Gloss Measurement

System Manual

6510020466 Rev 01

Gloss Measurement

March, 2013

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Introduction

The purpose of this manual is to provide instructions on how to operate, install, calibrate, and maintain Honeywell Gloss Measurement, model Q4208-52.

The Gloss Measurement, model Q4208-52, is designed to comply with the specifications of the TAPPI standard *T480*.

The TAPPI standard only applies to gloss measurements at a 75 degree angle.

ATTENTION

The terms *Gloss Measurement* and *Gloss Sensor* refer to the same system. These terms are used interchangeably in this manual.

ATTENTION

The marketing model number for the Gloss Measurement used for DIN gloss measurements is 4208-0 (*Precision Advanced Gloss Measurement User Manual* p/n 46022901).

The engineering and manufacturing model number for all Gloss Measurement is 09420852.

Audience

This manual is intended for use by Honeywell field and factory personnel and customers who operate, install, calibrate, or maintain the Honeywell Gloss Measurement, model Q4208-52.

It is assumed that the reader has some knowledge of the operation of paper machines and paper quality measurements, as well as basic understanding of mechanical, electrical and computer software concepts.

About this manual

This manual contains 11 chapters and two appendixes.

Chapter 1, **System Overview**, provides an overview of the Gloss Measurement system.

Chapter 2, **EDAQ**, describes the principles and operation of the Ethernet Data Acquisition (EDAQ) board.

Chapter 3, **System and Software Operations**, provides a general overview of system operations and software.

Chapter 4, **Displays,** describes the computer displays that are relevant to sensor operation, and provides instructions for configuring the software.

Chapter 5, **Installation**, describes field installation procedures, and provides instructions for configuring the hardware.

Chapter 6, **Calibration**, describes calibration procedures.

Chapter 7, **Preventive Maintenance**, describes and lists recommended ongoing preventive maintenance tasks.

Chapter 8, **Tasks**, describes procedures for maintenance, diagnostic, and troubleshooting tasks.

Chapter 9, **Troubleshooting**, describes symptoms, alarms, possible causes, and links to associated diagnostic or troubleshooting tasks.

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

Chapter 11, **Glossary**, lists and describes terms and acronyms used in this manual.

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

Appendix B, **Gloss Measurement Database**, describes and lists default values for setup constants.

Related reading

The following documents contain related reading material.

Honeywell Part Number	**Document Title / Description**
46022901	Precision Advanced Gloss Measurement User's Manual (March-2005) for Gloss Sensor Models 4208-0 (DIN gloss measurements at 45 degrees and 75 degrees) 4208-1 (TAPPI gloss measurements at 75 degrees)
6510020192	Da Vinci Operator's Manual (July 2004)
6510020381	Experion MX MSS and EDAQ Data Acquisition System Manual
6510020442	Experion MX Operators 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

1.1. Paper gloss

The gloss of flat paper and paperboard can be defined as the fraction of incident light that is specular-reflected from a sample when the angles of incidence and reflection are the same. To compute the gloss value, the ratio of the incident and reflected light is multiplied by a scale factor to standardize the measurement, and an offset is added to compensate for system drift, environmental effects, and other effects. The details of the measurement are precisely specified because gloss is a sensory perception that can change from one observer to another.

Gloss measurement is sensitive to variations, unrelated to the paper gloss, that change the amount of light reflected from the sample, such as dirt accumulating on system optics. An accurate and reliable measurement of gloss must account for these variations. The Gloss Measurement design includes a separate measurement system to correct for those effects.

1.2. Measurement principle

The Gloss Measurement can measure paper gloss with values between 0 and 100 gloss units. The sensor is capable of TAPPI gloss measurements at 75 degrees for medium to high gloss surfaces.

The Gloss Measurement measures visible reflections from one side of the paper sheet. The sensor employs a single head with four data channels that provide two measurements:

- gloss measurement of the sheet
- measurement of the cleanliness of the sensor windows

Each measurement has a reference channel and a measurement channel. The signal is reflected back into the single sensor head. All of the hardware for the sources and receivers is contained in that single sensor head.

Figure 1-1 shows the signal path for the Gloss Measurement.

