Honeywell

Rubber Thickness Measurement

System Manual

6510020471

Rubber Thickness Measurement

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Notice

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Introduction

The purpose of this manual is to provide an introduction to the Rubber Thickness Measurement system.

ATTENTION

The terms *Rubber Thickness Measurement*, and *Rubber Thickness sensor*, refer to the *Rubber Thickness Measurement* system, and may be used interchangeably in this manual.

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 nine chapters and an appendix.

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

Chapter 2, **System Components**, describes what paper fiber orientation is, how the papermaking process can affect it, and how to rectify some common fiber orientation problems.

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

Chapter 4, **Installation**, describes installation and set up tasks for the system.

Chapter 5, **Sensor Setup and Recipes**, describes operation of the system.

Chapter 6, **Operations**, describes software configuration parameters for the system software.

Chapter 7, **Maintenance and Troubleshooting**, describes recommended maintenance, and some symptoms, possible causes, and diagnostic or troubleshooting tasks.

Chapter 8, **Storage, Transportation, and End of Life**, describes methods for storing, transporting, and disposing sensor components.

Chapter 9, **Glossary**, describes the terms and acronyms used in this manual.

Appendix A, **Part Numbers**, lists the component part numbers for this system.

Related reading

The following documents contain related reading material.

Part Number	Document Title / Description
29706E2.0	VN Series Thickness Measurement Converter Instruction Manual. Available for download from SHINKAWA Sensor Technology, Inc. website.
6510020381	Experion MX MSS and EDAQ Data Acquisition System Manual

Conventions

The following conventions are used in this manual:

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

`Boldface`	Boldface characters in this special type indicate your input.
`Special Type`	Characters in this special type that are not boldfaced indicate system prompts, responses, messages, or characters that appear on displays, keypads, or as menu selections.
Italics	In a command line or error message, words and numbers shown in italics represent filenames, words, or numbers that can vary; for example, filename represents any filename. In text, words shown in italics are manual titles, key terms, notes, cautions, or warnings.

Boldface	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]** is the key you press to enter characters or commands into the system, or to accept a default option. In a command line, square brackets are included; for example: **SXDEF 1 [ENTER]**
[CTRL]	**[CTRL]** is the key you press simultaneously with another key. This key is called different names on different systems; for example, **[CONTROL]**, or **[CTL]**.
[KEY-1]-KEY-2	Connected keys indicate that you must press the keys simultaneously; for example, **[CTRL]-C**.
Click	Click means to position the mouse pointer on an item, then quickly depress and release the mouse button. This action highlights or “selects,” the item clicked.
Double-click	Double-click means to position the mouse pointer on an item, and then click the item twice in rapid succession. This action selects the item “double-clicked.”
Drag X	Drag X means to move the mouse pointer to X, then press the mouse button and hold it down, while keeping the button down, move the mouse pointer.
Press X	Press X means to move the mouse pointer to the X button, then press the mouse button and hold it down.
ATTENTION	The attention icon appears beside a note box containing information that is important.
CAUTION	The caution icon appears beside a note box containing information that cautions you about potential equipment or material damage.
WARNING	The warning icon appears beside a note box containing information that warns you about potential bodily harm or catastrophic equipment damage.

1. System Overview

This chapter provides a general system overview of the Rubber Thickness sensor.

1.1. Product description

The Rubber Thickness sensor is a contacting gauge that determines the thickness of non-conductive materials, such as plastic or rubber covering a steel (or conductive) roll, or other surface. The gauge rides on the surface of the material, and uses an Eddy Current sensor to determine the distance to the conductive surface below and provide a measurement of the thickness of the product.

The Rubber Thickness sensor can be used in industrial applications where accurate, high-speed measurement of material thickness is required. In calendering applications, the sensor can be used to measure the thickness of material, such as plastic or rubber sheeting, while the material is still in contact with the calender rolls.

The sensor is unaffected by water, oil, dust, and other material that might affect optical, ultrasonic, or X-ray systems. It is compact and easy to install.

1.2. Eddy current measurement principle

Eddy current sensors are a well established, well understood, mature technology. They consist of a wire coil embedded in a sensing probe, which can be quite small, and a box containing associated electronics for power and signal conditioning. The box and the coil are connected by a cable, which can be several meters long.

Eddy current sensors use magnetic fields. An electromagnetic circuit drives an alternating current in the sensing coil at the end of the probe. This creates an alternating magnetic field in the coil, which induces small currents in the surface, or *skin*, of the nearby target material. These currents are called *eddy currents*, and they create an opposing magnetic field that resists the field being imposed by the probe coil.

The magnetic fields interact and change the impedance of the sensing coil. The magnitude of the change depends on the distance between the probe and the target. The impedance change is converted through circuitry to a voltage that is proportional to the distance between the coil and the target.

High-end eddy current sensors are designed to be very linear, stable with temperature, and very sensitive. Typical sensitivities are 1 mV change in voltage for a 1 µm change in distance.

Eddy current sensors require a conductive target, or at least a target with a conductive skin that can sustain eddy currents. They function best if the target is more than three times the size of the probe. The strength of the eddy currents depends on the type of metal.

1.3. Hardware overview

The basic sensor system consists of:

- the retraction arm (either upward or downward facing, as required)
- the touch roller (mounted on the retraction arm)
- the eddy current sensor probe (mounted in the touch roller)
- the connecter cable
- the control cabinet (connected to the sensor with the connecter cable), which contains all the electronics required to power, read out, and control the sensor

A single control cabinet can support up to three eddy current sensors. The control cabinet requires:

- power
- optional water cooling (to keep the interior of the box cool)
- clean air for actuating the retraction mechanisms
- optional line speed input

- a dedicated Ethernet connection to an MXProLine server configured with the rubber caliper processor.

The MXProLine server is sold separately. It may be configured for monitoring purposes only (and will report on rubber thickness), or it may be expanded to include control functionality using the rubber thickness sensor measurements to control calender operation.

The sensor is factory-calibrated and, after offsets have been determined as described in Chapter 5, does not require onsite calibration.

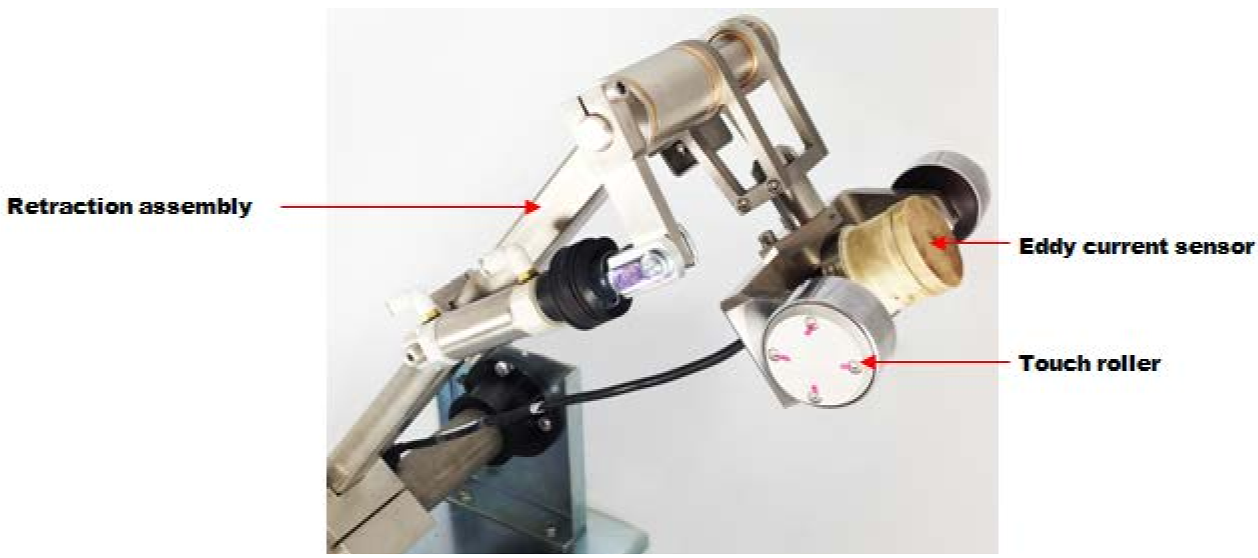


Figure 1-1 System Components

Figure 1-2 shows the control cabinet interior instrumented for a single sensor.

Figure 1-2 Control Cabinet Interior

The eddy current sensor rides a known and fixed distance (*L2* in Figure 1-3, set to 800 µm) above the wheels. The sensor measures the distance *L1* to the conductive surface below it; in this instance, the steel calender. The thickness of the product the wheels ride on may be easily determined.

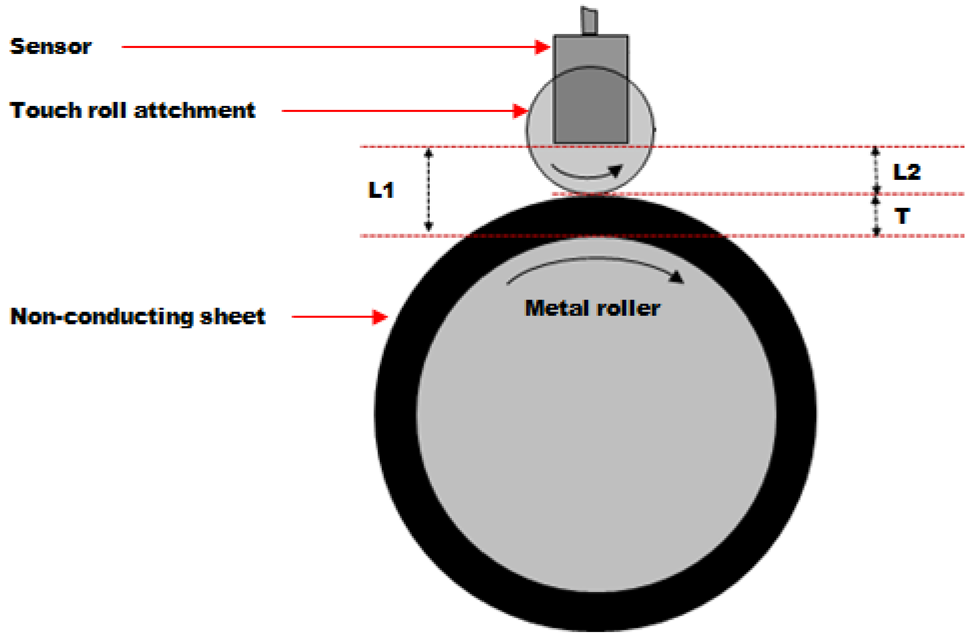


Figure 1-3 Measurement Principle

1.3.1. Wheel options

For applications with very tacky or sticky product, optional Teflon® or special low-friction nickel-plated wheels can be ordered.

In some extreme situations, stickiness may mean that the contacting sensor cannot be used.

1.4. System configurations

The typical system configuration consists of three rubber thickness sensors per calender, with a single control cabinet. Usually, two of the sensors are located at the outer edges of the gum sheet, and one is located in the middle, providing measurements for control.

Figure 1-4, Figure 1-5, and Figure 1-6 show possible mounting options for different calender configurations (the red block arrows represent possible measuring locations).

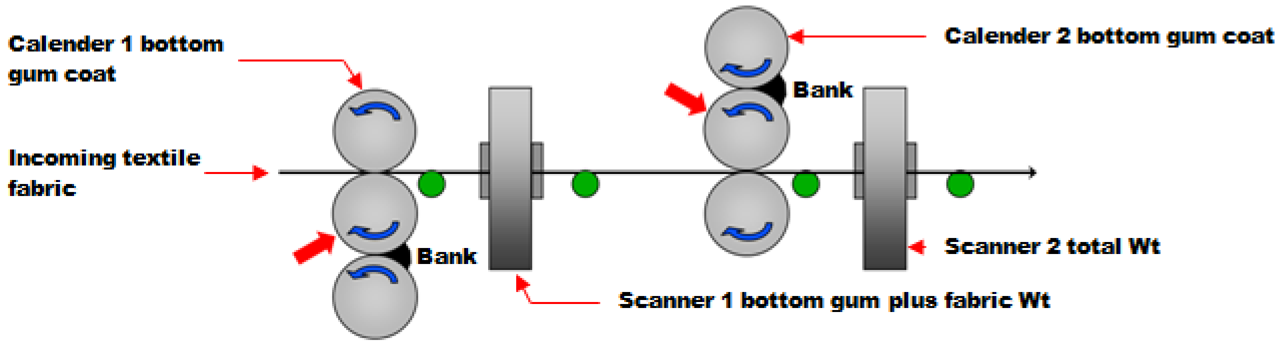


Figure 1-4 Three-roll Tandem Calender Configuration

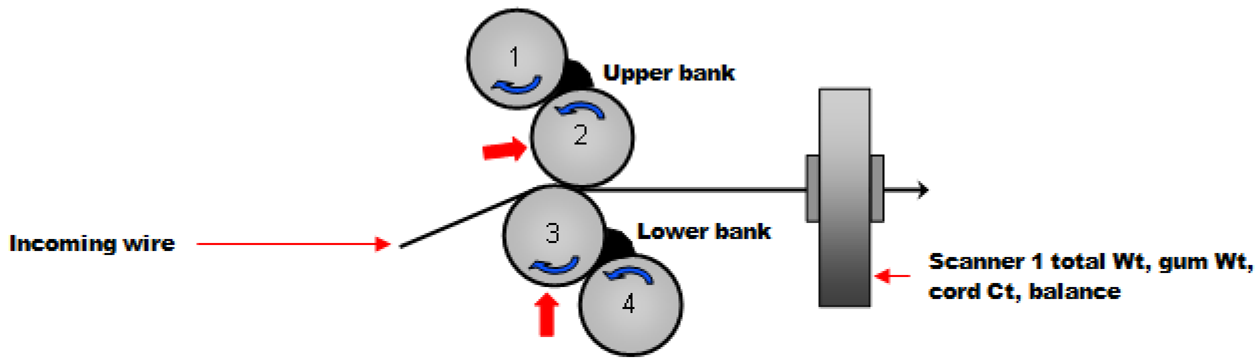


Figure 1-5 Four-roll Z-calender Configuration

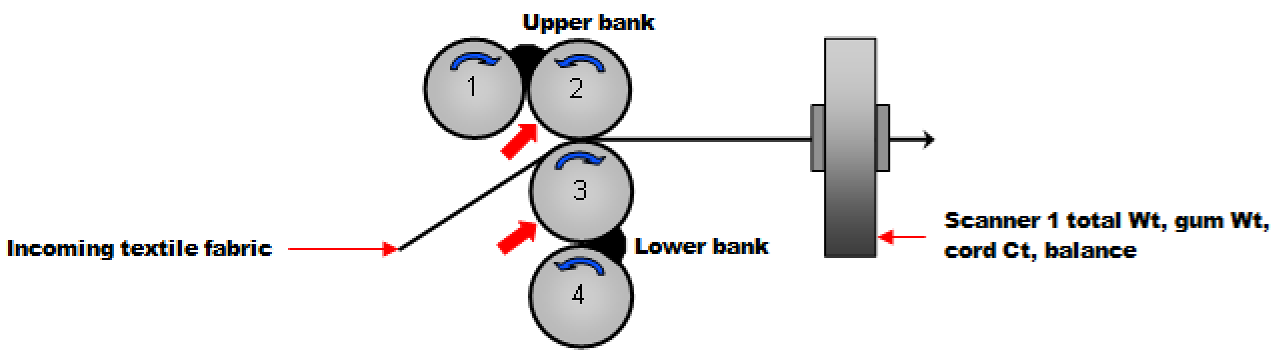


Figure 1-6 Inverted L-calender Configuration

1.5. Specifications

The general performance specifications of the sensor are listed in Table 1-1.

