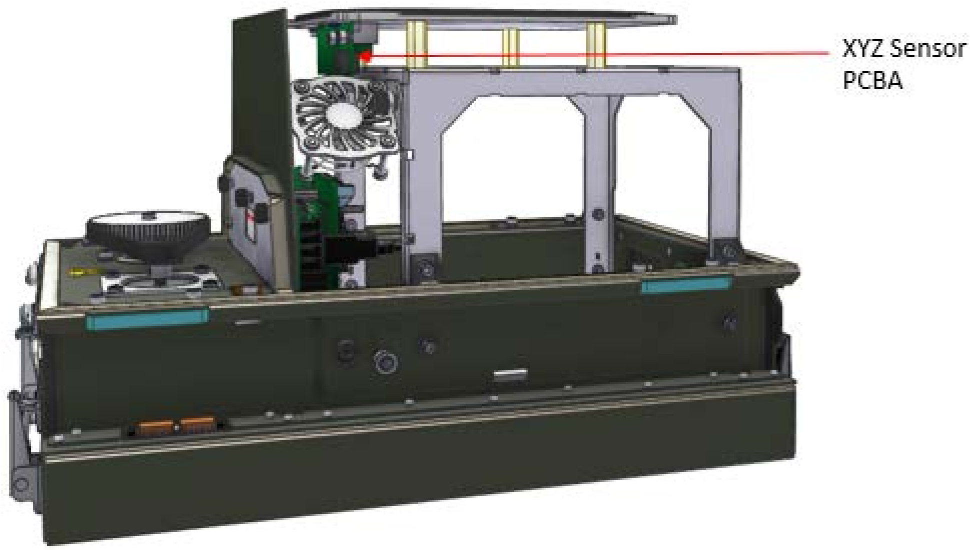


Figure 8-48: Lower measurement module with upper cover removed

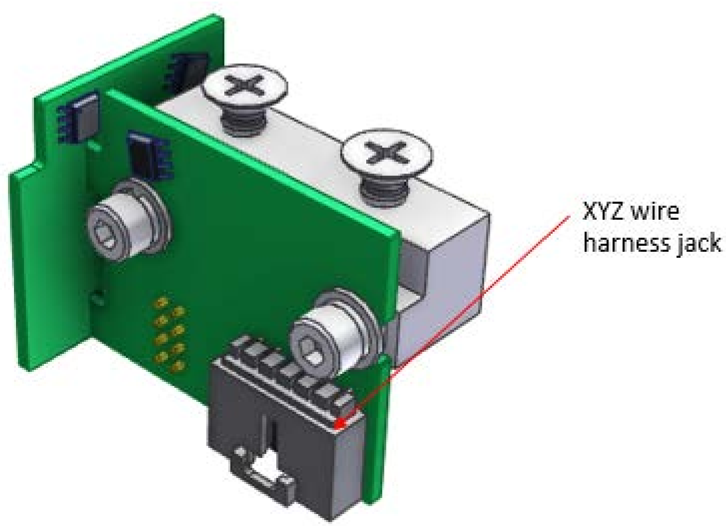


Figure 8-49: XYZ sensor assembly with PCBA and mounting bracket

5. Unplug the wire harness from the jack (see **Figure 8-49**).

6. Remove the two mounting screws from the top surface of the sensor platform using a Phillips screwdriver (see **Figure 8-50**).

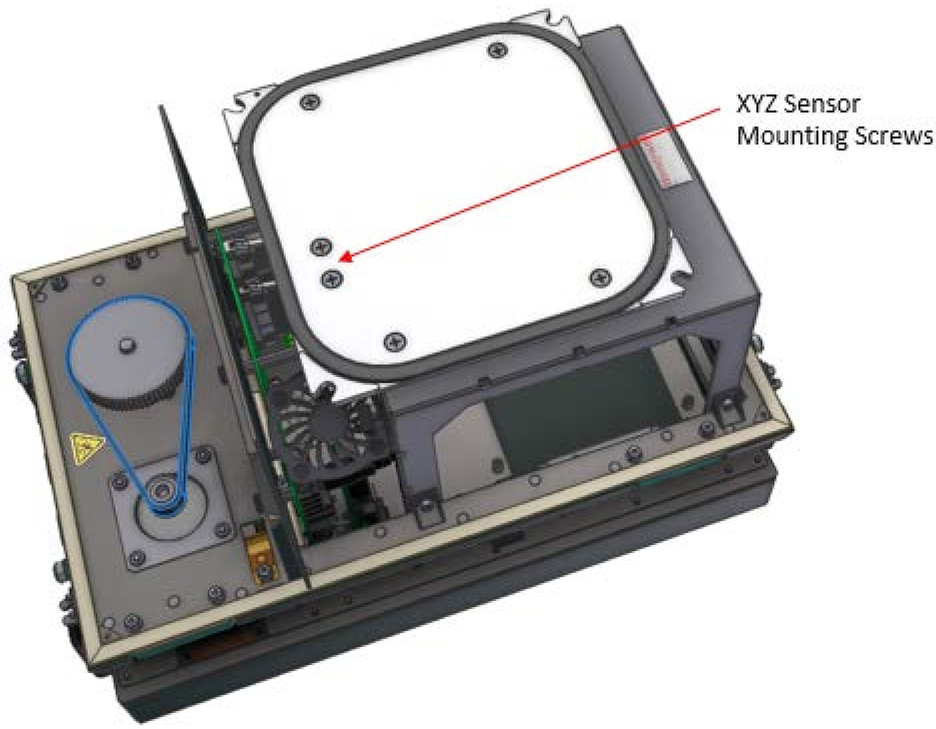


Figure 8-50: Location of XYZ sensor assembly mounting screws on topside of sensor platform

7. Install the new XYZ sensor assembly in the reverse order.
8. Remove motor drive LOTO.
9. Follow the XYZ sensor calibration and verification procedure.

8.3.11. Replace EDAQ

Activity Number:	Q3090-00-ACT-023	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician
Priority Level:	High	**Cautions:**	None
Availability Required:	Scanner Power Off	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	30 minutes	**# of People Required:**	1

Prerequisite Procedures:	Motor drive lockout/tagout	**Post Procedures:**	Remove motor drive lockout/tagout
Required Parts:	Part Number	Quantity	Lead Time
	• EDAQ PCBA (Honeywell PN 6581500030)		
Required Tools:	Part Number	Quantity	Lead Time
	• Square key (for removing electrical panel cover) • Ethernet network cable (3 m length minimum) • Small, flat screwdriver • Small, Phillips head screwdriver • Small wrenches		

1. Power off the scanner via the main power switch.
2. Open measurement module covers.
3. Unplug all cabling from the head power distribution (PDB) PCBA (Honeywell PN 6580500127) and the EDAQ PCBA (Honeywell PN 6581500030) noting that there are jacks on both sides of the PDB/EDAQ assembly.

ATTENTION	Label all ambiguous cables to ensure that they are inserted into the appropriate jacks during reassembly. Pay close attention to thermistor positions and other cables that use the same plug type.

4. Loosen the six captive fasteners which hold the PDB/EDAQ assembly to the bulkhead within the measurement module (see **Figure 8-51**).
   a. Three are located along the top edge, three along the bottom.
   b. A Phillips screwdriver may be useful to loosen these fasteners.

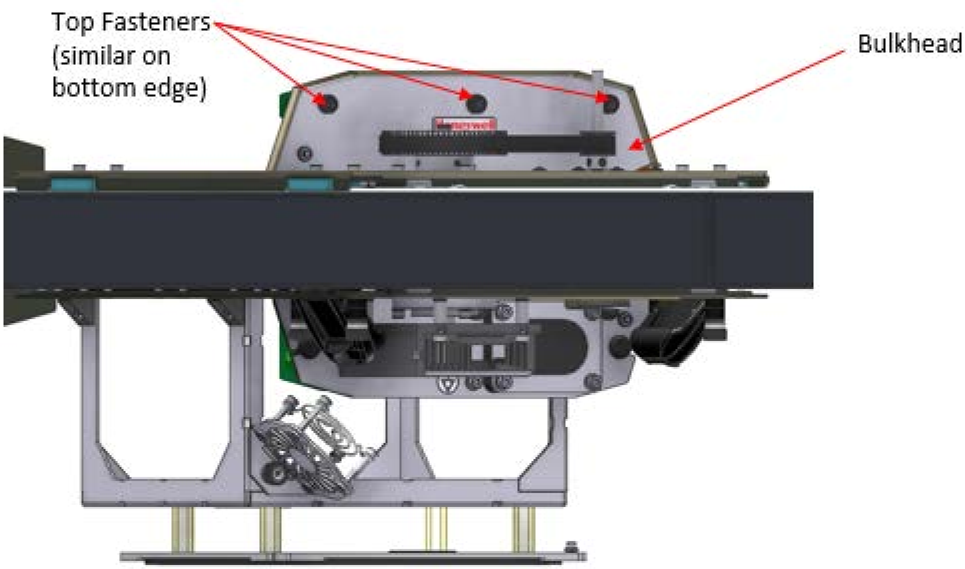


Figure 8-51: Location of fasteners which secure the PDB/EDAQ assembly inside the moeasurement module

5. Remove the PDB/EDAQ assembly from the measurement module (see **Figure 8-52**).

   a. In some cases it may be necessary to remove the sensor assembly in order to remove the PDB/EDAQ assembly.

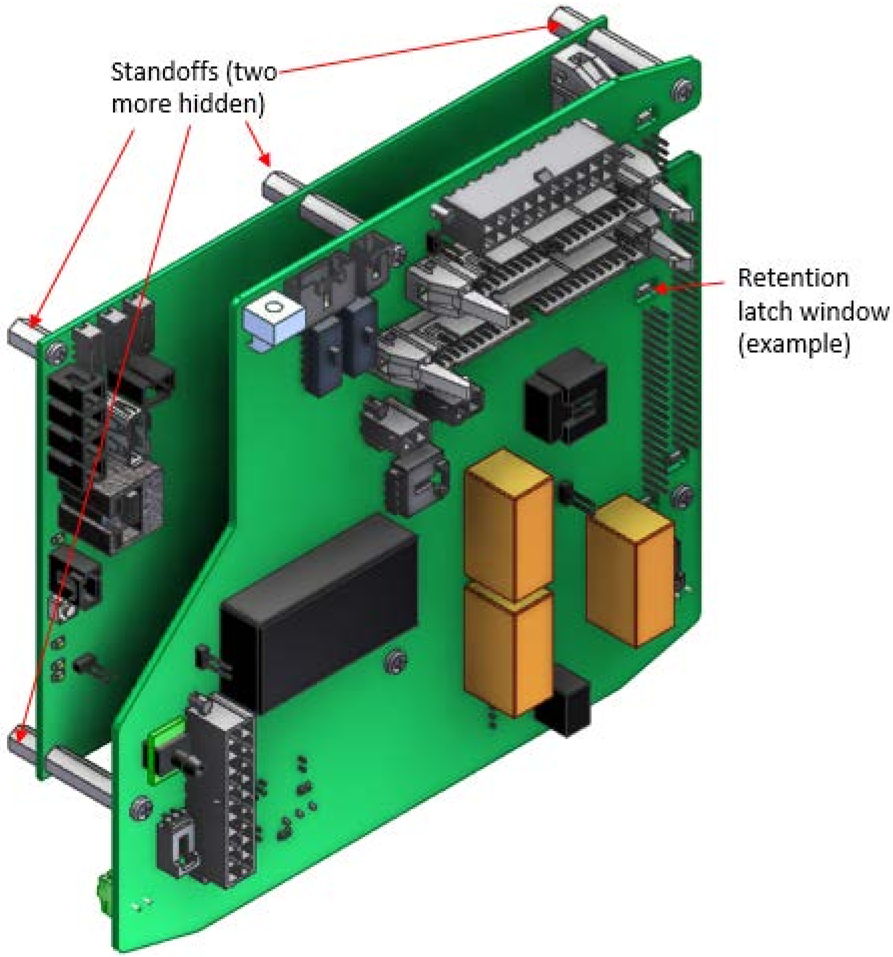


Figure 8-52: PDB/EDAQ assembly removed from measurement module

6. Remove the standoffs which hold the EDAQ in the assembly (see **Figure 8-52**).
7. Gently pry the EDAQ off the assembly.
8. Mate the new EDAQ to the PDB ensuring the connection is strong and that the standoffs from the PDB mate flush to the surface of the EDAQ.

ATTENTION	Pay attention to the retention latches of the EDAQ when mating it to the PDB. There are small window cutouts in the PDB through which the retention latches of J1, J2, and J8 of the EDAQ will enter (see Figure 8-52).

9. Reverse the disassembly instructions to complete the hardware setup section of this task (leave the top cover removed until completing the subsequent firmware setup steps).
10. Set up the EDAQ firmware and networking addresses according to the following instructions.

11. Locate the blue rotary switch SW1 on the PDB (see Figure 8-53).

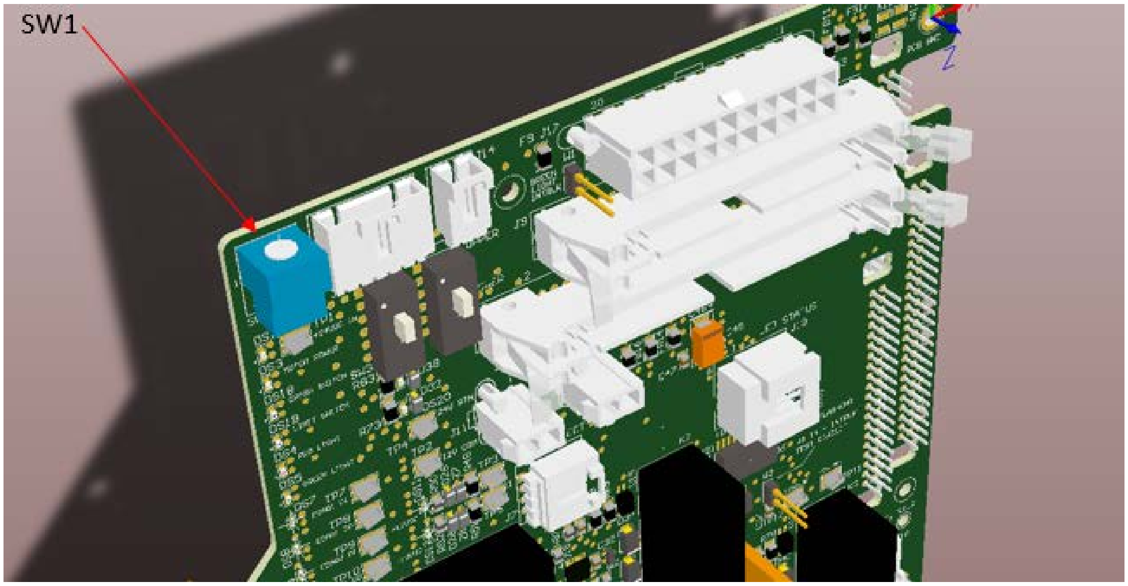


Figure 8-53: Location of rotary switch SW1 on the PDB PCBA

12. Use a small, flat screwdriver to turn SW1 to position 1 (switch positions are molded into the switch housing).

13. Remove the panel cover from the scanner endbell containing the electrical panel assembly.

ATTENTION	The MSS has two Ethernet ports: one faces the mill network and the other faces the scanner side. In normal operation only the mill network port will be occupied by a network cable. When setting up a new EDAQ the free port should be the correct port.

14. Perform a motor LOTO.

WARNING	Failing to disable motor power during the next operations could result in unexpected movement that could result in injury or equipment damage. Do not continue until motor power has been disabled via the HMI panel

15. Connect a network cable between the Ethernet port on the EDAQ and the MSS scanner-side port.

16. Power ON the scanner via the main power switch.

17. From the operator's station navigate to the MSS webpage and update the new EDAQ's firmware to the latest release (see "Update EDAQs" in **Figure 8-54**).

18. Sync the wireless configuration from the option on the MSS webpage (see "Sync Wireless Config" in **Figure 8-54**).

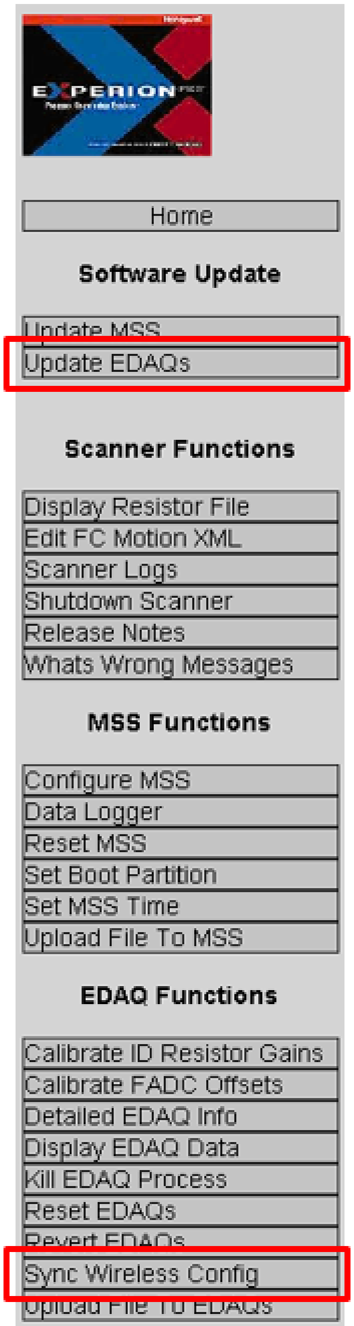


Figure 8-54: MSS webpage options on the left hand side

19. Power OFF the scanner.

20. Use a small, flat screwdriver to change rotary switch SW1 to the appropriate position.

a. Change SW1 to position 2 if using the default scanner wireless networking setup.

b. Change SW1 to position 3 if using a custom setup.

21. Remove the network cable connected between the EDAQ and the MSS.

22. Reinstall the the endbell cover using the square key.

23. Reinstall the head covers.

24. Reverse the motor lockout by twisting the scanner stop button on the HMI panel.

25. Turn the scanner ON via the main power switch.

8.3.12. Replace Head Power Distribution Board

Activity Number:	Q3090-00-ACT-024	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician
Priority Level:	High	**Cautions:**	None
Availability Required:	Scanner Power Off	**Reminder Lead Time:**	N/A
Overdue Grace Period:	N/A	**Frequency (time period):**	As needed
Duration (time period):	5 minutes	**# of People Required:**	1
Prerequisite Procedures:	Scanner lockout/tagout	**Post Procedures:**	Remove scanner lockout/tagpout
Required Parts:	Part Number	Quantity	Lead Time
	• 6580500127 PCBA Q3090 HEAD POWER DISTRIBUTION		
Required Tools:	Part Number	Quantity	Lead Time
	• Small flat screwdriver (for setting SW1) • Phillips screwdriver • Needle nose pliers		

1. Send the measurement modules to the offsheet position either from the operator's station or from the HMI panel.

2. Perform a scanner LOTO.

WARNING	Failing to perform a scanner lockout/tagout could result in live voltages or unexpected head movement either of which could cause personal injury or equipment damage.

3. Open measurement module covers.

4. Unplug all cabling from the head power distribution (PDB) PCBA (Honeywell PN 6580500127) and the EDAQ PCBA (Honeywell PN 6581500030) noting that there are jacks on both sides of the PDB/EDAQ assembly.

ATTENTION	Label all ambiguous cables to ensure that they are inserted into the appropriate jacks during reassembly. Pay close attention to thermistor positions.

5. Loosen the six captive fasteners which hold the PDB/EDAQ assembly to the bulkhead within the measurement module (see **Figure 8-51**).

    a. Three are located along the top edge, three along the bottom.

    b. A Phillips screwdriver may be useful to loosen these fasteners.

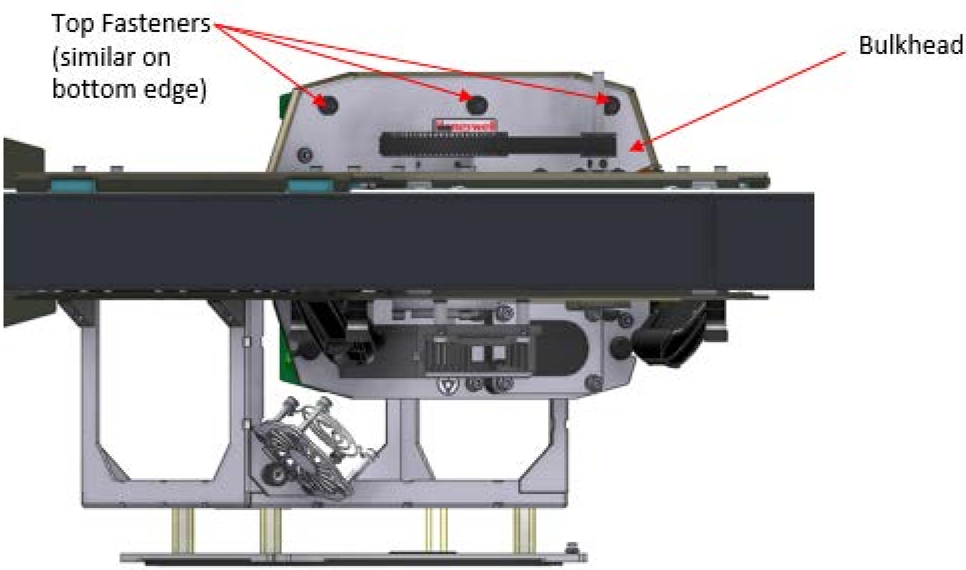


Figure 8-55: Location of fasteners which secure the PDB/EDAQ assembly inside the moeasurement module

6. Remove the PDB/EDAQ assembly from the measurement module (see **Figure 8-52**).

    a. In some cases it may be necessary to remove the sensor assembly in order to remove the PDB/EDAQ assembly.

7. Remove the phillips-head screws which mate the PDB to the standoffs connected to the EDAQ (five total). See **Figure 8-56**.

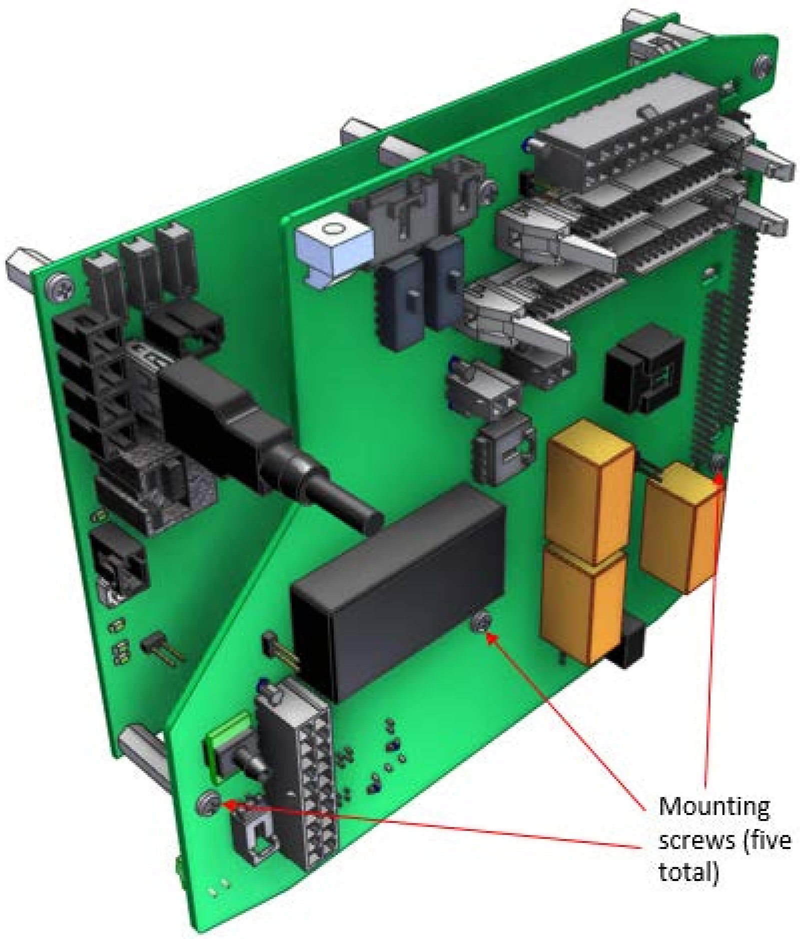


Figure 8-56: Mounting screws mate the PDB to the standoffs connected to the EDAQ

8. Gently pry apart the PDB/EDAQ assembly.

9. Set up the new PDB PCBA according to the following steps using the old board as a guide.

10. Set rotary switch SW1 using a small slot screwdriver according to **Table 2**. Switch positions are molded into the switch itself (i.e. 1, 2, 3 and 4).

Table 2: Switch positions for rotary switch SW1

Switch Position	Notes
1	Wired Ethernet setup connection
2	Single scanner system with default Wi-Fi setup
3	Additional scanner wireless communication settings

4	Reserved – do not use

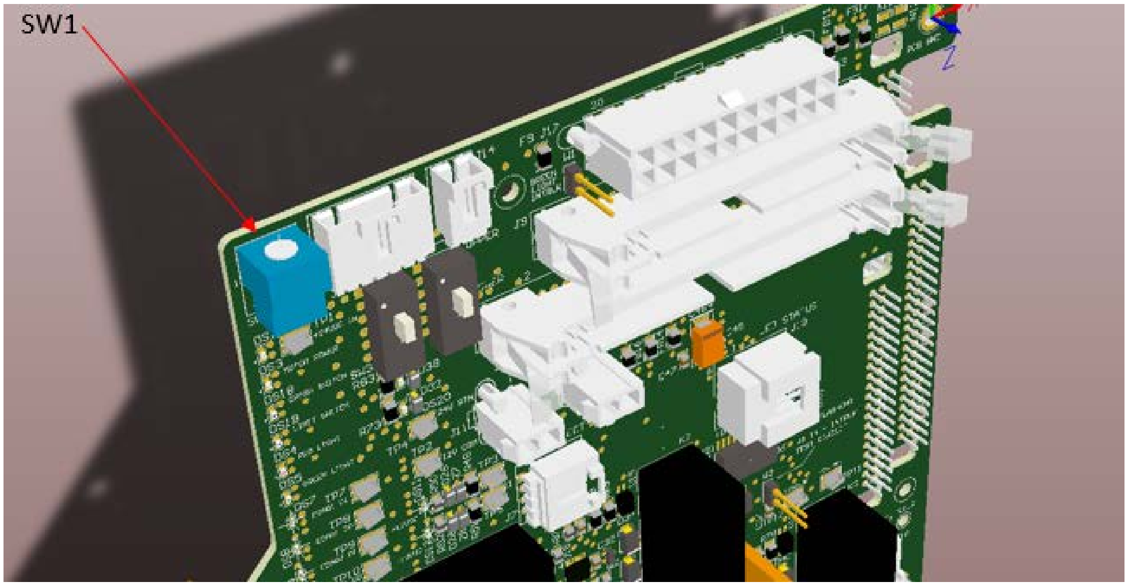


Figure 8-57: Location of rotary switch SW1 on the Head Power Distribution PCBA

11. Set slider switches SW2 and SW3 (see **Figure 8-58**) according to Table 3 below.

Table 3: Switch positions for slider switches SW2 and SW3

Switch	Upper Head	Lower Head
SW2	UP	DOWN
SW3	UP	DOWN

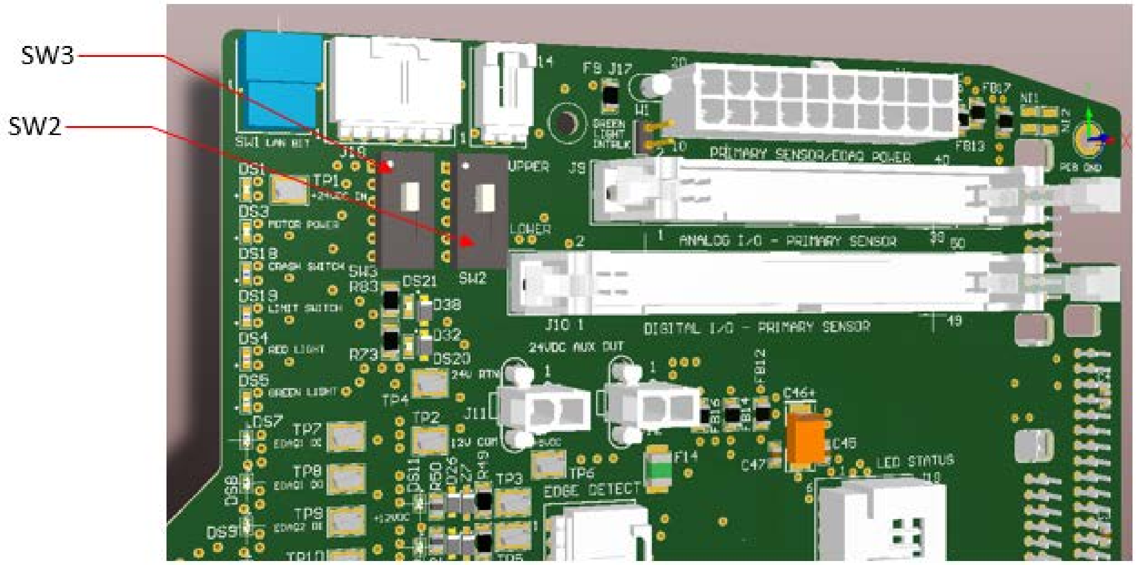


Figure 8-58: Portion of PCBA depicted with switches SW2 and SW3 in the UP positions.