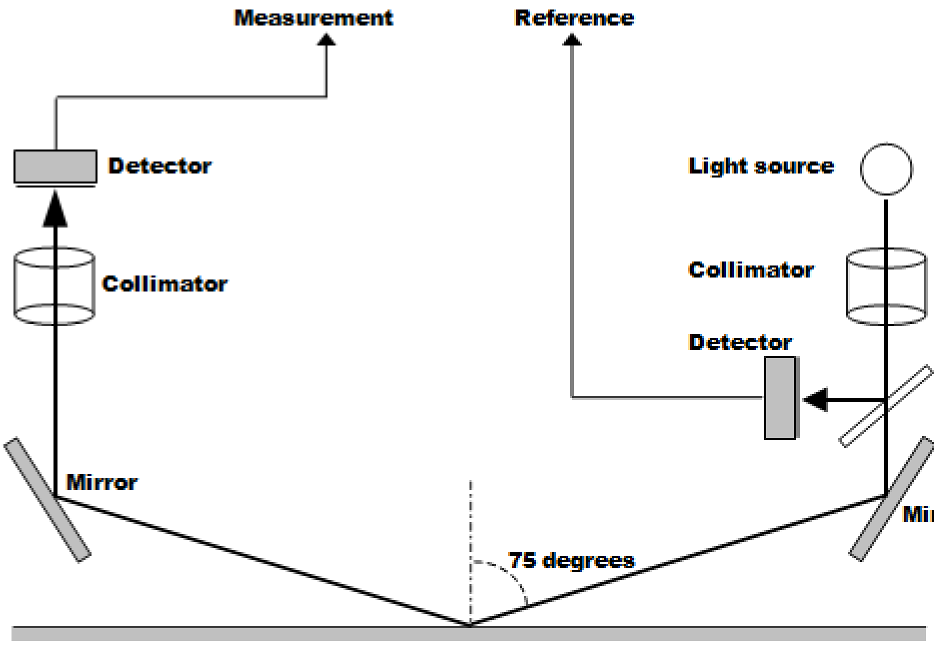


Figure 1-1 Gloss Measurement Signal Path

The visible light that illuminates the sheet is modulated to distinguish *signal* from *ambient* light, and to allow for improved signal amplification.

A separate optical path and subsystem are included in the sensor design to provide continuous monitoring of window cleanliness. Figure 1-2 provides a block diagram of the window cleanliness signal path for the Gloss Measurement.

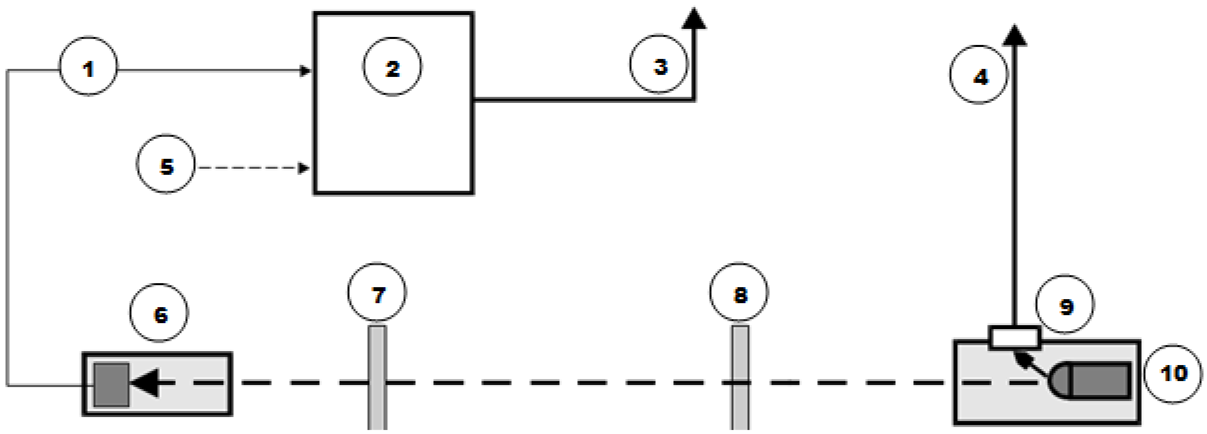


Figure 1-2 Window Cleanliness Signal Path

Table 1-1 lists and describes the items shown in Figure 1-2.

Table 1-1 Window Cleanliness Signal Path Items

Item	Description
1	75 degree window signal
2	Commutator (45 or 75 degree)
3	Direct correction measurement
4	Dirt correction reference
5	Not used (45 degree signal window)
6	Dirt detector
7	Receiver window (75 degree)
8	Source window (75 degree)
9	Dirt reference detector
10	LED

To minimize the influence of sheet flutter and variations in the sheet surface on the measurements, the sensor uses an air vortex clamp to stabilize the sheet position.

A temperature stability system improves sensor performance and extends the lifetime of the Gloss Measurement components.

1.3. Hardware overview

The Gloss Measurement hardware design is similar in many respects to the hardware used in the Honeywell moisture sensors, the Direct IR Coat Weight sensor, and other similar sensors. Figure 1-3 shows the Gloss Measurement head with the cover removed.