Table 1-1 Performance Specifications

Item	Specification
Thickness range	0-10 mm (0–0.4 in.); 2 mm (0.08 in.), 5 mm (0.2 in.), and 10 mm (0.39 in.) sensors available
Thickness measurement repeatability; lab environment, 23–27 °C (73.4–80.6 °F)	2 microns (2-sigma)
Linearity; lab environment, 23–27 °C (73.4–80.6 °F)	0.5% of full scale (2-sigma)
On-process accuracy	1% of full scale (2-sigma)
Maximum operating temperature	Sensor 130 °C (266 °F); cable 85 °C (185 °F)
Measurement rate	Data acquisition at 4 kHz
Spot size	< 50 mm (1.2 in.)
Sensor temperature sensitivity	1 micron per degree Celsius if *shocked* more than 50 °C (122 °F) between offsheet and onsheet conditions; otherwise, negligible
Power requirements	115 V,15 Amp AC or 220 V, 7.5 Amp AC and 50/60 Hz
Options	Teflon or Ni-coated wheels for sticky products
Software	MXProLine and RAE 6.10

2. System Components

The Rubber Thickness sensor is supplied for use in a Honeywell MXProLine system only. The sensor can be mounted in a variety of configurations, in either an upward or downward facing orientation.

This chapter describes the various hardware components of the sensor, and covers the basics of operation and servicing.

See Chapter 4 for detailed installation instructions.

2.1. Hardware description

The Rubber Thickness sensor consists of the following components:

- Eddy Current probe and integral thermocouple
- touch roller
- retraction arm and mounting clamp, together with air lines

The system includes the following additional parts:

- signal cables (one for the thermocouple; one for the Eddy Current sensor)
- control cabinet (can service up to three sensors) with power, air supply, and optional water cooling
- air lines for retraction and insertion
- Ethernet connection to the MXProLine server

Figure 2-1 shows the basic components of the Rubber Thickness sensor.

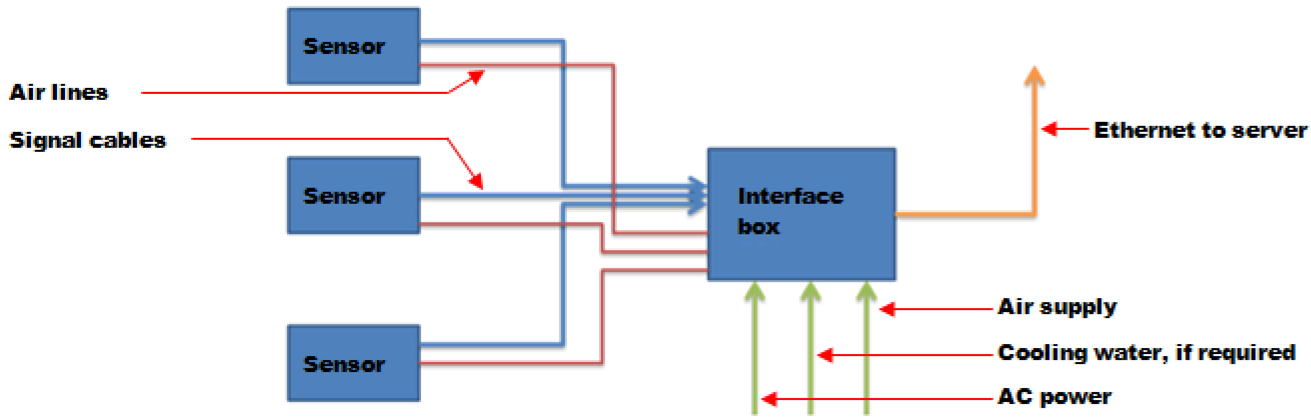


Figure 2-1 Component Diagram

2.1.1. Eddy Current probe

The Eddy Current probe is a third-party sensor manufactured by Shinkawa Electric Co., Ltd. of Japan. It is an extremely robust sensor, and no maintenance is required on the probe other than keeping the probe tip free of obstructions.

There are three sizes currently supported, each with a different optimal measurement range:

- 0–2 mm (0–0.08 in.)
- 0–5 mm (0–0.2 in.)
- 0–10 mm (0–0.4 in.)

In general, the larger the range of the sensor, the less accurate it will be at the lower range of operation.

The probe has an integral thermocouple, which serves to read the body temperature. Because the response of the probe is sensitive to rapid thermal shock of over 50 °C (122 °F), the thermocouple may be used to correct the thickness readings in situations where the temperature cycles steeply.

The probe cannot be taken apart for servicing or repair. In the unlikely case of suspected malfunction, a spare (listed in the Appendix) should be installed, and the broken one returned to the factory for possible repair.

More detailed information may be found in the sensor manual published by Shinkawa Electric Co., Ltd.. See Related Reading.

2.1.2. Touch roller

The touch roller is also manufactured by Shinkawa, and is sized to match the Eddy Current probe.

The wheels of the carriage are chrome-plated, mild steel, and are designed to be low-friction. Low-friction Teflon-coated or nickel-plated wheels are available as an option if the measured product is sticky.

The Eddy Current probe may be removed from the touch roller by removing the locknut (see Figure 2-2).

Figure 2-2 Touch Roller Assembly (locknut)

The probe is offset from the plane defined by the wheels by 800 µm (30 mm). Take care to ensure that the standoff is accurately maintained if the probe is ever removed from the touch roller assembly. Changing the offset requires adjusting the zero offset (see Section 5.2).

ATTENTION

If the probe is removed from the touch roller, it must be put back with an offset of 800 µm (30 mm). Use a shim to achieve the offset. The zero offset must be readjusted (see Section 5.2).

ATTENTION

A large offset decreases the measurement range of the sensor. Do not exceed an offset of 800 µm (30 mm).

In the unlikely event that the touch roller sustains damage, install the spare. If the damage is deemed repairable, the touch roller can be returned to the factory.

More detailed information may be found in the sensor manual published by Shinkawa, See Related Reading.

2.1.3. Retraction mechanism

The retraction arm consists of a spring-loaded platform (to which the touch roller is fastened), an air-actuated cylinder that inserts and retracts the platform, and a mounting clamp for fastening the entire mechanism to the calender frame. To accommodate non-uniformities in the product and/or the mounting, the arm is designed to swivel.

The retraction mechanism may be ordered for upward-facing, or downward-facing applications.

2.1.4. Signal cables

The 6 meter (19.69 ft.) long signal cable connects the Eddy Current probe and the thermocouple to the control cabinet.

The cable carries high frequency voltage to the sensor, and returns the low voltage sensor signal. A separate, parallel, cable carries the thermocouple signal.

ATTENTION

> Do not sharply bend, twist, or cut the cables. Replace damaged cables. The minimum bend radius is 30 cm (12 in.).

ATTENTION

> The ends of the cable are color-coded: the black end connects to the eddy current sensor, and the silver end connects to the control cabinet.

2.1.5. Control cabinet

The control cabinet (see Figure 2-3) provides the power, retraction logic, air power, and data acquisition hardware to operate up to three gauges simultaneously.

The control cabinet requires the following services:

- 115 V/15 A, or 220 V/7.5 A, single phase dedicated circuit, 3c cable, and associated conduit
- mill air pressure 4.1–5.5 bar (60–80 psi), instrument quality air, free of oil and moisture
- for installations where the ambient temperature of the cabinet is greater than 35 °C (95 °F), the mill water at the following conditions must be supplied:

  pressure 3.1–4.1 bar (45–60 psi)

  flow rate 3.8–9.5 L/min (1–2.5 gpm)

  temperature 30 °C (85 °F) maximum
- 10 Base-t Ethernet connection to the MXProLine server (control room)

Figure 2-3 shows the schematic diagram of the control cabinet.

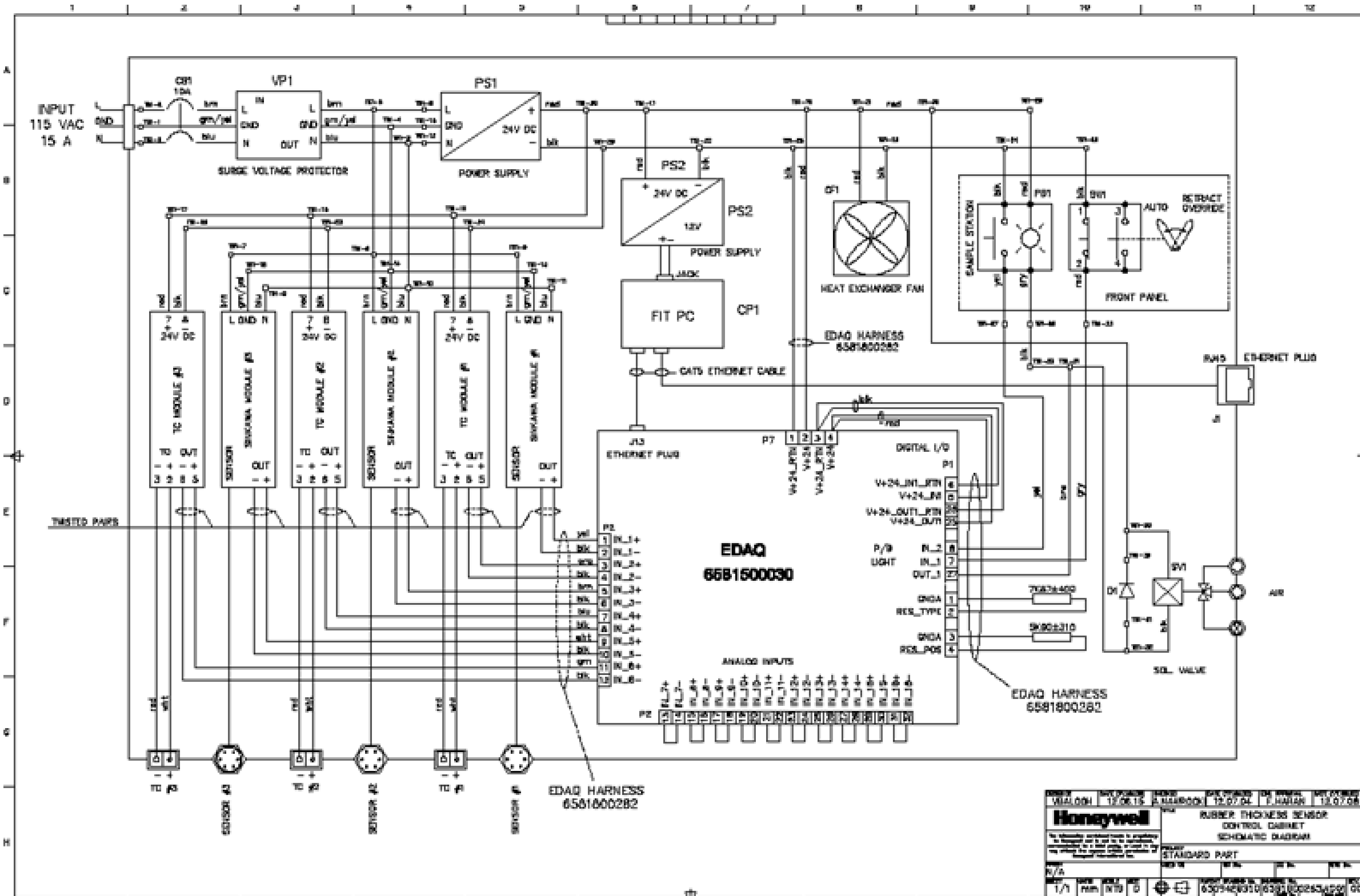


Figure 2-3 Rubber Thickness Sensor Control Cabinet Schematic Diagram

The most important elements are:

- displacement converter
- MSS on-board computer
- EDAQ board
- main power switch
- air manifold and solenoid

Figure 2-4 shows the control cabinet interior wired for a single sensor (for three sensors, there would be three displacement converters) with the elements labeled.

The air manifold and solenoid are not visible in this image. They are located underneath the shelf holding the displacement converters.

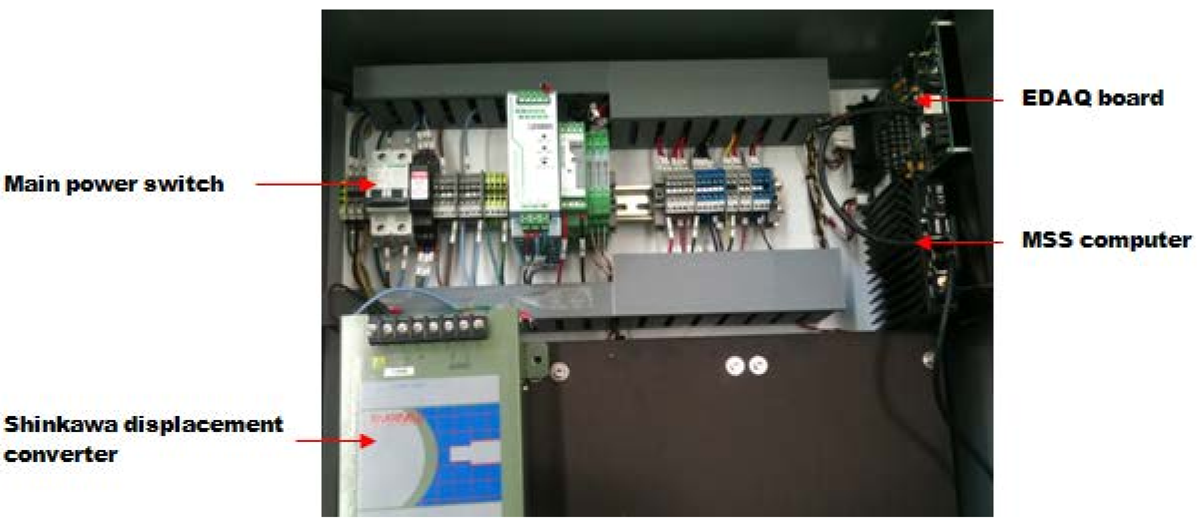


Figure 2-4 Control Cabinet

2.1.5.1. Displacement converter

The displacement converter is manufactured by Shinkawa, and is calibrated to operate with a specific Eddy Current probe, as identified by serial number on the unit. Matching an Eddy Current probe to a displacement converter is done in the factory; if the pair is broken up for any reason, the matching process must be redone. It is not currently possible to do this in the field.

ATTENTION

> Using a mismatched set of displacement converter, plus the Eddy Current probe, will compromise accuracy and performance.

The displacement converter provides the high frequency AC to the coil in the Eddy Current probe, and also converts the sensor output from a low-voltage signal to a linear 0–10 V signal.

ATTENTION

There are three adjustable resistors on the displacement converter. They have been adjusted in the factory and should not be touched.

2.1.5.2. MSS on-board computer

The MSS on-board computer is located on the right hand side of the control cabinet. It is connected to the EDAQ board, and externally, using standard Ethernet cables. The heat sink ribbing snaps off of the unit. The MSS may be removed from the side of the cabinet by giving it a slight counterclockwise twist, and then pulling it off its mounting.

The MSS computer can be rebooted by cycling its power. The power switch is located on the front of the unit, which faces the bottom of the control cabinet (the back of the MSS, with its cable connections, faces upwards).

The computer packages the information sent to it by the EDAQ board into MXProLine-compatible format, and relays MXProLine commands back to the EDAQ.