Note: This is the setup for a power distribution PCBA to be used in an upper head.

ATTENTION

> The switch positions UP and DOWN are marked on the legend of the PCBA with text UPPER for the upper measurement module and LOWER for the lower measurement module. See the text next to the indicated switches in Figure 8-58 above. SW2 and SW3 should always be either both UP or both DOWN.

12. Set Green Light jumper W1 according to **Table 4** (see **Figure 8-59**). Needle nose pliers may be helpful in removing or setting the jumper.

Table 4: Jumper W1 settings depend on installed sensor

Sensor	W1 Setting
Sensor which does not use interlocking (e.g. MXIR)	IN
Sensor which uses interlocking (e.g. nuclear gauge)	OUT

ATTENTION

> Green light circuitry is only active on the upper head. Jumper settings for W1 and W2 are irrelevant on the bottom measurement module but it is good practice to match the upper module's settings.

13. Set “Green Light” jumper W2. Needle nose pliers may be helpful in removing or setting the jumper.

    a. In any single sensor system W2 will be IN.

    b. In any dual sensor system W2 will be IN or OUT according to Table 4 (see Figure 8-59).

14. Ensure “Interlock Test Circuits” jumper W3 is OUT. This jumper should only be used by qualified personnel for testing board functionality (see **Figure 8-59**).

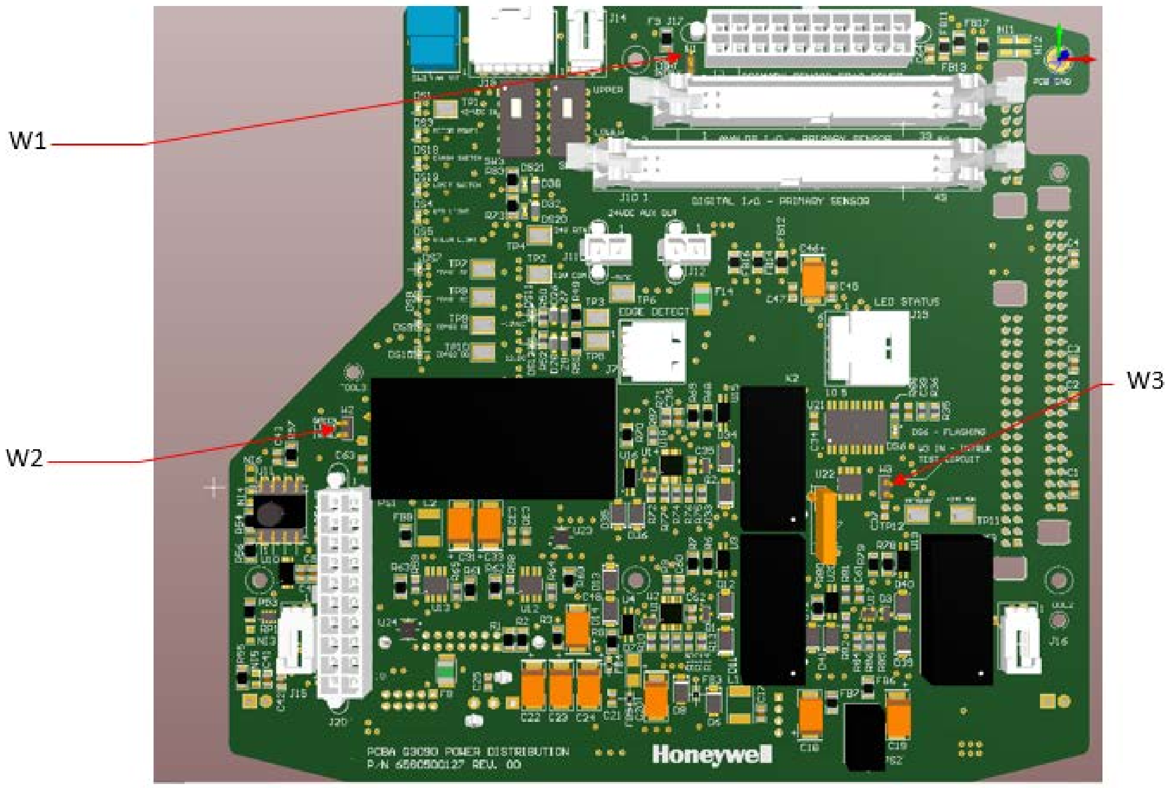


Figure 8-59: Locations of jumpers W1, W2, and W3 on the Head Power Distribution PCBA

WARNING	Jumper W3 should never be installed in a production scanning system. Failure to adhere to this warning could result in unsafe operating conditions that can pose a risk of injury to operators.

15. Reinstall the PDB/EDAQ assembly by reversing the removal instructions.

16. Remove the scanner LOTO.

8.3.13. Remove and Replace the Motor Drive

Activity Number:	Q3090-00-ACT-025	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician
Priority Level:	Average	**Cautions:**	None
Availability Required:	Scanner Power Off	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	15 minutes	**# of People Required:**	1
Prerequisite Procedures:	Scanner Lockout/Tagout, Remove and Install the Inner and Outer Measurement Module covers	**Post Procedures:**	Scanner Lockout/Tagout, Remove and Install the Inner and Outer Measurement Module covers
Required Parts:	Part Number	Quantity	Lead Time
	• 6541900070 MOTOR CONTROLLER 24/48VDC 10A		
Required Tools:	Part Number	Quantity	Lead Time
	• 3mm hex key wrench		

1. Scan the Measurement Modules Offsheet, power down the scanner and follow all appropriate Scanner Lockout/Tagout safety procedures.
2. Remove the inner and outer covers from the Measurement Modules. See section **8.3.16**.
3. The motor drive is located as shown in the figure below.

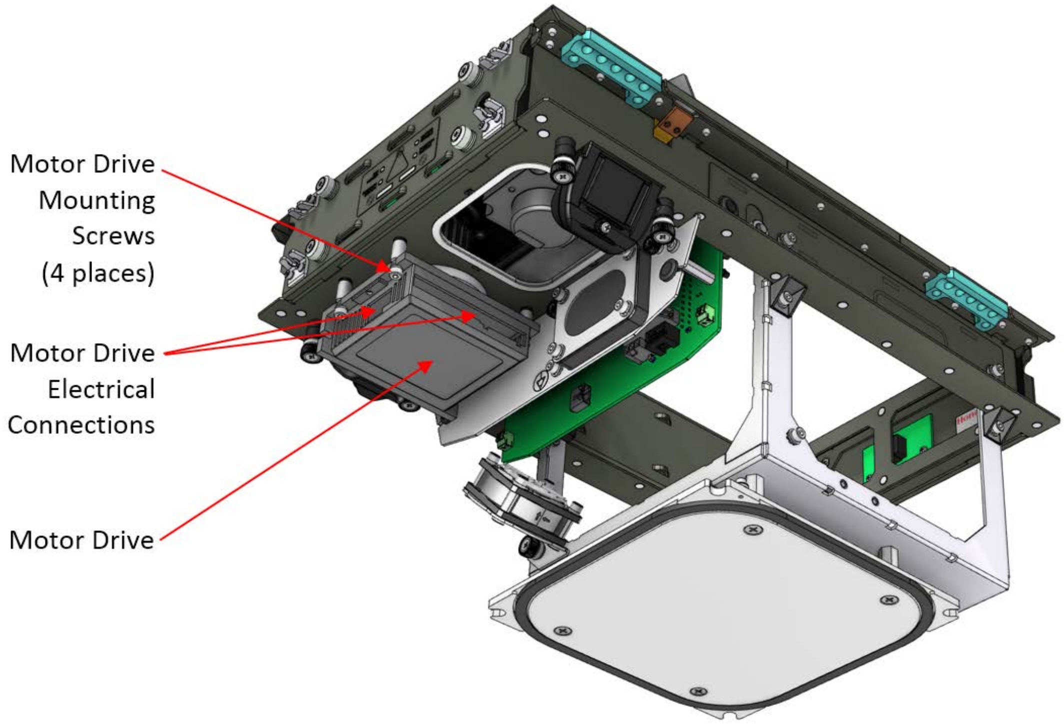


Figure 8-60: Motor Drive

4. Remove all of the motor drive electrical connection connectors.

5. Using a 3mm Hex Key Wrench, remove the two outermost Motor Drive Mounting Screws.

6. Using the same 3mm Hex Key Wrench, loosen the two innermost Motor Drive Mounting Screws. It is not necessary to remove these screws as the mounting holes in the motor drive are slotted through to the edge of the unit. Once the screws are loose, the motor drive can be simply removed.

7. To install the Motor drive, simply slide the two rear mounting slots onto the rear mounting screws that are already in place on the Measurement Module. Then install the front mounting screws and tighten all four screws.

8. Re-connect all of the motor drive electrical connection connectors.

9. Replace all covers that were instructed to be removed at the beginning of this procedure.

10. Remove the Scanner Lockout/Tagout.

8.3.14. Replace the Motor

Activity Number:	Q3090-00-ACT-026	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician
Priority Level:	Average	**Cautions:**	None
Availability Required:	Scanner Power Off	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	45 minutes	**# of People Required:**	1
Prerequisite Procedures:	Scanner Lockout/Tagout, Remove and Install the Inner and Outer Measurement Module covers, Remove and Install the Measurement Module End Covers, Remove and Install the Motor Belt	**Post Procedures:**	Scanner Lockout/Tagout, Remove and Install the Inner and Outer Measurement Module covers, Remove and Install the Measurement Module End Covers, Remove and Install the Motor Belt
Required Parts:	Part Number	Quantity	Lead Time
	• 6580801929 Q3090 HEAD STEP MOTOR/ENCODER ASSY		
Required Tools:	Part Number	Quantity	Lead Time
	• 2mm hex key wrench • 3mm hex key wrench (non-ball end) • Small slotted screwdriver • Loctite 242 or 243 threadlocker		

1. Scan the Measurement Modules Offsheet, power down the scanner and follow all appropriate Scanner Lockout/Tagout procedures.

2. Remove the inner and outer covers from the Measurement Modules. See section **8.3.16**.

3. The motor is located as shown in the following figure. Note that there is an encoder on the end of the motor. These are a single unit and must also be removed and replaced as a single unit.

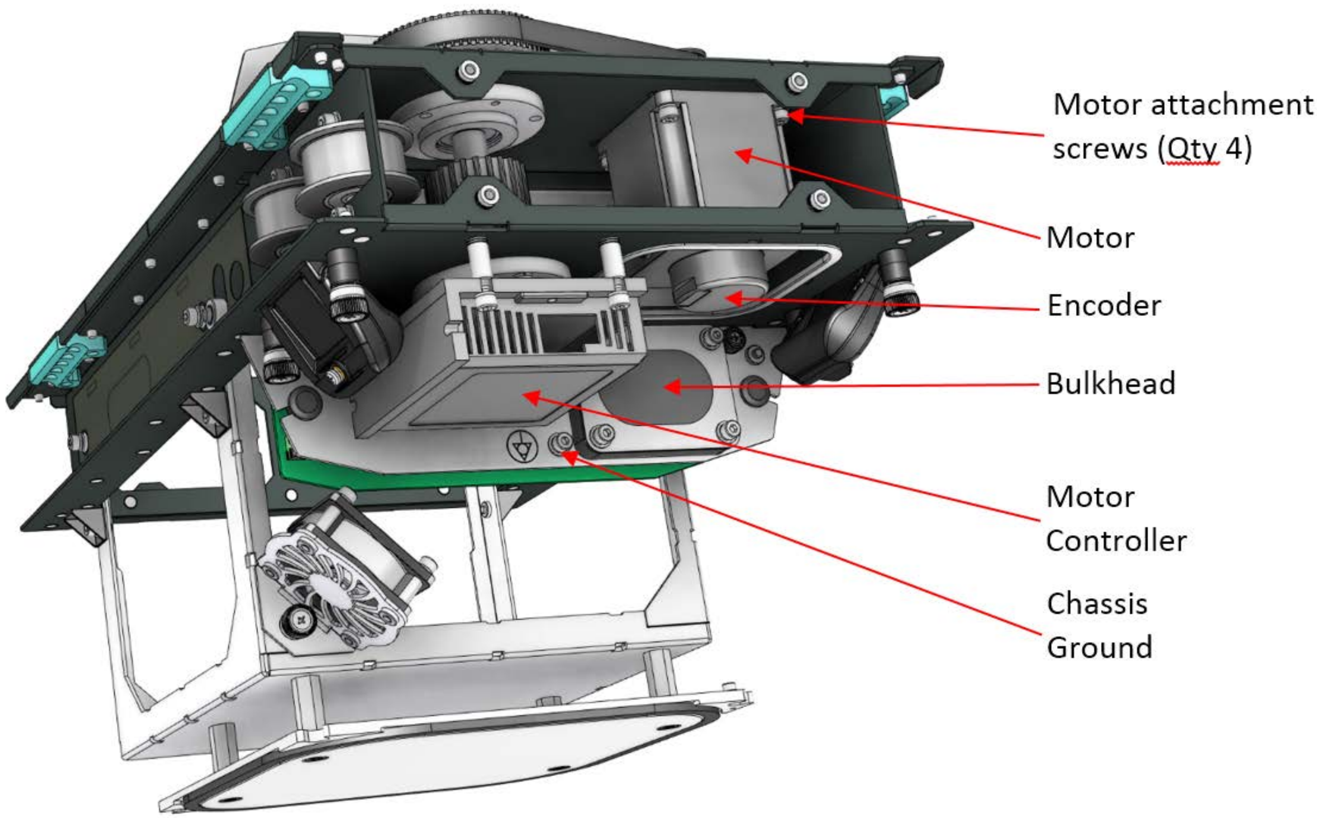


Figure 8-61: Motor

4. Remove the Measurement Module End Cover on the motor compartment end. See 8.3.17.

5. Disconnect all of the motor electrical connections:

    a. Unplug the connector at the end of the wire harness that terminates at the encoder.

    b. Unplug the connector at the end of the motor wiring that terminates at the motor controller.

    c. Unplug the connector with the black "GND" ground wire from the motor controller.

    d. Follow the red/black motor power "V+" and "V-" wires through the bulkhead to where they are connected to the Power Distribution Board on connector "P5". Unplug P5 from the PDB and pull the connector through the bulkhead.

    e. Use a 3mm hex key wrench and remove the chassis ground screw in order to disconnect the motor/motor controller ground wires from the chassis.

6. Use a 3mm hex key wrench to loosen the four motor attachment screws, but do not remove them yet.

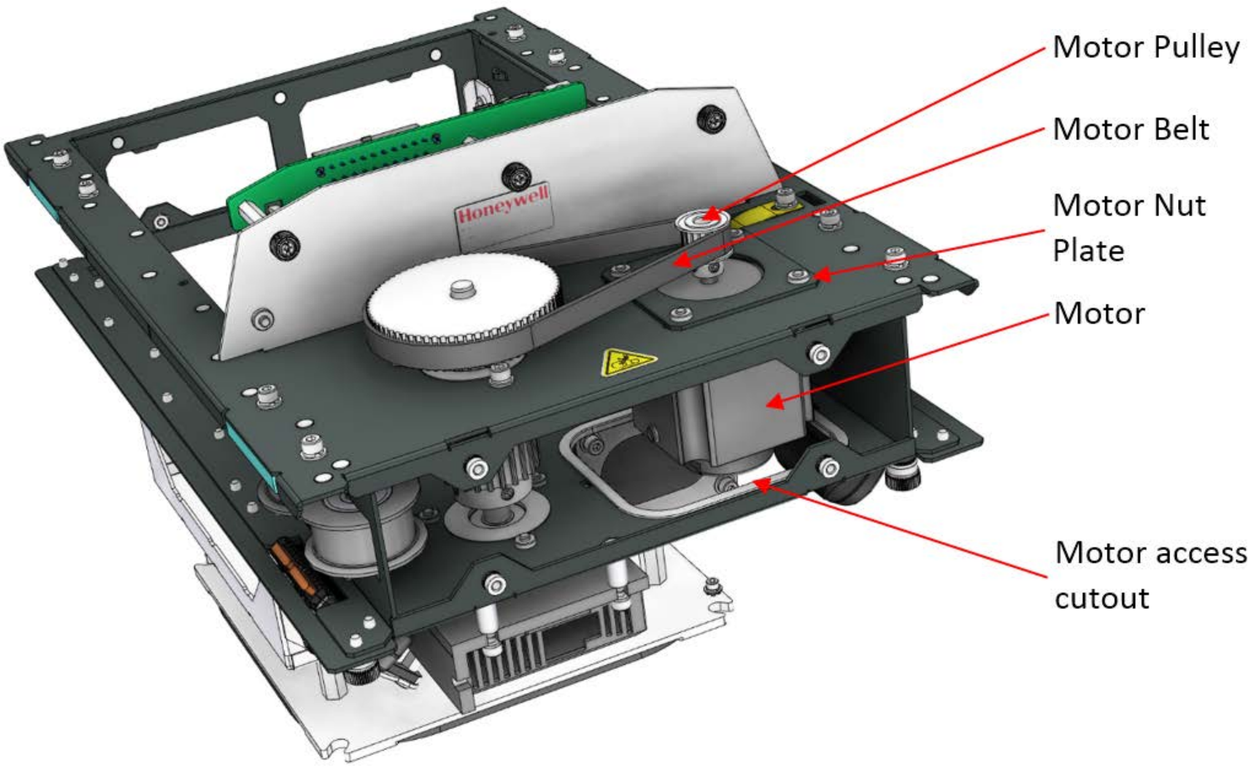


Figure 8-62: Motor Belt and Motor Nut Plate

7. With the motor attachment screws loose, this will relieve the tension on the motor belt making it easy to simply lift the belt off of the pulleys. Remove the motor belt in this manner.
8. Completely remove the four motor attachment screws. The motor nut plate will now be loose, set aside for re-use upon installation of the new motor.
9. Carefully feed the motor down through the motor access cutout on the underside of the measurement module chassis. Move any other cabling that may impede motor removal if necessary.
10. Use a 2mm hex key wrench to loosen the set screws from the motor pulley and remove the pulley from the motor shaft.
11. Use a small slotted screwdriver to remove the motor leads from the screw terminals in the motor controller connectors. Take note of which leads were terminated where in order to duplicate the connections with the new motor leads. Set the old motor aside.
12. Using a new 6580801929 Motor/Encoder assembly, connect the new motor leads to the connectors from the previous step, duplicating the connections as noted.

13. Install the Motor Pulley from the old motor onto the new motor shaft. Set the motor pulley height as shown in Figure 8-63. Ensure one set screw is aligned with the flat on the shaft. Apply Loctite 242 or 243 on setscrew threads and torque both set screws to 1.7 N-m (15 in-lbs).

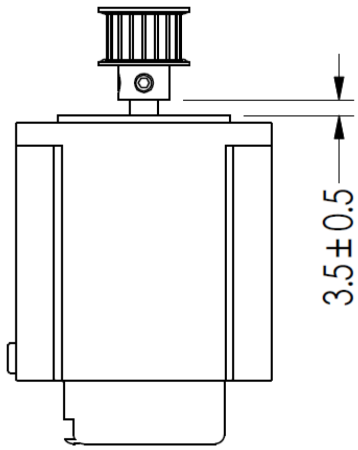


Figure 8-63: Motor Pulley Detail

14. To install the new motor, carefully feed the motor up through the motor access cutout and back into place within the motor compartment. Place the Motor Nut Plate back in place and align the holes in the motor, slots in the chassis and the threaded holes in the nut plate. Insert the screws and use a 3mm Hex Key Wrench in order to thread in the screws but do not tighten them yet. It is best to use a non-ball end type wrench in order to facilitate using the wrench to feed the screw through the motor cavity to the motor mounting flange.

15. Tension the Motor Belt properly including fully tightening the motor mounting screws.

16. Reconnect all of the motor electrical connections:

    a. Feed the red/black motor power “V+” and “V-“ “P5” wires through the bulkhead and connect to the Power Distribution Board jack “J5”.

    b. Re-plug the connector at the end of the wire harness labelled “PA” to the encoder.

    c. Re-plug all of the removed connectors that were removed from the motor controller back into the motor controller.

    d. Use a 3mm hex key wrench in order to re-connect the motor/motor controller ground wires to the chassis using the chassis ground screw (refer to Figure 8-61).

17. Replace all covers that were instructed to be removed at the beginning of this procedure.

18. Remove the Scanner Lockout/Tagout.

8.3.15. Replace Scanner Magnet Position Switch

Activity Number:	Q3090-00-ACT-027	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician
Priority Level:	Low	**Cautions:**	None
Availability Required:	Scanner Power Off	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	5 minutes	**# of People Required:**	1
Prerequisite Procedures:	Scanner Lockout/Tagout, Remove and Install the Inner and Outer Measurement Module covers	**Post Procedures:**	Scanner Lockout/Tagout, Remove and Install the Inner and Outer Measurement Module covers
Required Parts:	Part Number	Quantity	Lead Time
	• 6541320029 SWITCH REED NO 200V 0.5A 10W M8 BARREL		
Required Tools:	Part Number	Quantity	Lead Time
	• ½” wrench		

1. Scan the Measurement Modules Offsheet, power down the scanner and follow all appropriate Scanner Lockout/Tagout safety procedures.
2. Remove the inner and outer covers from the Measurement Modules. See section **8.3.16**.
3. Each measurement module has a magnet position switch mounted on each of the two sides of the chassis. These are located as shown in the following figure.

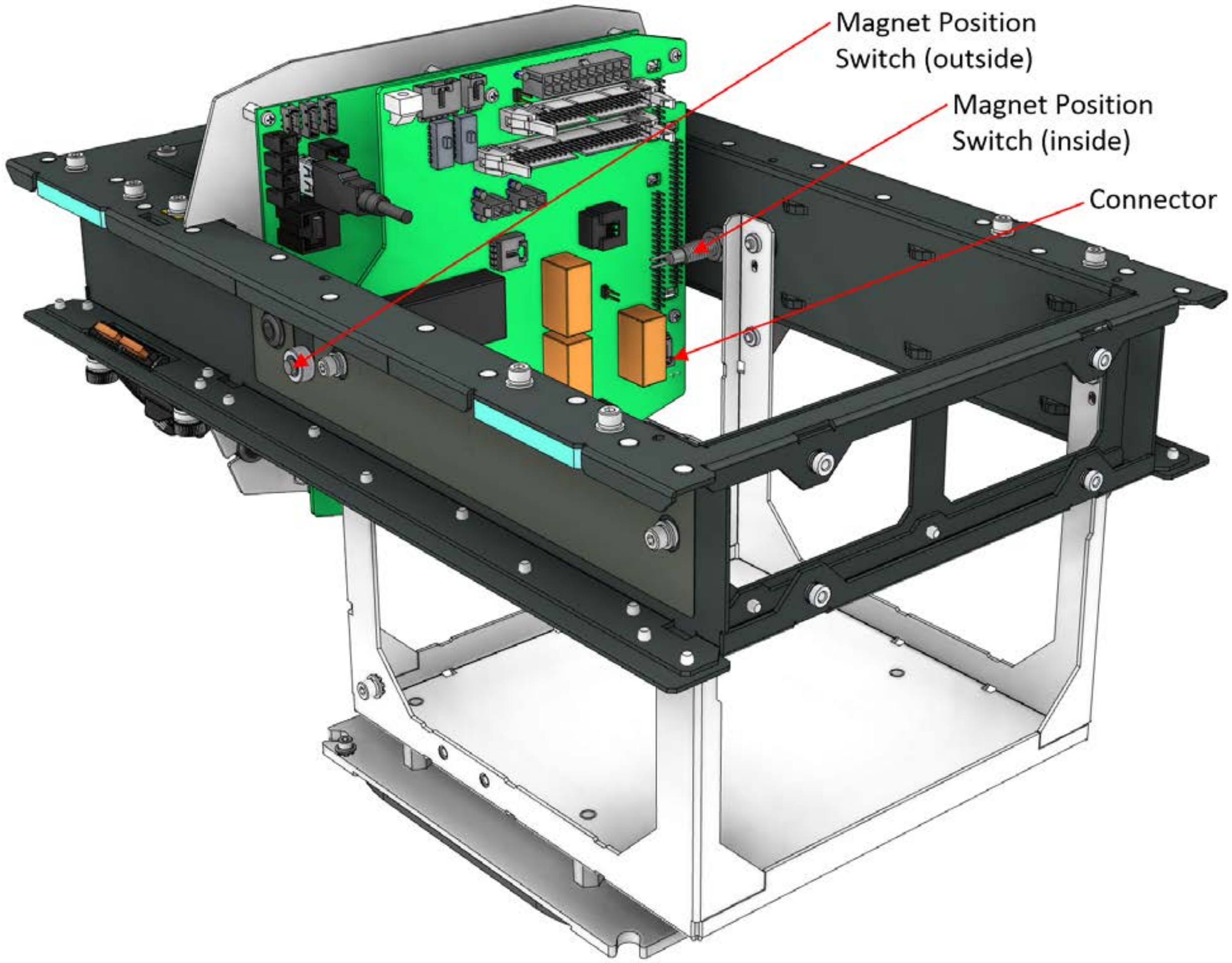


Figure 8-64: Magnet Position Switches

4. In order to remove a magnet position switch, first carefully unplug its connector from the Power Distribution Board.
5. Loosen the locknut on the inside of the chassis.
6. Remove the switch by unscrewing the entire assembly, switch body, wires and all.
7. Install the new switch by threading back into the same threaded hole on the inside of the chassis. Thread it in until the end of the switch body protrudes about 1.5-2.0mm out on the outside of the chassis.
8. Tighten the locknut in order to lock in position.
9. Plug the connector into the Power Distribution Board.
10. Replace all covers that were instructed to be removed at the beginning of this procedure.
11. Remove the Scanner Lockout/Tagout.