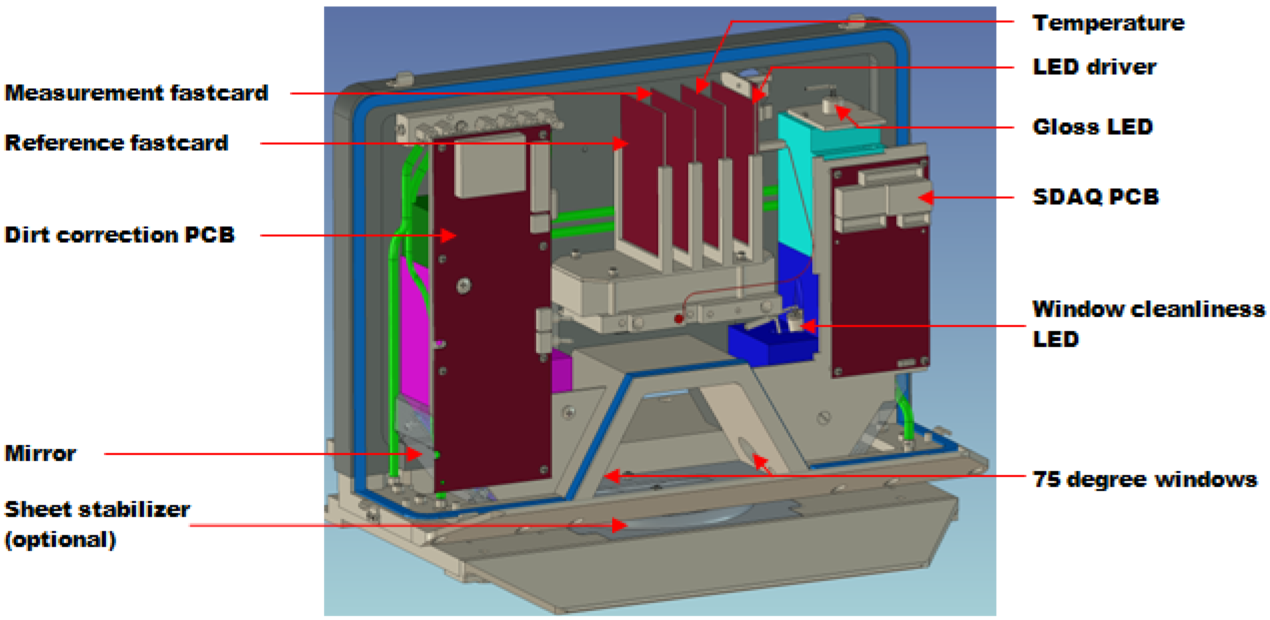


Figure 1-3 Sensor Head

1.3.1. Light sources and optics

The LED sources for the measurement of gloss and window cleanliness have a visible output, nominally 5000 micro-candelas brightness, centered around 540 nm (a green wavelength). The gloss LED has its own driver board, which supplies power to the LED and provides deep modulation of the light source at 570 Hz. The driver for the window cleanliness LED, modulated at 2.8 kHz, is on the dirt corrector printed circuit board (PCB).

The light from the gloss LED is collimated by a lens (see Figure 1-1). A beam splitter reflects a portion of the beam to a photo detector that provides a reference for the gloss measurement. The transmitted portion of the beam is set incident to the sheet at a 75 degree angle.

The light is reflected from the sheet and collected by the receiver lens. The lens directs the light to the silicon photo detector.

The Gloss Measurement is calibrated using an external standard gloss tile. There is no internal standard in the Gloss Measurement, and it does not make use of the standardize operation found in other, similar Honeywell sensors.

The beam from the window cleanliness LED passes through the windows (see Figure 1-2). The beam has its own detector, and the signal from the detector is amplified by the dirt corrector PCB and sent to the system software to provide a correction to the gloss measurement.

A reduction of sensor accuracy might result if the sensor windows are allowed to accumulate water, dust, or other materials. See Section 8.2 for procedures for cleaning sensor windows.

1.3.2. Receiver electronics

The driver circuit that powers and modulates the LEDs also sends the 570 Hz and 2.5 kHz synchronization signals through the backplane to the fastcard amplifiers (to the dirt corrector PCB). The synchronization signals are used in the demodulation of the received signals to make the sensor insensitive to ambient light.

The System Data Acquisition (SDAC) board is shown in Figure 1-3. The SDAC provides the output signals from the sensor head in Da Vinci systems. Gloss measurement of Experion MX system does not contain SDAC. Gloss sensor provides output signals to EDAQ, which is located inside the Experion head (see Chapter 2).

The light for each channel is detected by a silicon photo detector, and is then amplified. The fastcard amplifier for the receiver electronics provides rapid sensor response time. The amplified signal is demodulated using the synchronization signal. The resulting 0–8 V DC signal is read by the system.

The components used for gloss measurements are supported by the Unigauge backplane. This backplane passes the various signals and voltages to the other components, and houses the DC–DC converters used to power the electronics. The dirt corrector PCB provides the same functions for the components used for window cleanliness measurements. The dirt corrector PCB is responsible for all of the measurement and control electronics for the subsystem that monitors window cleanliness.

The temperature control PCB in the Gloss Measurement is used to monitor and control the temperature inside the sensor. The temperature measurement is not used as a measurement or control parameter for gloss.

See Chapter 5 for more details on sensor hardware.

2. 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).

2.1. Physical layout

Figure 2-1 and Figure 2-2 show the EDAQ PCB 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.