The MXProLine software supplies tools and screens for monitoring the MSS.

2.1.5.3. EDAQ board

The EDAQ board can be found in the upper right-hand corner of the control cabinet. It is connected to the MSS using a standard Ethernet cable.

The EDAQ can be rebooted externally by pushing on the small white reboot button near the top of the board.

The EDAQ collects the data from the control cabinet and sends it to the MSS. It directly controls the insertion/retraction mechanism.

The MXProLine software supplies tools and screens for monitoring the EDAQ. See Chapter 3 for additional information on the EDAQ, and refer to the *Experion MX MSS and EDAQ Data Acquisition System Manual* (p/n 6510020381).

2.1.5.4. Control cabinet power management

The upper left hand corner of the control cabinet contains the main power circuit breaker and various power management units. There are surge protectors, regulators, and fuses to protect the DC power supply.

2.1.5.5. Air manifold and solenoid

The retraction mechanism is driven by the air supply. The manifold and the solenoid are located underneath the platform that holds the displacement converters. The platform can be easily removed.

The manifold and solenoid should not require servicing. The individual air lines are connected on the outside of the cabinet using quick-connect fittings, which can also be individually adjusted for flow rate.

2.2. Software

MXProLine with RAE 6.10 has a dedicated and specialized processor for the Rubber Thickness sensor. It is structured with up to three sensors on a single frame; insertion and retraction operates on the entire frame with all sensors retracting simultaneously.

The rubber thickness processor calculates a final thickness and a temperature for each sensor. These can be monitored on various displays as desired.

The processor generates insertion and retraction commands based on operator commands and process events. The processor also monitors the condition of the pushbutton, and the force retraction switch, to accurately reflect the state of the hardware.

2.2.1. Thickness calculations

MXProLine expects two inputs (0–10 V) from each sensor:

- displacement
- temperature

There are two levels of computation applied to the thickness signal:

1. A raw thickness is calculated from the eddy current response signal.
2. A final thickness is determined by applying the optional temperature correction, using the measurement supplied by the thermistor.

2.2.1.1. Raw thickness

The algorithm for the conversion from voltage to thickness is as follows:

R = raw thickness = $f(A_0, A_1, A_2;V) \times$ slope_r + constant_r

Equation 2-1

- A_0, A_1, A_2 are constants determined during sensor calibration in the factory. These constants are listed in the documentation that ships with each sensor.
- The constants for each sensor are entered in the RTHKPxy calibration constants table (x = frame #, y = sensor #), as described in Chapter 5.
- The slope and constant reside in the RTHKPxy calibration table (x = frame #, y = sensor #). The slope_r should be 1.0 always. The constant_r is the grade-independent offset obtained from running the sensor on an empty roll, as described in Chapter 5.

2.2.1.2. Final thickness

The final thickness measurement, including the temperature correction, uses the raw thickness measurement, and is defined as follows:

T = Final Thickness = R – f(B0, B1, B2; (T – T0)) × slope_t + constant_t

Equation 2-2

- B_0, B_2 should always be zero.
- B_1 is the temperature corrector slope and, if used, should be very close to 10 (between 9 and 11). A value of zero turns the corrector off. *This is the default.*
- T_0 is the temperature at which the calibration was performed, in C, divided by 10 (giving a value of 2.2–2.5), and T is the present reading, in volts, from the thermocouple (between 0–10 V).

- These constants reside in the THKPxy calibration constants table (x = frame #, y = sensor #), as described in Chapter 5.

- The slope_t is the *dynamic slope* and should always be 1.0. It may be found in the THKPxy calibration table (x = frame #, y = sensor #), as described in Chapter 5.

- The constant_t is the dynamic offset and is grade-dependent. It takes into account any adjustment that may be required for compressible product. It may be found in the THKPxy calibration table (x = frame #, y = sensor #), as described in Chapter 5.

The expected correction should be approximately one µm for every one degree Celsius different from the steady-state temperature (steady-state is when the sensor is retracted over the hot product). The temperature corrector is meant to adjust for any temperature shocks that the sensor may experience when going from offsheet to onsheet conditions during production. If the sensor will be regularly used during cold startups, going from 25–125 °C (77–257 °F), using the temperature corrector is advised because the sensor takes approximately one hour to warm up under these conditions; however, if the sensor is not used until the hot product is present on the roll, the temperature swings are expected to be much smaller, and the sensor will have time to stabilize offsheet. The temperature corrector is not required in this case.

ATTENTION

By default, the temperature corrector is turned *off*. It is required only if the sensor experiences rapid thermal shocks, for example, changes of more than 50 °C (122 °F) to the sensor temperature between offsheet and onsheet operations.

2.2.2. Pushbutton and force retract switch

The force retract switch on the front cover of the control cabinet allows the operator to retract the sensors under any conditions. When engaged, the switch prevents the software from inserting the sensors, and renders the pushbutton, on the control cabinet, inoperative.

The pushbutton is active when the force retract switch is set to auto. Pushing the button when it is not lit, requests an insertion. The light goes on and the software inserts the sensor if safe to do so. Pushing the button when it is lit, requests a retraction. The light extinguishes and the software retracts the sensor.

The processor monitors the position of the switch and the pushbutton to accurately reflect their state in the software.

3. EDAQ

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

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

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

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

The EDAQ board contains a large number of input/output (I/O) systems, including:

- analog inputs (16 inputs of 12 bits @ 4 kHz and 8 inputs of 10 bits @ 1 Hz)
- analog outputs (2 @ 12 bits)
- digital inputs (16 @ 24 V logic)
- digital output (16 @ 24 V logic)
- frequency input (400 Hz to 500 kHz)
- three serial ports
- USB (presently unused)
- Ethernet

Except for a few dedicated signals such as the green light (radiation safety), all sensor signals connect through the EDAQ to the new Experion MX MSS by Ethernet.

The EDAQ contains sensor-specific code for all sensors. All EDAQs, including the frame controller (FC) EDAQ (in the endbell), and the head alley EDAQ, are identical and can be interchanged.

This chapter gives a brief overview of the EDAQ board and some of the diagnostic information. More detail is provided in the *Experion MX MSS & EDAQ Data Acquisition System Manual* (p/n 6510020381).

3.1. Physical layout

Figure 3-1 and Figure 3-2 show the EDAQ PCBA as it is mounted next to a sensor. To the left are the digital and analog I/Os, which connect directly to a sensor. Below these two large connectors is a 16-pin expansion connector that is only used when the EDAQ is attached to the FC expansion board.

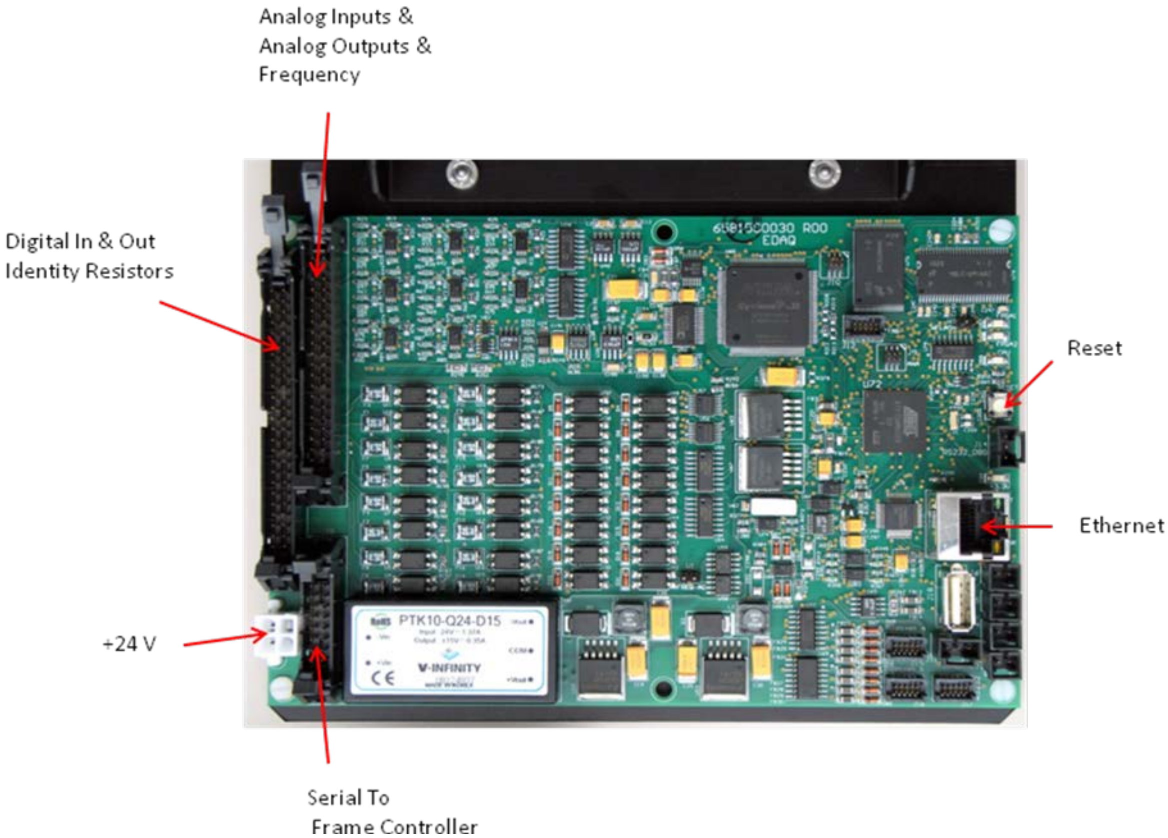


Figure 3-1 EDAQ Board

As shown in Figure 3-2, J1 is the large 50-pin connector on the far left. J2 is the smaller 40-pin connector. J8 on the lower left is used for the FC only. To the right are the Ethernet port, some diagnostic LEDs, serial connections, and temperature inputs. There are no test points for use in the field. A serial debug port is available (115200 kb/s, no flow control, 8N1) that may be connected to any PC running a serial terminal program. For diagnostic purposes, service personal may be asked to connect a serial cable between the debug port and the RS-232 of any neighboring EDAQ.

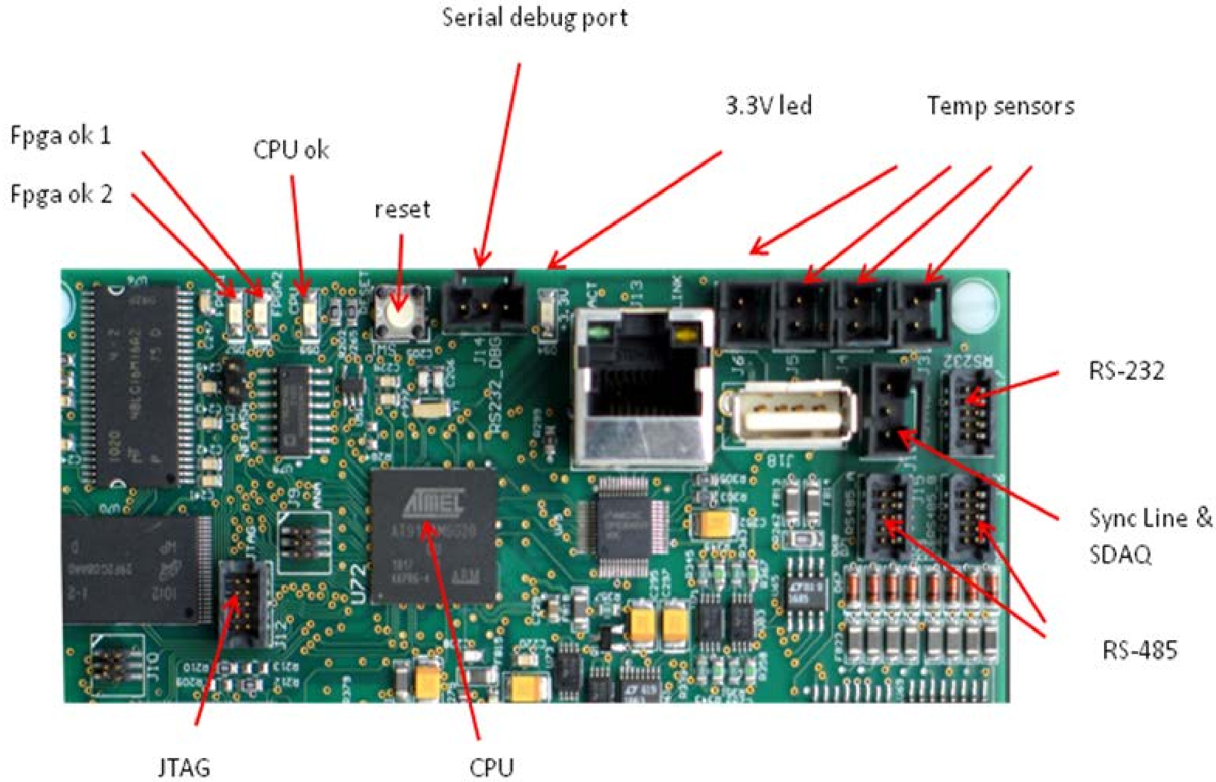


Figure 3-2 EDAQ Board: Ports and Diagnostic LEDs

3.2. Hardware status information

There are four diagnostic LEDs on the EDAQ (see Figure 3-2).

- The *3.3 V LED*. When lit, this indicates that all power supplies on the board are functional. The signal is derived from the 3.3 V power supply, which in turn is derived from the 15 V power supply, which is derived from the + 24 V input.
- The *CPU OK LED*. This LED is under control of the central ARM CPU. It will be lit when the main sensor application (edaqapp) is running on the CPU.
- The *Fpga ok 1* (not used at present).
- The *Fpga ok 2*. This LED will blink if the FPGA is loaded and running code.

The Ethernet connector contains two LEDs:

- amber indicating a good link to the switch
- green indicating activity on the network

3.3. EDAQ reset

A soft reset of the EDAQ may be performed through a Web interface running on the scanner MSS. This interface may be accessed from a QCS operator station.

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

3.4. EDAQ sensor identification and IP addressing

Assuming the firmware (flash code) is the same, all EDAQs are identical. EDAQs can be freely interchanged between sensors and the scanner endbell.

Each EDAQ contains all the code for all supported sensors, and loads the appropriate software depending on the identification ID code read at boot time. Two resistors are used to uniquely identify the EDAQ.

For sensor-connected EDAQs, there is a sensor model resistor embedded in the cable harness connecting the sensor to the EDAQ. This resistor determines the function code. Function codes are unique for each sensor model to the extent that the EDAQ needs to differentiate the models. For example, all Source 9 basis weight measurement sensors presently have the same function code, regardless of radioactive isotope.

In addition, the head power distribution board has a resistor for each EDAQ platform connector. This determines the position of the EDAQ in the head. The EDAQ can self-identify both its position and function.

Refer to your scanner system manual to troubleshoot the EDAQ if it does not identify itself properly (or to find the correct resistor values).

Every EDAQ has a unique IP address on the scanner network. If the EDAQ can identify its position, it will set its IP address to 192.168.0.*XYZ* (where *XYZ* is the position number in the head). The FC-EDAQ always sets itself to IP number 192.168.0.2. The MSS is always 192.168.0.1 on the scanner network, and usually 192.168.10.*n*+100 (where *n* is the number of MSSs on the same MX Experion network) on the Experion MX LAN. The MSS is assigned 192.168.10.101 at the factory, but this can be set to any IP address by using the MSS Web page. Refer to your scanner system manual.