8.3.16. Removing and Installing the Inner and Outer Measurement Module Covers

Activity Number:	Q3090-00-ACT-028	**Applicable Models:**	Q3090-00
Type of Procedure:	Maintenance Access	**Expertise Level:**	Technician
Priority Level:	Low	**Cautions:**	N/A
Availability Required:	Scanner Offsheet	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	5 minutes	**# of People Required:**	1
Prerequisite Procedures:	Scanner Lockout/Tagout	**Post Procedures:**	
Required Parts:	Part Number	Quantity	Lead Time
	• None		
Required Tools:	Part Number	Quantity	Lead Time
	• None		

1. This procedure explains how to remove and re-install the Inner and Outer Measurement Module Covers.

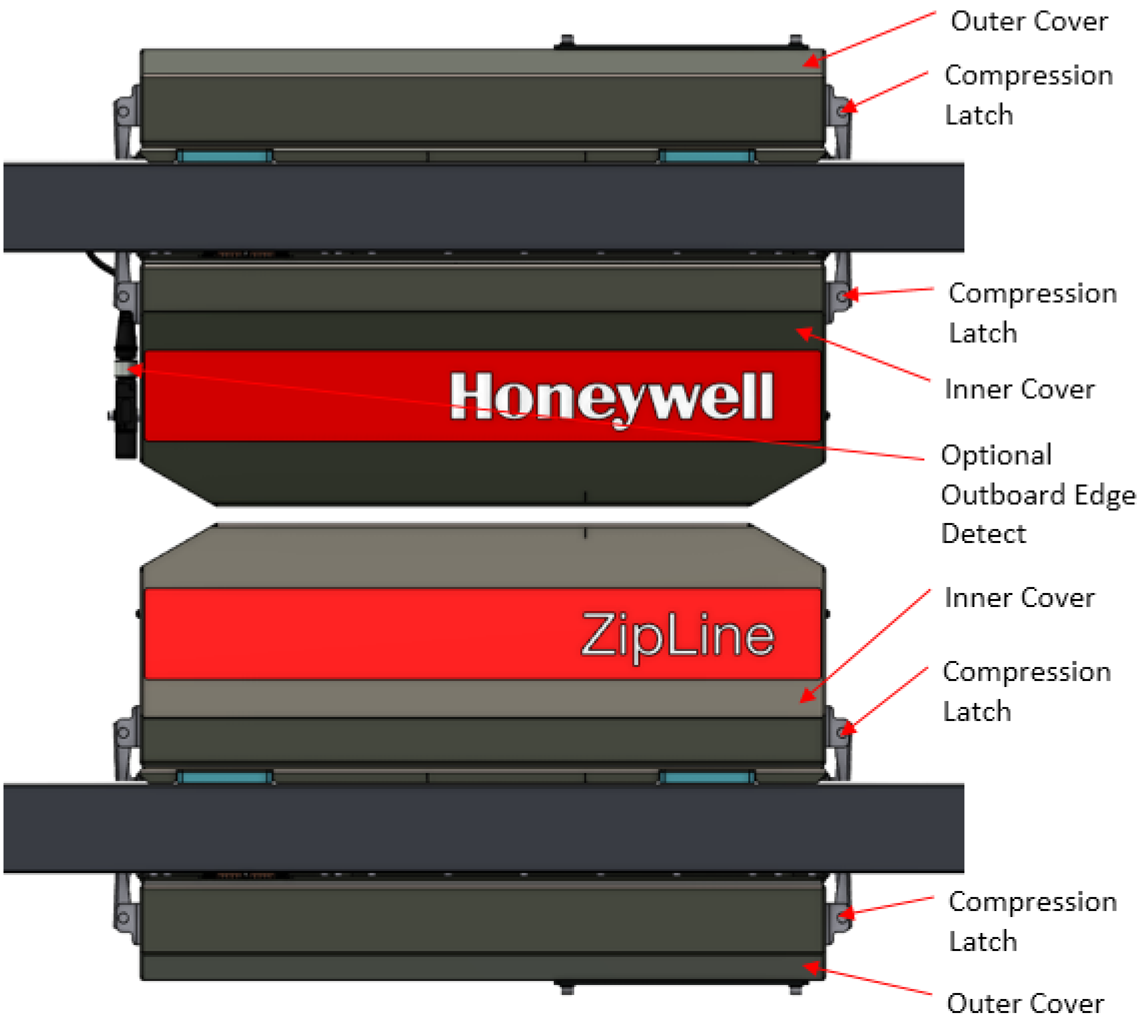


Figure 8-65: Inner and outer measurement module covers.

2. Scan the Measurement Modules Offsheet, power down the scanner and follow all appropriate Scanner Lockout/Tagout safety procedures.
3. Split the Upper and Lower Measurement Modules such that they are not vertically aligned with each other by manually sliding either one of the modules to the left or right.
4. Disconnect any optional cover mounted accessory cables. These are easily removable using provided quick-disconnect fittings. Examples of cover mounted accessories are outboard edge detect and head fan cooling kit.
5. Simply un-fasten the compression latches that hold the module cover in place and either lift or lower the cover to remove from the module.

6. Set the covers aside until ready to re-install. It is not necessary to note which cover was removed from which location. The upper and lower outer covers are identical and interchangeable. The upper and lower inner covers are identical except for the “Honeywell” and “Zipline” labels on them. The inner covers should be replaced such that the labels are in the correct orientation.

7. In order to install the covers back onto the measurement modules, simply place the covers back into their original location and re-fasten with the compression latches.

ATTENTION	Take care to ensure that the compression latches are not set at too much tension. If they are, you may bend the chassis sheet metal upon closure of the latches causing the chassis to interfere with the rail cover extrusions.

8. Connect any optional cover mounted accessory cables that need to be re-connected.

8.3.17. Remove and Install the Measurement Module End Covers

Activity Number:	Q3090-00-ACT-029	**Applicable Models:**	Q3090-00
Type of Procedure:	Support	**Expertise Level:**	Operator
Priority Level:	Average	**Cautions:**	
Availability Required:	Scanner Offsheet.	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	5 minutes	**# of People Required:**	1
Prerequisite Procedures:		**Post Procedures:**	
Required Parts:	Part Number	Quantity	Lead Time
	• None		
Required Tools:	Part Number	Quantity	Lead Time
	• Phillips Screwdriver		

1. Scan the Measurement Modules Offsheet, power down the scanner and follow all appropriate Scanner Lockout/Tagout procedures.

2. Remove the Inner and Outer Measurement Module Covers as per section **8.3.16**.

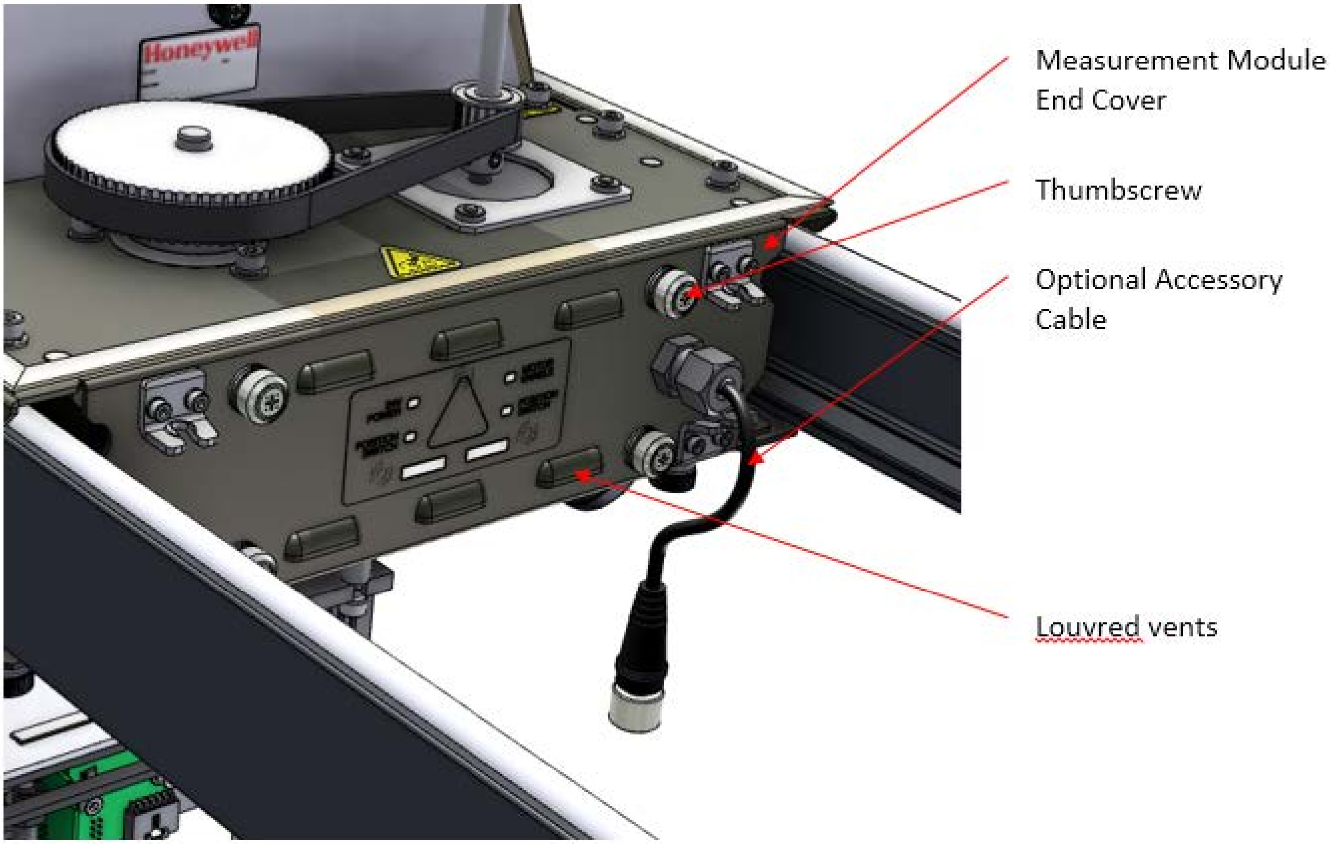


Figure 8-66: Measurement Module End Cover

3. Remove the 4 thumbscrews. A Phillips screwdriver may be used if needed. The cover will fall out of place.

4. Disconnect the cable connected to the status LED board on the back side of the cover.

5. Disconnect the optional accessory cable (if present) if necessary. For many tasks where it is necessary to remove the Measurement Module End Covers, it may be sufficient to let the end covers dangle from the accessory cable as it may not be worth the effort to trace the optional accessory cable to its termination point in order to remove.

6. When reinstalling the end covers, note that the covers at each end of the Measurement Module are different. The end covers at the Motor Compartment end of the module features louvred vents (as shown in Figure 8-66 above), while the end covers at the Sensor Compartment end of the module does not have any vents.

7. In order to reinstall the end covers, reconnect any cables that were disconnected. Place the cover back in position on the end of the module, taking care to ensure the cable is routed neatly inside and will not interfere with the inner workings of the module. Then simply retighten the 4 thumbscrews.

8. Follow section **8.3.16** in order to reinstall the Inner and Outer Measurement Module covers.

8.3.18. Set and verify pressure control settings

Activity Number:	Q3090-00-ACT-030	**Applicable Models:**	Q3090-00
Type of Procedure:	Repair/Adjust	**Expertise Level:**	Technician
Priority Level:	Average	**Cautions:**	None
Availability Required:	None	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	1 week
Duration (time period):	15 minutes	**# of People Required:**	1
Prerequisite Procedures:	None	**Post Procedures:**	None
Required Parts:	Part Number	Quantity	Lead Time
	N/A		
Required Tools:	Part Number	Quantity	Lead Time
	N/A		

If the ZipLine scanner includes a basis weight or x-ray sensor, it will also be outfitted with an on-board micro-compressor to generate on-board pneumatic pressure to drive the shutter and flag solenoids.

The pressure achieved in the ZipLine system is monitored by a pressure sensor that is part of the power distribution board. The output from this pressure sensor is taken as an analog input by the upper sensor module's EDAQ. Depending on the value of this analog input, the EDAQ will command the micro-compressor to operate and drive the pressure up or to remain dormant if the sensed signal represents adequate pressure.

Figure 8-67 shows the family of analog inputs associated with the top performance job set of which the first entry "Upper Air Pressure" indicates the signal from the pressure sensor.

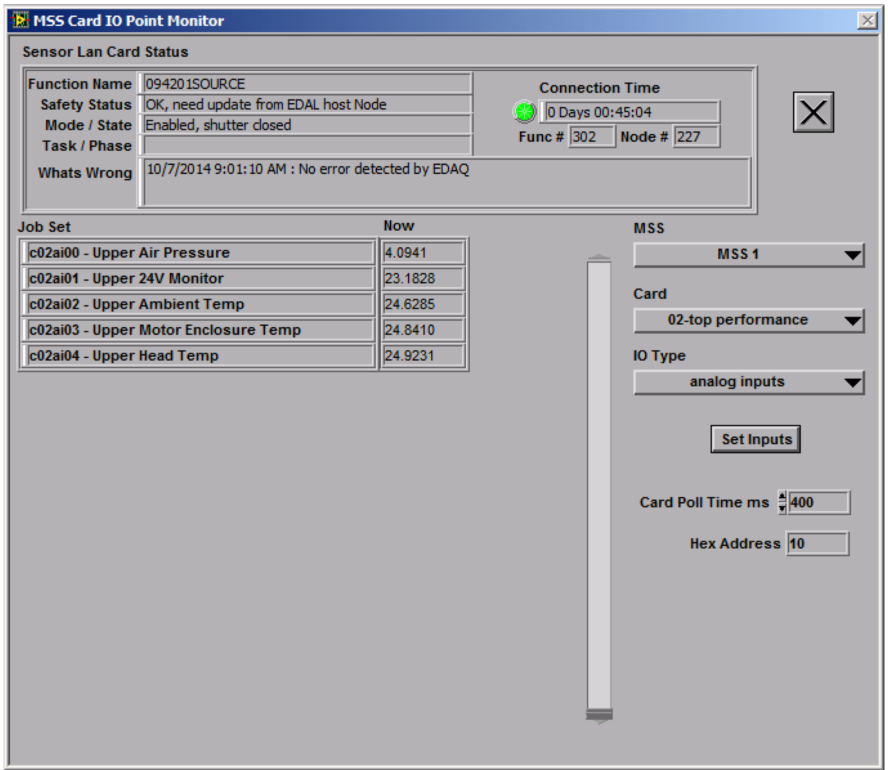


Figure 8-67: MSS top performance analog inputs

The signal in volts is related to pressure, P, in units of psi (gauge), in the following way where V is the signal reported by the upper air pressure:

$$P = 7.5V – 3.75.$$

A signal of 0.5V indicates that the pressure sensing chip on the power distribution board senses no pressure generated.

Shutter operation requires a pressure greater than 25psi to operate the shutter adequately. Thus, verify that a signal larger than 3.85V is present on this channel. If this is not the case, verify that the parameter “compressor_on_volts” in the upper EDAQ ID file is 3.85. See Figure 8-68. A suitable upper threshold to turn off the compressor is 4.15. “compressor_off_volts” is the parameter to be set to 4.15.

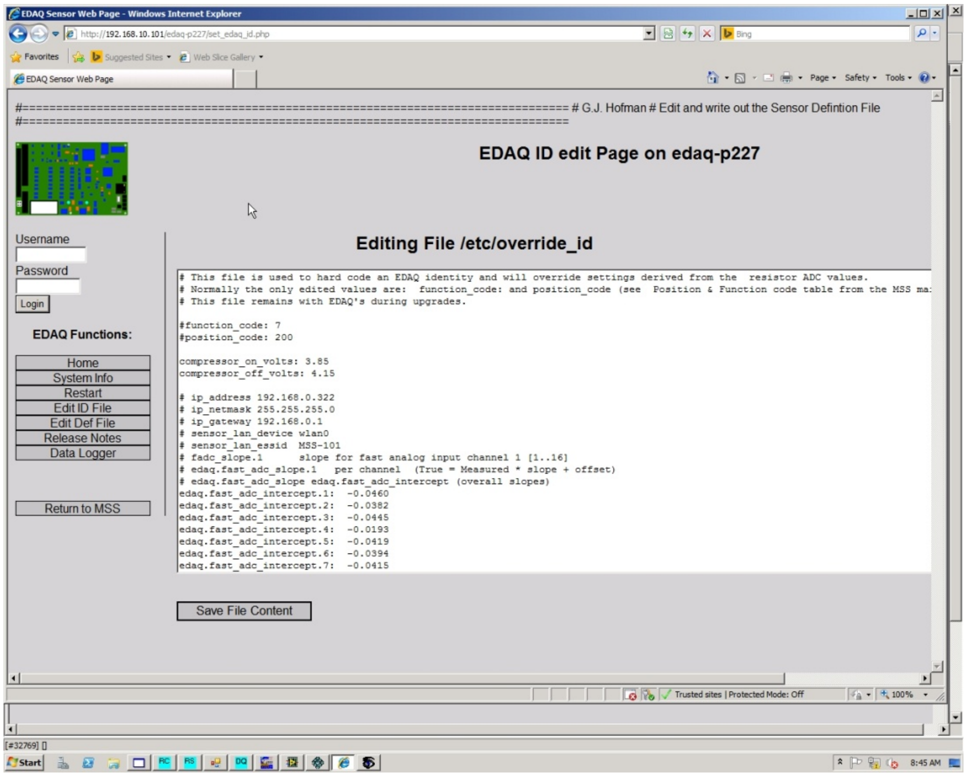


Figure 8-68: Set pressure limits on upper EDAQ ID file

The following behaviour should be observed: very slowly the system pressure should fall, to the lower threshold at which time the compressor should engage to re-pressurize the system until the upper threshold is achieved. Trending the pressure signal will result in a plot such as **Figure 8-69**. It is normal to see the pressure drop as shutter or flag toggles are executed.

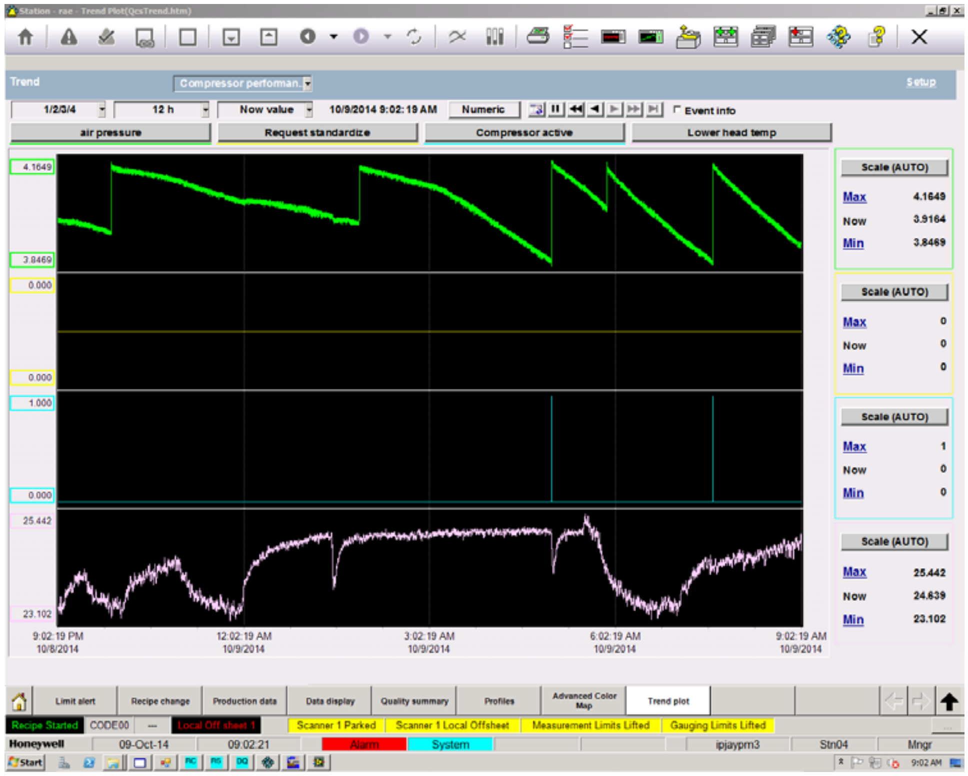


Figure 8-69: Compressor validation.

8.3.19. Verify XYZ Sensor Functionality

Activity Number:	Q3090-00-ACT-031	**Applicable Models:**	Q3090-00
Type of Procedure:	Repair/Adjust	**Expertise Level:**	Operator
Priority Level:	Low	**Cautions:**	None
Availability Required:	Scanner offsheet	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	3 Months
Duration (time period):	5 minutes	**# of People Required:**	1
Prerequisite Procedures:	None	**Post Procedures:**	None
Required Parts:	Part Number	Quantity	Lead Time

	N/A		
Required Tools:	Part Number	Quantity	Lead Time
	N/A		

The functionality of the XYZ sensor in the ZipLine can be verified by first observing that appropriate signals are reported by the MSS and then by gently pushing one head relative to the other, confirming that the polarity and magnitude of the response is within guidelines.

To view the signal reported by the XYZ sensor, use the MSS Job Set IO Point Monitor display found under the MSS Setup Diagnostics tab—see **Figure 8-70** for the locations of the signal values.

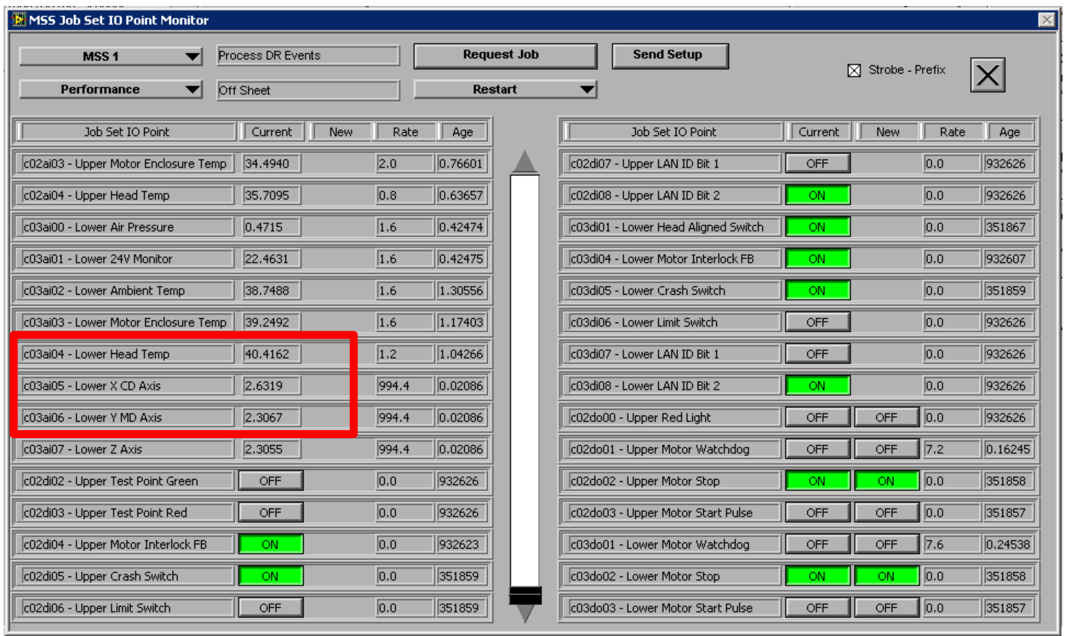


Figure 8-70: MSS Job Set IO Point Monitor display.

8.3.19.1. **Quickly verifying X response**

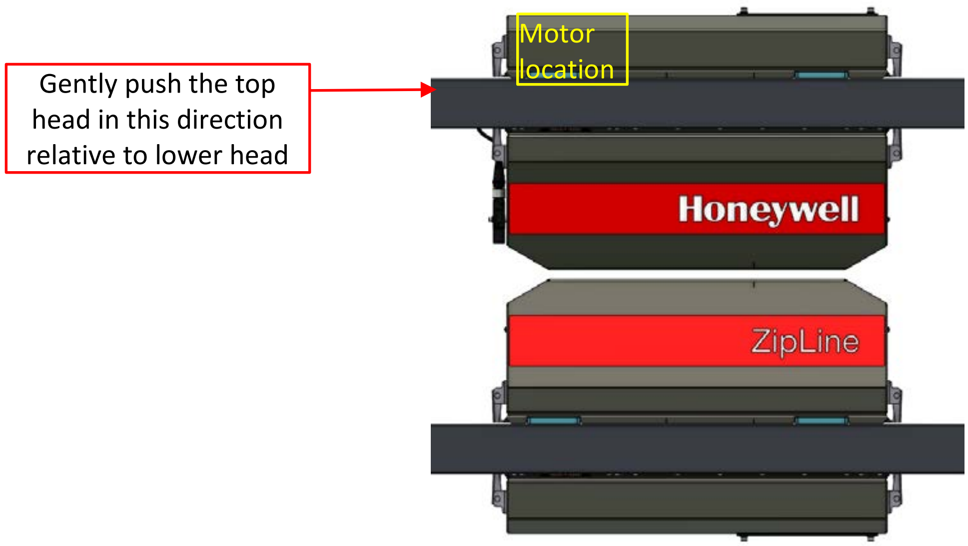


Figure 8-71: Orientation of head to stimulate X response.

The nominal signal of the x-response for well aligned heads is approximately 2.6V. This value should be stable to ±200mV while the heads are stationary. Locate the end of the upper head where the motor is mounted. Gently push the motor end of the upper head, as shown in Figure 8-71 and observe the response on the x-sensor. One should see a signal decrease of approximately 0.5V/mm when pushed as shown in the figure. When pushed in the other direction, a properly functioning sensor will show a signal increase of approximately 0.5V/mm.

8.3.19.2. Quickly verifying Y response

The nominal signal of the y-response for well aligned heads is approximately 2.3V. This value should be stable to ±200mV while the heads are stationary.

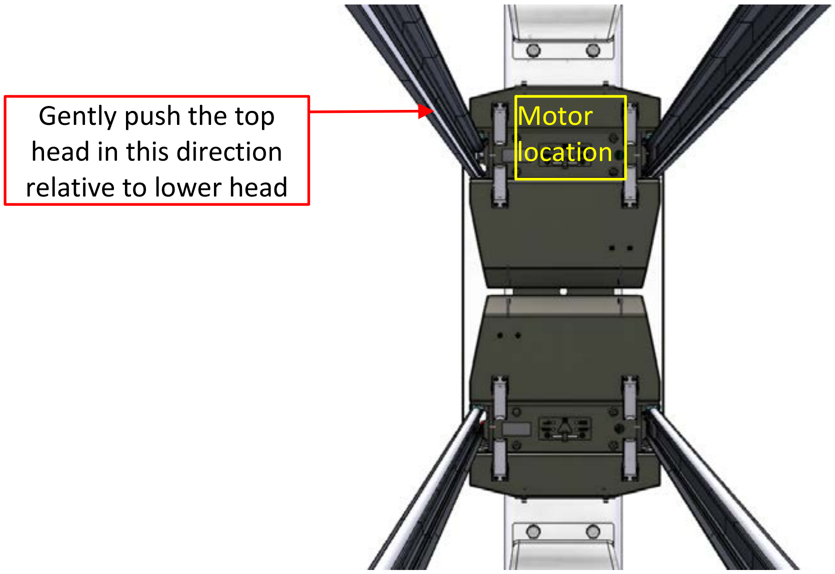


Figure 8-72: Orientation of head to stimulate Y response.

Gently push the side of the upper head, as shown in **Figure 8-72** and observe the response on the y-sensor. One should see a signal increase of approximately 0.17V/mm when pushed as shown in the figure. When pushed in the other direction, a properly functioning sensor will show a signal increase of approximately 0.17V/mm.

8.3.19.3. **Quickly verifying Z response**

The nominal signal of the z-response for well aligned heads is approximately 2.3V. This value should be stable to ±200mV while the heads are stationary.