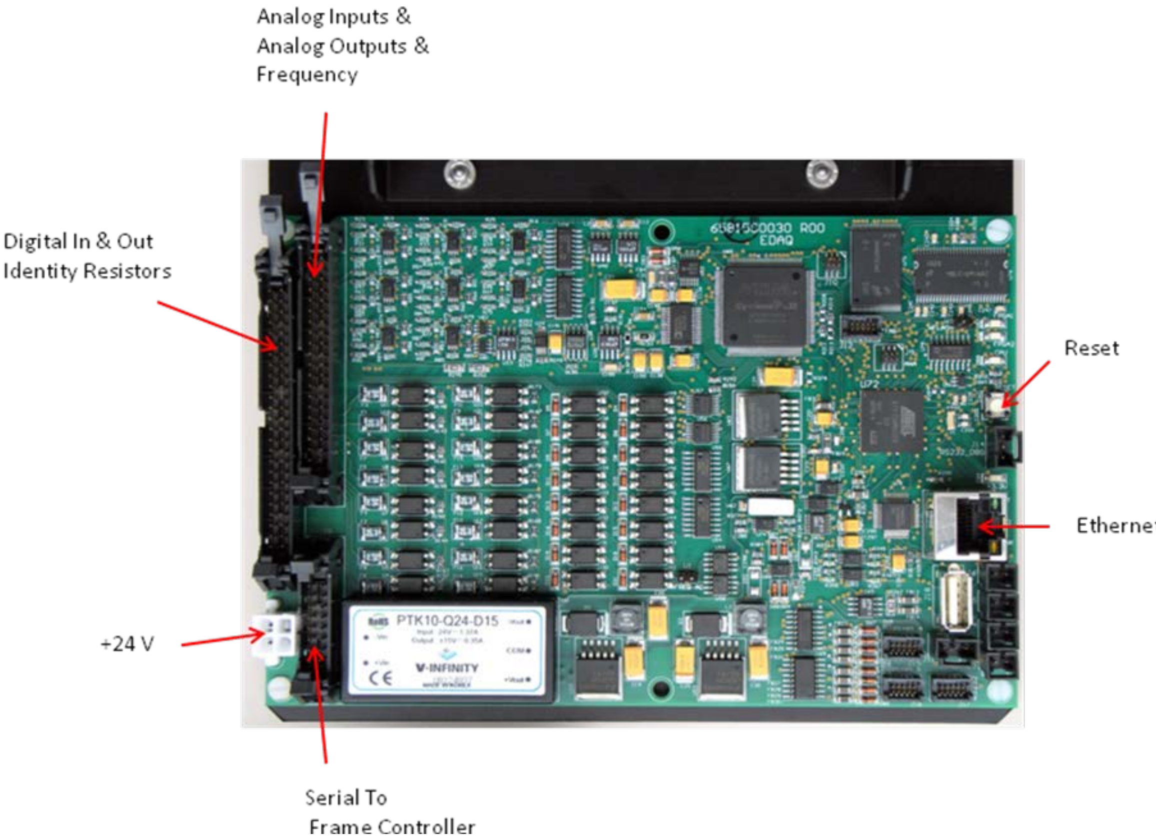


Figure 2-1 EDAQ Board

As shown in Figure 2-2, 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.

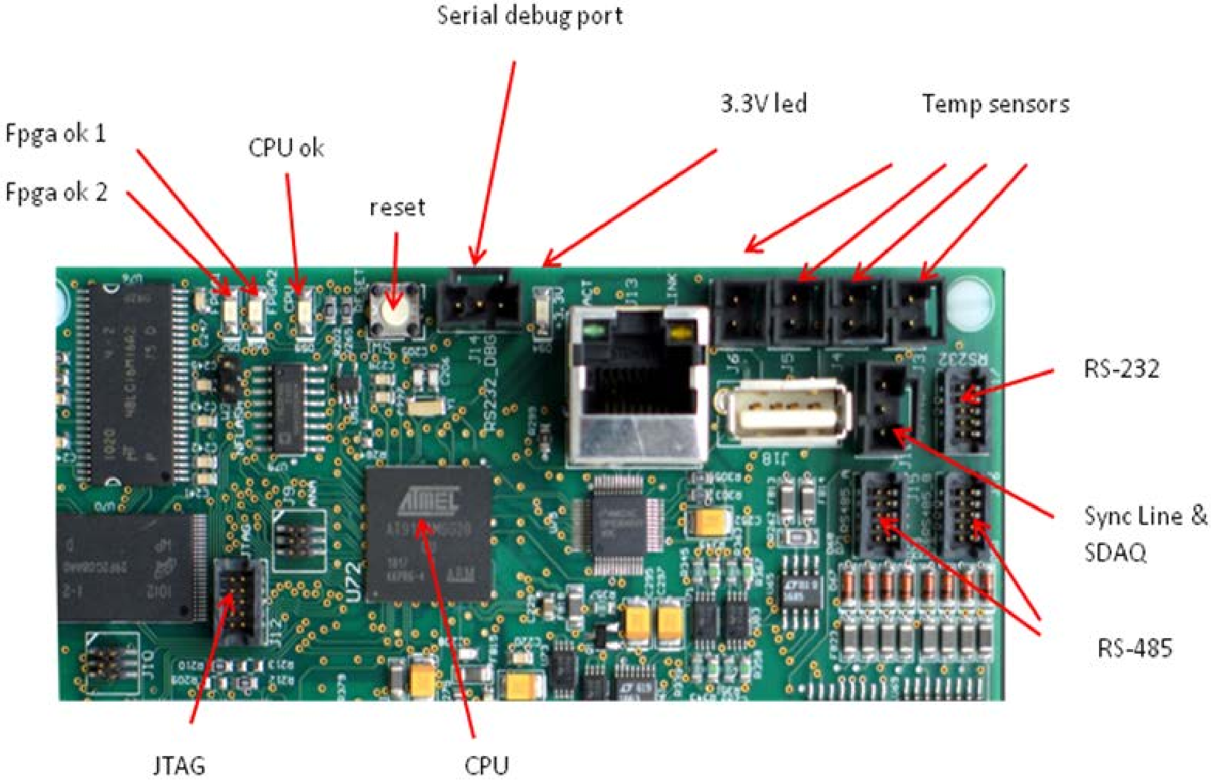


Figure 2-2 EDAQ Board: Ports and Diagnostic LEDs

2.2. Hardware status information

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

- 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

2.3. 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.

2.4. 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.

2.5. 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 2-3, is the list of expected EDAQs with three types of status indicators (from left to right).