If an EDAQ fails to determine a position, it requests an address of the local DHCP server (which is either running on the FC-EDAQ or the MSS). Any laptop will get an IP address when plugged into any of the scanner Ethernet switches.

3.5. Obtain status information

An overall status page is available from a QCS operator station under the **MSS Setup Diagnostics** tab (select the **MSS Summary** display).

On the left side of the **MSS Summary** display, as shown in Figure 3-3, is the list of expected EDAQs with three types of status indicators (from left to right).

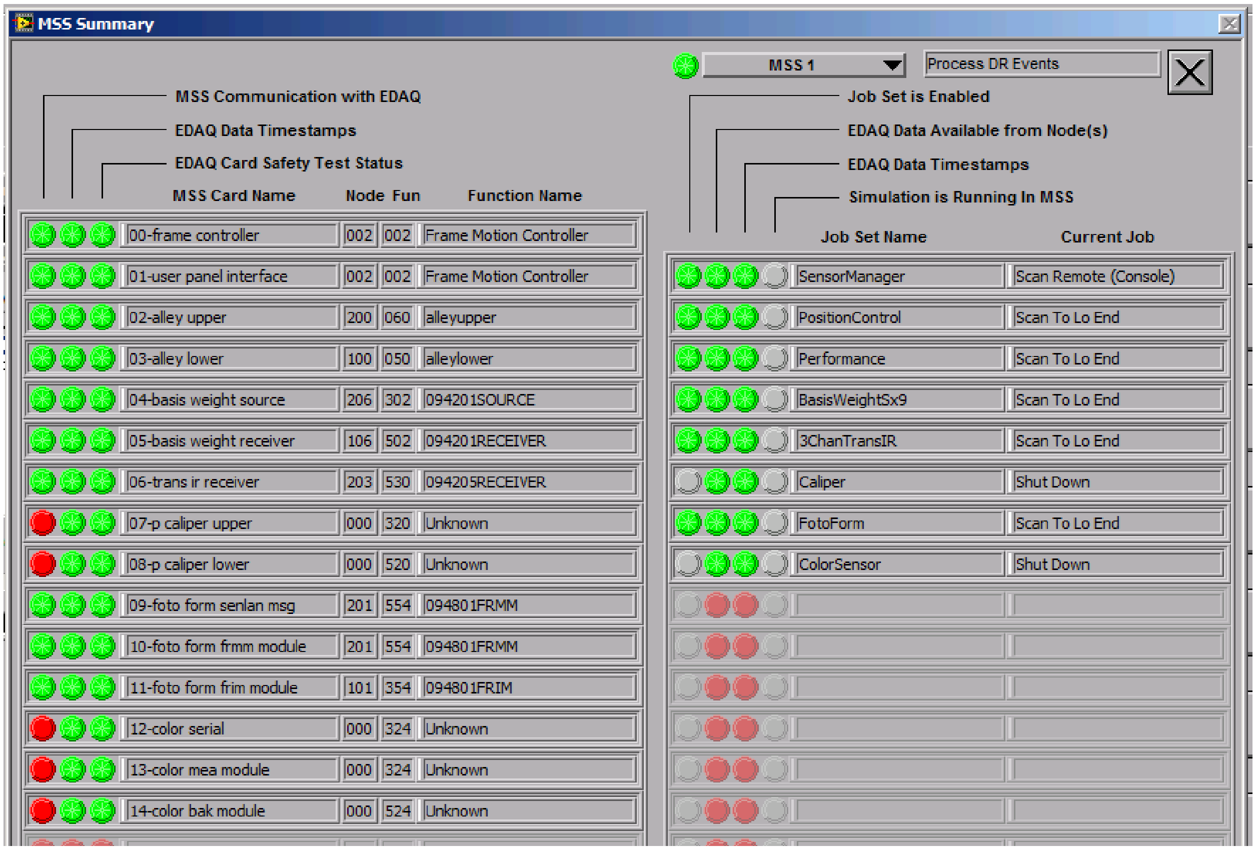


Figure 3-3 MSS Summary

Table 3-1 MSS Summary Display Status Indicators and Descriptions

Column	Description
MSS Communication with EDAQ	EDAQ is communicating (through the EDAL protocol) with the MSS
EDAQ Data Timestamps	Data that the MSS is expecting from that EDAQ is being supplied at the expected rate
EDAQ Card Safety Test Status	EDAQ is not reporting any errors such as interlock or motion control issues

Sensors that are part of the QCS database, but are not enabled on the scanner, appear in the left column indicators in red, for example, *07-caliper upper* in Figure 3-3.

3.6. MSS and EDAQ web pages

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

- go to the **MSS Diagnostic** tab, click on **MSS Monitor**, choose the appropriate MSS, and click on **MSS Web** page
- open a browser on any computer connected to the Experion MX level network, and use the address *http://192.168.10.101/mss.php* (the first MSS on the LAN), or the address set up for the MSS in the Experion MX system
- open a browser on any computer connected to the scanner LAN switch, and use the address *http://192.168.0.1/mss.php* or *http://192.168.10.101* (for the first MSS on the system)

Figure 3-4 shows **PHP MSS Page** (the main MSS Web page).

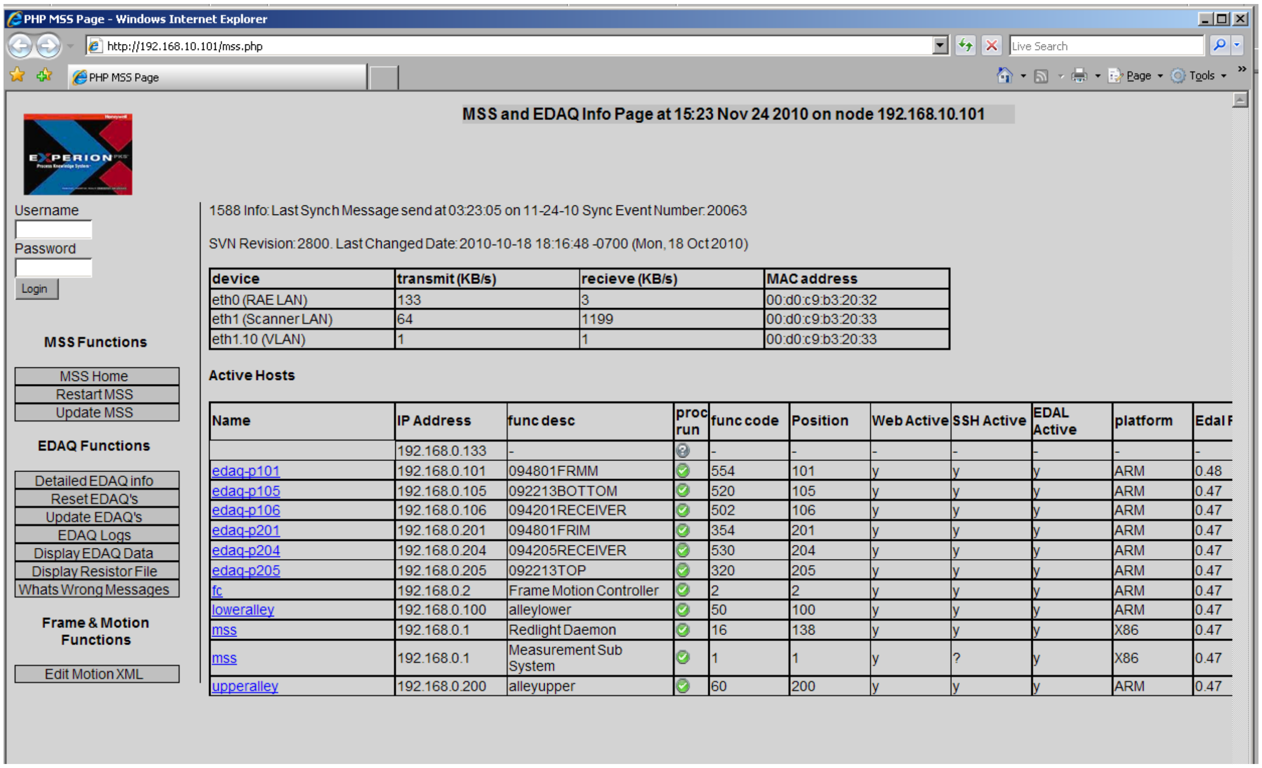


Figure 3-4 PHP MSS Page

The left panel shows a column of options divided into:

- **MSS Functions**
- **EDAQ Functions**
- **Frame and Motion Functions**

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

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

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

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

The **proc/run** status column is green if all processes known to run on the EDAQ are present. Hovering the cursor over the status indicator calls up a list of running and stopped processes.

More detailed information on each EDAQ can be obtained by clicking **Detailed EDAQ info** on the left panel.

The resulting table (see Figure 3-5) shows a number of technical details that are not discussed in this document. Important columns include **Process load** (usually less than 0.5), **local time** (matches MSS time clock shown at top), and **Offset From MSS (µs)** (less than 50 µs a few minutes after start up).

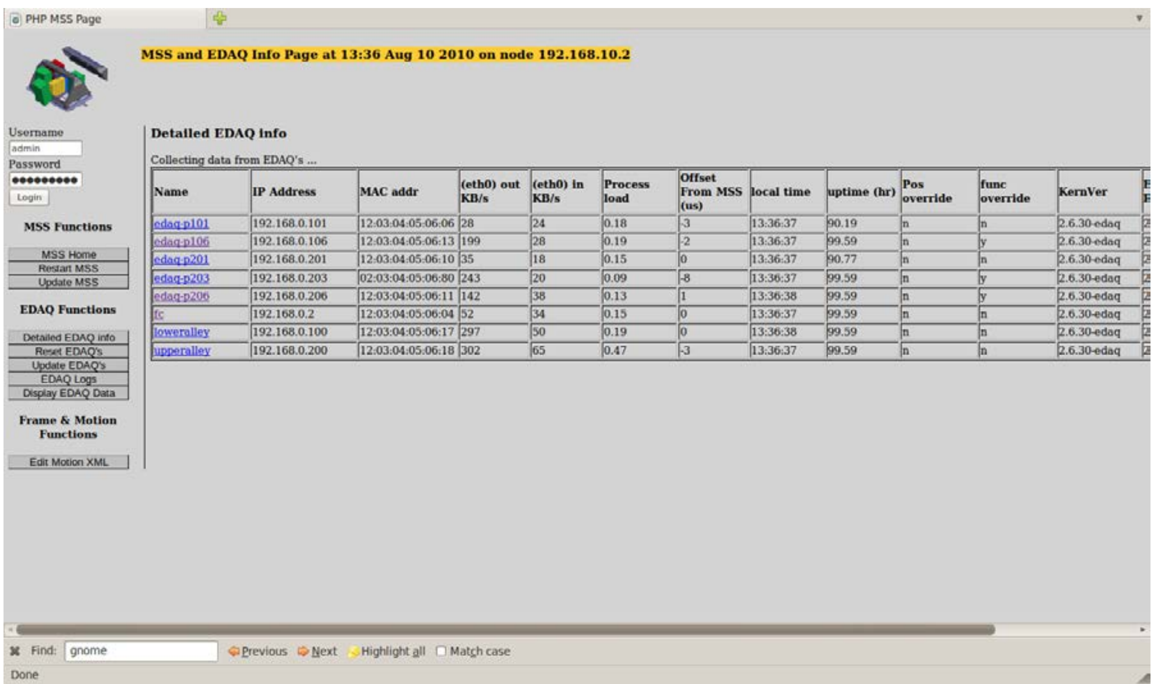


Figure 3-5 Detailed EDAQ Information: Partial Display

4. Installation

The Rubber Thickness sensor is intended for use with the MXProLine system. The sensor may be mounted in a variety of configurations.

See Chapter 1 and Chapter 2 for a detailed description of the hardware, and an overview of sensor operation.

This chapter is intended to compliment the installation drawing package specific to the installed mill site.

4.1. Safety Concerns – Electrical Shock

There is no risk of electrical shock when handling the Rubber Thickness sensor itself, or the cable.

However, within the control cabinet – in particular, on the Shinkawa Displacement Converter (see Figure 2-4) - some terminations are not completely covered by access shields or insulation.

At these locations you could come into contact with AC power at 208-240VAC levels. Electrical shock warning labels (see Figure 4-1) have been placed in locations where bare terminations pose electrical shock hazards. Be careful with hands and fingers in areas marked with this label without properly disabling power first.

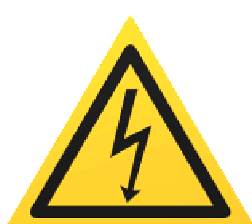


Figure 4-1 Electric Shock Warning Label

4.2. System components

Figure 4-1 shows the typical system components of an upwards facing (sensor faces upwards), or T1, retraction.

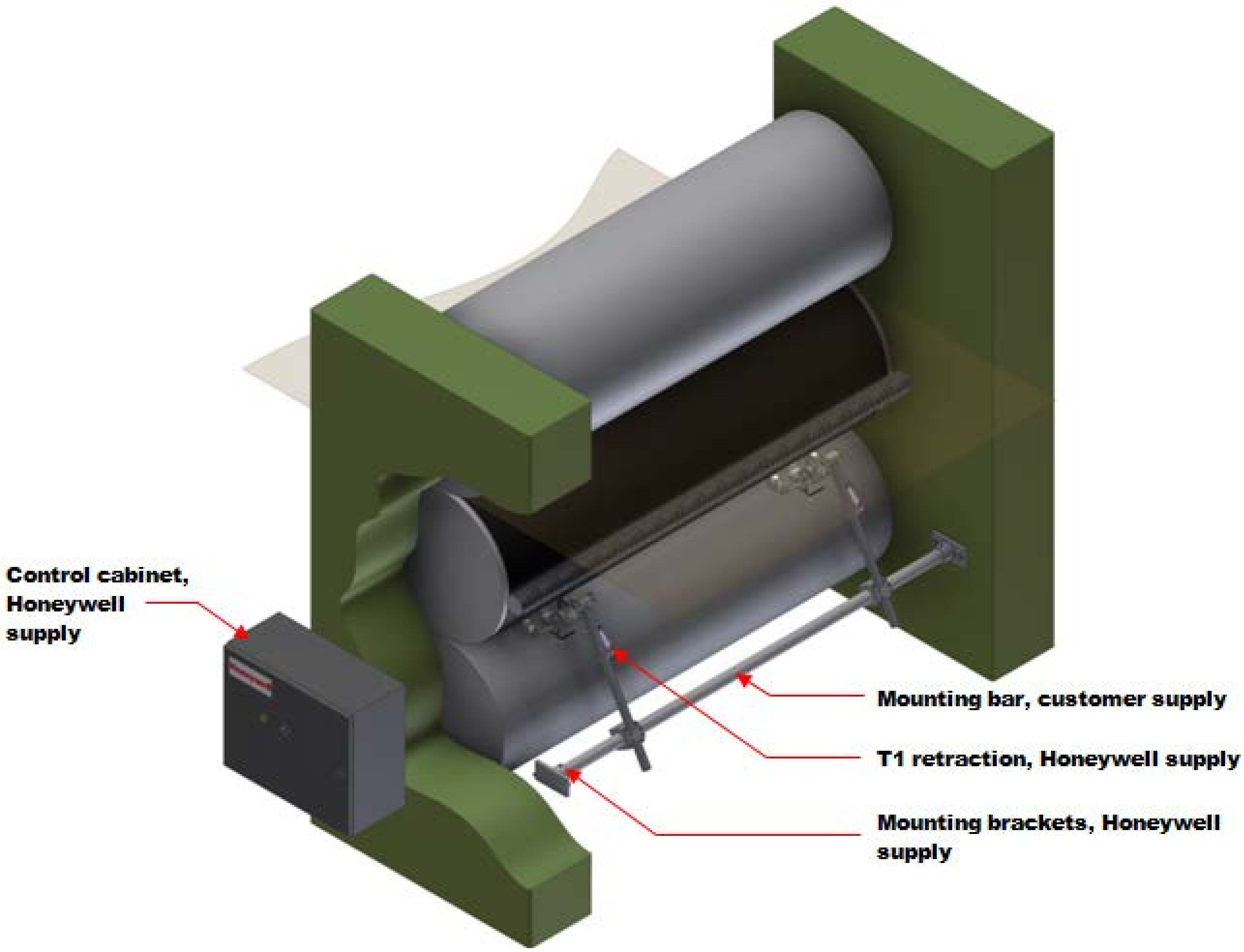


Figure 4-2 T1 Retraction

Figure 4-2 shows the typical system components of a downwards facing (sensor faces downwards), or T2, retraction.