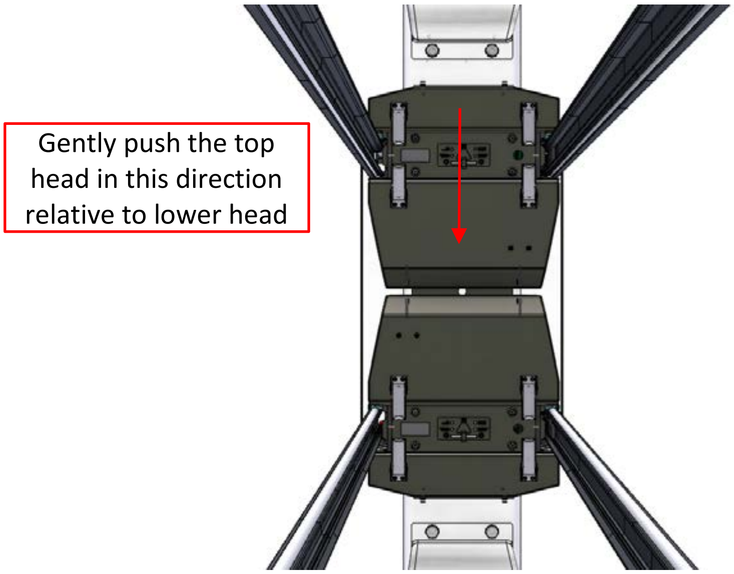


Figure 8-73: Orientation of head to stimulate Z response.

Gently push the top of the upper head, as shown in **Figure 8-73**, slightly decreasing the head gap and observe the response on the z-sensor. One should see a signal decrease of approximately 0.25V/mm when pushed as shown in the figure.

8.3.19.4. **Comprehensively verifying XYZ response**

To absolutely validate the XYZ sensor reading, perform the entire Setup XYZ Profile Correction can be performed. In doing this procedure, one validates that the X and Y values do stay constant when the upper and lower modules are locked together and validates the magnitude of a z-displacement relative to a known displacement.

8.4. Drive and positioning system

8.4.1. Setup head position magnets

Activity Number:	Q3090-00-ACT-032	**Applicable Models:**	Q3090-00
Type of Procedure:	Repair/Adjust	**Expertise Level:**	Technician
Priority Level:	Average	**Cautions:**	None
Availability Required:	Scanner Offsheet	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	30 minutes	**# of People Required:**	1
Prerequisite Procedures:	None	**Post Procedures:**	None
Required Parts:	Part Number	Quantity	Lead Time
Required Tools:	Part Number	Quantity	Lead Time
	5 units of 6580101612 (3/4” long magnet) 3 units of 6580101611 (1” long magnet) 1 units of 6580101610 (1/2” long magnet)		

For the ZipLine modules to properly traverse, absolute location information must be sensed by permanent magnets inserted into the extrusions. Drawing 6580801969 indicates this arrangement formally.

1. To install the magnets, first identify the low and high ends of your scanner. Be aware that the low and high ends of the scanner are defined by the orientation of the sensing modules. The side of the sensor module that contains the motor cavity determines the high end. See **Figure 8-74** and **Figure 8-75**.

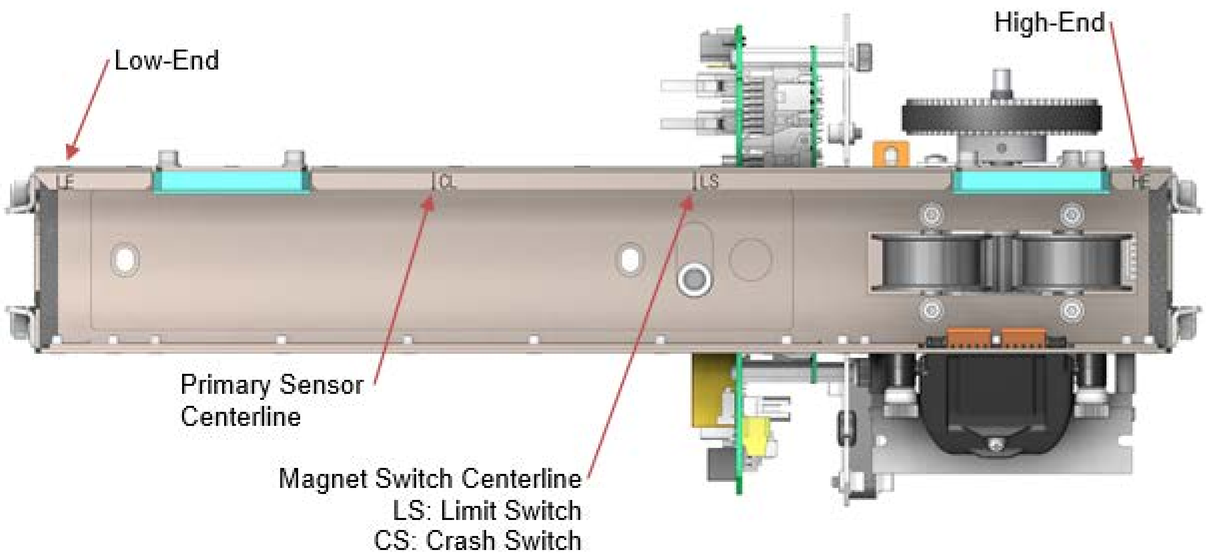


Figure 8-74: Orient high and low system ends relative to sensor modules.

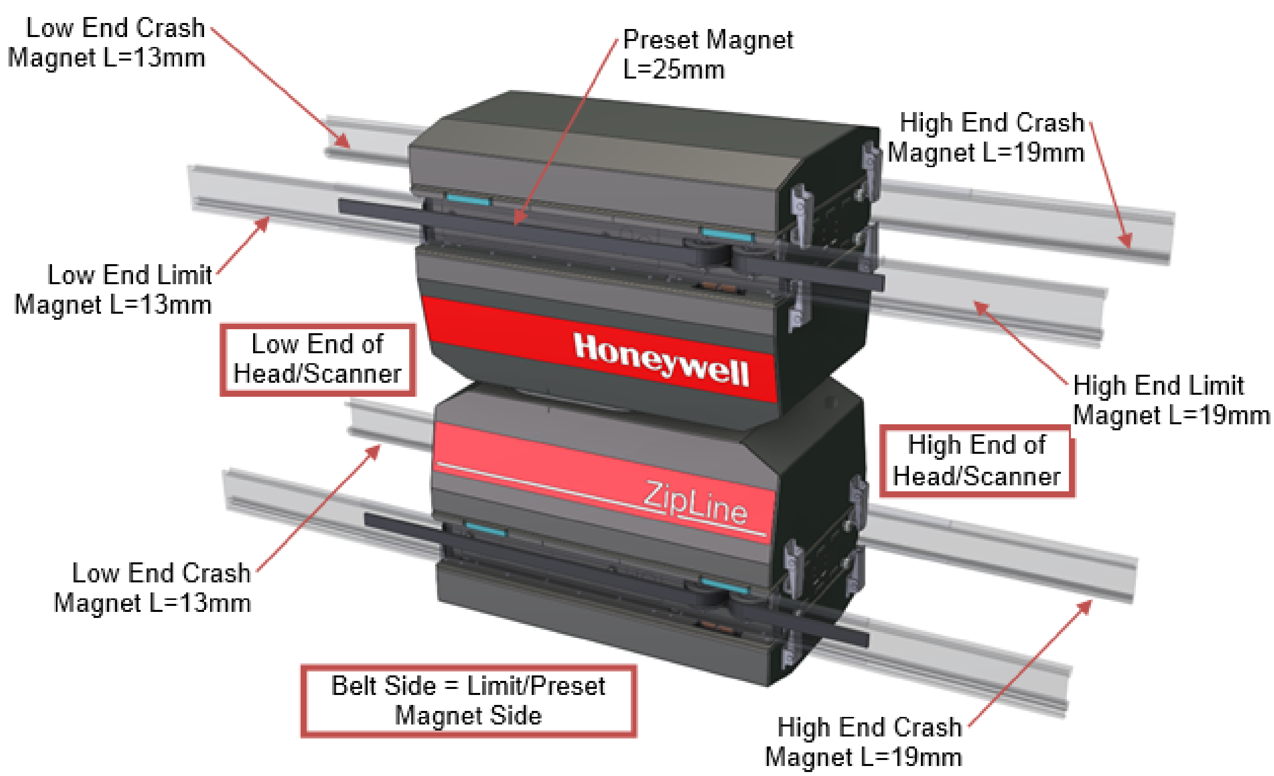


Figure 8-75: Orient magnet positions relative to high and low ends of travel.

2. Once the high and low ends of the system have been determined, insert the magnets as indicated on drawing 6580801969 and illustrated in **Figure 8-75**. **Table 5** describes the function of each magnet.

Table 5: Magnet summary.

Magnet Length	**Location**	**Head Action**
Low End Crash: 13mm (1/2in) High End Crash: 19mm (3/4in)	40cm inboard of each end of upper and lower rails Crash switch side of the heads (no drive belt side)	Stop motion in current direction. Reverse out of magnet zone.
Low End Limit: 13mm (1/2in) High End Limit: 19mm (3/4in)	Each end of upper rail only >10cm inboard of crash magnet locations Limit switch side of the head (drive belt side)	Signals limits to scanning length. Head will not scan past this zone regardless of QCS scanner configuration.
Preset: 25mm (1in)	Middle of upper rail only. Limit switch side of the head (drive belt side)	Trigger location event for head encoder position monitoring.

3. Ensure the correct length of magnets are applied at the correct locations. The ZipLine system uses the length of the magnets to distinguish them.
4. Once the magnets are positioned, from RAE select “Restart MSS to Clear Sensor Safety Fault” from the Scanner Control pop-up. See **Figure 8-76**. This will induce the sensor modules to traverse from lower crash limit to high crash limit to re-identify magnets, ensure they are distinct lengths and record their positions.

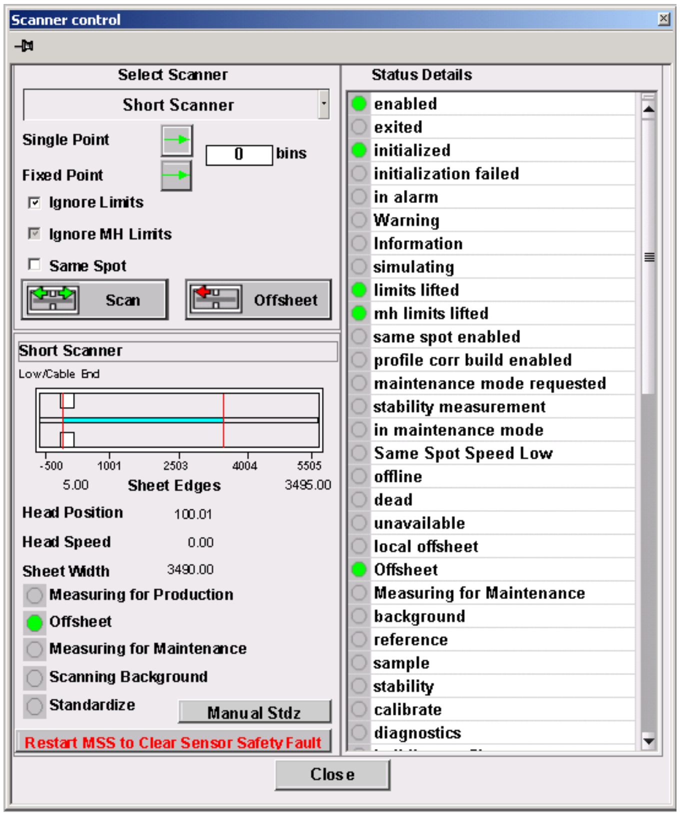


Figure 8-76: Scanner control pop-up.

5. Re-perform a scanner calibration from the “MSS Scanner Calibration” display found under the “MSS Setup Diagnostics” tab if position control errors result from “unstable latches.” This would mean the preset magnets have moved relative to RAE’s last known position for them.

8.4.2. Remove and Install the Scanner Drive Belt

Activity Number:	Q3090-00-ACT-033	**Applicable Models:**	Q3090-00
Type of Procedure:	Replace	**Expertise Level:**	Technician
Priority Level:	Average	**Cautions:**	None
Availability Required:	Shutdown	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	3 years
Duration (time period):	30 minutes	**# of People Required:**	1
Prerequisite Procedures:	Scanner Lockout/Tagout, Remove and Install the Inner and Outer Measurement Module covers, Remove and Install the Measurement Module End Covers, Remove and Install the Scanner End Cover, Remove and Install the Motor Belt	**Post Procedures:**	Scanner Lockout/Tagout, Remove and Install the Inner and Outer Measurement Module covers, Remove and Install the Measurement Module End Covers, Remove and Install the Scanner End Cover, Remove and Install the Motor Belt
Required Parts:	Part Number	Quantity	Lead Time
	• None if removing/installing the same belt, 6580101609 “BELT SYNCH 5MM PITCH 15MM W X 12M L” if replacing the belt.		
Required Tools:	Part Number	Quantity	Lead Time
	• 5mm hex key wrench		

1. Scan the Measurement Modules Offsheet, power down the scanner and follow all appropriate Scanner Lockout/Tagout procedures.

2. Remove the inner and outer covers from the Measurement Modules. See section **8.3.16**.

3. Remove the Measurement Module End Covers. See section **8.3.17**.

4. Select which end of the scanner you want to remove the belt from. Which end you select does not really matter, but is easier to select the end that is closest to where the measurement modules are going to be parked for the task.

5. Remove the scanner end cover at the end of the scanner selected above.

6. Completely remove the Scanner Drive belt Tensioning Screw using a 5mm hex key wrench in order to disconnect the drive belt from the end of the scanner.

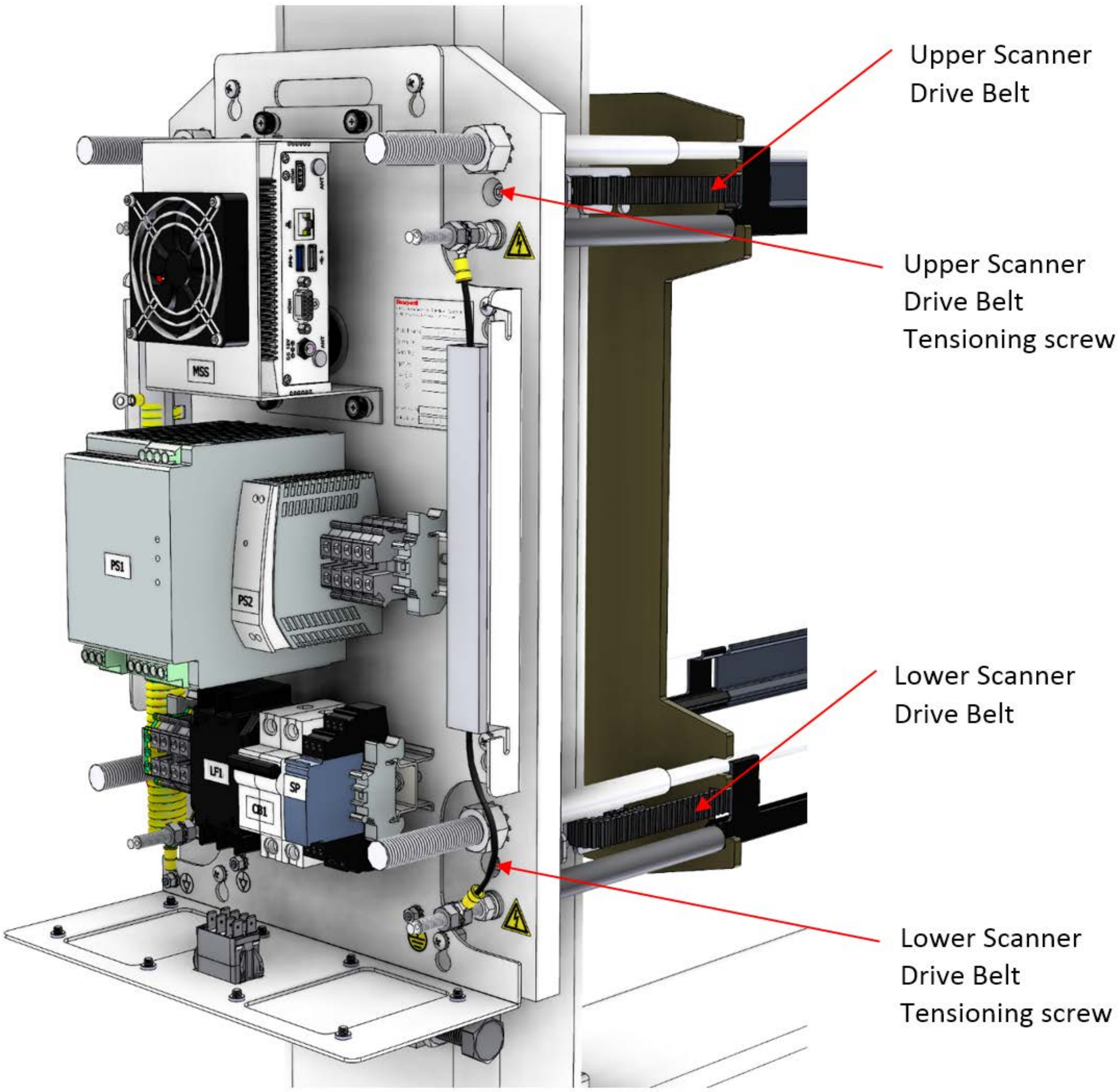


Figure 8-77: Scanner Drive Belt End Termination

7. **Figure 8-78** shows the end termination wrap. Simply unwrap the belt from the sheet metal bracket that it is wrapped around in order to free up the end of the belt.

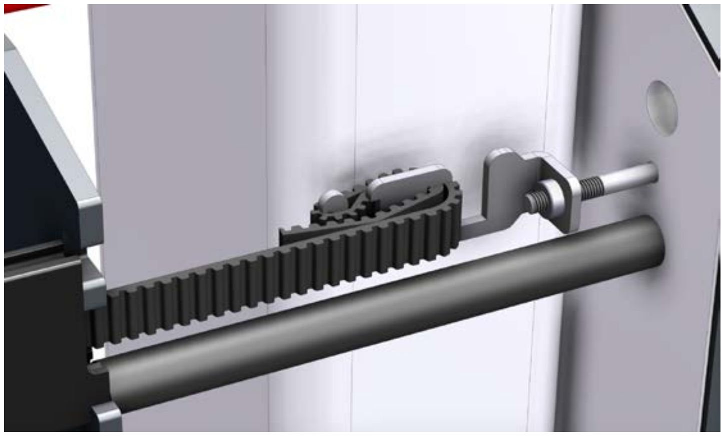


Figure 8-78: Scanner Drive Belt End Termination Wrap

8. Remove the motor belt, see **Figure 8-79** below. Doing this disconnects the scanner drive pulley from the motor such that the pulley can be freely rotated to facilitate feeding the belt through it without having to overcome the resistance of the motor.

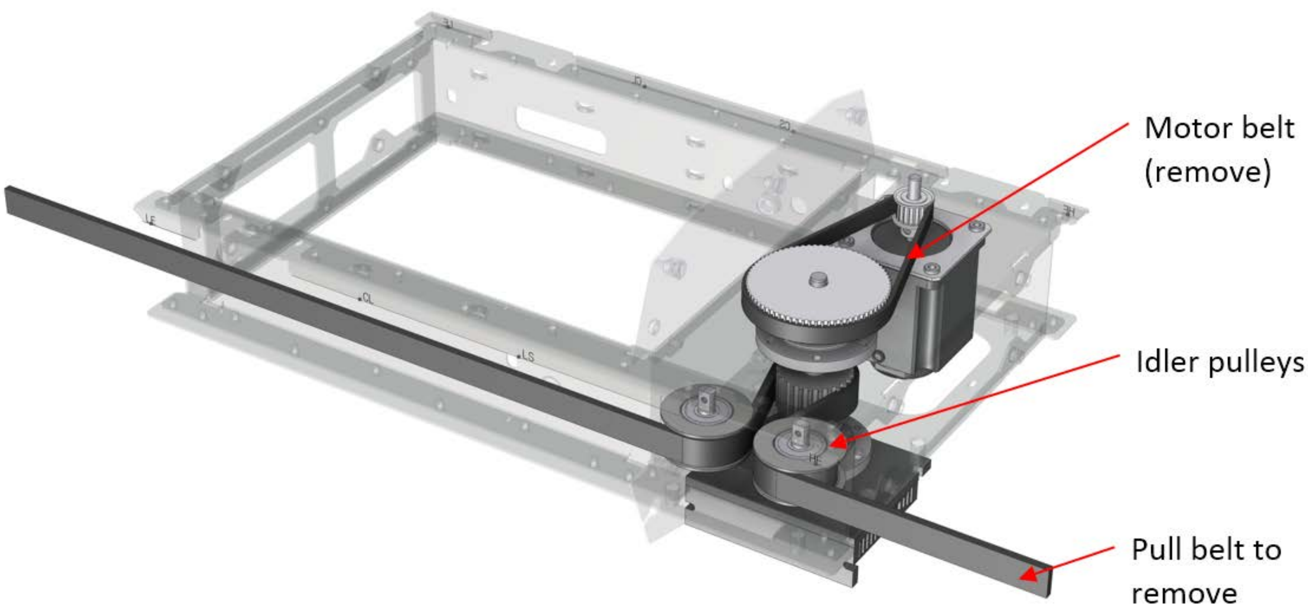


Figure 8-79: Scanner Drive Belt

9. Refer to **Figure 8-79** above and note the belt path. Simply pull the belt in order to disengage and remove it from the measurement module.

10. If you need to completely remove the belt from the scanner in order to replace it, remove the Scanner Drive belt Tensioning Screw using a 5mm hex key wrench in order to

disconnect the drive belt from the end of the scanner and unwrap the belt from the sheet metal bracket in order to free up the belt, as was done previously at the other end of the belt.

11. In order to install the Scanner Drive Belt, begin by wrapping one end of the belt around the sheet metal end termination bracket as shown in the figure below. It is important that the belt wrap is exactly as shown below and that the belt teeth are facing outward. Note that the orientation of the sheet metal bracket will be different at one end of the scanner than it is at the other end.

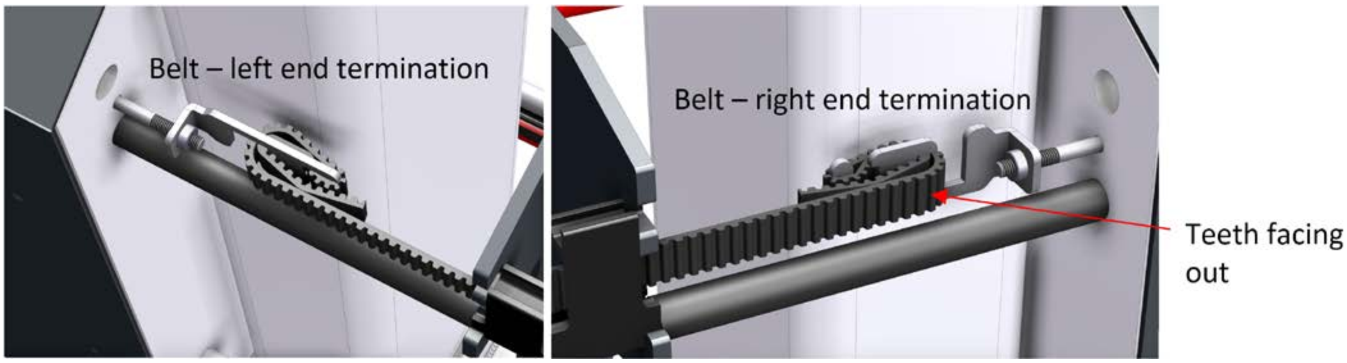


Figure 8-80: Belt Left/Right End Terminations

12. Attach the Scanner Drive belt end bracket at one end of the scanner using the tensioning screw. A 5mm hex key wrench will be needed to do so. Refer to **Figure 8-77** in order to locate where to attach these. Thread the screw into the end termination bracket a maximum of 3-4 threads in order to ensure sufficient thread availability to fully tension the belt in subsequent steps.

13. Thread the free end of the belt through the measurement module, ensuring that it follows the path as shown in **Figure 8-79**. Take care to ensure that there are no twists in the belt from the terminated end and through the measurement module.

14. Continue to pull the belt toward the other end of the scanner, taking further care to ensure it is not or does not become twisted. Wrap the free end of the belt around the sheet metal end termination bracket as shown in **Figure 8-80**. It is important that the belt wrap is exactly as shown and that the belt teeth are facing outward. Note that the orientation of the sheet metal bracket will be different at this end of the scanner than it was at the other end.

15. Attach the Scanner Drive belt end bracket at the remaining end of the scanner using the tensioning screw. A 5mm hex key wrench will be needed to do so. Refer to **Figure 8-77** in order to locate where to attach these. Some trial and error may be needed in order to get the belt wrap at the correct location along the length of the belt. You should aim to just be able to thread the tensioning screw into the bracket a few turns when pulling the belt towards the end termination by hand.

16. Double check that the belt remains threaded through the measurement module correctly as shown in **Figure 8-79**. Correct the path and re-wrap the belt at the end termination if needed.

17. Begin tensioning the belt using a 5mm hex key wrench at the tensioning screws at both ends of the belt. Ensure that the tensioning screws are threaded fully through the end termination brackets at both end of the scanner at minimum.

18. Continue tensioning in this manner such that the belt stays vertical and stays within the middle section of the rail cover extrusions along the full length of the belt. Refer to **Figure 8-81** below.

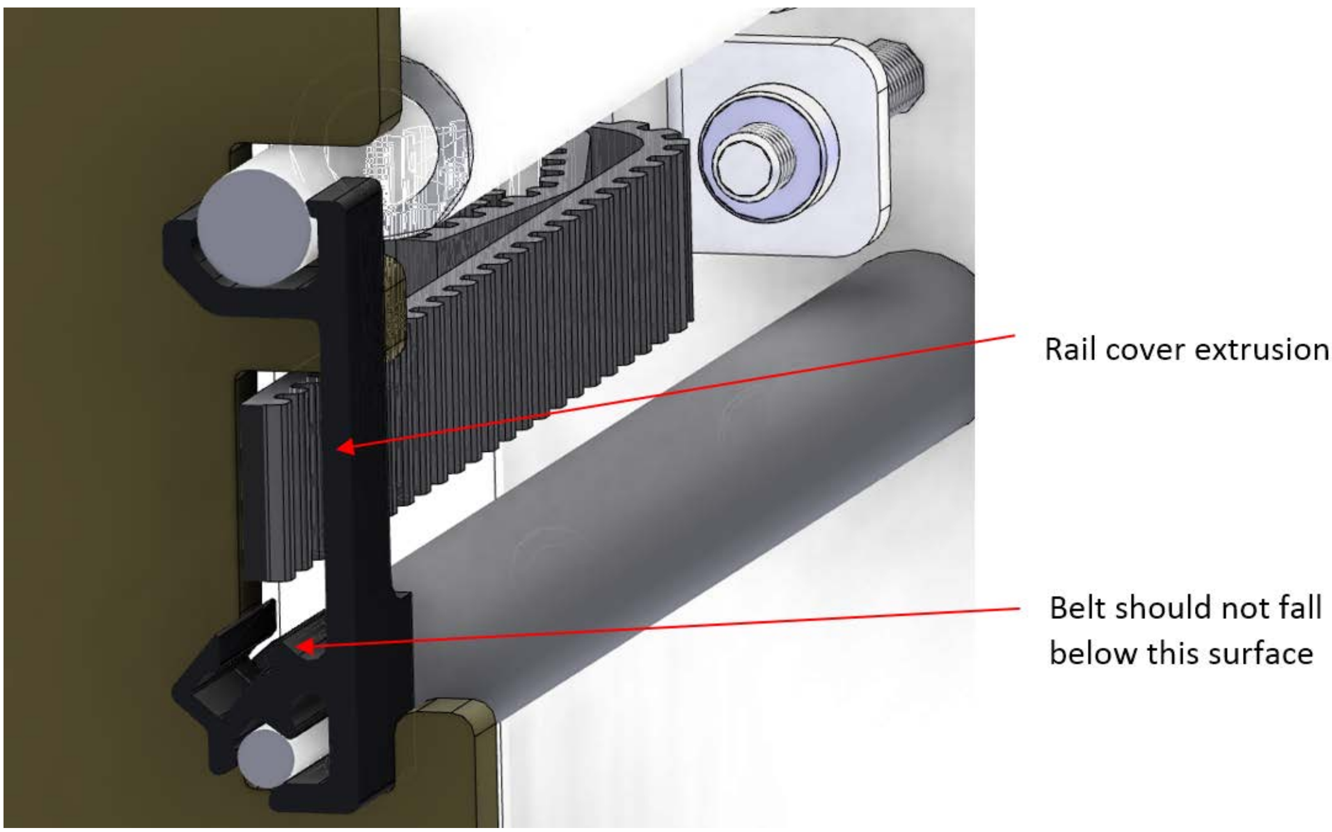


Figure 8-81: Tensioned Belt Position

19. Manually push the measurement module back and forth along the length of the belt and re-tension if necessary.

20. Replace the motor belt that was removed earlier.

21. Replace all covers that were instructed to be removed at the beginning of this procedure.

22. Remove the Scanner Lockout/Tagout.

8.5. System setup

8.5.1. Setup XYZ Profile Correction

Activity Number:	Q3090-00-ACT-034	**Applicable Models:**	Q3090-00
Type of Procedure:	Repair/Adjust	**Expertise Level:**	Technician
Priority Level:	Low	**Cautions:**	None
Availability Required:	Shutdown	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	2 hours	**# of People Required:**	1
Prerequisite Procedures:	None	**Post Procedures:**	None
Required Parts:	Part Number	Quantity	Lead Time
	• 4 units of 6580801916 calibration spacers (10mm gap) or • 4 units of 6580801932 calibration spacers (25mm gap) • 4 identical washers of approximately 1mm thickness		
Required Tools:	Part Number	Quantity	Lead Time
	• Micrometer		

The X, Y, and Z sensors in the ZipLine head require a baselining adjustment to compensate for ambient magnetic field, typically emanating from the structural steel in the scanner's environment. This operation is required on all scanners for initial setup and should be repeated if there is reason to believe the scanner alignment is improperly reported by the XYZ sensor.