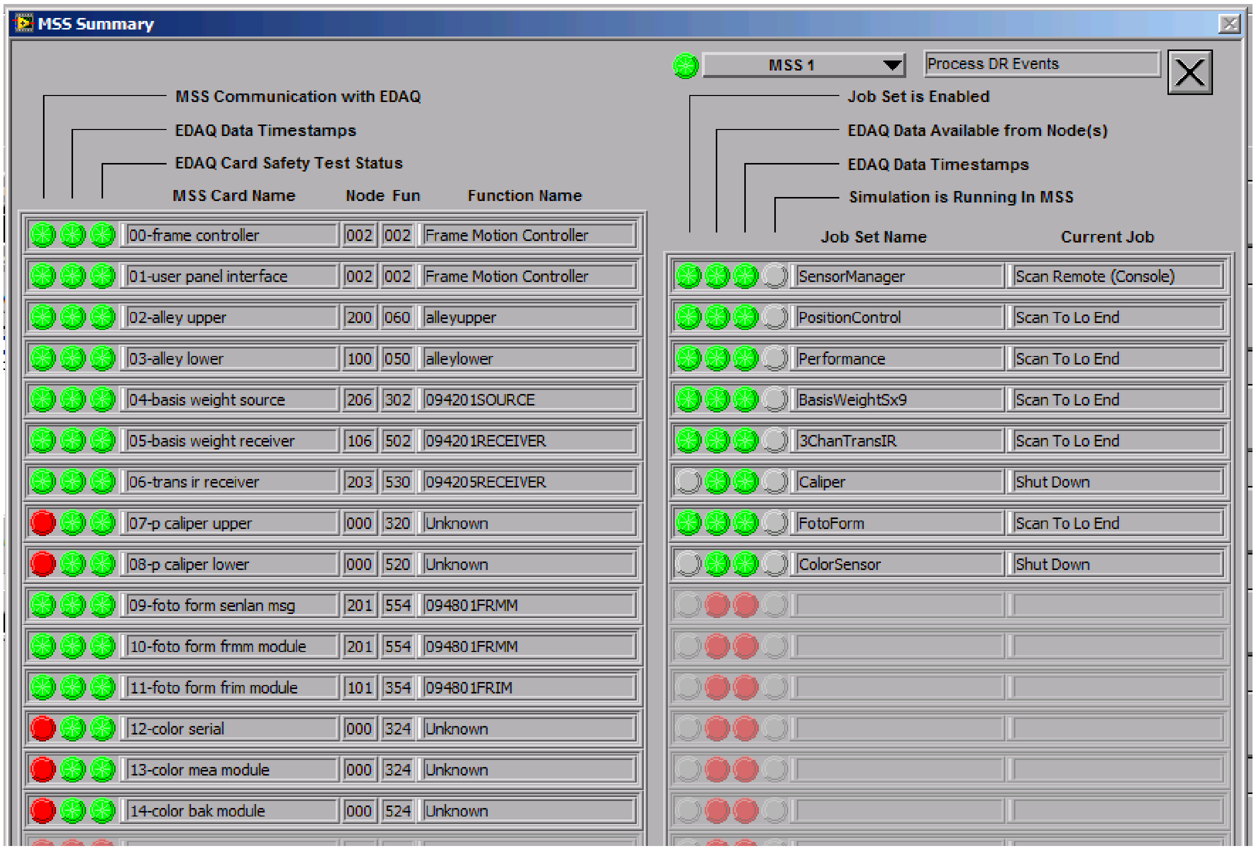


Figure 2-3 MSS Summary

Table 2-1 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

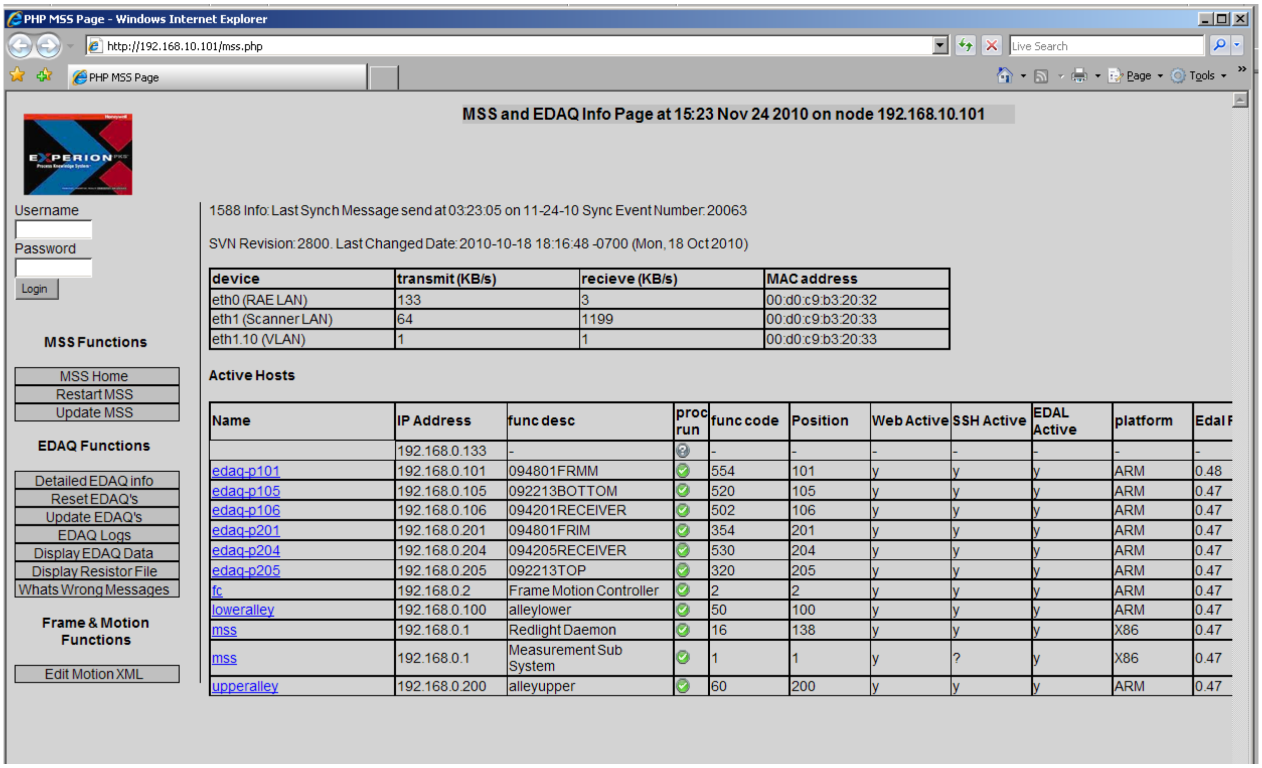
Sensors that are part of the QCS database, but are not enabled on the scanner, appear in the left column indicators in red, for example, *07-caliper upper* in Figure 2-3.