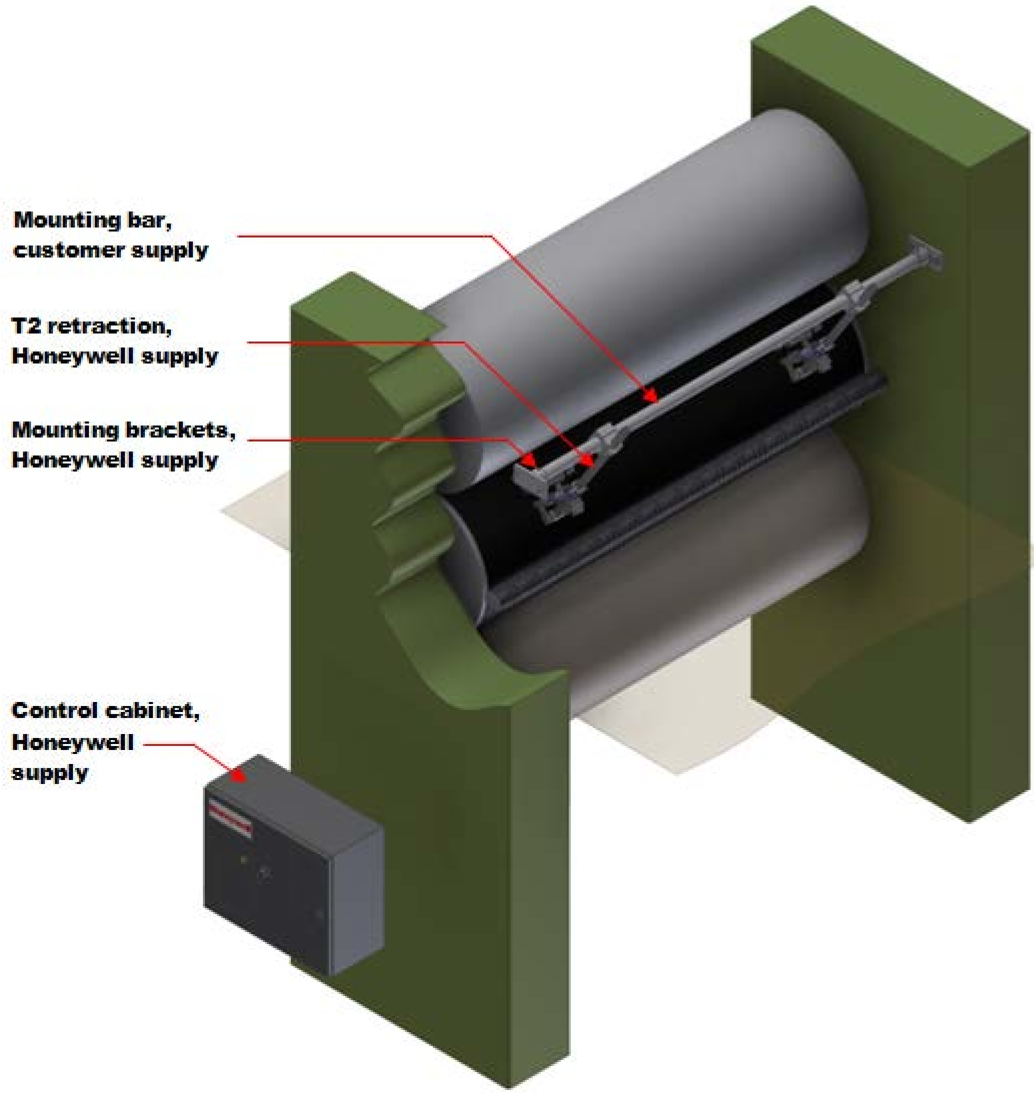


Figure 4-3 T2 Retraction

Both system types utilize the same control cabinet, sensor, sensor wheel assembly, mounting brackets, sensor cabling (not shown), and retraction air tubing (not shown), and differ only in the type of retraction, T1 or T2, used.

One control cabinet can support up to three sensors; all sensors connected to the control cabinet will retract and insert simultaneously.

A typical installation consists of one control cabinet per calender roll.

The cable connecting the control cabinet to each sensor has a maximum length of 6 m (19.7 ft.). The location of the control cabinet must be within 6 m (19.7 ft.) of the furthest sensor.

The minimum roll diameter for accurate sensor measurement is 152.4 mm (6 in.).

If ambient temperatures at the control cabinet location are greater than 35 °C (95 °F), water cooling to the control cabinet should be supplied.

The sensors are not self-cleaning. Mount the sensors in an accessible location if product is expected to accumulate on either the mounting arms or on the sensors themselves.

4.3. Installation preparation

Installation can be performed by one or two people. Typically, the control cabinet can be installed off-machine prior to the installation of the sensors. The sensors and retraction arms require a machine shutdown for installation. Allow up to two hours per sensor, and up to two hours for the control cabinet installation.

Installation requires the following tools:

- metric wrench set
- metric Allen key set
- screwdriver set
- various hand tools (wire strippers, utility knife, pliers, and so on)

4.3.1. Control cabinet services

The control cabinet requires the following services:

- 115 V/15 A, or 220 V/7.5 A, single phase dedicated circuit, 3c cable, and associated conduit
- mill air pressure 4.1–5.5 bar (60–80 psi), instrument quality air, free of oil and moisture

- for installations where the ambient temperature of the cabinet is greater than 35 °C (95 °F), the mill water at the following conditions must be supplied:

  pressure 3.1–4.1 bar (45–60 psi)

  flow rate 3.8–9.5 L/min (1–2.5 gpm)

  temperature 30 °C (85 °F) maximum

- 10 Base-t Ethernet connection to the MXProLine server (control room)

4.3.2. Sensor mounting bar

The sensors are designed to be mounted on a bar spanning the width of the calender. The bar is to be supplied and installed by the customer using the Honeywell supplied end brackets.

The end brackets have been designed to accept a 38.1 mm (1.5 in.) nominal diameter pipe, 40 mm (1.6 in.) DN, with an outer pipe diameter of 48.3 mm (1.9 in.).

The length of the bar will typically be the inside frame length 35 mm (1.38 in.). The exact length and wall thickness of the bar depends on the particular installation. Consult the system installation drawing package for the exact bar specifications.

4.4. Installation

4.4.1. Mounting the control cabinet

Figure 4-3 shows the overall dimensions of the control cabinet.

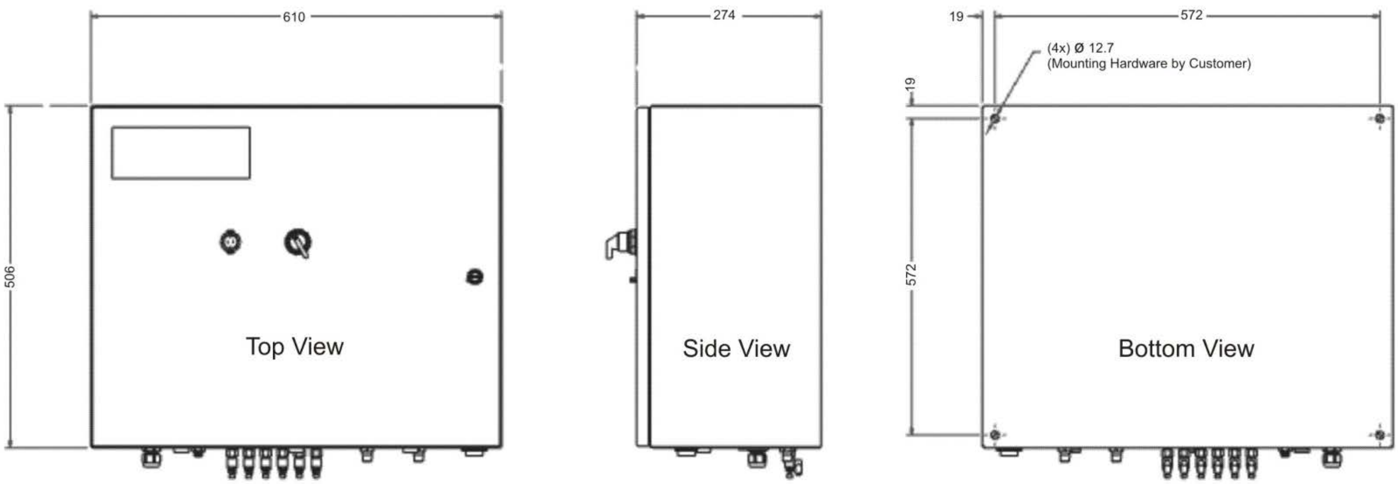


Figure 4-4 Control Cabinet Dimensions

The control cabinet weighs 32 kg (70 lbs), and needs to be anchored using the bolt pattern shown in Bottom view in Figure 4-3.

Mounting hardware and the control cabinet mounting location must be supplied by the customer.

4.4.1.1. Control cabinet services

Figure 4-4 shows the control cabinet services connections, and the pneumatic connections for the sensor retraction.

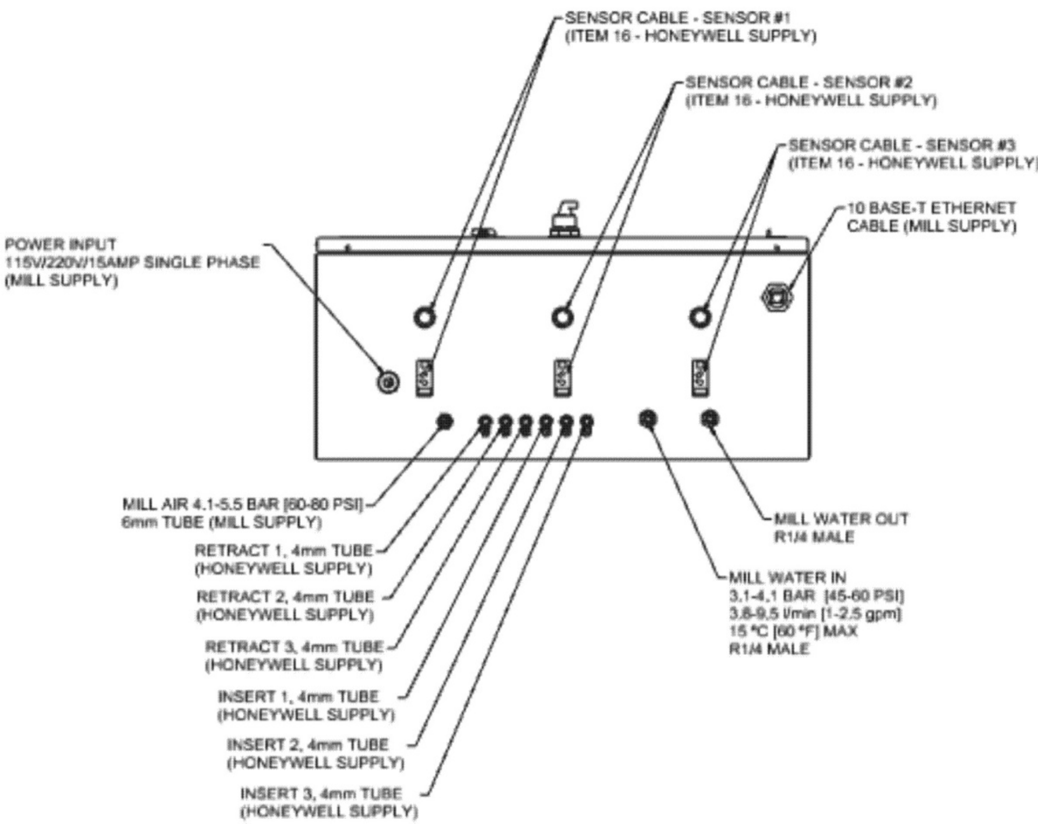


Figure 4-5 Control Cabinet Services

Tubing and cabling for the power input, mill air, mill water, and Ethernet must be supplied by the customer.

Sensor cabling and pneumatic tubing are supplied by Honeywell.

4.4.2. Mounting the sensor

With reference to Figure 4-1 and Figure 4-2, and Subsection 4.2.2, the exact sensor mounting configuration will vary from mill to mill, and will be documented in the system installation drawing package.

Figure 4-5 shows a typical end mounting bracket supplied by Honeywell.

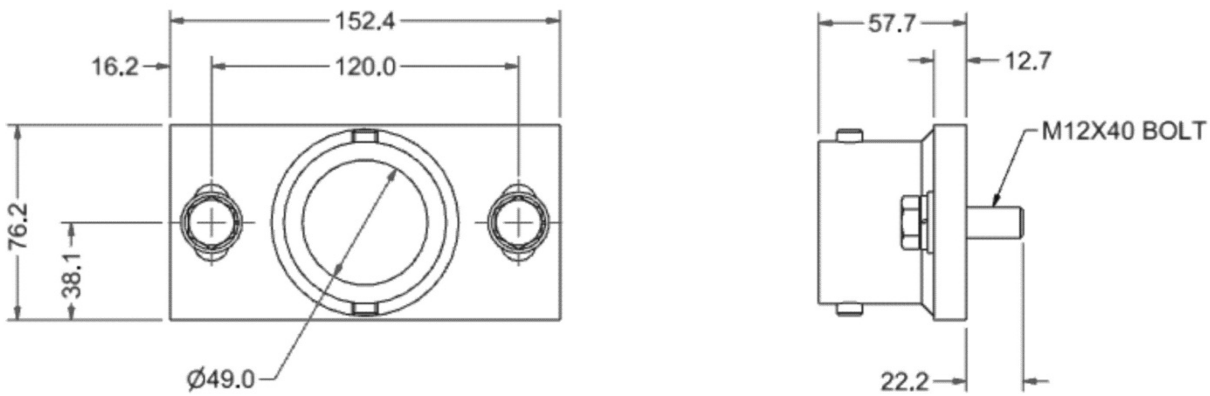


Figure 4-6 End Mounting Bracket

The mounting bracket should be mounted, using the bolt pattern shown in Figure 4-5, to the customer calender frame as per the installation drawings.

The end bracket is supplied with the M12 mounting hardware. The tapped mounting holes on the calender frame are supplied by the customer.

4.4.3. Attachment of retraction air

Each sensor requires two air lines:

- one for insertion
- one for retraction

The tubing is supplied. Use the quick-connect fittings on the cylinder, and on the outside of the control cabinet, to connect the air lines. Be careful not to pinch or kink the tubing because doing so will restrict air flow and prevent proper operation.

Connect the air supply before attempting retraction adjustments.