This is a multiple step process to execute and confirm the scanner alignment.

8.5.1.1. Determine and enter X, Y, and Z baseline profile correctors

To do this the heads need to move together with a known alignment to capture the influence of the external magnetic fields. Do this by mechanically locking the heads together and driving the pair of heads with the upper head motor. Do the following steps to set up the system mechanically for this assessment:

- Remove all head covers and set them aside for the balance of the test.

- Remove the motor belt from the motor pulley and set it aside as well. See **Figure 8-82**.

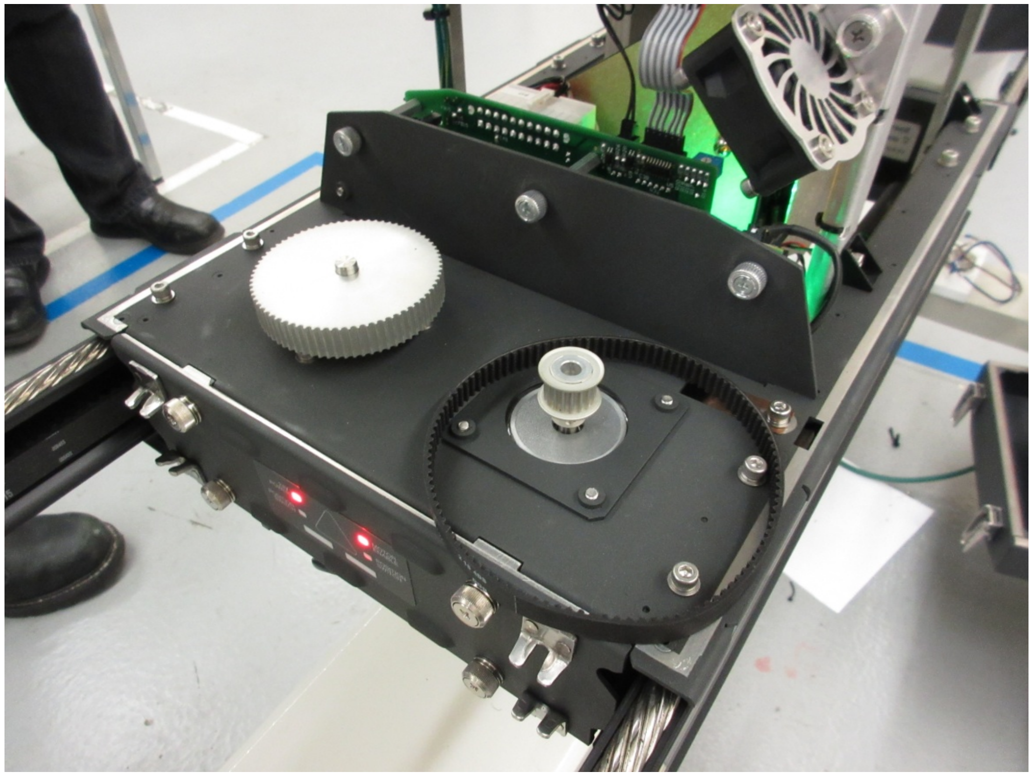


Figure 8-82: Remove lower head motor belt from head drive system.

- Lock the lower head to the upper head using four gap spacers. Insert a gap spacer into the slotted cutout on each corner of the sheet guide. Keep the washers outside the sheet guides. See **Figure 8-83**.

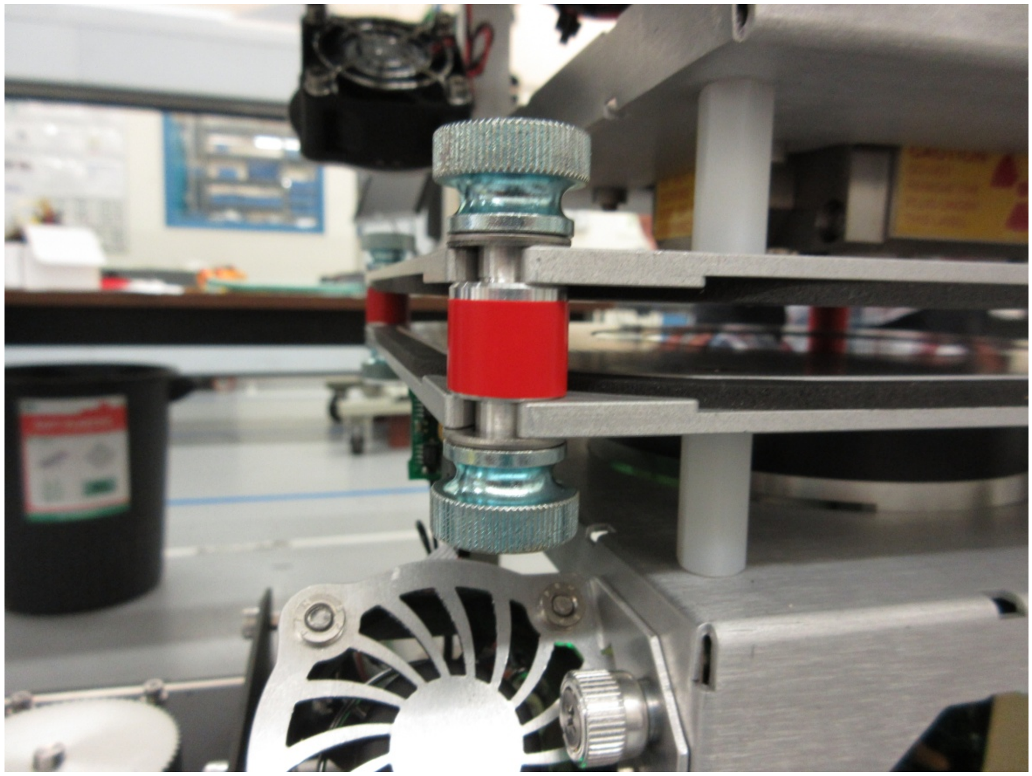


Figure 8-83: Gap spacers maintain an exact 10mm alignment between heads.

Because the X, Y, and Z baseline correctors need to be applied at standardize, sample, and reference the bucketized sheet width needs to include these areas.

- Navigate to the profile correction display from the scanner/sensor tab.
- On this display, there are written instructions on the left upper area of the screen, see **Figure 8-84**.

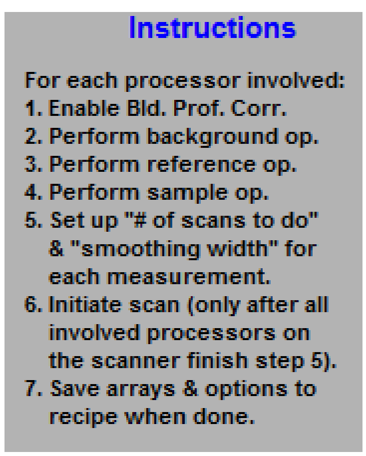


Figure 8-84: Generic profile correction instruction on the Profile Correction screen.

- Place the system in maintenance mode, from the profile correction display.

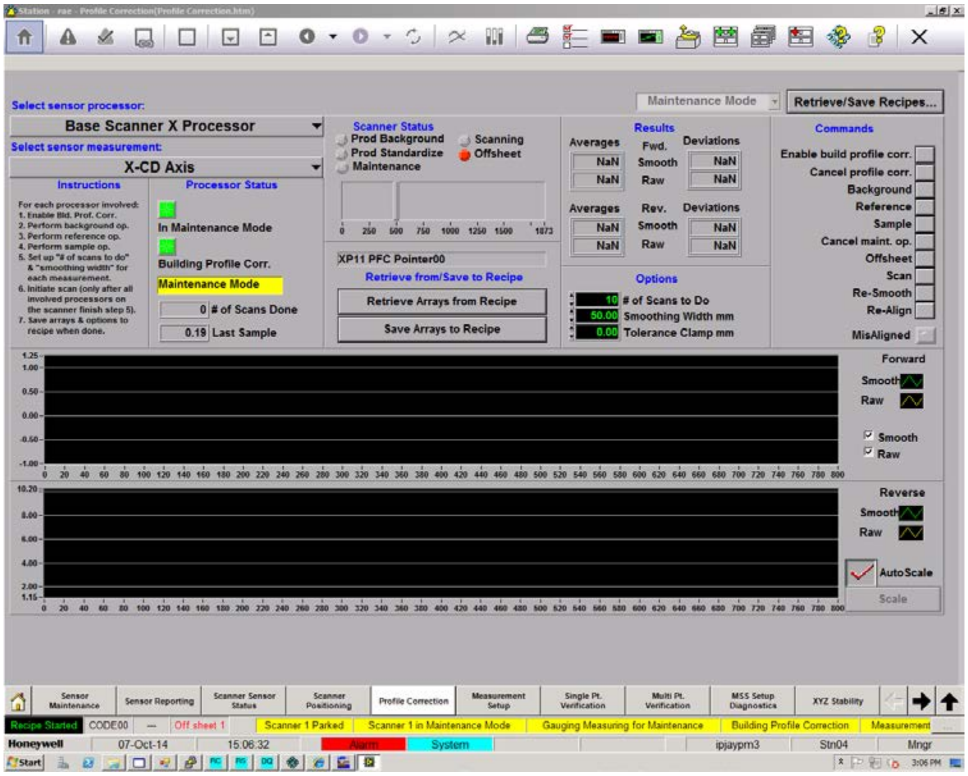


Figure 8-85: Profile correction display.

- Select “Base Scanner X Processor” as the processor and “X-CD axis” as the sensor measurement. Do step 1 and 5 of the on-screen instructions for X. The green indicator “Building Profile Corr.” should illuminate. Select 10 scans, a smoothing width of 50mm and a tolerance clamp of 1mm.

- Select “Base Scanner Y Processor” as the processor and “Y-CD axis” as the sensor measurement. Do step 1 and 5 of the on-screen instructions for Y. Select 10 scans, a smoothing width of 50mm and a tolerance clamp of 1mm.

- Select “Base Scanner Z Processor” as the processor and “Z-CD axis” as the sensor measurement. Do step 1, 2, 3, 4 and 5 of the on-screen instructions for Z. Select 10 scans, a smoothing width of 50mm and a tolerance clamp of 1mm.

- Re-verify that scanning limits include the standardize position on the “scanner positioning.” The standardize position must be captured inside the span swept out by the profile correction procedure.

- Do step 6. This will scan the scanner with the heads locked together. The number of scans executed will count up on the “# of scans done” indicator.

Ensure the full scanning width is being executed while the profile correction is being captured.

- The individual X, Y, and Z correctors need to be saved individually. Do step 7 for X. Save the profile corrector to all grades – this is a geometrical corrector and applies to all grades.
- Do step 7 for Y.
- Do step 7 for Z.
- Return the system to production mode from the profile correction display.
- The recipe has now been modified with the most recent X, Y, and Z baselines. Re-load using the pop-up bar icon. See Figure 8-86.

Figure 8-86: Load recipe.

- In the sensor maintenance screen, select the options for the X, Y, and Z sensor processors. Select "Base scanner performance processor" and press supporting sensors.
- Verify selected correctors, for X select options as in **Figure 8-87**.

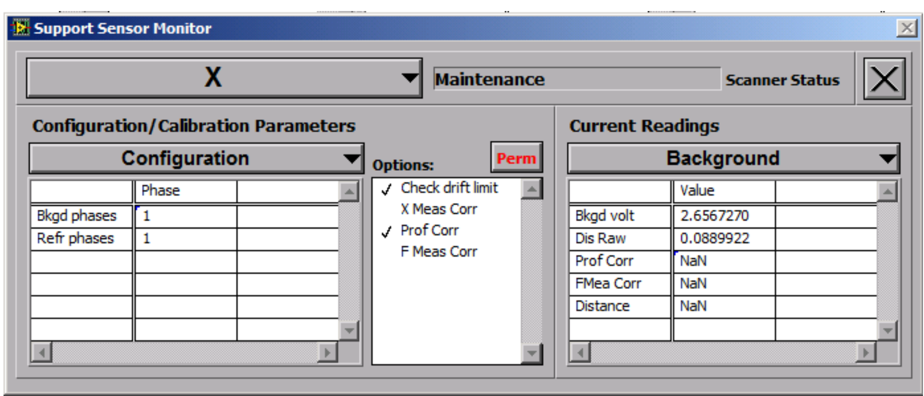


Figure 8-87: X profile correction settings for measurement.

- For Y select options as in **Figure 8-88**.

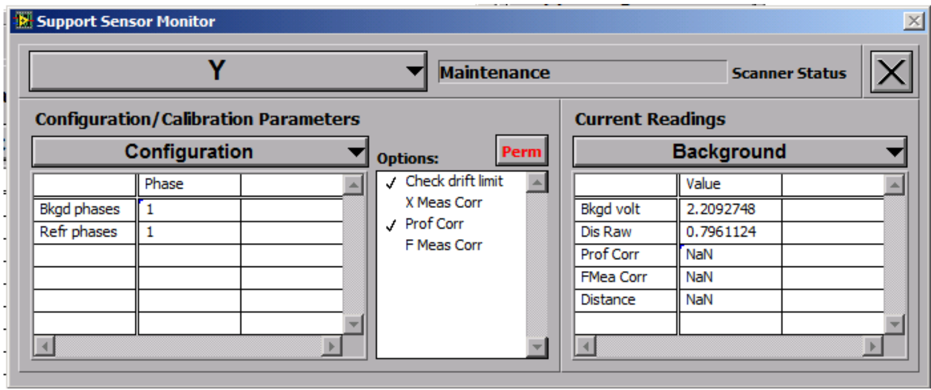


Figure 8-88: Y profile correction settings for measurement.

- For Z select options as in **Figure 8-89**.

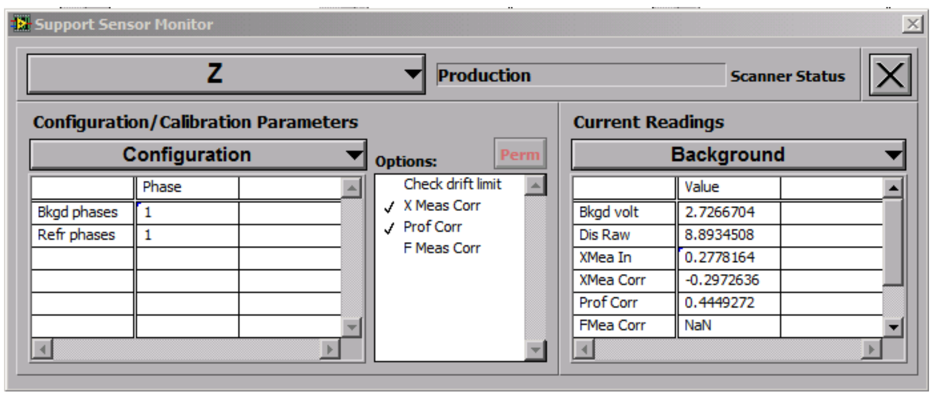


Figure 8-89: Z profile correction settings for measurement.

- Keep the heads locked together and scan in production mode. The scanner passes this item if for X, Y, and Z the profile ranges are less than 0.05mm for each item. See **Figure 8-90** for a passing example.

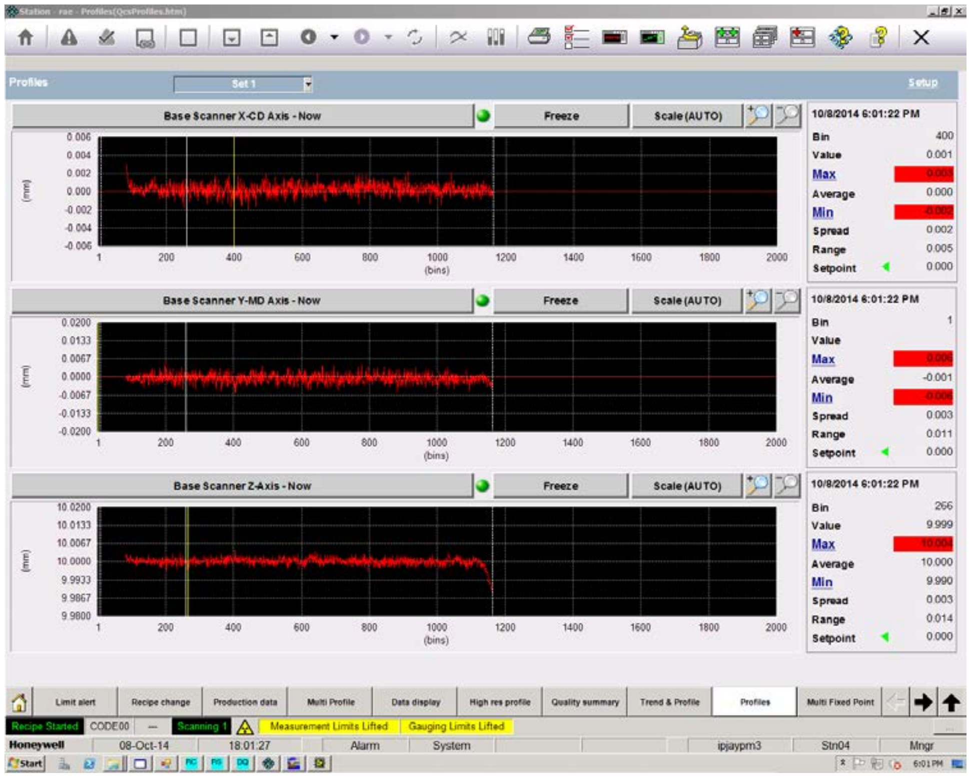


Figure 8-90: X, Y and Z profiles with heads locked together and profile correctors applied.

8.5.1.2. **Determine and set x-sensor signal corresponding to ideal head alignment**

- While the scanner is scanning with the heads locked together, also verify the x-sensor signal that the MSS is seeing. This value is needed to define the target voltage for the x-sensor to ensure head alignment when the heads are operated in master/follower mode. Go to MSS Scan Voltages and select “ss1 performance” as the “sensor set” and “x axis” and the channel. See **Figure 8-91**.

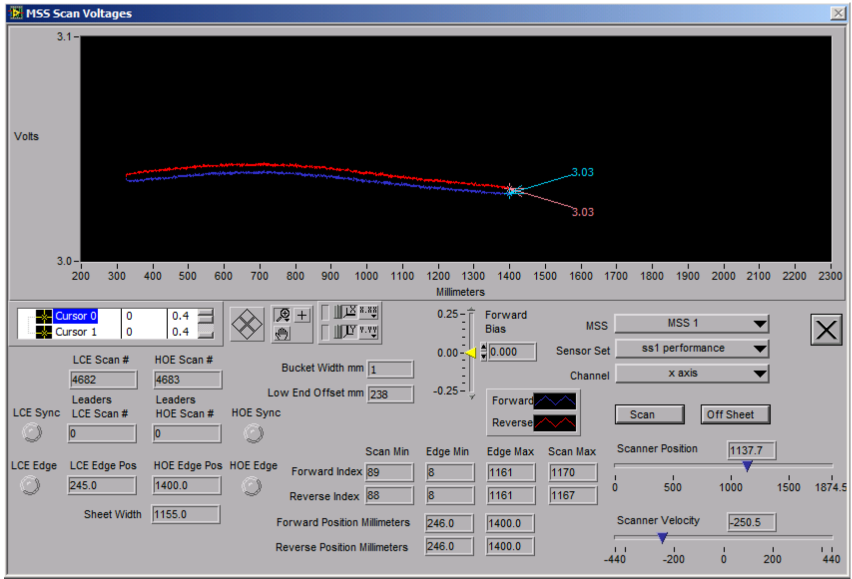


Figure 8-91: MSS scan voltage showing x-signal when heads are aligned

- Note the average signal value of the x-axis sensor when the heads are locked. In the example above, it is approximately 3.0V. The scaling factor between signal and distance is approximately 2mm/V. For the example above, we estimate 3.0V as the voltage the x-sensor should report when the heads are nominally aligned. Estimating within 50mV is acceptable. Call this signal level V_x^o.

- The target x-sensor signal is related to the calibration of the x-sensor. The following formula relates relative head displacement, X, (in mm) to the x signal,

V_x (in volts), the slope of the displacement/signal relationship, dX/dV_x (in mm/V) and a displacement offset, X_o (in mm):

$$X = \frac{dX}{dV_x} V_x + X_o.$$

The goal of this step is to adjust X_o so that the aligned x-sensor voltage corresponds to an X displacement of zero millimeters. Execute this computation as follows:

$$X_o = -\frac{dX}{dV_x} V_x^o$$

Where (dx/dVx) is 2.08 mm/V (default in RAE) and V_x^o is the value recorded from Figure 8-91. In the example in this document, the computation is realized as:

$$X_o = -\left(2.08\frac{mm}{V}\right)(3.0V) = -6.24mm$$

- Enter this value by navigating to the scanner/sensor maintenance tab and enter maintenance mode. The X-sensor is a supporting sensor of the performance processor. Select its pop-up and select the “constants” list. See **Figure 8-92**.

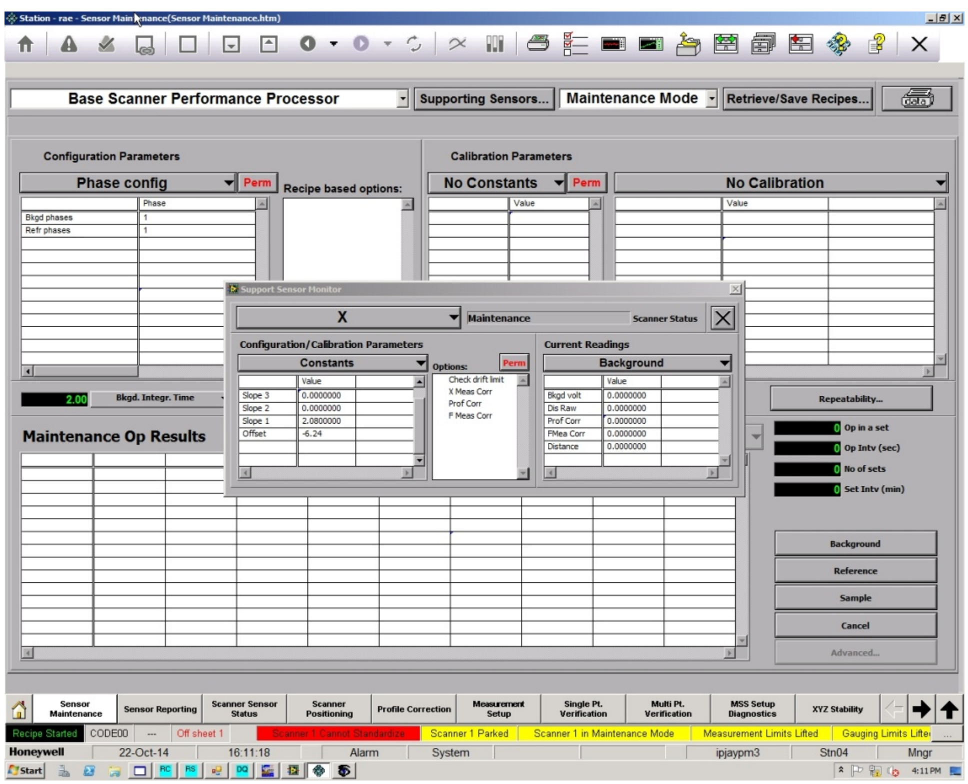


Figure 8-92: Access X-sensor constants

- In the offset field, directly type the value computed for X_o, in this example -6.24V.

8.5.1.3. Validate Z profile calibrations

- Validate the Z calibration by adding a washer's width to each gap spacer thus expanding the gap by the width of a washer. See **Figure 8-93**. Scan again.

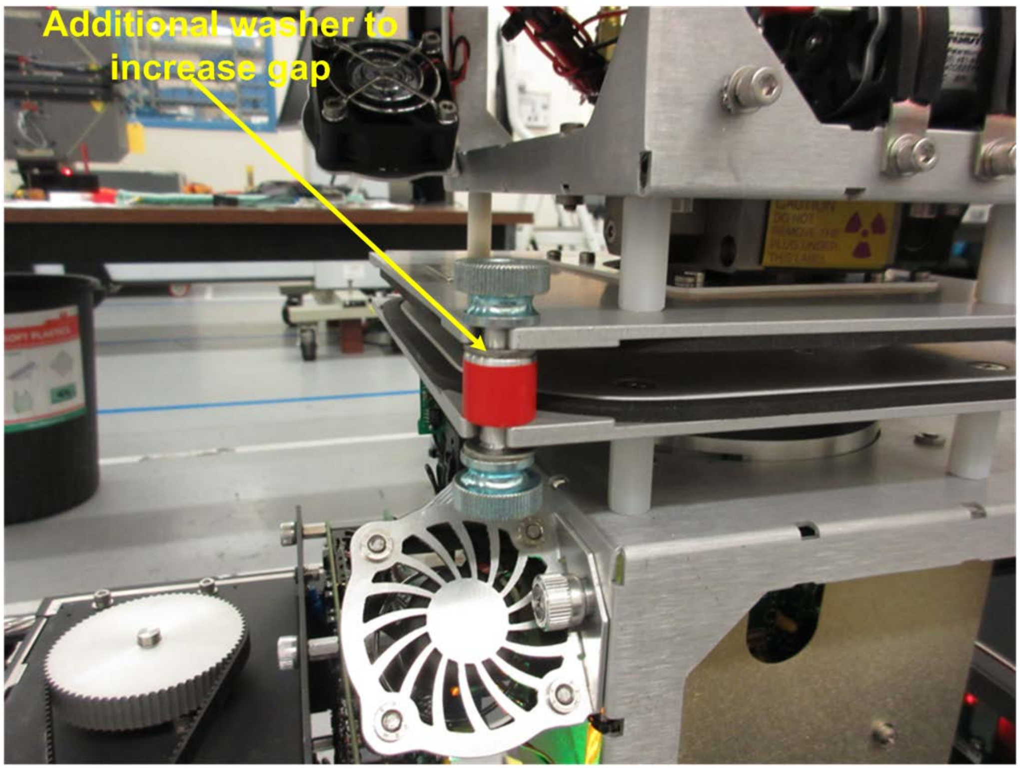


Figure 8-93: Add additional washer in gap to further separate heads.