2.6. 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 2-4 shows **PHP MSS Page** (the main MSS Web page).



PHP MSS Page - Windows Internet Explorer

http://192.168.10.101/mss.php

MSS and EDAQ Info Page at 15:23 Nov 24 2010 on node 192.168.10.101

Username

Password

Login

MSS Functions

MSS Home
Restart MSS
Update MSS

EDAQ Functions

Detailed EDAQ info
Reset EDAQ's
Update EDAQ's
EDAQ Logs
Display EDAQ Data
Display Resistor File
Whats Wrong Messages

Frame & Motion Functions

Edit Motion XML

1588 Info: Last Synch Message send at 03:23:05 on 11-24-10 Sync Event Number: 20063

SVN Revision: 2800. Last Changed Date: 2010-10-18 18:16:48 -0700 (Mon, 18 Oct 2010)

device	transmit (KB/s)	recieve (KB/s)	MAC address
eth0 (RAE LAN)	133	3	00:d0:c9:b3:20:32
eth1 (Scanner LAN)	64	1199	00:d0:c9:b3:20:33
eth1.10 (VLAN)	1	1	00:d0:c9:b3:20:33

Active Hosts

Name	IP Address	func desc	proc run	func code	Position	Web Active	SSH Active	EDAL Active	platform	Edal F
	192.168.0.133	-		-	-	-	-	-	-	-
edaq-p101	192.168.0.101	094801FRMM		554	101	y	y	y	ARM	0.48
edaq-p105	192.168.0.105	092213BOTTOM		520	105	y	y	y	ARM	0.47
edaq-p106	192.168.0.106	094201RECEIVER		502	106	y	y	y	ARM	0.47
edaq-p201	192.168.0.201	094801FRIM		354	201	y	y	y	ARM	0.47
edaq-p204	192.168.0.204	094205RECEIVER		530	204	y	y	y	ARM	0.47
edaq-p205	192.168.0.205	092213TOP		320	205	y	y	y	ARM	0.47
fc	192.168.0.2	Frame Motion Controller		2	2	y	y	y	ARM	0.47
loweralley	192.168.0.100	alleylower		50	100	y	y	y	ARM	0.47
mss	192.168.0.1	Redlight Daemon		16	138	y	y	y	X86	0.47
mss	192.168.0.1	Measurement Sub System		1	1	y	?	y	X86	0.47
upperalley	192.168.0.200	alleyupper		60	200	y	y	y	ARM	0.47

Figure 2-4 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.

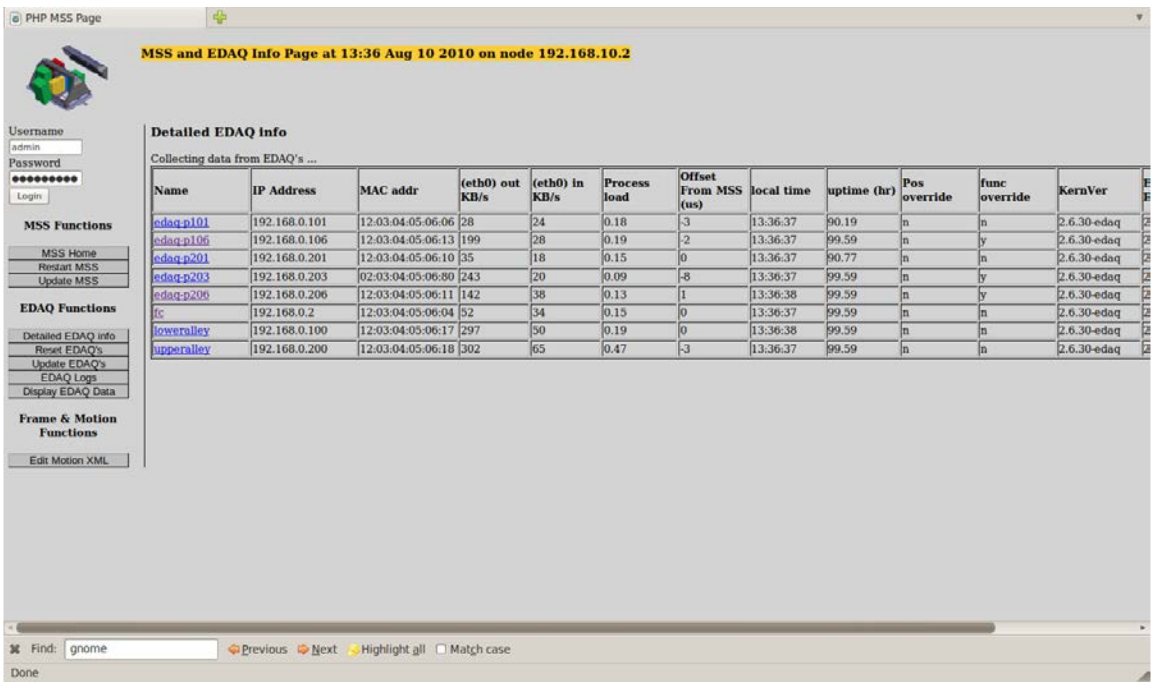
The second table lists all EDAQs discovered on the scanner LAN, their IP numbers, a brief description (related to model number), a program status column, the associated function code and position code, and whether the communication protocols are running (http, SSH, and Edal, the proprietary sensor data 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 2-5) 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).