4.4.4. Adjusting T1 retraction

Figure 4-6 shows the general adjustments available on the T1 retraction.

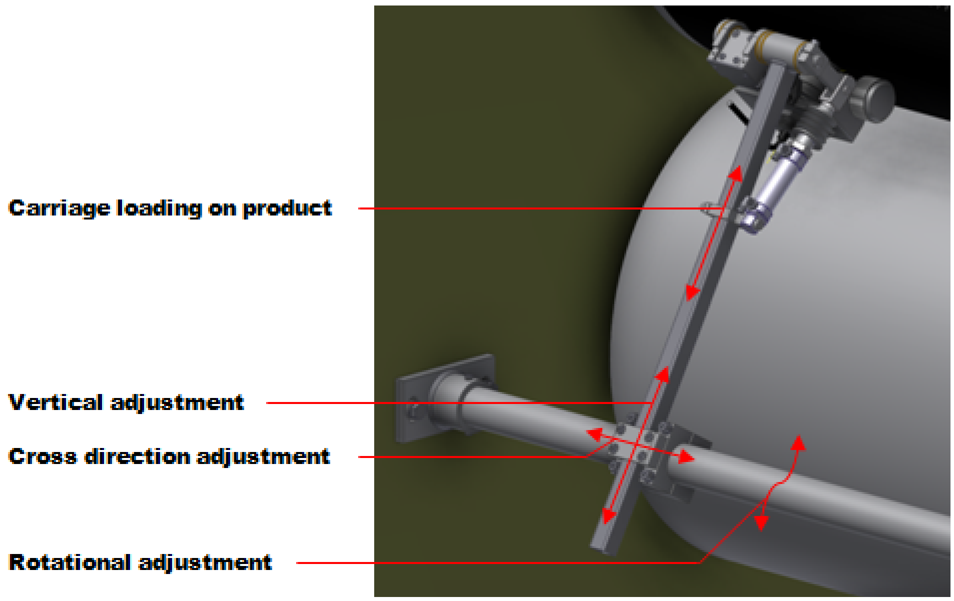


Figure 4-7 T1 General Adjustments

Figure 4-7 shows the hardware for cross direction, vertical, and rotational adjustment of the T1 retraction.

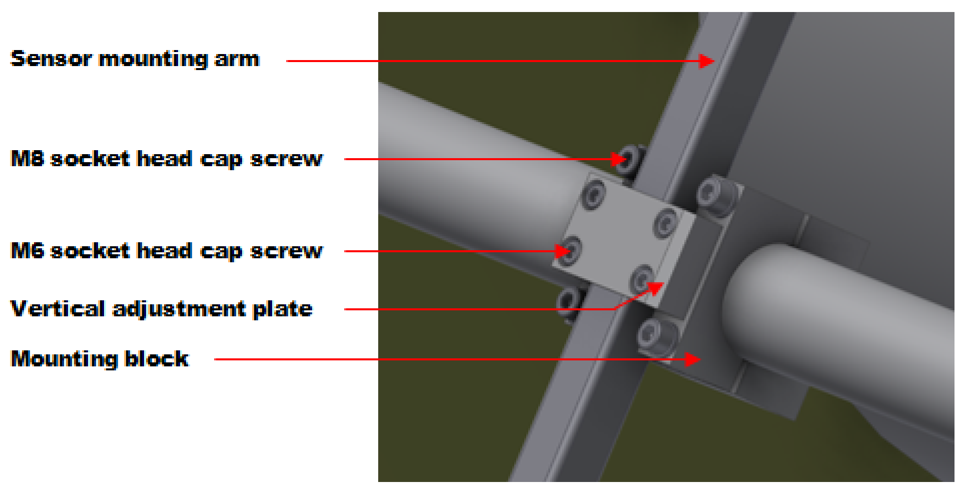


Figure 4-8 T1 Cross Direction, Vertical, and Rotational Adjustments

To make cross direction and rotational adjustments, loosen the M8 socket head cap screws on the mounting block, and manipulate the sensor assembly into the desired position. To make vertical adjustments, loosen the M6 socket head screw on the vertical adjustment plate, and move the sensor mounting arm to the desired position.

Figure 4-8 shows the sensor wheel carriage and retraction cylinder deployed. The air supply lines are not shown.

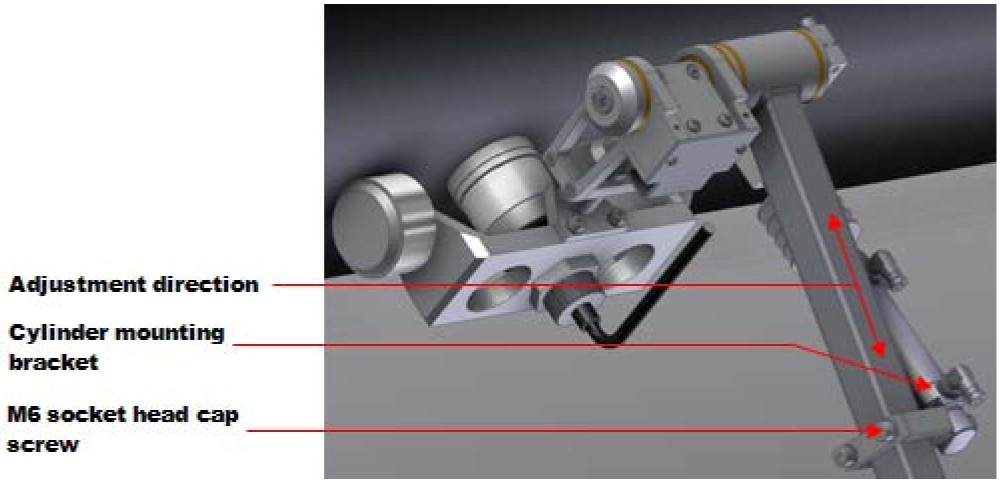


Figure 4-9 T1 Carriage Loading Adjustments

To adjust the sensor wheel carriage loading on to the product, loosen the M6 socket head cap screw on the cylinder mounting bracket, and slide the bracket *toward* the roll to increase the loading; slide the bracket *away* from the roll to decrease the loading. Note that the retraction cylinder will need to be extended, and remain extended, during the adjustment.

4.4.5. Adjusting T2 retraction

Figure 4-9 shows the general adjustments available on the T2 retraction.

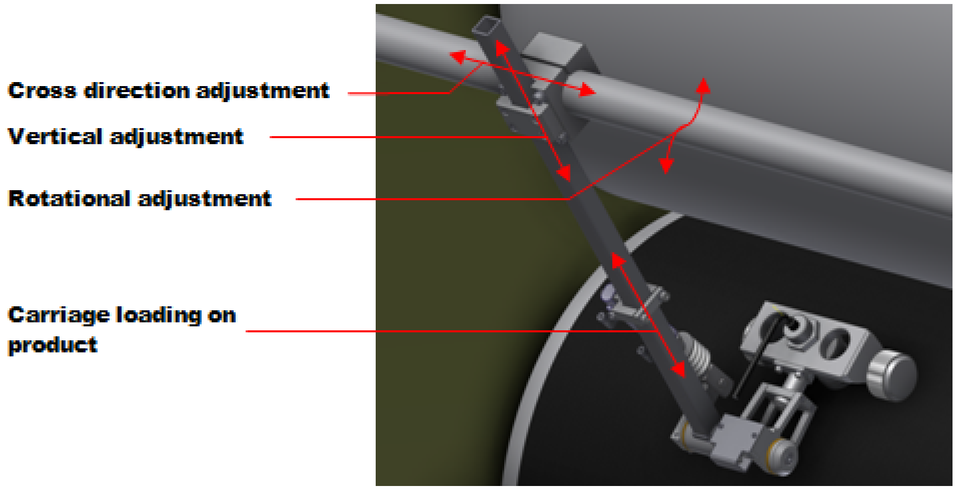


Figure 4-10 T2 General Adjustments

Figure 4-10 shows the hardware for cross direction, vertical, and rotational adjustment of the T2 retraction.

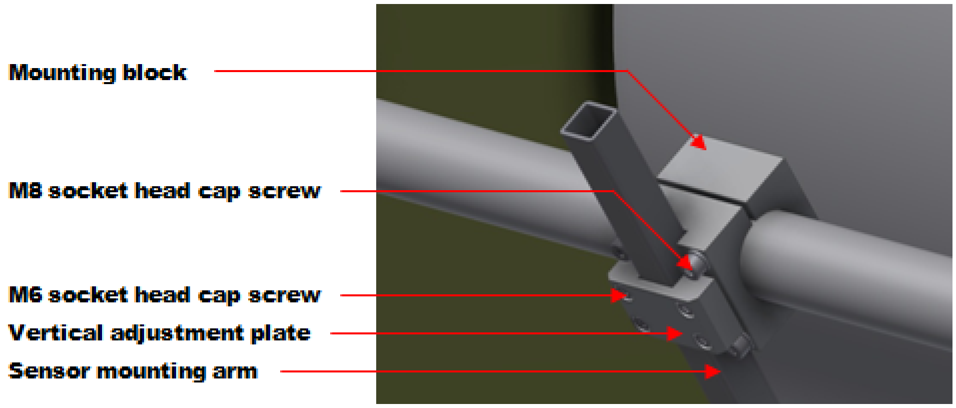


Figure 4-11 T2 Cross Direction, Vertical, and Rotational Adjustments

To make cross direction and radial adjustment, loosen the M8 socket head cap screws on the mounting block, and manipulate the sensor assembly into the desired position. To make vertical adjustment, loosen the M6 socket head screw on the vertical adjustment plate, and move the sensor mounting arm to the desired position.

Figure 4-11 shows the sensor wheel carriage and retraction cylinder deployed. Again the air supply lines are not shown.

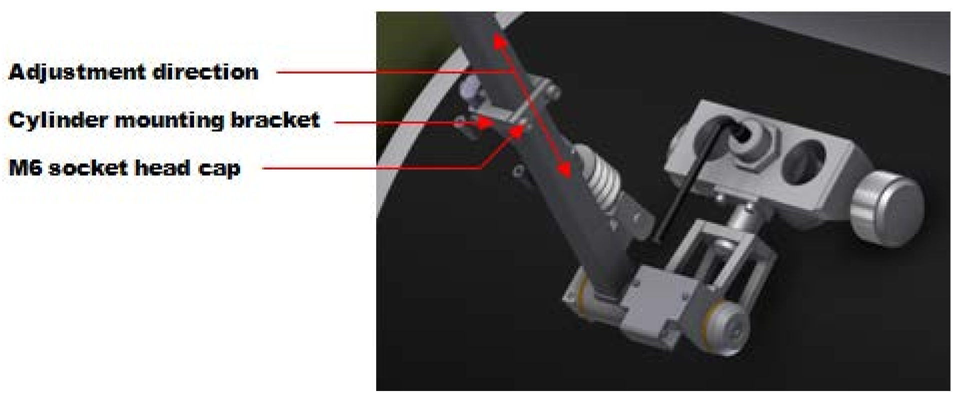


Figure 4-12 T2 Carriage Loading Adjustments

To adjust the sensor wheel carriage loading on to the product, loosen the M6 socket head cap screw on the cylinder mounting bracket and slide the bracket *toward* the roll to increase the loading; slide the bracket *away* from the roll to decrease the loading. Note that the retraction cylinder will need to be extended, and remain extended, during the adjustment.

5. Sensor Setup and Recipes

This chapter describes how to set up the Rubber Measurement sensor for proper measurement after it has been installed and, if required, how to manage different grade-dependent recipes.

The sensor is calibrated at the factory, and the calibration constants ship with it. Each sensor has its own basic, grade-dependant calibration. For new systems, the constants are entered into the MXProLine software by the installation team. For replacement sensors, the operator will need to enter the calibration constants for the new sensor.

When each sensor is installed, and after the amount of pressure with which the sensors press on the roll has been adjusted as desired, a grade-independent zero offset must be determined for each sensor.

Each sensor may require adjustment (the dynamic offset) that is dependent on the grade of product being made. These adjustments can be stored in a recipe that is called up whenever that grade is run.

If the sensors are subject to large and rapid thermal shocks greater than 50 °C (122 °F) between retracted and inserted positions, a temperature corrector might be required.

This chapter provides procedures for implementing these parameters.

5.1. Set up basic calibration constants

Each sensor ships with calibration documentation. Ensure that you save the documentation for future reference. Each sensor is identified by a serial number, which is also listed in the calibration documentation.

There are three calibration constants for each sensor: *A*, *B*, and *C*. The constants should be entered into the RTHKPxy calibration coefficients table (where x =

frame #, and y = sensor # on the frame) in the database. This table is accessible via the **Recipe Maintenance** tab (**Home → Setup → Recipe Maintenance**) in MXProLine. Table 5-1 lists the calibration coefficient from the **Rubber Caliper Calibration** display, and the coefficient name in the RTHKPxy calibration coefficients table in the database, and shows the correspondence between the coefficient names on the **Rubber Caliper Calibration** display and in the RAE database.

Table 5-1 Calibration Constants

Coefficient	**Name**
A	Element 1
B	Element 2
C	Element 3

When they are entered into the database and saved, the constants will appear whenever the appropriate recipe is loaded. See Section 5.5 for more detailed instructions on where to enter the constants.

5.2. Determine the zero offset

Before operating the Rubber Thickness sensor, determine what the zero offset is. The zero offset is grade-independent, and different for each sensor.

To determine the zero offset, from RAE, load a recipe, enter maintenance mode, and begin taking measurements (scan) on an empty roll. Under the **Sensor Maintenance** tab you should be able to see the thickness measurement for each sensor on the frame. They should read 800–900 µm, the standoff of the Eddy Current sensor. Monitor the fixed point trends (**Standard → Multi Fixed Point** display) for a short time, and note the average readings for each sensor. These readings are the zero offsets and must be entered into the calibration.

Under the **Recipe Maintenance** tab, open the RTHKPxy calibration table (where x = frame #, and y = sensor # on the frame). There is an entry for **slope**, which should always be set to 1.0, and an entry for **constant**. Enter the average reading on the empty roll as the constant and save. See Section 5.5 for more detailed instructions. All the sensors should now report zero thickness when running on an empty roll. The calibration constants are independent of product, and will be the same regardless of the grade that is run.

5.3. Determine the dynamic offset

Each grade will have its own final thickness calibration dynamic offset, which must be determined by running on hot product with a known thickness. The offset will depend on the pressure the sensor applies to the product, the temperature differential between the hot product and room temperature (where the sensor was calibrated), and on the product *compressability*. Monitor the fixed point trend readings for each grade for a short time to determine the offset required to make each sensor read the correct value. Enter the dynamic offsets into the THKPxy calibration table (dynamic intercept) for each sensor and grade.

5.4. Temperature correction (optional)

Each sensor comes equipped with an on-board thermocouple, which can be used to add an additional temperature corrector. By default, the temperature correction is turned *off*. A temperature corrector is required only when the temperature difference between the onsheet and offsheet conditions is greater than 50 °C (122 °F).

The error induced by temperature fluctuations on the thickness measurement is about one µm per degree Celsius.

See Subsection 2.2.1.2 for a more detailed description of the temperature correction. To turn this corrector on, element 2 in each of the THKPxy calibration constants tables should be set to 10. The default value is zero, which turns the corrector off.

5.5. Recipe maintenance

Setting up system behavior, in terms of calibrations, alarms, and checks, is done using the **Setup** display. The **Recipe Maintenance** tab calls up the **Recipe maintenance** display, where all tables are accessed. Each recipe consists of a hierarchical tree of linked tables, with each table describing some configuration parameters of the system. If required, tables can be shared between recipes.