- The scanner passes this item if the following conditions are achieved:
  - X, Y, and Z ranges are less than 0.05mm.
  - The Z profile average measures the washer to within +/-0.1mm.
- See **Figure 8-94** and **Figure 8-95** for additional detail. In this example case, the washer measures 1.46mm using a digital Vernier caliper. When this washer is added to the scanner gap, the Z-profile now reports an average of 11.41mm, meaning the 10mm gap has been increased by 1.41mm. This is within +/-0.1mm of the washer thickness, thus a pass.

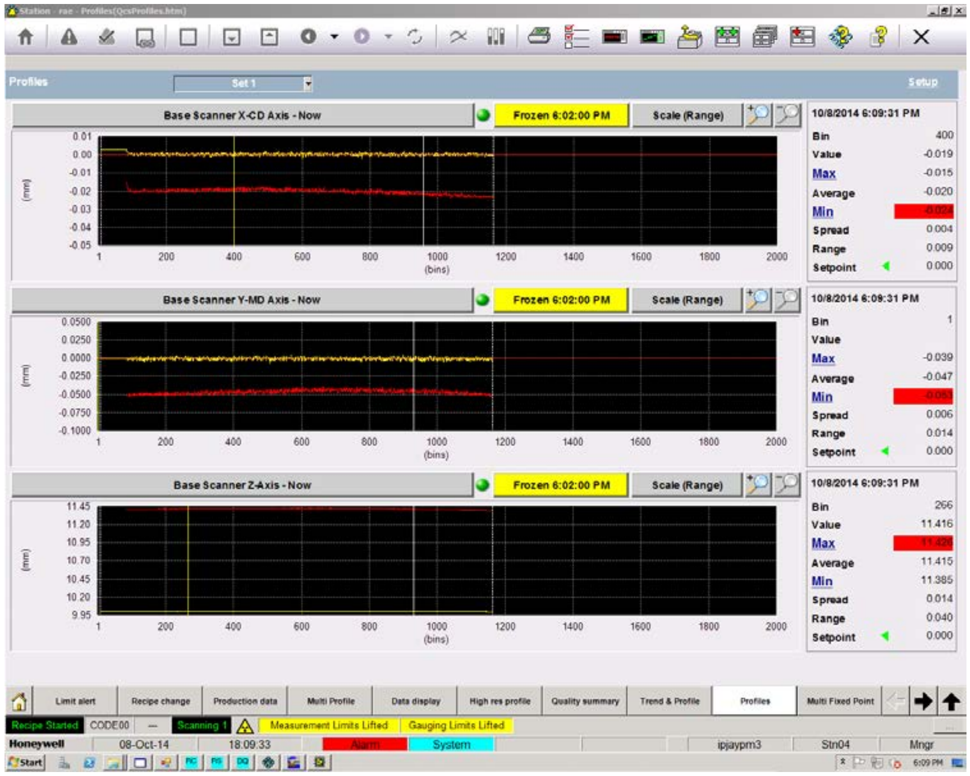


Figure 8-94: Z sensor measures the additional space after calibration

Figure 8-95: Physical measurement of additional spacing washer

- The X, Y, and Z measurement operation is now confirmed.

8.5.1.4. Verify scanner geometric alignment

With the X, Y, and Z measurements set-up, validate the scanner geometry itself.

- Remove the gap spacers and replace the lower head motor belt. Scan the heads normally in master/follower mode and confirm X, Y, Z ranges are inside the factory specifications of:
  - X average is between -0.2mm and 0.2mm.
  - X range is less than 2mm.
  - Y range less than 2mm.
  - Z average is between 9.5mm and 10.5mm.
  - Z range less than 0.8mm.
- See **Figure 8-96** for a passing example.

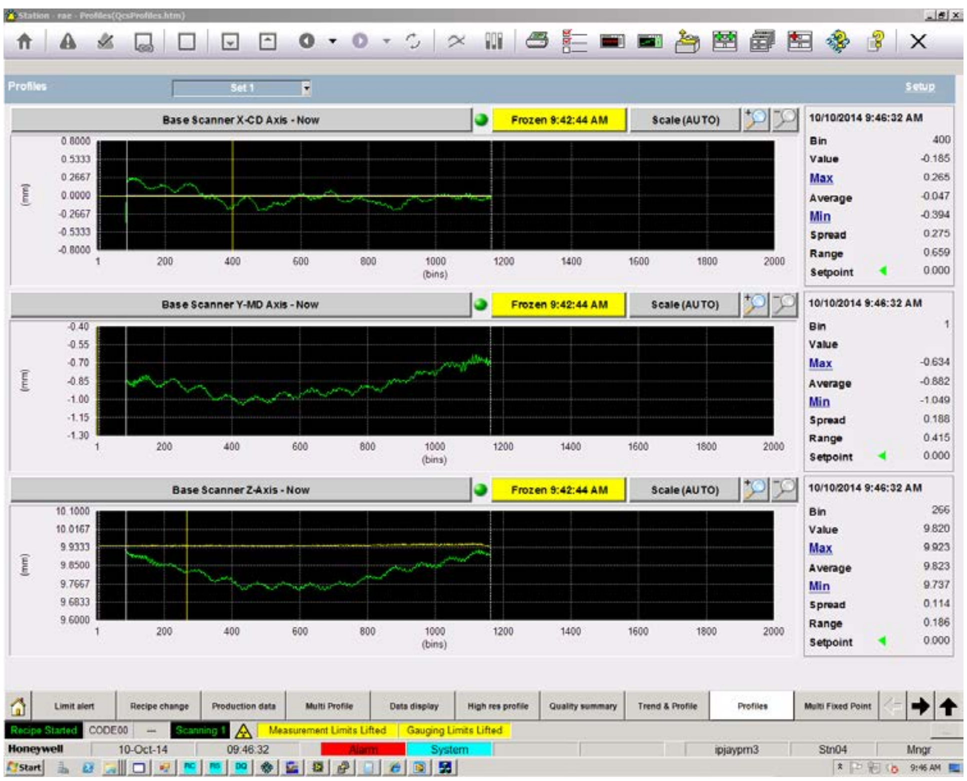


Figure 8-96: Representative X, Y, and Z passing ZipLine alignment

- This concludes the Q3090 scanner test. The balance of these tests verify sensor integration into the head.

8.5.2. First Time Install of Sample Holder

Activity Number:	Q3090-00-ACT-035	**Applicable Models:**	Q3090-00
Type of Procedure:	Support	**Expertise Level:**	Technician
Priority Level:	Average	**Cautions:**	Mechanical
Availability Required:	Scanner Offsheet	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	
Duration (time period):	30 minutes	**# of People Required:**	1
Prerequisite Procedures:	None	**Post Procedures:**	Choose an item.
Required Parts:	Part Number	Quantity	Lead Time
	• 6580801935 Q3090 Sample Holder Ass'y		
Required Tools:	Part Number	Quantity	Lead Time
	• Metric Allen Keys • Straight edge • Fine tipped marker • Masking tape • Hand drill • Drill bits 7mm [9/32”] and 9mm [11/32”] • Small C-clamp or similar		

ATTENTION

> Before starting this procedure the machine must be shut-down and the scanner functioning in computer mode.

1. Send the heads off-sheet.
2. Power off the scanner at the cable end switch.
3. Locate on the lower head cover the text CL with a solid line beside. This is the center of the sensor.

Figure 8-97: Locate CL with solid line

4. Apply masking tape orientated vertically and in-line with the text CL with a solid line beside. See **Figure 8-97**.

ATTENTION

The use of masking tape is optional. Sometimes it's difficult to see the line on the black plastic rail cover extrusion.

5. Using a straight edge mark a line inline with the CL line. Repeat for the opposite side. See **Figure 8-98**.

Figure 8-98: Mark line on plastic rail cover

6. Verify the gap between the two heads. The gap should be either 10mm or 25mm.

7. Carefully push the Upper and Lower heads towards the center of the scanner approximately 1 meter.

8. Obtain PN 6580601116 Q3090 SAMPLE HOLDER NUT PLATE TEMPLATE which is part of the assembly PN 6580801935.

9. Hook the template on the rail and align the ‘notch’ with the line on the plastic rail cover.

ATTENTION

> On the belt side of the scanner:
>
> Before applying the clamp make sure that the head belt is not clamped as well. Gently pull the belt up and place the clamp on the template and the rail cover. The clamp will hold the belt away from the rail cover to prevent damage when drilling.

10. Clamp the template to the rail to ensure the template doesn’t move when drilling. See **Figure 8-99**.

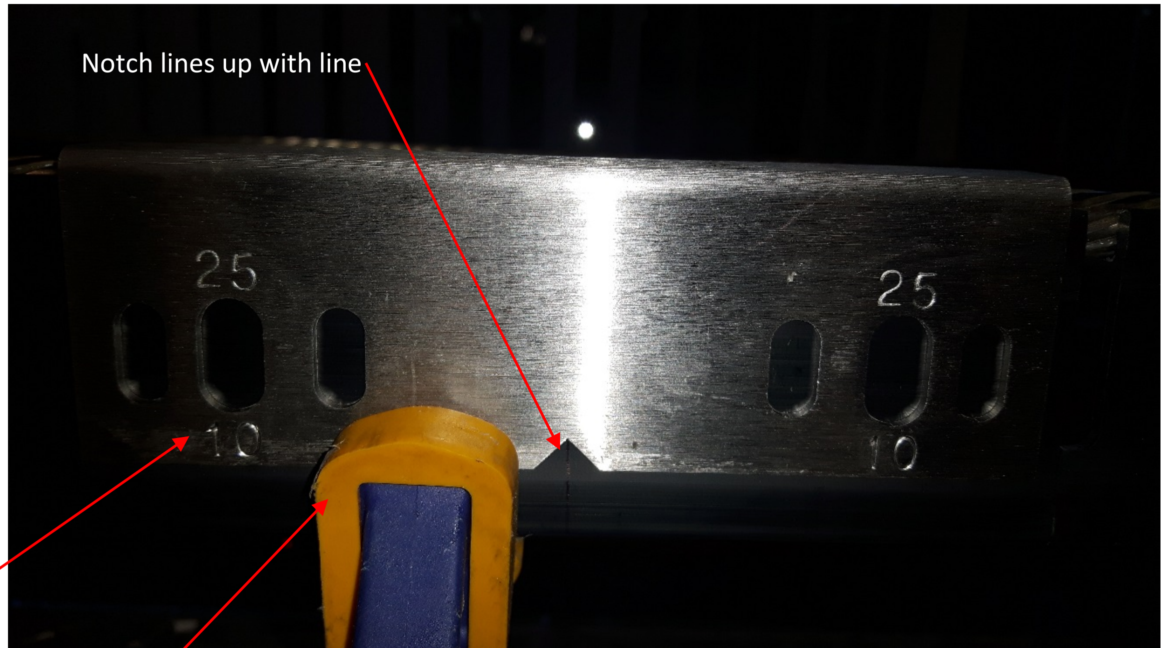


Figure 8-99: Template clamped to plastic rail cover

ATTENTION

When drilling holes on the belt side be careful not to damage the head drive belt.

11. Note on the template the appropriate head gap value, either 10 or 25. Using a hand drill, drill 4x 7mm [9/32”] dia holes, and then 2x 9mm [11/32”] dia holes. Repeat for the opposite side. Remove any plastic debris. See **Figure 8-100**.

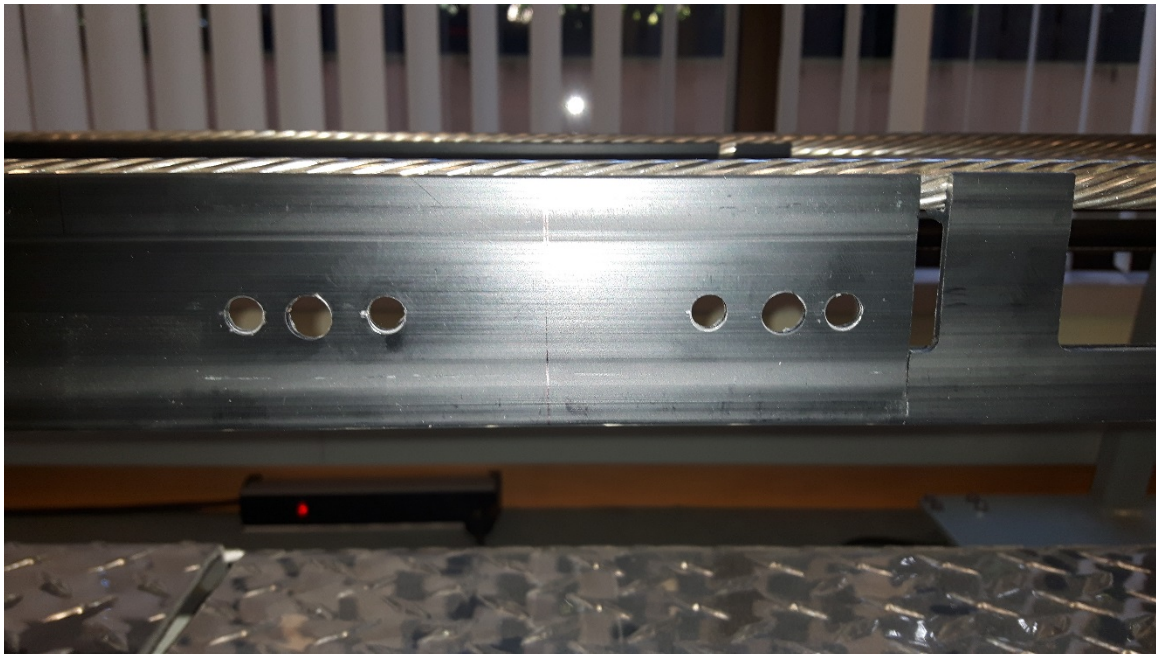


Figure 8-100: Plastic Rail Cover drilled

12. Install PN 6580601115 Q3090 SAMPLE HOLDER NUT PLATE with the hardware provided. Repeat for the opposite side.

Figure 8-101: Sample Nut Plate Holder installed

13. Place the Sample Holder Assembly on the Nut Plate dowel pins. Tighten the captive knurled knobs on the Sampl Holder Assembly to the Nut Plate.

14. Carefully push the Lower Sensor head towards the Sample Holder Assembly to check for any interference. If there is minor interference the screws holding the nut plate to the rail can be loosened to adjust the position of the Sample Holder Assembly slightly.

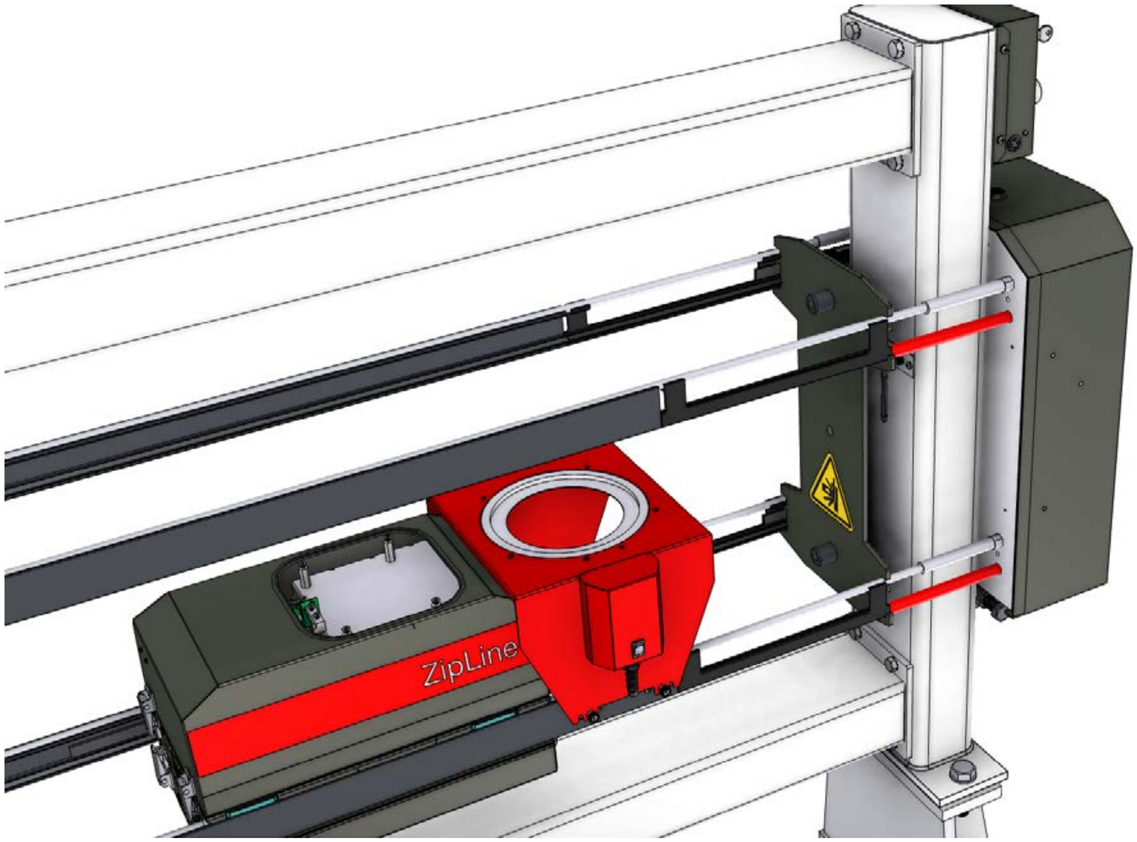


Figure 8-102: Lower head

15. Carefully push the Upper Sensor head towards the Sample Holder Assembly to check for any interference. If there is minor interference loosen the screws holding the nut plate to the rail to adjust the Sample Holder Assembly position slightly.

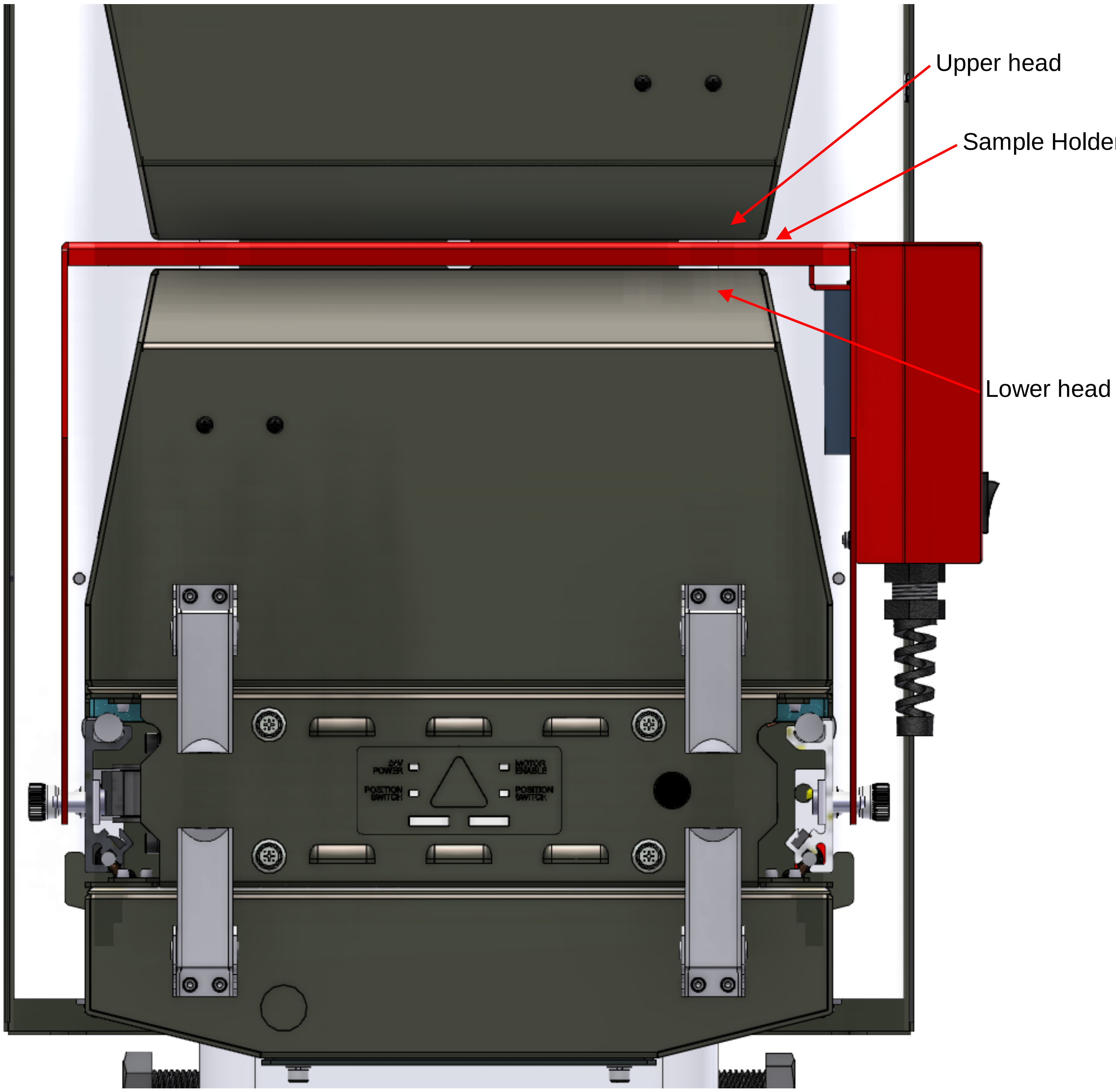


Figure 8-103: Upper & Lower Heads over Sample Holder

16. Turn the scanner power switch on.

17. Put the scanner into ‘maintenance’ mode.

18. Move the Upper and Lower heads from the ‘off sheet’ position to clear the Sample Holder.

19. Plug the Sample Holder plug into the side of the HMI panel. Press the motor switch to ensure the rotor spinds freely.

20. Put the scanner in ‘computer’ mode and push the ‘reference’ button. The heads should move from the ‘off sheet’ position to the ‘reference position’, pause then return to ‘off sheet’. Once the samples have been taken the Sample Holder can be unplugged and removed from the Nut Plate. The Nut Plate can remain on the scanner until the Sample Holder is required again.

9. ZipLine troubleshooting procedures

Getting information while troubleshooting the ZipLine system can be found in four places in the system. This section enumerates the locations where helpful troubleshooting information can be obtained.

1. The first are the system alarms. The presence of a system alarm is indicated by the flashing word “Alarm” in the lower bar of the MXProline Station applicaton. See **Figure 9-1: Alarm indicator.**

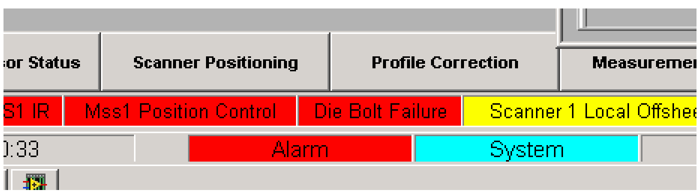


Figure 9-1: Alarm indicator.

Clicking on the “Alarm” location navigates the user to the Alarm Summary tab where the individual alarms are listed. See **Figure 9-2**. The ZipLine specific alarms are hyperlinked to the same troubleshooting help content written in this manual.

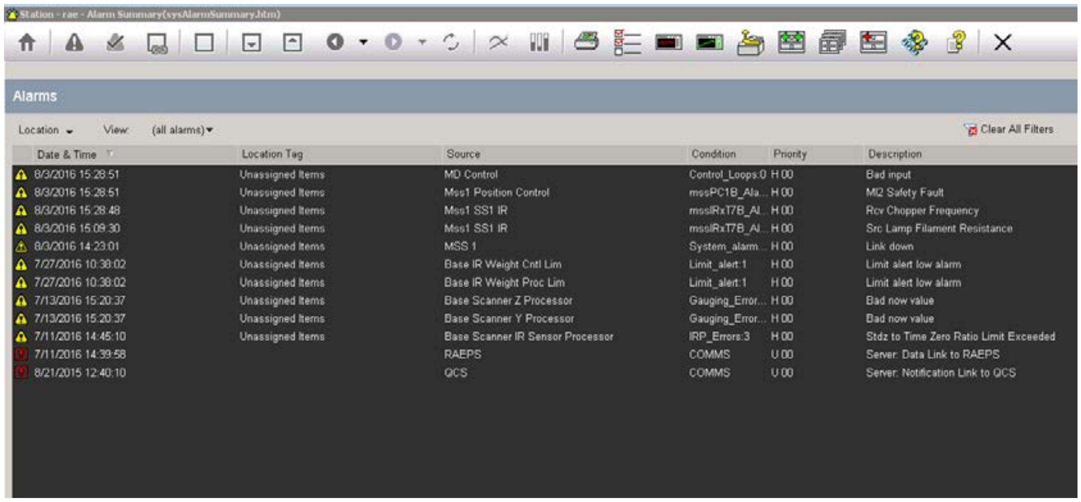


Figure 9-2: Alarm summary list.

2. The MSS provides useful information via its "What's wrong" messages. These can be accessed via the "MSS Setup Diagnostics" tab, see and further selecting the MSS Monitor.

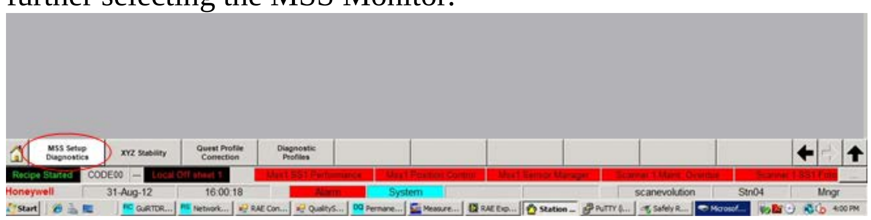


Figure 9-3: MSS Setup Diagnostics Tab.

The MSS Summary displays a listing of “What’s Wrong” messages in the lower portion of the pop-up. See **Figure 9-4**.

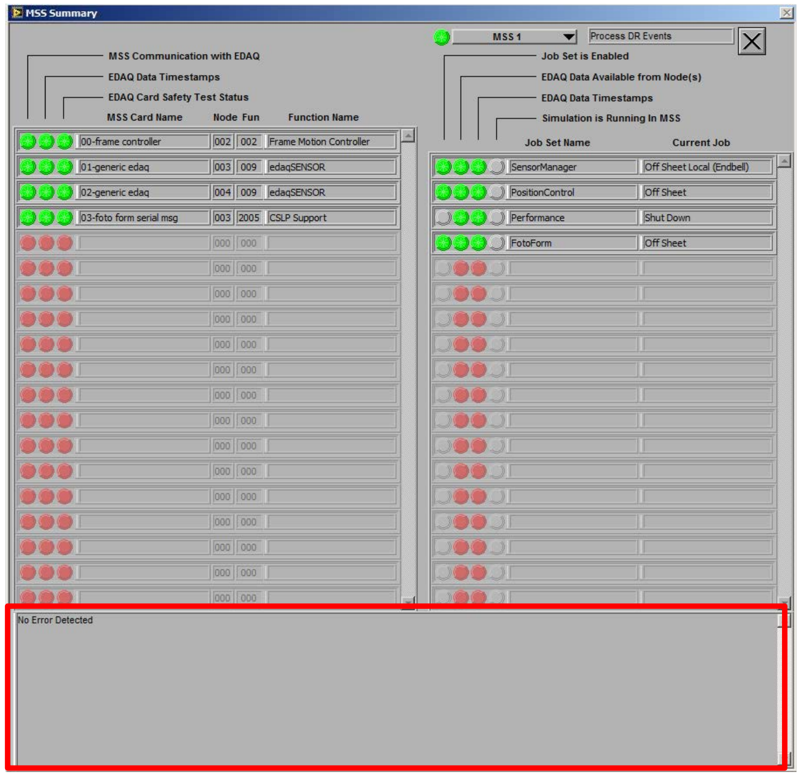
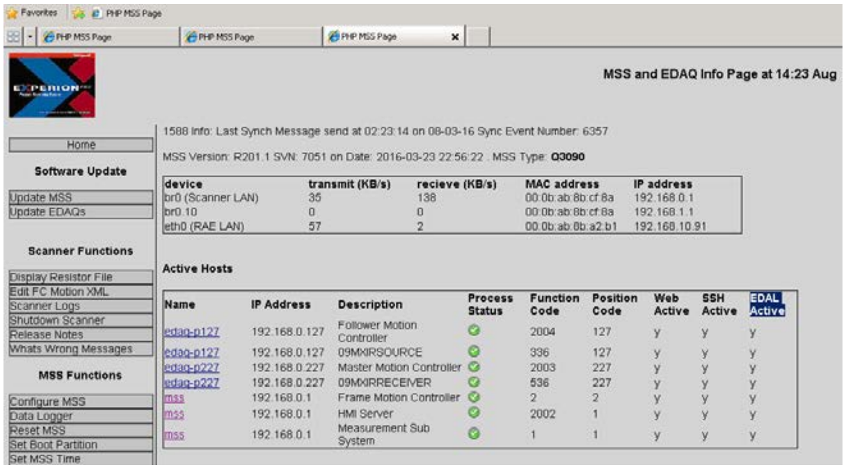


Figure 9-4: MSS Summary with "What's wrong" message are indicated by red rectangle.