Name	IP Address	MAC addr	(eth0) out KB/s	(eth0) in KB/s	Process load	Offset From MSS (us)	local time	uptime (hr)	Pos override	func override	KernVer
edaq-p101	192.168.0.101	12:03:04:05:06:06	28	24	0.18	-3	13:36:37	90.19	n	n	2.6.30-edaq
edaq-p106	192.168.0.106	12:03:04:05:06:13	199	28	0.19	-2	13:36:37	99.59	n	y	2.6.30-edaq
edaq-p201	192.168.0.201	12:03:04:05:06:10	35	18	0.15	0	13:36:37	90.77	n	n	2.6.30-edaq
edaq-p203	192.168.0.203	02:03:04:05:06:80	243	20	0.09	-8	13:36:37	99.59	n	y	2.6.30-edaq
edaq-p206	192.168.0.206	12:03:04:05:06:11	142	38	0.13	1	13:36:38	99.59	n	y	2.6.30-edaq
fc	192.168.0.2	12:03:04:05:06:04	52	34	0.15	0	13:36:37	99.59	n	n	2.6.30-edaq
loweralley	192.168.0.100	12:03:04:05:06:17	297	50	0.19	0	13:36:38	99.59	n	n	2.6.30-edaq
upperalley	192.168.0.200	12:03:04:05:06:18	302	65	0.47	-3	13:36:37	99.59	n	n	2.6.30-edaq

Figure 2-5 Detailed EDAQ Information: Partial Display

3. System and Software Operations

The Gloss Measurement is controlled by the quality control system (QCS) using the same operations as many other Honeywell sensors. This chapter describes how paper gloss is calculated from gloss measurements taken during such operations as background and onsheet scanning. See Chapter 4 for descriptions of the QCS displays used by the Gloss Measurement.

The system performs many safety limit checks, and limit checks on data quality, which are referred to throughout this chapter. Those limits are stored in the real-time data repository (RTDR) database, and accessed through Experion MX, as described in Chapter 4. Tables of the database values, typical for normal operation, are provided in Appendix B.

ATTENTION

Prototypes of the Gloss Measurement used a laser to measure window cleanliness, and references to the laser occur in software variables. The software variables using the term *laser* refer to the window cleanliness measurement beam, whether it is a laser or an LED. The term *LED* refers *only* to the LEDs used to check the photo detectors in the beam path that monitor window cleanliness. The term *LED* in the software does not refer to the LED used to measure gloss, nor the LED that has replaced the laser.

3.1. System inputs from gloss measurement

Variables described in this section can be viewed on the **Sensor Maintenance** display and on the **Scanner Diagnostics** display (see Figure 4-3), and are usually found under the **Scanner/sensor** selection tab (see Subsection 4.1.6).

3.1.1. Sensor inputs

Input to the Experion MX system comes from the Ethernet Data Acquisition (EDAQ) board, which is in the Experion MX head (see Chapter 2). The EDAQ collects sensor voltages and provides digital signals to the system. There are four data used for gloss calculation. Table 3-1 lists the signals, and the signal names found on the **Sensor Maintenance** display.

Table 3-1 Sensor Data Inputs

Variable	Description	Software Variable
CH1	Gloss Reference	Reference
CH2	Gloss Measurement	Signal
CH3	Window Cleanliness Reference	Lasr Ph Det
CH4	Window Cleanliness Measure	Lasr Win Det

3.1.2. Temperature measurement

There is one additional ADC input to the system indicating temperature. Channel 5 provides the voltage corresponding to the temperature of the electronics in the sensor head. The ADC input is read during the various system operations described in this chapter. The temperature measurement is available to the user (see Subsection 4.1.6), but the software does not use the temperature in any of the measurements or calculations of gloss values.

3.1.3. Inputs from other types of sensors

No inputs from other types of sensors in the system, for example, a moisture sensor, are required to calculate gloss measurements.

3.2. System outputs to the Gloss Measurement

Table 3-2 lists and describes the contact outputs that are sent by the system to the sensor.

Table 3-2 Contact Outputs

Contact Output	Description
DARK	Sets signals from detectors to zero. Used to record offsets due to electronics. Offsets are subtracted from subsequent measurements.
OPTIC DIR	Optical direction selection 45 degrees or 75 degrees (model Q4208-52 only). Default is 75 degrees: flag is not set.