Each recipe is configured from the bottom of the hierarchy to the top. The complete list of recipes can be found in the **Main Code table** display. Each recipe has its own main table. The main code table is at the top of the hierarchy. It references the RTHKPxy tables and the THKPxy tables. There is a pair of these tables for each sensor on the frame. Each of these tables contains some constants plus a reference to its **Calibration Coeffs** table.

The lower levels of the hierarchy should be set up first.

5.5.1. RTHKPxy calibration coeffs table

The RTHKPxy calibration coeffs table is at the bottom of the recipe hierarchy. Figure 5-1 shows **RTHKP12 Calibration Coeffs00**, the second sensor on the first frame.

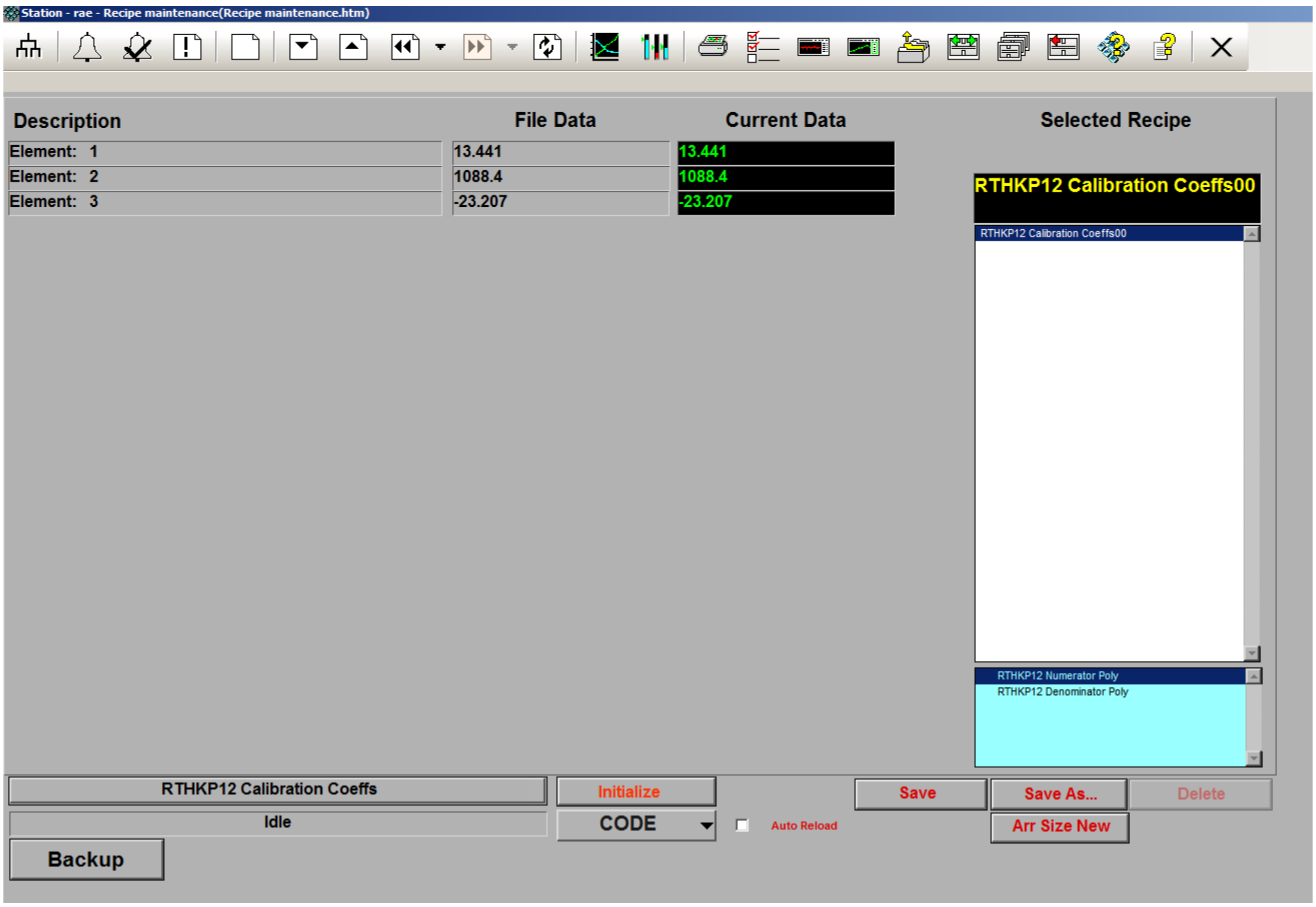


Figure 5-1 Recipe maintenance Display: RTHKP12 Calibration Coeffs

The table contains the grade-independent calibration constants for the sensor. These values are set during factory calibration and should not be changed unless the sensor is replaced, at which time new constants must be entered.

The table should have three elements (there are three calibration constants), and the values should correspond to the constants in the documentation shipped with the sensor.

If the values need to be changed, they can be edited on this display. Ensure that you click **Save** to save the changes. To remove a table, select it and click **Delete**.

5.5.2. RTHKPxy calibration table

The RTHKPxy calibration table is the parent of the calibration coefficients table. **RTHKPxy calibration table00** is shown in Figure 5-2.

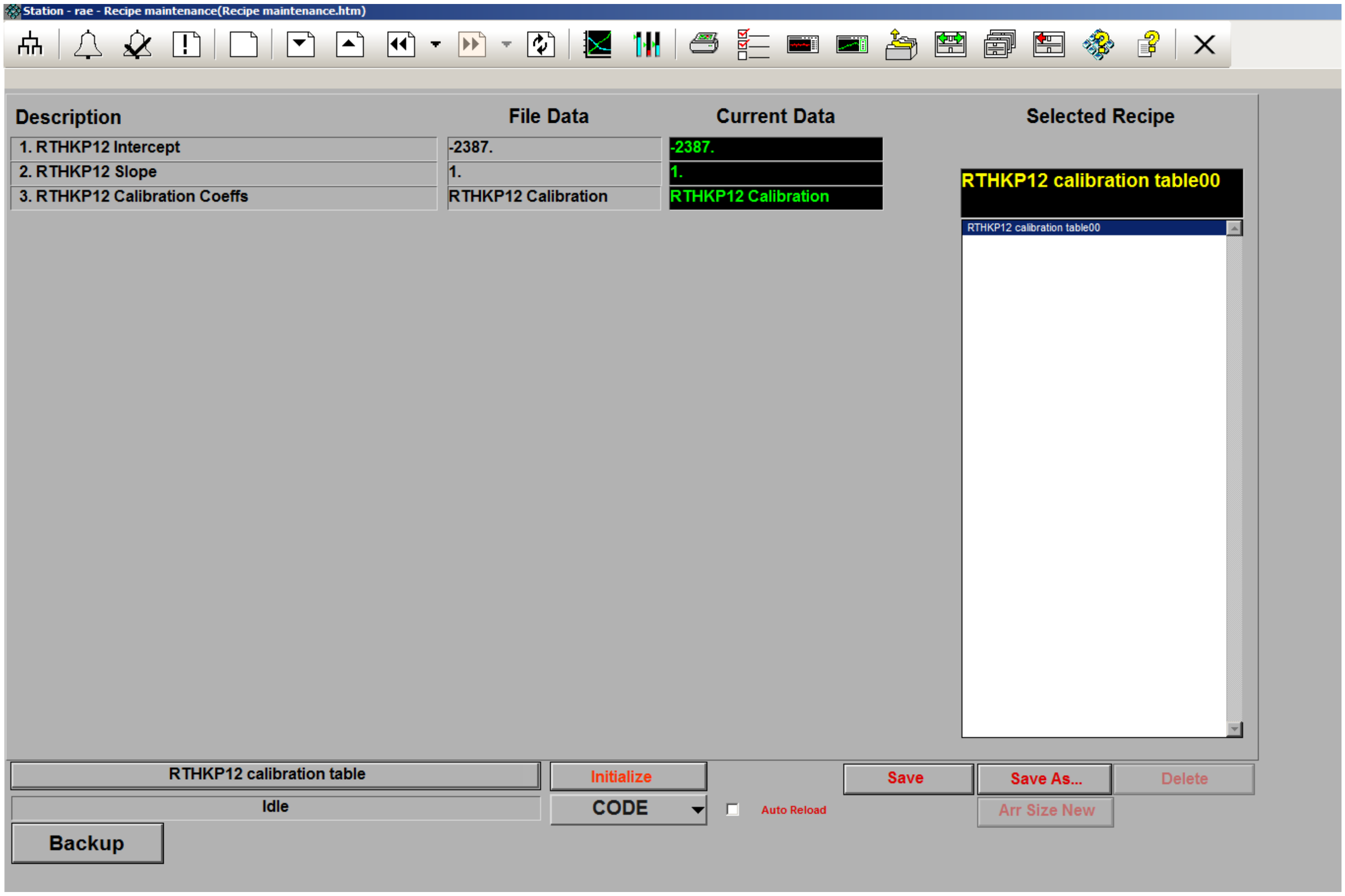


Figure 5-2 Recipe maintenance Display: RTHKP12 calibration table

In addition to the link to the grade-independent calibration coefficients for the sensor, this table contains a slope, which should always be set to one, and an offset or intercept. The offset is the zero offset determined in Section 5.2.

5.5.3. THKPxy calibration coeffs table

This calibration table is not used. All elements should be zero.

5.5.4. THKPxy calibration table

This table, which is the parent of the THKPxy calibration coeffs table, holds the grade-dependent intercept or dynamic offset for each sensor and grade. This is where the dynamic offset determined in Section 5.3 is kept.

There is also a slope corrector, which should always be set to one.

A new THKPxy calibration table should be made for every grade that requires a different dynamic offset. To create a new table, click **Save As**, and enter a new name. The constants can be edited. Ensure that you click **Save** to preserve the new numbers.

5.5.5. Main code table

The main code table gathers together all the other tables for each grade recipe required (see Figure 5-3).

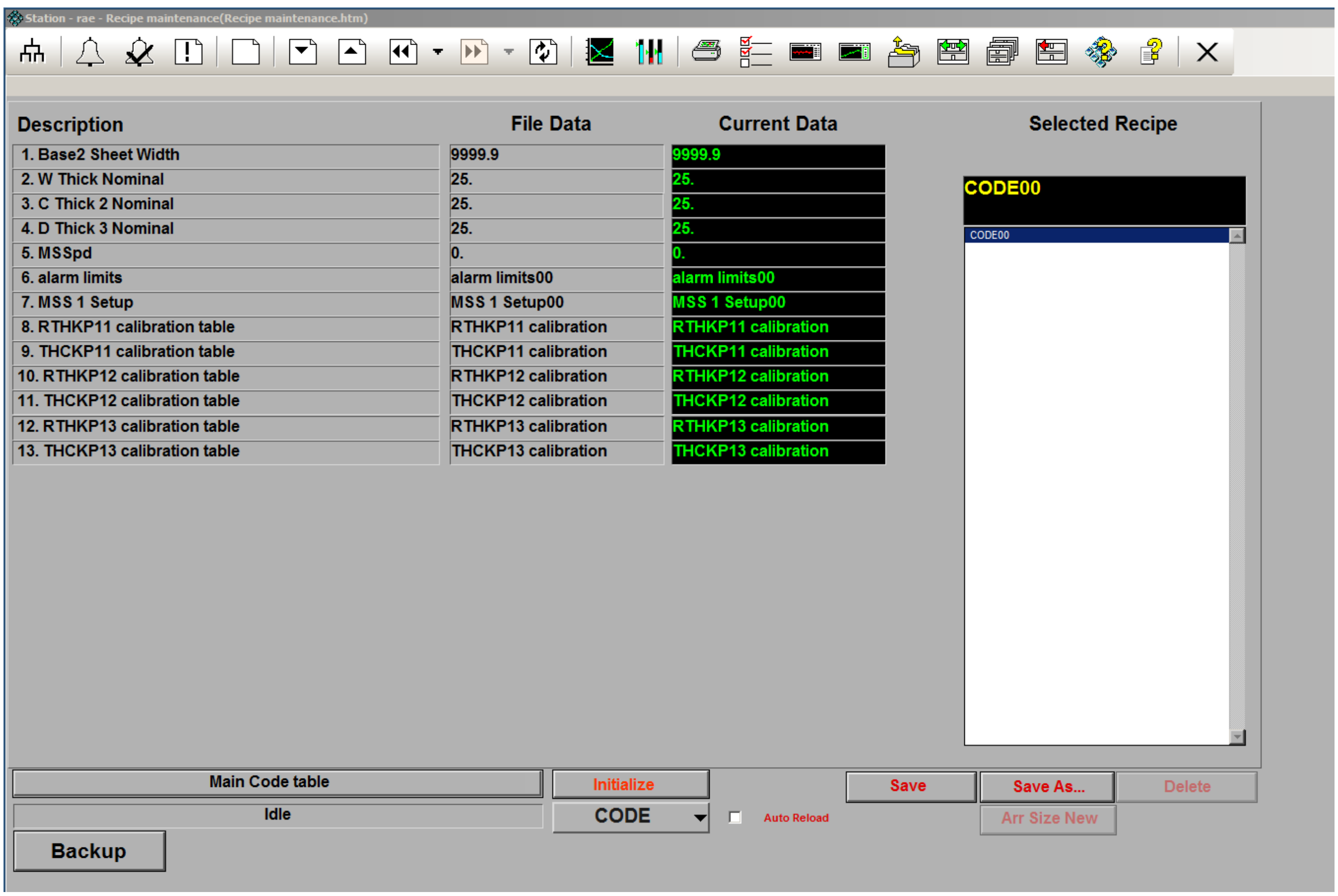


Figure 5-3 Recipe maintenance Display: Main Code table

Create a grade recipe for each grade as required, for example, CODE00 to CODE02. Link to the appropriate (grade-dependent) THCKPxy calibration table. Each grade should link to the same RTHKPxy calibration tables–these tables contain the grade-independent calibration constants.

6. Operations

This chapter describes how to monitor the basic, day-to-day functioning of the Rubber Thickness sensor.

6.1. Emergency retraction

The Rubber Thickness sensor can be forced to retract by setting the switch on the front of the control cabinet to the *force retraction* position. When the switch is set, the sensors will no longer respond to computer commands, or to the pushbutton on the front of the control cabinet.

The gauges will remain retracted until the switch is set back to the *auto* position, and an insertion request is made through software, or by using the pushbutton on the front of the control cabinet.

6.2. Using the pushbutton

If the emergency retraction switch is set to the *auto* position, the pushbutton on the front of the control cabinet can be used to insert and retract the sensors.

If an insertion is requested by pushing the button, the button will light up. The sensors will insert when the software determines it is safe to do so, which will typically take a second or so. Pushing the button again requests a retraction. The button light goes off, and the sensors retract.

The software records and reflects pushbutton requests.

Under normal operating conditions, the emergency retract switch is set to the *auto* position, and the software, the MXProLine operator station, is used to insert and retract the sensors.

6.3. Monitoring sensor function

The main sensor information page is the **Sensor Maintenance** display (see Figure 6-1), called up using the **Scanner/Sensor** tab.