3. Using the MSS Monitor, one can launch the “MSS Web page.” This is hosted on the MSS and provides a view on the EDAQ and MSS applications that are active on the system. This webpage is particularly useful to determine if EDAQs are communicating with the MSS, if they are behaving per the expected function and positon assignments and if their hosted applications are up and running as expected. An example of this display is shown in **Figure 9-5**.



device	transmit (KB/s)	recieve (KB/s)	MAC address	IP address
br0 (Scanner LAN)	35	138	00:0b:ab:8b:cf:8a	192.168.0.1
br0.10	0	0	00:0b:ab:8b:cf:8a	192.168.1.1
eth0 (RAE LAN)	57	2	00:0b:ab:8b:a2:b1	192.168.10.91

Name	IP Address	Description	Process Status	Function Code	Position Code	Web Active	SSH Active	EDAL Active
edaq-p127	192.168.0.127	Follower Motion Controller		2004	127	y	y	y
edaq-p127	192.168.0.127	09MXIRSOURCE		336	127	y	y	y
edaq-p227	192.168.0.227	Master Motion Controller		2003	227	y	y	y
edaq-p227	192.168.0.227	09MXIRRECEIVER		536	227	y	y	y
mss	192.168.0.1	Frame Motion Controller		2	2	y	y	y
mss	192.168.0.1	HMI Server		2002	1	y	y	y
mss	192.168.0.1	Measurement Sub System		1	1	y	y	y

Figure 9-5: Example EDAQ/MSS Webpage with EDAQ and MSS status.

4. Finally, the most detailed repository for system information can be found in the scanner log files. Scanner log files are text files, typically dozens of megabytes in size, that log numerous events and errors executed or encountered by the EDAQs and MSS. It can be possible to reconstruct the chain of events that led up to an issue by reviewing the logs.

   Scanner logs can be downloaded by following the links in the MSS webpage and reviewed offline with a suitable tool.

The following sections outline the alarm based trouble shooting steps recommended for system alarms.

9.1. Alarm-based troubleshooting

9.1.1. Position Control - EDAQ IO Not Ready

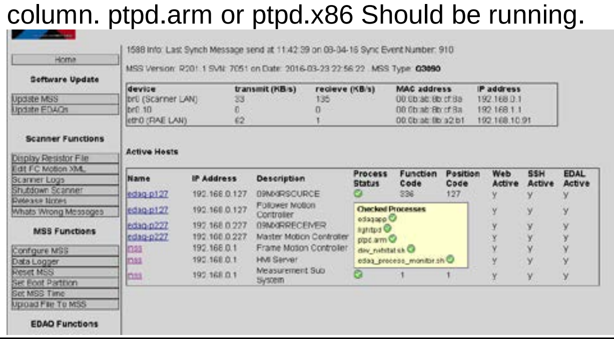
This alarm indicates the MSS is waiting for data from the EDAQ over the LAN. The **EDAQ IO Not Ready** alarm stays active until all IO in the the job set are available to be processed. In general this error happens when an EDAQ or an application running on an EDAQ is not communicating properly with the MSS.

Symptom	Possible Cause	Solution
Red 24 Volt Power indicator LED is not lit on the side of the lower head.	Lower head is not powered.	Verify fuse to lower head is in good working order. **Change Branch Fuse in Endbell** if required.
		Verify all 24V and ground brush contact to 24V and return rail is satisfactory **Verify Power Brush Tracking**. If required **Replace Power Brushes** and/or **Replace Ground Brushes**
Red 24 Volt Power indicator LED is not lit on the side of the upper head.	Upper head is not powered.	Verify fuse to upper head is in good working order. **Change Branch Fuse in Endbell** if required.
		Verify all 24V and ground brush contact to 24V and return rail is satisfactory **Verify Power Brush Tracking**. If required **Replace Power Brushes**
EDAQ-P127 does not show up in the list of active hosts, on the MSS Home web page.	EDAQ in lower head is not configured for position code 127.	See the setup steps from task **Replace Head Power Distribution Board** for lower head. I.e ensure card is setup as wireless.
	EDAQ is not communicating on the wireless network	**Replace Wireless Adapter**
		Replace EDAQ
EDAQ-P227 does not show up in the list of active hosts, on the MSS Home web page.	EDAQ in upper head is not configured for position code 227.	See the setup steps from task **Replace Head Power Distribution Board** for upper head. I.e ensure card is setup as wireless.
	EDAQ is not communicating on the wireless network	**Replace Wireless Adapter**
		Replace EDAQ
HMI Server, function code 2002, position code 1 does not show up in the list of active hosts, on the MSS Home web page.	HMI server application is not running on the MSS computer.	Do a hard reset, using the **Reset MSS**, MSS web page.
Frame motion controller, function code 2, position code 2 does not show up in the list of active hosts, on the MSS Home web page.	Frame motion controller application is not running on the MSS computer.	Do a hard reset, using the **Reset MSS**, MSS web page.
Follower motion controller, function code 2004, position code 127 does not show up in the list of active hosts, on the MSS Home web page.	Follower motion application is not running on the EDAQ in the lower head.	Do a hard reset on EDAQ-P127, using the **Reset EDAQs**, MSS web page.

Master motion controller, function code 2003, position code 227 does not show up in the list of active hosts, on the MSS Home web page.	Master motion application is not running on the EDAQ in the top head.	Do a hard reset on EDAQ-P227, using the **Reset EDAQs**, MSS web page.

9.1.2. Position Control - EDAQ IO Time Stamps

This alarm indicates a time stamp mismatch between data received from the EDAQ and MSS. EDAQ LAN IO Time Stamps are suspect is EDAQ analog input time stamps deviate from the MSS time by more than 2 seconds. The emss application running on MSS CPU, subscribes to EDAL entities from multiple nodes on the sensor LAN. Streaming analog input subscriptions continously send data to the emss application. Each job set being processed by the emss application is interested in a subset of these entities. Periodically the job set calculates the IO's age using the most recent data sample sent from the EDAQ. The IO's age and type of subscription is checked by a VI running in RAE. The **EDAQ IO Time Stamps** alarm is set when any of the job set's streaming IO appears to be stale.

Symptom	Possible Cause	Solution
The last update time, and local time differ by large amount on the **Detailed EDAQ Info** MSS web page.	Presicion Time Protocol Deamon is not running.	Verify EDAQ process status, using MSS **Home** web page. Hover over the circles in the process status column. ptpd.arm or ptpd.x86 Should be running. 
Values in the rate column for analog inputs on the **MSS Job Set Monitor** display drop to zero.	The node suppling the data, is not sending the data, at the expected rate.	Use the MSS web pages **Home** and **Detailed EDAQ Info** to verify that the lastest MSS and EDAQ SW is being used for the scanner.

9.1.3. Position Control - MI2 Lost Connection

The EDAQ/Frame controller (EFC) application running on MSS CPU lost connection (EDAL) with the master motion application running on the EDAQ in the top head. EDAL connection criteria is function code 2003 and position code 227.

Symptom	Possible Cause	Solution
Master motion controller, function 2003, position 227 shows up in the list of active hosts, on the MSS Home web page.	Commincation with Node EDAQ-P227, the top head, may have gone away and came back.	Press Restart MSS to clear sensor safety fault button on **scan control** display to reset.
Master motion controller, function 2003, position 227 does not show up in the list of active hosts, on the MSS Home web page, but other functions with position 227 do show up.	Master motion application quit running on the EDAQ in the top head.	Do a hard reset on EDAQ-P227, using the **Reset EDAQs**, MSS web page.
Red 24 Volt Power indicator LED is not lit on the side of the upper head.	Upper head is not powered.	Verify fuse to upper head is in good working order. **Change Branch Fuse in Endbell** if required.
		Verify all 24V and ground brush contact to 24V and return rail is satisfactory **Verify Power Brush Tracking**. If required **Replace Power Brushes**
EDAQ-P227 does not show up in the list of active hosts, on the MSS Home web page.	EDAQ in upper head is not configured for position code 227.	See the setup steps from task **Replace Head Power Distribution Board** for lower head. I.e ensure card is setup as wireless.
	EDAQ is not communicating on the wireless network	**Replace Wireless Adapter**
		Replace EDAQ

9.1.4. Position Control - MI2 Safety Fault

The frame controller application running on the MSS was notified by the master motion application running on the EDAQ in the top head that there is a safety fault in the motion interface. There can be multiple causes of this error, see table below. The "What's wrong messages" as accessed on the MSS Webpage. See **Figure 9-6.**

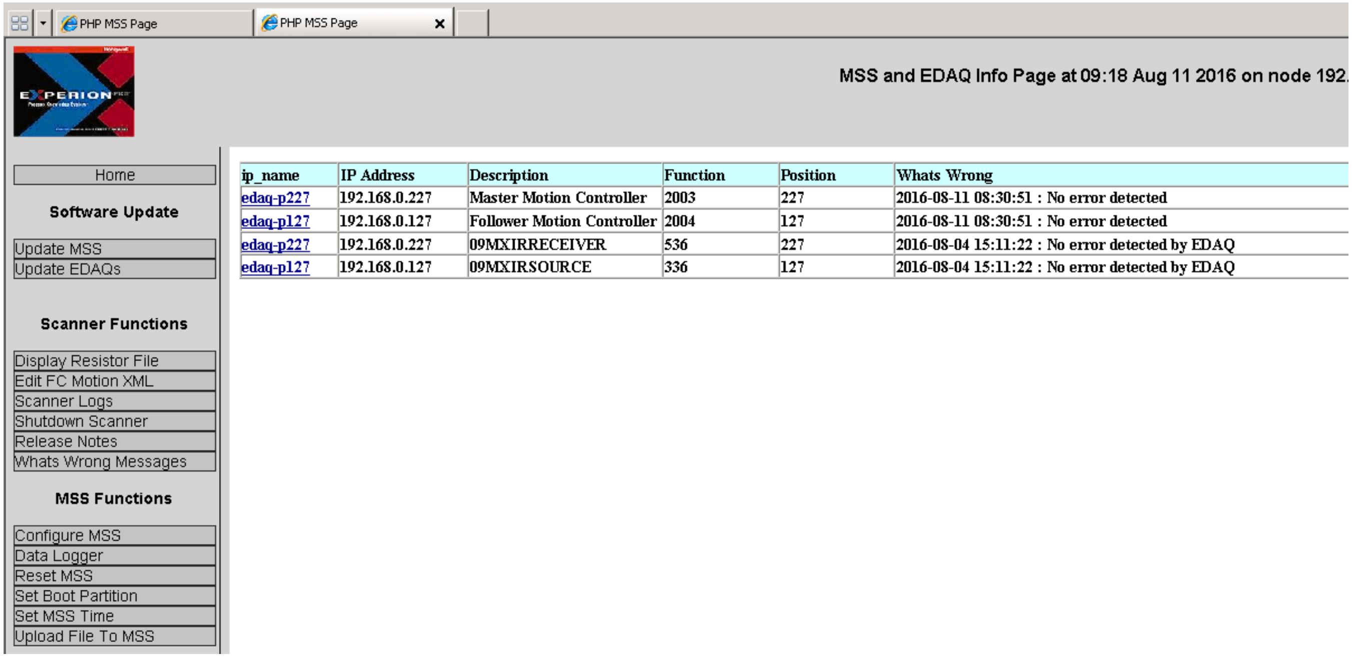
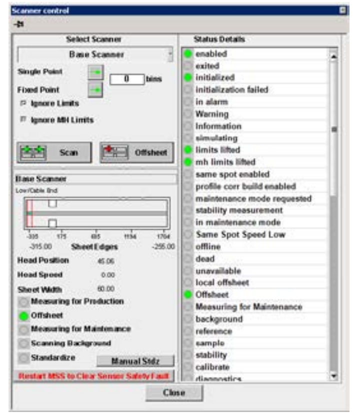


Figure 9-6: What's wrong messages on MSS webpage.

Symptom	Possible Cause	Solution
Requests for scanner motion / movement are ignored. The what's wrong messages, on the MSS web page, indicate a one of the symptoms listed below for Master Motion Controller, function 2003, position 227.	There are many conditions that cause a fault to be declared. They are listed below.	As a first attempt to reset the using either the RAE server or the frame's HMI Panel. On the RAE server, press safety reset, on scanner control panel.  On frame HMI panel, hold off sheet button until scan, offsheet, single point indicators quit flashing.
Conflicting magnets. Example message—lengths may vary: %s: Min:%.01f-Max:%.01f : %s: Min:%.01f-Max:%.01f	The scanner found a different length magnet than it expected for either the crash, limit or present magnet.	**Setup head position magnets**
Drive is not initialized	Either Initialization never finished or termination of drive low level functions was invoked.	Reset the scanner stop button(s) on frame's HMI panels, so they illuminate with a red color.
Error detecting forward %s magnet length	The length of the the magnet was not collected during forward movement. The switch may have been over the magnet, before the head started moving.	Verify the magnet detection indicators for crash and limit, turn on and off, crossing each magnet in both directions.
Error detecting reverse %s magnet length	The length of the the magnet was not collected for during reverse movement. The switch may have been over the magnet, before the head started moving.	Verify the magnet detection indicators for crash and limit, turn on and off, crossing each magnet in both directions.
Error running reset mode	During, reset mode, failed to align both heads, after detecting low limit magnets.	Verify X alignment sensor from steps in task **Verify XYZ Sensor Functionality** **Replace XYZ Sensor Assembly**

Error resetting follower position	During auto mode, the follower's static alignment failed to adjust its heads position to match the master's head position.	Verify X alignment sensor from steps in task **Verify XYZ Sensor Functionality**
		Replace XYZ Sensor Assembly
Error tagging low crash switch	During, reset mode, the low end crash magnet was not detected.	**Setup head position magnets**
		Verify the magnet detection indicators for crash and limit, turn on and off, crossing each magnet in both directions. If no magnet is detectable, **Replace Scanner Magnet Position Switch**
Error tagging low limit switch	During, reset mode, the low end limit magnet was not detected.	**Setup head position magnets**
		Verify the magnet detection indicators for crash and limit, turn on and off, crossing each magnet in both directions. If no magnet is detectable, **Replace Scanner Magnet Position Switch**
"Heads split unexpectedly message" and heads are physically split when observed	One head is blocked from moving by an obstable on the support rails.	Check for debris blocking the head progress. Reset Safety Fault.
"Heads split unexpectedly message" and heads are not physically split when observed	Erroneous head split signal from scanner.	Verify head split switch functionality.
		If required **Replace Head Split Switch**
Invalid crash switch magnet length	The detected length of the magnet triggerning the crash switch did not meet the criteria for for low end crash or high end crash magnets. The detected length of the magnet was at least 10 mm.	**Setup head position magnets**
Invalid limit switch magnet length	The detected length of the magnet triggering the limit switch input did not meet the criteria for low limit, preset or high limit magnets. The detected length of the magnet was at least 10 mm.	**Setup head position magnets**

Invalid magnet length: %s: Min:%.01f-Max:%.01f	Validate Magnet Calibration, failed. The magnet length calibration data, minimum was < 10 mm, or maximum was > 75 mm, or minimum was >= maximum.	**Setup head position magnets**
Invalid switch mask in calibrate mode	During calibration mode, there was an indication, that multiple magnets were detected at the same time.	**Setup head position magnets**
Partner in safety fault	Follower motion application had the safety fault first. The follower's safety fault caused the master to enter a fault condition.	Check both master and followers what's wrong messages, on the MSS web page, for symptoms listed on left side of this table.
Partner needs magnet recalibration	The system did not recognize the partner's magnet	**Setup head position magnets**
Power cycle required to reset encoder	The motor was probably run without a belt the software has built a a large bias for encoder counts.	Power frame down then wait one minute prior to repowering.
Reset interrupted	Reset or Calibrate modes, were interrupted with a stop command before they could be finshed	Reset the scanner stop button(s) on frame's HMI panels, so they illuminate with a red color.
Scanner stop activated	The scanner stop button on the frame UPI, is pressed in.	Reset the scanner stop button(s) on frame's HMI panels, so they illuminate with a red color.
Stop is not armed	The scanner stop button on the frame UPI, is pressed in.	Reset the scanner stop button(s) on frame's HMI panels, so they illuminate with a red color.
SetLoScanLimit: Invalid head location: %s	Head is not positioned between the low end crash and the low end scan limit magnets	**Setup head position magnets**
SetHiScanLimit: Invalid head location: %s	Head is not positioned between the high end scan limit and the high end crash magnets	**Setup head position magnets**
SetHiScanLimit: Low scan limit setting was not done	Low limit measured position or low limit stopped position were 0, indicating the data was not collected.	**Setup head position magnets**
Start timeout : Drive stalled	The actual head position never reached the location where steady movement would start within the allotted time.	Check for debris, blocking the heads. Reset Safety Fault.
	Motor failure	**Replace the Motor**

Velocity error exceeded : Drive stalled	The measured speed does not match the expected speed. The velocity error limit is the maximum of 10% of the target speed, or 5. The thread runs every 4 ms, so the speed was out of limit for 100ms.	Check for debris, blocking the heads. Reset Safety Fault.
Drive commn error : Check motor power and harnesses	The EDAQ cannot communicate with the motor controller.	Verify this failure mode by searching logs for sequence of error messages such as in **Figure 9-7** Verify cable integrity between EDAQ and motor controller.

```
Aug  3 14:12:02 edaq-p227 edaqmotion: 1470233522.001347 Generic.Error: Serial response timeout : Retries left: 3
Aug  3 14:12:02 edaq-p227 edaqmotion: 1470233522.245895 Generic.Error: Serial response timeout : Retries left: 2
Aug  3 14:12:02 edaq-p227 edaqmotion: 1470233522.491364 Generic.Error: Serial response timeout : Retries left: 1
Aug  3 14:12:02 edaq-p227 edaqmotion: 1470233522.733483 Generic.Error: Serial response timeout : Retries left: 0
Aug  3 14:12:02 mss emss: 1470233522.822580 Generic.Status: RaeCard00: SafetyStatus - MI2 Has Safety Fault
```

Figure 9-7: Series of repeated failed retries serial.

Error processing encoder time	Subscription callback function, Process Encoder. Negative delta time was detected.	Reset safety fault
Error stopping motion : Motor power disabled	Head motion was detected after the drive interface indicated it was already done moving the head. Power to the drive motor was removed by allowing the watch dog circuit to time out.	Reset safety fault
Drive control processing error	This is the default error message, from the drive interface software layer, when no specific message string is passed in. Should not see this error, as all calls to SetDriveError, seem to be passing in a specific drive error string.	Gather log file for analysis by TAC. Reset safety fault.
Error loading magnet calibration	Motion config file could not be parsed; Crash magnet, minimum or maximum lengths missing from the motion configuration file	**Setup head position magnets**
Error opening calibration file for writing	Execute Remote Command, ProcessScanLimitCommand(HiScanLimit); DCTL_SetHiScanLimit();CalibrateScanner(); was unable to open /usr/local/permanents/edaqmotion/testmode	Gather log file for analysis by TAC. Reset safety fault.
Error opening motion config file for writing	Drive Control, Save Magnet Calibration, was not able to open the drive control config file to store the magnet calibration data. The magnet calibration had to be invalidated.	Gather log file for analysis by TAC. Reset safety fault.
SetupMove: Invalid state: %s	The head was still in motion when a new move was defined for the drive	Gather log file for analysis by TAC. Reset safety fault.
StartMoving: Invalid state: %s	The head was still in motion when a new movement was requested to be started	Gather log file for analysis by TAC. Reset safety fault.
Master is not ready to init	Follower waited for over 60 seconds, for the master to be ready to initialize. The master's mode or phase, stayed invalid.	Reset safety fault, if that fails reboot EDAQ using MSS Web page.

Follower is not ready to init	Master waited for over 60 seconds, for the follower to be ready to initialize. The follower's phase, was not, Partner Wait, Command Wait, or Reset Wait.	Reset safety fault, if that fails reboot EDAQ using MSS Web page.
Follower is not ready to move	Master waited for over 60 seconds, for the follower to be ready to move. The follower's mode, was either not the same, or the phase, was not Partner Wait, or the sync number did not match.	Reset safety fault, if that fails reboot EDAQ using MSS Web page.
Error executing solo movement	Failed send move profile to drive or failed to start drive movement	Use MSS Web page to reboot the EDAQs
Error sending sync command to the partner drive	Master's Send Sync Info, EDAL write to the follower failed.	Reset safety fault, if that fails reboot EDAQs using MSS Web page.
Error sending move info to the partner drive	Master's Setup Sync Move, EDAL write to the follower failed.	Reset safety fault, if that fails reboot EDAQs using MSS Web page.
Error setting up master movement	Master's Setup Sync Move, failed to setup the drive parameters.	Reset safety fault, if that fails reboot EDAQs using MSS Web page.
Error starting sync move	Master's Start Sync Move, failed to start drive movement.	Reset safety fault, if that fails reboot EDAQs using MSS Web page.
Error setting up follower movement	Process Move Info Write, failed to put the move setup into the drive.	Reset safety fault, if that fails reboot EDAQs using MSS Web page.
Error starting follower movement	Process Sync Info Write, Sync Command Solo Move, failed to start the drive	Reset safety fault, if that fails reboot EDAQs using MSS Web page.
Error changing velocity	Move mode is not Jog; Motion state not forward or reverse; Failed to send serial command to drive.	Reset safety fault, if that fails reboot EDAQs using MSS Web page.
Error running auto mode	Logic Error, Master's next phase was not, forward move, reverse move, or command wait.	Gather log file for analysis by TAC. Reset safety fault.
Unexpected phase in calibrate mode	Logic Error, follower's next phase during calibrate mode, was not either init or command wait.	Gather log file for analysis by TAC. Reset safety fault.
Error running head split mode	Logic Error, follower's next phase during split mode, was not either align move or command wait.	Gather log file for analysis by TAC. Reset safety fault.
Error running shop mode	Logic Error, Master's next phase was not, forward move, reverse move, or command wait.	Gather log file for analysis by TAC. Reset safety fault.
Invalid drive role	Logic error in motion control application. Master was running follower code, or follower was running master code.	Gather log file for analysis by TAC. Reset safety fault.
Invalid partner mode	Logic Error, Subscription callback function, Process Partner Mode; value exceeded number of modes	Gather log file for analysis by TAC. Reset safety fault.

Invalid partner phase	Logic Error, Subscription callback function, Process Partner Phase; value exceeded number of phases	Gather log file for analysis by TAC. Reset safety fault.
Invalid phase in auto mode	Logic Error, Unknown drive phase	Gather log file for analysis by TAC. Reset safety fault.
Invalid phase in calibrate mode	Logic Error, Unknown drive phase	Gather log file for analysis by TAC. Reset safety fault.
Invalid phase in dynamic alignment	Logic Error, Follower drive phase should only be forward move or reverse move.	Gather log file for analysis by TAC. Reset safety fault.
Invalid phase in head split mode	Logic Error, Unknown drive phase	Gather log file for analysis by TAC. Reset safety fault.
Invalid phase in reset mode	Logic Error, Unknown drive phase	Gather log file for analysis by TAC. Reset safety fault.
Invalid phase in shop mode	Logic Error, Unknown drive phase	Gather log file for analysis by TAC. Reset safety fault.
Invalid phase in test mode	Logic Error, Unknown drive phase	Gather log file for analysis by TAC. Reset safety fault.
Invalid phase processing auto move command	Logic Error, Unknown drive phase, during Auto Mode.	Gather log file for analysis by TAC. Reset safety fault.
Invalid phase processing shop move command	Logic Error, Unknown drive phase, during Shop Mode.	Gather log file for analysis by TAC. Reset safety fault.
Drive in invalid mode	Logic Error, Unknown drive mode. Was not any of the following; Reset, Calibrate, Auto, Shop, Head Split, Safety Fault, or Test.	Gather log file for analysis by TAC. Reset safety fault.
Invalid sync command	Logic Error, Unknown sync command. Was not any of the following; StopMove, SyncMove, SoloMove, Align, Reset, or Calibrate.	Gather log file for analysis by TAC. Reset safety fault.
Lost head split switch state	Subscription callback function, Process Head Split Switch, EDAL status wasn't good.	Use MSS Web page to reboot the EDAQs
Lost partner mode	Subscription callback function, Process Partner Mode, EDAL status wasn't good.	Use MSS Web page to reboot the EDAQs
Lost partner phase	Subscription callback function, Process Partner Phase, EDAL status wasn't good.	Use MSS Web page to reboot the EDAQs
Lost partner position	Subscription callback function, Process Partner Position, EDAL status wasn't good.	Use MSS Web page to reboot the EDAQs
Lost partner sync number	Subscription callback function, Process Partner Sync Number, EDAL status wasn't good.	Use MSS Web page to reboot the EDAQs

Lost whats wrong subscription from partner	Subscription callback function, Process Partner Whats Wrong Info, EDAL status wasn't good.	Use MSS Web page to reboot the EDAQs
Lost wireless switch state	Subscription callback function, Process Wireless Switch, EDAL status wasn't good. Digital Input states, defining the wireless channel index	Use MSS Web page to reboot the EDAQs
Lost X sensor measurement	Subscription callback function, Process X Sensor Volts, EDAL status wasn't good.	Use MSS Web page to reboot the EDAQs
Invalid master mode transition	Master came out of head split mode before the follower. The follower performs head alignment, and should have come out of head split mode first.	Gather log file for analysis by TAC. Reset safety fault.
Error driving digital output	edaqapp is not running	Use MSS Web page to reboot the EDAQs
Error expanding drive command string	Logic Error, RunDriveCommand called with bad command string	Gather log file for analysis by TAC. Reset safety fault.
Error writing serial command to the drive	The serial port device on the EDAQ is being used by another process or is the wrong device name is used for the serial port.	Gather log file for analysis by TAC. Reset safety fault.
Error reading serial command response from the drive	The serial port device on the EDAQ, could not be read. The wrong device name may have been is used for the serial port.	Verify cable integrity between EDAQ and motor controller. **Remove and Replace the Motor Drive**
NACK received from the drive	We sent a command to the drive with the serial port, and we got a NACK message back.	Verify cable integrity between EDAQ and motor controller.
Encoder subscription failed	Subscription callback function, Process Encoder, EDAL status wasn't good.	Use MSS Web page to reboot the EDAQs
Limit switch subscription failed	Subscription callback function, Process Limit Switch, EDAL status wasn't good.	
Crash switch subscription failed	Subscription callback function, Process Crash Switch, EDAL status wasn't good.	
HMI Server subscription failed	Subscription callback function, Process Scanner Stop Interlock, EDAL status wasn't good.	
Motor brake subscription failed	Subscription callback function, Process Brake Output, EDAL status wasn't good.	
Error setting up encoder subscription	edaqapp, may not be running, or started up with different position or function codes.	Verify function and position codes, using MSS Web pages. Use MSS Web page to reboot the EDAQs.
Error setting up limit switch subscription		
Error setting up crash switch subscription		
Error setting up motor brake subscription		
Error setting up scanner stop subscription	HMI Server application may not be running on the MSS CPU.	Use MSS Web page to reboot the MSS

9.1.5. Position Control - FIO Lost Connection

The EFC application running on MSS CPU lost the EDAL connection with the field IO application running on the MSS CPU. EDAL connection criteria is, function code 2002, position code 1.