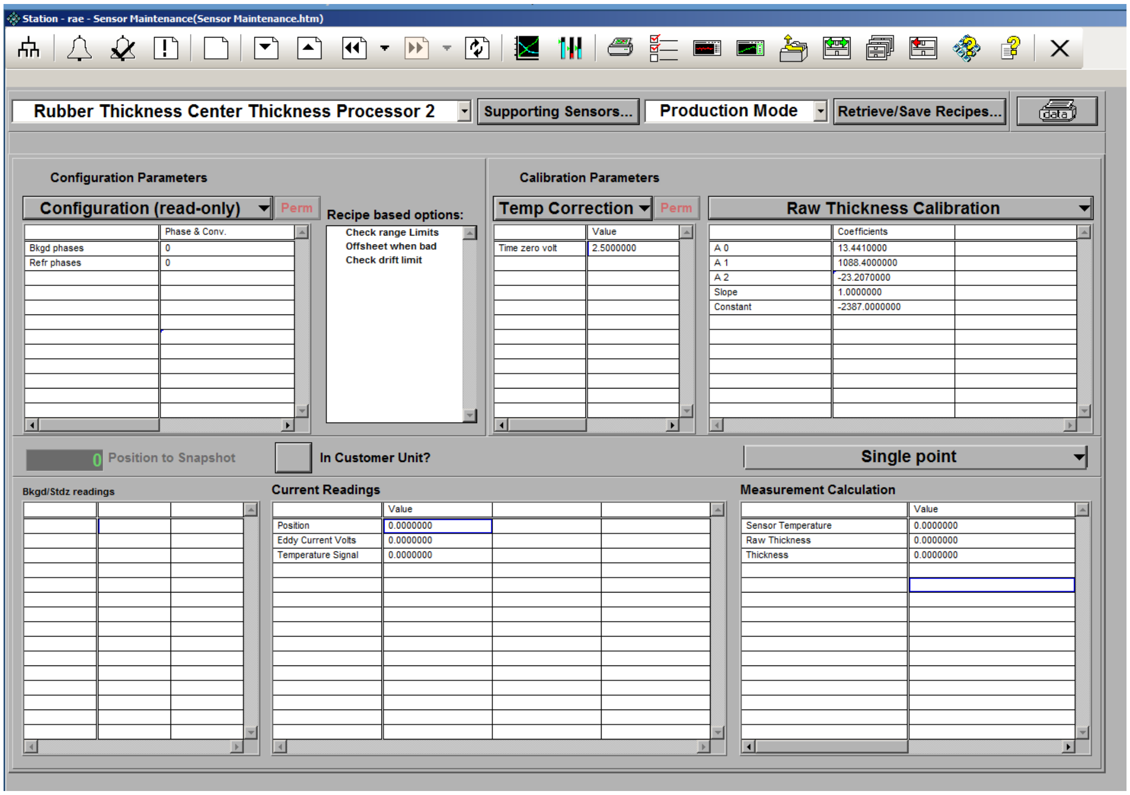
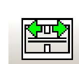
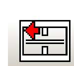


Figure 6-1 Sensor Maintenance Display

Click the yellow file button  at the top of the page to load the desired recipe. The constants associated with each recipe will appear in the top right-hand table. Using the drop-down arrow, you can select **Raw Thickness Calibration** (for the grade-independent calibrations), or **Final Thickness Calibration** (for the grade-dependent dynamic offset). Verify that these constants are as expected.

All sensors mounted together on a frame will insert and retract together.

Insertion and retraction is automatically handled during grade changes. To manually insert and retract, use the icons at the top of the page (these buttons only work in production mode):

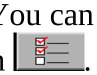
- the green scanning button  inserts the sensors
- the red offset button  retracts the sensors

Experimental changes to calibration constants can only be done in maintenance mode. In maintenance mode, the values in the calibration table on the **Sensor Maintenance** display can be edited. They can be saved by clicking **Retrieve/Save Recipes**. If the recipe is then reloaded in production mode, the new values will be used.

Alternatively, the **Product tuning** display (under the **Setup** tab) can be used to make changes to the dynamic offsets.

The bottom of the **Sensor Maintenance** display shows the current readings from the sensor. Each sensor can be called up in turn using the drop-down menu at the top left of the page.

6.4. Measurement set up and trend display

Customer units can be chosen by checking the customer unit checkbox. The defaults are microns and degrees Celsius. You can change the customer units by pressing the system setup and debug button . Units can be set by using the **Report Units** setup.

Sensor measurements can be viewed as a trend plot in the **Multi Fixed Point** display, accessible from the **Standard** tab.

Figure 6-2 Multi Fixed Point Display

Using the drop-down menu on each graph, you can select up to three measurements to view. Different sets of plots can be defined as desired.

The measurements can be displayed either as Now values (the current measurement), or as a filtered Trend value. Trended data is based on a weighted running average algorithm. The weighting factor (filter factor) can be changed (a typical value is 0.2). This is the equivalent of averaging approximately 10 scans of data. To set the filter factor on the **Scanner Setup** display to 0.2:

1. Click the scanner/sensor button.
2. Click **Measurement Setup**.
3. In the **Measurement Setup** display (see Figure 6-3), under the **Select measurement** option, choose which measurement to set up. You can choose any of the coat weight component measurements, or the coat weight itself.
4. Under **Measurement Arrays**, set **Trend Filter Factor** to 0.2.

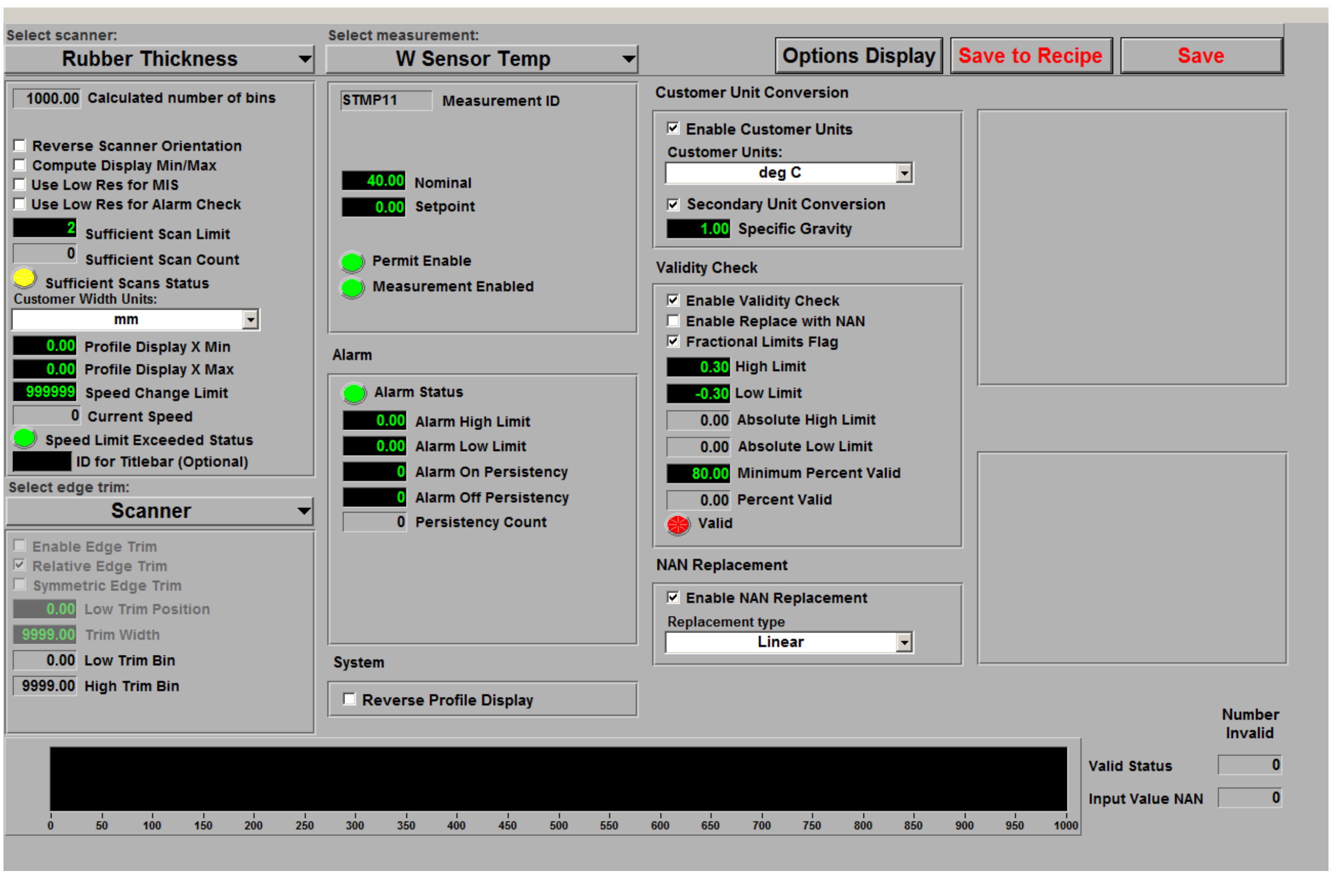


Figure 6-3 Measurement Setup Display

7. Maintenance and Troubleshooting

This chapter describes the periodic maintenance tasks to be performed, and details some troubleshooting techniques.

7.1. Maintenance

The Rubber Thickness sensor is robust and generally does not require routine maintenance. It is important to keep the face of the sensor clean and free of obstruction. Metal objects (other than the calender roll) should be kept 10 cm (3.93 in.) away from the Eddy Current sensor because they can interfere with measurement.

7.2. Troubleshooting

Table 7-1 details some possible problems and solutions. If problems persist after trying the solutions listed in the table, contact your local Honeywell Technical Assitance Center (TAC).

For additional troubleshooting information, refer to the *VN Series Thickness Measurement Converter Instruction Manual* for the Eddy Current sensor. See Related Reading.

Table 7-1 General Troubleshooting

<table>
<tr><th>Symptom</th><th>Possible Cause</th><th>Solution</th></tr>
<tr><td rowspan="3">Wheels stick to product</td><td rowspan="3">Rubber sticks preferentially to colder surfaces</td><td>Teflon or low-friction Ni-coated wheels can be ordered</td></tr>
<tr><td>Allow time for the sensor carriage to heat up</td></tr>
<tr><td>In the worst case, the sensor cannot be used</td></tr>
</table>

Symptom	**Possible Cause**	**Solution**
Sensor does not retract when the force retract switch is engaged	Air line problem	Check that the air lines are properly connected at both the retraction arm and the control cabinet. A common problem is that they are inverted (retract air plugged into insertion mechanism, and vice-versa).
		Check that the air supply is delivering enough pressure at the control cabinet
		Check that the supply lines are not kinked or pinched
		Check that the solenoid is not broken or plugged at the control cabinet
Sensor does not retract or insert when pushbutton is used or when under software control	Force Retract switch is engaged	Confirm that the force retract is set to auto
	Air line problem	Check that the air lines are properly connected at both the retraction arm and the control cabinet. A common problem is that they are inverted (retract air plugged into insertion mechanism, and insertion mechanism plugged into retract air).
		Check that the air supply is delivering enough pressure at the control cabinet
		Check that the supply lines are not kinked or pinched
		Check that the solenoid is not broken or plugged at the control cabinet
	Signal propagation problem	Confirm that the MXProLine software receives the insertion/retraction request; if it does not, check that the EDAQ harness is not damaged and is correctly plugged in.
Sensor always reads 0 or 10 volts	Signal propagation problem	Check that the correct sensor is being monitored with the MXProLine software
		Check the EDAQ harness for damage and proper insertion
		Check the sensor cable for damage
		Check that the Eddy Current sensor responds, by monitoring voltage across the output points on the displacement converter (see Figure 2-3 and Figure 2-4), while moving a metal surface towards and away from the sensor measurement surface. If the sensor responds, there is a wiring issue inside the interface box; call TAC.
		If the sensor does not respond, refer to the *VN Series Thickness Measurement Converter Instruction Manual*. See Related Reading.

8. Storage, Transportation, and End of Life

This chapter summarizes Honeywell policy with regards to the storage and disposal of components of the Rubber Thickness sensor.

8.1. Storage and transportation environment

In order to maintain integrity of system components, storage and transportation of all equipment must be within the parameters shown in Table 11-1.

Table 11-1 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

8.2. 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.

9. Glossary

Downstream	Towards the reel, or in the direction of travel of the sheet
Ethernet Data Acquisition Board (EDAQ)	Digitization and control board used on each sensor on the Experion MX platform
Gauge Support Processor (GSP)	A software layer in the Experion MX host, which manages the status and measurements of a sensor as sent by the MSS
Human Machine Interface (HMI)	Also referred to as UPI
LED (light emitting diode)	An illuminator with high speed response capable of short intense light pulses
Linux	Computer operating system running on the EDAQ CPU as well as the MSS computer
Machine Direction (MD)	The direction in which product travels down the machine
Management Information System (MIS)	System or subsystem that collects and manages information on the product production
Measurement Sub System (MSS)	A node in the Experion MX which controls the Q4000 scanner and interfaces to the sensors in that scanner
MXProline	A quality control system (QCS).
Quality Control System (QCS)	A computer system that manages the quality of the product being produced
Real-Time Application Environment (RAE)	The system software used by Experion MX QCS to manage data exchange between applications

Real-Time Data Repository (RTDR)	The database managed by RAE to store system data, and data for individual applications
Sensor Set	The term used in the **Sensor Maintenance** display to describe a set of sensors working together on a scanner to perform one measurement

A. Part Numbers

The Rubber Thickness sensor component part numbers listed in Table A-1 are provided for reference purposes.

Table A-1 Part Numbers

Part Number	Name
6540100051	Fan 103 cfm 24 V DC brushless
6541002769	Power supply 24 V DC 5 A at 60◦C
6541002796	Conv DC–DC 12–24 V DC to 5–15 V DC 2 A
6541800074	Solenoid valve five port, two position, 24 V DC
6543100033	Computer diskless 1600 MHz 1 GB RAM
6543120016	Hard drive SATA 63.5 mm (2.5 in.)
6553400078	Spring component, 12.19 mm (0.48 in.) x 1.39 mm (0.055 in.) x 44.45 mm (1.75 in.) ss316
6555100254	Universal speed control
6555240311	90 degree fitting, 4 mm (0.16 in.)
6581100067	Air cylinder 25 mm (0.98 in.) diameter x 25 mm (0.98 in.) stroke
6581100069	Wheel assembly 2 mm (0.07 in.) range
6581100070	Wheel assembly 5 mm (0.2 in.) range
6581100071	Wheel assembly 10 mm (0.4 in.) range
6581100073	Bellows (protector)
6581100074	Cuff insert 19 mm (0.75 in.) bellows 12.7 (0.5 in.) ID
6581100075	Cuff insert 19 mm (0.75 in.) bellows 19 mm (0.75 in.) ID
6581200058	Rubber sensor 2 mm (0.07 in.) range with thermocouple
6581200059	Rubber sensor 5 mm (0.2 in.) range with thermocouple
6581200061	Rubber sensor 10 mm (0.4 in.) range with thermocouple
6581200065	Rubber extension cable with 6 m (32.8 ft.) thermocouple lead
6581200067	Rubber displacement converter 2 mm (0.07 in.) range 115 V AC
6581200069	Rubber displacement converter 2 mm (0.07 in.) range 220 V AC
6581200071	Rubber displacement converter 5 mm (0.2 in.) range 115 V AC
6581200073	Rubber displacement converter 5 mm (0.2 in.) range 220 V AC

Part Number	Name
6581200079	Rubber displacement converter 10 mm (0.4 in.) range 115 V AC
6581200081	Rubber displacement converter 10 mm (0.4 in.) range 220 V AC
6581500030	EDAQ PCBA