Symptom	Possible Cause	Solution
HMI Server function 2002, position 1, is missing from the list of active hosts, on the MSS Home web page.	MSS Type is not Q3090 ZipLine Scanner	Use MSS web page, click ‘Configure MSS’ Select Q3090 ZipLine Scanner, for the MSS Type.
	HMI Server application is not running on the MSS.	Use MSS Web page, click ‘Reset MSS’, and click ‘Hard Reset’

9.1.6. Position Control - MI2 - Interface Not Ready

The master motion application running on the top EDAQ sends position samples, to the EFC application running on the MSS. One of the status bits in the position sample, is the ready bit. If the ready bit is set the master motion interface is ready to accept commands for movement from the EFC application. The master motion interface will be ready to take motion commands from the EFC, once the slave and master heads, have tagged the scan limit switches, and set their head positions to a known value.

Symptom	Possible Cause	Solution
	Master and slave motion interfaces are still initializing	This is a temporary state, wait for completion of initialization.
The scanner stop button on the HMI panel is not indicating red.	Master and slave motion interfaces never allowed to initialize due to motion interlock.	Reset the scanner stop switch on the HMI panel.
Position Control - MI2 Safety Fault	Master or slave motion interface have a fault	Refer to Position Control - MI2 Safety Fault, alarm based trouble shooting section

9.1.7. Position Control - Low edge missing

To be able to dectect sheet edges, the scanner needs to be scanning over the sheet, with the edge-detecting device scanning past the sheet edges. Edge detection processing is done on either an analog input voltage or a digital input state. Generally a digital input, will be used with outboard edge detection devices, and an analog input will be used with a measurment sensor, example basis weight signal, as the edge detection device.

Symptom	Possible Cause	Solution
Edge detection quits working after loading a recipe. May or may not start working after a standardize.	The edge detection threshold voltages in the recipe, differ enough from the values calculated during standardize by the sensor processor, that the sheet edge is not detected until, the next sensor standardize.	Edit the MSS Setup, using **Recipe Maintenance display** with values that you find in the RTDR for max and min signal thresholds. Example RTDR Path: ./Scanner 1/Mss/Lo cable end/Max signal threshold
	The new recipe, may call out a different edge detection setup or edge detection device.	Check edge detection setup parameters, on the **Scanner Positioning** display.
		Use the **Recipe Maintenance** display to compare the edge detection setup parameters, used for the previous and current recipes.
Outboard edge detected LED indicator, does not change states, when crossing the edge of sheet	Outboard edge detector has dust build-up or debris blocking its optics	Clean dust build-up or remove the debris on the cross direction outboard edge detection sensor
		Check the sensor’s air purge operation
	Outboard edge detection hardware not operating properly	Check electrical connections and trigger LED on cross direction outboard edge detection sensor
Sheet edge is not detected, or is detected every other scan.	Edge detection device is not crossing the edge of the sheet at low / cable end of the frame.	Decrease the low / cable end scan position and / or increase the low / cable end turn around distance, on the **Scanner Positioning** display.
Sheet edge not detected, even though the edge-detecting device crosses the edge of sheet at the low / cable end of frame.	The edge of sheet is outside of the edge detection zone.	Adjust the low / cable end, max and min edge detection positions, on the **Scanner Positioning** display.
	The edge of sheet is outside of the bucketizing zone. The process may have been changed and the sheet is now running closer to the low cable end of the frame; or the bucketizing zone was too small when the measurement system was originally setup.	Increase the bucketized sheet width, and lower the low end offset, on the **MSS Scanner Calibration** display. Note: You’ll probably need to run profile correction, and re-align the CD acturator controls, if you change the location of the bucketizing zone on the scanner.
	The physical position of the outboard edge detector was moved	Check edge detection offset setup parameters, on the **Scanner Positioning** display.
Indicated head position, does not match physical head position.	Head position drifted over time, because the preset compensation was disabled. The position given to the edge transition is outside the edge detection zone.	Enable P2 - Forward Preset Switch, Adjust Position, on the **MSS Scanner Calibration** display
	Scan limit or preset magnets my have been moved.	Recalibrate the head position, using the **MSS Scanner Calibration** display.

Symptom	Possible Cause	Solution
Sheet edge is not detected, and voltage from the sensor we are using as the edge detection device, is skewed or offset, when viewed on the **MSS Scan Voltages** display.	The voltage from the sensor is lower than expected due to debris in the gap.	Clean the gap between the sensor heads.
	The sensor heads are mis-aligned in the cross direction, causing the voltage from the sensor to be lower than expected.	Check head alignment.
Sheet edge is not detected	Edge detection software not set up properly	Check edge detection setup parameters, on the **Scanner Positioning** display.

9.1.8. Position Control - High edge missing

To be able to dectect sheet edges, the scanner needs to be scanning over the sheet, with the edge-detecting device scanning past the sheet edges. Edge detection processing is done on either an analog input voltage or a digital input state. Generally a digital input, will be used with outboard edge detection devices, and an analog input will be used with a measurment sensor, example basis weight signal, as the edge detection device.

Symptom	Possible Cause	Solution
Edge detection quits working after loading a recipe. May or may not start working after a standardize.	The edge detection threshold voltages in the recipe, differ enough from the values calculated during standardize by the sensor processor, that the sheet edge is not detected until, the next sensor standardize.	Edit the MSS Setup, using **Recipe Maintenance display** with values that you find in the RTDR for max and min signal thresholds. Example RTDR Path: ./Scanner 1/Mss/Lo cable end/Max signal threshold
	The new recipe, may call out a different edge detection setup or edge detection device.	Check edge detection setup parameters, on the **Scanner Positioning** display.
		Use the **Recipe Maintenance** display to compare the edge detection setup parameters, used for the previous and current recipes.
Outboard edge detected LED indicator, does not change states, when crossing the edge of sheet	Outboard edge detector has dust build-up or debris blocking its optics	Clean dust build-up or remove the debris on the cross direction outboard edge detection sensor
		Check the sensor's air purge operation
	Outboard edge detection hardware not operating properly	Check electrical connections and trigger LED on cross direction outboard edge detection sensor
Sheet edge is not detected, or is detected every other scan.	Edge detection device is not crossing the edge of the sheet at high / other end of the frame.	Increase the high / other end scan position and / or increase the high / other end turn around distance, on the **Scanner Positioning** display.
Sheet edge not detected, even though the edge-detecting device crosses the edge of sheet at the low / cable end of frame.	The edge of sheet is outside of the edge detection zone.	Adjust the high / other end, max and min edge detection positions, on the **Scanner Positioning** display.
	The edge of sheet is outside of the bucketizing zone. The process may have been changed and the sheet is now running closer to the high other end of the frame; or the bucketizing zone was too small when the measurement system was originally setup.	Increase the bucketized sheet width, and or increase the low end offset, on the **MSS Scanner Calibration** display. Note: You'll probably need to run profile correction, and re-align the CD acturator controls, if you change the location of the bucketizing zone on the scanner.

Symptom	Possible Cause	Solution
	The physical position of the outboard edge detector was moved	Check edge detection offset setup parameters, on the **Scanner Positioning** display.
Indicated head position, does not match physical head position.	Head position drifted over time, because the preset compensation was disabled. The position given to the edge transition is outside the edge detection zone.	Enable P2 - Forward Preset Switch, Adjust Position, on the **MSS Scanner Calibration** display
	Scan limit or preset magnets my have been moved.	Recalibrate the head position, using the **MSS Scanner Calibration** display.
Sheet edge is not detected, and voltage from the sensor we are using as the edge detection device, is skewed or offset, when viewed on the **MSS Scan Voltages** display.	The voltage from the sensor is lower than expected due to debris in the gap.	Clean the gap between the sensor heads.
	The sensor heads are mis-aligned in the cross direction, causing the voltage from the sensor to be lower than expected.	Check head alignment.
Sheet edge is not detected	Edge detection software not set up properly	Check edge detection setup parameters, on the **Scanner Positioning** display.

9.1.9. Position Control - In simulate

The emss application running on the MSS is simulating one or more of its job sets. Simulation may have been turned on to test some application software before there was sensor hardware available in the scanner. This alarm has nothing directly to do with the position control job set. It was placed into the job set to leverage, the job set alarm processing logic done by RAE Vis.

Symptom	Possible Cause	Solution
Actual scanner sensor data not displayed	MSS is simulating one or more of its job sets	Make sure scanner is not scanning. Turn off job set simulation. Do send kill, from the **MSS Monitor** Display

9.1.10. Position Control - Bad alignment

The detected sheet edges or scan positions, need to be in the zone where we are bucketing data, so the rest of the system works correctly with profile (array) data. In RAE 600, additional tests were added to limit the values opertors could use for edge detection zones, which should reduce the likely of this alarm occurring.

Symptom	Possible Cause	Solution

This alarm	One or both of the MSS edge positions are outside of the zone where we are bucketzing sensor data. Edge position was less than the low end offset, or edge position was greater than the sum of low end offset plus bucketized sheet width.	Verify the the low end offset, and bucketized sheet width on the **MSS Scanner Calibration** display follow the guide lines given in the insturctions on the display.

9.1.11. Position Control - P1/2/3/4 latch unstable

Symptom	Possible Cause	Solution
Px latched head position unstable; differs from the calibration position more than movement adjustment allows	Magnet physically moved from expected position	**Setup head position magnets**
	When the head recognized the appropriate preset or limit magnet, the number of reported steps executed by the motor did not match the expected number. Only the motion of the upper head is used to determine the position of the bin position of the measurement.	Verify drive belt adequately tensioned and engaged with gear teeth. If required replace the drive belt by following instructions in task **Remove and Install the Scanner Drive Belt**

9.1.12. Position Control - Frame in manual mode

Symptom	Possible Cause	Solution
Scanner will not scan under control of MxProline. MSS What's wrong message indicates "Frame is in manual mode, check the Auto / Man / Shop / Split selection on UPI"	Frame is in manual mode.	Toggle the system back to host mode via the HMI user panel.

9.1.13. Position Control - Stop armed is open

The alarm is triggered when the stop button on any user panel is pressed.

Symptom	Possible Cause	Solution
Scanner was scanning and then stopped (potentially not in parked position) or the scanner is parked but will not scan	**Stop** buttons pushed in to *stop* position (**Stop** buttons are buttons located at end of each scanner) When scanner is free to scan they illuminate in red, when scanner is stopped they do not illuminate.	Check **Stop** buttons on all user panels.
	Stop armed interlock no longer enabled. This field IO connects to the scanner HMI panel and is indicated by a labeled yellow. This IO must be closed to eliminate this alarm.	Check yellow indicator on HMI panel for status—LED labeled “STOP ARMED” will be illuminated when ZipLine is free to scan. If extinguished, verify external circuit connected to HMI controller card 6580500128 TB1-7 and TB1-8. If no field external circuit is present, these pins should be jumped together.
System is being staged or tested and scanner will not scan	Stop armed interlock no longer enabled. This field IO connects to the scanner HMI panel and is indicated by a labeled yellow. This IO must be closed to eliminate this alarm.	Jump closed the stop armed input on HMI controller card 6580500128 TB1-7 and TB1-8.

9.1.14. Sensor Manager - Scan disabled

Symptom	Possible Cause	Solution
Scanner was scanning, then went offsheet. Scanner will not begin scanning.	Scan-enable interlock is no longer enabled. Signal may be derived by a hardware interlock (for example, sheet threader, safety gate), or through a PLC or DCS system. System is being staged or tested and scanner will not scan. Off-machine, scan-enable signal needs to be simulated with a jumper.	Check yellow indicator on HMI panel for status—LED labeled “SCAN ENABLE” will be illuminated when ZipLine is free to scan. If extinguished, verify external circuit connected to HMI controller card 6580500128 TB1-5 and TB1-6. If no field external circuit is present, these pins should be jumped together.

9.1.15. Sensor Manager - MSS emss SW Version

MSS emss SW version is too low. Additional job set tasks, or card drivers are needed, to work with this version of RAE. The test is not perfect, as it rquires the sensor manager job set to be able to run to send the emss application version info, to RAE.

Symptom	Possible Cause(s)	Solution (Tasks)
This alarm or some of the job sets stuck in restart.	RAE was updated but the scanner software was not.	Upgrade scanner MSS and EDAQ software to latest MSS SW 2.x.x supported release

9.1.16. Sensor Manager - EDAQ IO Not Ready

See section **9.1.1**.

9.1.17. Sensor Manager - EDAQ IO Time Stamps

See section **9.1.2**.

9.1.18. Sensor Manager - Host Alive Time Out

LabView Quit sending Host Alive to the MSS. Scanner was placed off sheet local mode, with safety failed. The host alive message, trigger by labview code, is periodically sent to the sensor manager job set, to refresh a timer. The intent being, if LabView goes away, but the MSSLink.exe, is still talking to the RTDR, the scanners will be enventually sent off sheet.

Symptom	Possible Cause	Solution
Only the sensor manager job set has the safety test failed, set in the RTDR.	Communication between RAE server, and MSS, was delayed for a long time.	Resolve server-to-MSS communication issue. Press Restart MSS to clear safety fault.
	Sensor had a safety fault, and was cleared by some other means. Example rebooting an EDAQ	Restart MSS to clear safety fault.

9.1.19. Sensor Manager - MSS Reboot Required

The MSS is indicating it needs to be rebooted. It is possible the disk access is read only.

Symptom	Possible Cause(s)	Solution (Tasks)
This Alarm	Internal MSS issue detected, such as a faulty disk partition	A restart from the MSS main web page allows the system to perform hard disk checks and correct errors.

9.1.20. Sensor Manager - MSS TCP Retransmission Rate Too High

MSS TCP Retransmit Ratio is High. MSS was requested to resend a multitude of packets.

Symptom	Possible Cause(s)	Solution (Tasks)
Intermittent network failures on scanner's / RAE sever's MSS LAN.	Failing Ethernet cable	Use cable tester, or different cable
Network connection is using, a slower than expected bit rate. Example 10 mbps instead of 100 mbps	Ethernet cable not seated correctly	Reseat Ethernet cable
Seems to communicate ok, until scanning starts (higher network load).	Switch used between the MSS and RAE Sever, has Incorrect port settings	Settings on the switch port, which is connected to the MSS, should be auto-negotiate
Intermittent network failures on scanner's sensor LAN	Wireless signal interface	Check antenna alignment / connections, in scanner heads and end of frame. Verify wireless adapter is securely seated in the EDAQ's USB port. Replace Wireless Adapter

9.1.21. Sensor Manager - MSS TCP Loss Ratio Too High

MSS TCP Loss Ratio is High. The MSS had to request a lot packets to be resent to it. (Missing sequence number).

Symptom	Possible Cause(s)	Solution (Tasks)
Intermittent network failures on scanner or RAE network	Failing Ethernet cable	Use cable tester, or different cable
Network connection is using, a slower than expected bit rate. Example 10 mbps instead of 100 mbps	Switch used between the MSS and RAE Sever, has Incorrect port settings	Settings on the switch port, which is connected to the MSS, should be auto-negotiate

Intermittent network failures on scanner's sensor LAN	Wireless signal interface	Check antenna alignment / connections, in scanner heads and end of frame. Verify wireless adapter is securely seated in the EDAQ's USB port. **Replace Wireless Adapter**

9.1.22. Sensor Manager - In Off Near

Frame In Off Sheet To Nearest Side Mode To Clear Press Off Sheet. The Mode Will Not Clear If Lump Condition Still Exists.

Symptom	Possible Cause	Solution
Scanner refuses movement commands	Lump Detect, digital input on field IO interface triggered.	Press offsheet

9.1.23. Sensor Manager - UPI EDAL Com Down

The EFC application in the MSS is not communicating with the User Panel Interface (HMI server) application in the MSS.

Symptom	Possible Cause	Solution
HMI Server, function code 2002, position code 1 does not show up in the list of active hosts, on the MSS Home web page.	HMI server application is not running on the MSS computer.	Do a hard reset, using the **Reset MSS**, MSS web page.

9.1.24. Sensor Manager - UPI 1/2 Com Down

The MSS HMI Server application is not communicating with User Panel Interface #1.

Symptom	Possible Cause	Solution
No indicators lit on the front of the local HMI panel	Local HMI panel power / communications missing	Check Fuse F4, TS2 on the electrical panel assembly located at the end of the frame
		Check P18 connection, for MSS COMM and POWER, on local HMI Controller Board
		Check DB9 connection on MSS CPU
	Failed hardware	**Replace HMI panel and/or control boards**
No indicators lit on the front of the remote HMI panel	Remote HMI panel power / communications missing	Check P21 connection, for MSS COMM and POWER, on local HMI Controller Board
	Failed hardware	**Replace HMI panel and/or control boards**
HMI Panel not responsive to user requests.	Communications missing	Check DB9 connection on MSS CPU
	Incorrect panel address selection	Verify orientation of cable connecting remote and local HMI panels. Panel Address Bit 0, on HMI Controller Board is determined from the cable that plugs into the P21 connection for RS485 COMM AND Power. The local end of the cable has a jumper on pins 7 & 8, the other, remote end of the cable, the pins are open.
		Panel Address Bit 1, P11 on HMI Controller Board
	Default setting were modified in RAE	Verify user panel interface selections on the **MSS EFC Miscellaneous Setup** display
	Failed hardware	**Replace HMI panel and/or control boards**

9.1.25. Sensor Manager - MSS CPU core temp high

Symptom	Possible Cause	Solution
MSS CPU core temperature has exceeded set limit	MSS fan failed	Check case fan on electronics panel for proper wiring, power connection, and operation. If required **Replace MSS fan**

Symptom	Possible Cause	Solution
	Temporary temperature excursion	Set up trend to track temperature and correlate to mill environmental issues.
	Temperature limit set too low	Check temperature limit. Limit value can be found at RTDR path: *./Scanner 1/Mss/Sensor manager/Job set/Mss cpu core temp/Limit*. Default value is 80°C (176 °F).

9.1.26. Sensor Manager - Scan disabled

See section **9.1.14**.

9.1.27. Sensor Manager - In break

Symptom	Possible Cause	Solution
Scanner has stopped in offsheet location due to a safety interlock	FC break I/O input triggered by external signal	Clear external break signal
		Press **Offsheet** or **Scan**
	If no sheet break has occurred, break I/O input to scanner may have an issue.	Check yellow indicator on HMI panel for status—LED labeled “SHEET BREAK” will be extinguished when ZipLine is free to scan. If illuminated, verify external circuit connected to HMI controller card 6580500128 TB1-9 and TB1-10.
	If no break I/O connected, signal may originate in RAE system as an application specific customization	Application specific

9.1.28. Performance – Upper air pressure low

This alarm relates only to scanners including an air driven solenoid for Sx18 basis weight sensors.

Symptom	Possible Cause	Solution
Air pressure reported to be low and shutter cannot be actuated effectively	Inadequate pressure command to micro-compressor	Adjust lower pressure threshold for compressure activation. See **Set and verify pressure control settings**

Symptom	Possible Cause	Solution
	Low air pressure due to failure in pneumatic system	Verify hoses and clamps are leak free. See trending instructions from task **Set and verify pressure control settings**and verify system can hold pressure adequately.
	Low air pressure due to failed compressor	**Replace Air Compressor**
Air pressure reported to be low and shutter can be actuated effectively	Pressure measurement error—likely compressor will be running 100% duty cycle unnecessarily	Verify pneumatic connections to pressure sensing chip on power distribution board.
		Replace Head Power Distribution Board

9.1.29. Performance – Upper 24V monitor low

Symptom	Possible Cause	Solution
24V monitor low alarm on a single head	Nuisance alarm from inappropriate alarm setting.	Measure voltage at head on power rail with mutli-meter and ensure reported reading is accurate. Ensure alarm lower limit is set a 23 (Volts). Example RTDR is path is: */scanner 1/mss/ss1 performance/job set/upper 24 volt power supply/limit* Disable alarm if required on the following RTDR path: */scanner 1/mss/ss1 performance/job set/upper 24 volt power supply/enabled*
	Poor contact between brush and power rail	Verify all 24V and ground brush contact to 24V and return rail is satisfactory. **Verify Power Brush Tracking**. If required **Replace Power Brushes** and/or **Replace Ground Brushes**.

Symptom	Possible Cause	Solution
	Excessive current draw inducing a potential drop as the current flows down the power cable.	Plot 24V signal and determine if it drops as measurement modules move away from power supply connection. Check for unwanted shorts in impacted head inducing excessive currents. Disconnect sensor for example and scan with measurement modules only. Sloping pontential can be rectified by running an additional wire to carry power from the DC power supply to the far end of the scanner. Contact TAC for parts list to accomplish.
24V monitor low alarm on both upper and lower modules simultaneously	Low output from power supply.	Measure power supply at end bell. Verify 24V is provided. Adjust power supply output.
	Excessive current draw from specific head	Disconnect one head at a time. See if excessive current draw is being drawn from an individual head.
	Failed power supply	**Replace power supply**

9.1.30. Performance – Lower 24V monitor low

See section **9.1.29**.

9.1.31. Performance – Upper ambient temperature too high

Symptom	Possible Cause	Solution
Ambient temperature too high alarm	Nuisance alarm from inappropriate alarm setting.	Verify the alarm value is set to a sensible value. The RTDR path for this alarm is: */scanner 1/mss/ss1 performance/job set/upper ambient temp/limit*

Symptom	Possible Cause	Solution
	Incorrect reading	Read the head's reported ambient temperature and verify it makes sense with an independent temperature reading. The ambient temperature reading is taken outside the head just inside the extrusion that spans the suppor and power rails. If the reading is grossly incorrect, replace thermistor assembly 6580801960. The recommended ambient limit for a ZipLine system with cooling kit is 50ºC. It is 40ºC for a system without.
	Temporary excursion	Trend the temperature variable and determine if this is a temporary excursion or permament condition.
	Permanent excursion	If one cannot influence the process temperature, upgrade your ZipLine modules to include the cooling kit model 6509309120.

9.1.32. Performance – Upper motor enclosure temperature too high

Symptom	Possible Cause	Solution
Ambient temperature too high alarm	Nuisance alarm from inappropriate alarm setting.	Verify the alarm value is set to a sensible value. The RTDR path for this alarm is: */scanner 1/mss/ss1 performance/job set/upper motor enclosure temp/limit* The default setting is 55ºC.
	Incorrect reading	Read the enclosure's reported temperature and verify it makes sense with an independent temperature reading. The reading is taken inside the motor cavity. If the reading is grossly incorrect, replace thermistor assembly 6580801960.
	Temporary excursion	Trend the temperature variable and determine if this is a temporary excursion or permament condition.

9.1.33. Performance - EDAQ IO Not Ready

See section **9.1.1**.

9.1.34. Performance - EDAQ IO Time Stamps

See section **9.1.2**.

9.1.35. Performance - TOP EDAQ FPGA Error

Top EDAQ sensor safety test failed. An anomalous behaviour in the FPGA was detected.

Symptom	Possible Cause	Solution
FPGA chip on the EDAQ failed to return new or good data.	EDAQ PCB failed temporarily.	Cycle power on impacted head EDAQ.
	EDAQ PCB failed permanently.	

9.1.36. Performance - TOP EDAQ Time Synch

The Top EDAQ time synch test failed. The EDAQ's local time is too far (more than 1 second) from the master clock in the MSS.

Symptom	Possible Cause	Solution
The last update time, and local time differ by large amount on the **Detailed EDAQ Info** MSS web page.	Presicion Time Protocol Deamon is not running.	Verify EDAQ process status, using MSS **Home** web page. Hover over the circles “process status” column. Either “ptpd.arm” or “ptpd.x86” should be running. See **Error! Reference source not found.**. Reboot EDAQ, using MSS Web pages.
	Presicion Time Protocol Deamon is running but not able to track the master clock.	Reboot EDAQ, using MSS Web pages.

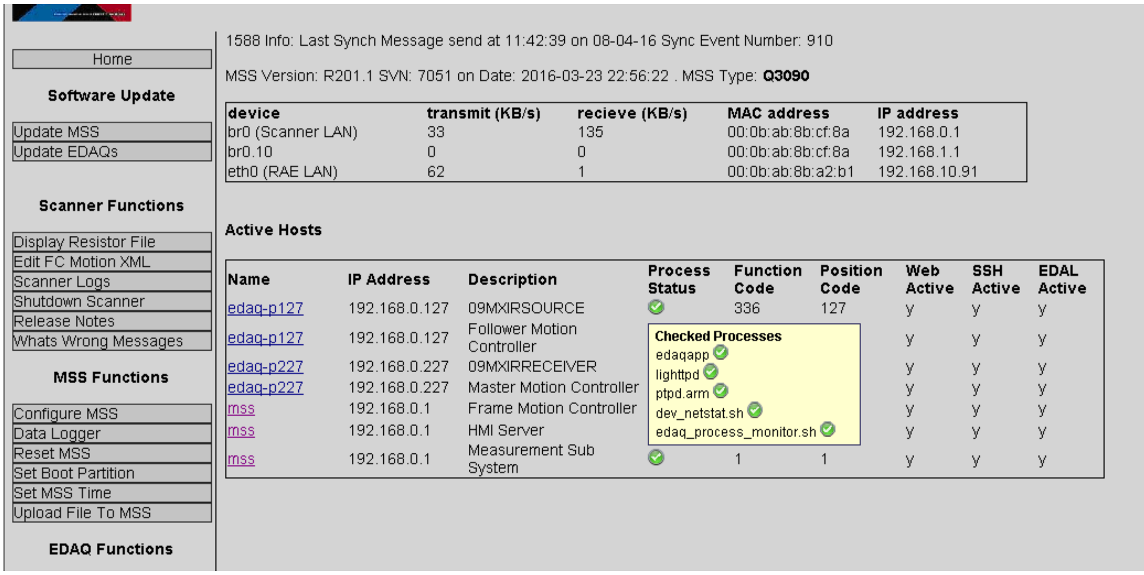


Figure 9-8: Verify time synchronization applications are running.

9.1.37. Performance - BTM EDAQ FPGA Error

See section **9.1.35**.

9.1.38. Performance - BTM EDAQ Time Synch

See section **9.1.36**.

10. Storage, Transportation, End of Life

This chapter summarizes Honeywell policy with regards to the storage and disposal of Q4000-80 system components.

10.1. Storage and transportation environment

In order to maintain integrity of system components, the storage, and transportation of all equipment must be within the parameters shown in Table 10-1.

Table 10-1 Storage and Transportation Parameters

Duration of Storage	Acceptable Temperature Range	Acceptable Humidity Range
Short Term: less than one week	-20–45 °C (-4–113 °F)	20–90% non-condensing
Long Term	-10–40 °C (14–104 °F)	20–90% non-condensing

10.2. 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.

Guidelines for disposal of equipment by Honeywell or the customer for sensor-specific materials are as described in Subsection 10.2.1.

10.2.1. Solid materials

- metals should be recycled, and in many cases have value as scrap
- remove all non-metallic parts (except plastic) from the sensor and dispose through the local refuse system
- recycle plastic parts if possible
- wire and cabling should be removed and recycled; the copper may have value as scrap

Electrical and electronic components (for example, solder, circuit boards, batteries, and oil-filled capacitors) should be recycled or handled as special waste to prevent them from being put in a landfill, as there is potential for lead and other metals leaching into the ground and water.

Also contact Honeywell Certified Recycled Parts center.