Table 3-3 lists the settings of the contact outputs used during gloss measurement operations.

Table 3-3 Contact Output Values

Operation	DARK	OPTIC DIR
Background :phase 1	On	Unchanged
Background: phase 2	Off	Unchanged
Reference	Off	Unchanged
Sample	Off	Unchanged
Onsheet mode	Off	Unchanged

3.3. Background

Taking a background for the Gloss Measurement has two phases:

1. Measure dark values for subsequent correction of readings.
2. Reset contact outputs.

Typically, a background is scheduled every eight or 24 hours to measure the dark offsets. Figure 1-1 and Figure 1-2 are helpful for understanding the sequence of operations for a background. Table 3-4 summarizes system actions during the two background phases.

Table 3-4 Background Phases

Background	Read and Save	DARK	Software
Phase 1	Dark offsets	x	Signal Dark Reference Dark Laser Ph D Dark Laser Win D Dark
Phase 2			Reset

The contact output OPTIC DIR should not be changed during the background. It is essential that a background be scheduled following a change in optical direction. Because the optical direction is saved in the database, and because the choice of beam path is recipe-dependent, the system will normally schedule a background and a reference automatically following a change in the recipe parameter.

3.3.1. Background: phase 1

The DARK contact outputs are arranged to obtain dark readings from the measurement and reference detectors for the gloss and window paths. The signals from all photo detectors to their respective amplifiers are set to zero, and the dark background values for the measurements are saved:

- *Signal Dark*: dark values for gloss measurement
- *Reference Dark*: dark values for gloss reference
- *Laser Ph D Dark*: dark values for window detector reference
- *Laser Win D Dark*: dark values for window measurement

3.3.2. Background: phase 2

The contact outputs are turned off, and the results of the background are reported.

3.4. Reference

The Gloss Measurement does not use a scheduled standardize procedure. For the Gloss Measurement, a standardize is referred to as a *reference*. It is identical to a manually requested standardize. When the software indicates standardize, it is referring to a reference procedure.

A reference has only one phase for the Gloss Measurement. The readings taken during a reference are used to correct measurements for electronic drift, changes in light source brightness, and window dirt build-up.

When a reference is requested, the measurement and reference values for the appropriate window detector are taken and corrected for dark values. These corrected readings are normalized using the corresponding time-zero values, and the results are compared to the appropriate drift limits in the database. The time-zero values used are the ones for the optical direction currently selected for the sensor.

These equations check for the intensity level of the window LED, and the build-up of dirt on the windows, respectively:

ABS {[(Lasr Ph Det - Laser Ph D Dark) / T0 Lasr Ph Det] - 1} ≤ Lasr Ph D Drift

Equation 3-1

ABS {[(Lasr Win Det - Laser Win D Dark) / T0 Lasr Win Det] - 1} ≤ Lasr Win D Drift

Equation 3-2

Similarly, the gloss measurement and gloss reference detectors are corrected for dark values, normalized using the time-zero values, and limit checked using the drift limits appropriate for the optical path. The resulting equations check the intensity level of the lamp and the possible drift of the reference electronics:

ABS {[(Reference - Reference Dark) / T0 Reference] - 1} ≤ Reference Drift

Equation 3-3

3.4.1. Limit checks during reference

If the sensor passes the reference test, ratios for the dark-corrected gloss and window measurements are displayed on the **Sensor Maintenance** display, in maintenance mode (see Figure 4-4).

If any of the limits are exceeded, the system re-tries the reference. If the test fails three consecutive times, the sensor is disabled and a message is displayed requiring you to either replace the light source, or to clean the windows.

A flashing alarm appears on the display, stating the nature of the failure. If the sensor is scanning, another reference (referred to as an *STDZ*) is forced. If the system is offsheet, for example, for sampling, the bad reference should not prevent subsequent sampling. You are given a choice of how to proceed following a bad reference by, for example, taking the scanner offsheet.

3.5. Onsheet and sample

3.5.1. Measurements and ratio calculations

The channels are read, and the corresponding dark values from the background operation are subtracted from each. Three ratios are calculated and used to determine the corrected gloss values described in Subsection 3.5.2.

The gloss (*signal*) measurement ratio, *Gloss Ratio*, is formed from the dark-corrected gloss measurement divided by the dark-corrected reference measurement:

Gloss Ratio = (Signal - Signal Dark) / (Reference – Reference Dark)

Equation 3-4

The ratio for the window reference detector is formed from the dark-corrected measurement value, divided by the time-zero value:

Laser Ph D Ratio = (Laser Ph Det - Laser Ph D Dark) / T0 Laser Ph Det

Equation 3-5

The ratio for the window cleanliness detector is formed from the dark-corrected measurement value, divided by the time-zero value:

Laser Win D Ratio = (Laser Win Det - Laser Win D Dark) / T0 Laser Win Det

Equation 3-6

A total correction value for window cleanliness is calculated in several steps. First, a generalized ratio is formed from the ratios for the window cleanliness reference channel and the window cleanliness measurement channel, and is used to multiply the gloss measurement ratio. This factor is then multiplied by a recipe-dependent slope (*Dirt Slope*, default value of one), and corrected by a recipe-dependent intercept value (*Dirt Intercept*, default value of zero) as follows:

*Dirt Ratio = {Gloss Ratio * [(Laser Ph D Ratio / Laser Win D Ratio) - 1] * Dirt Slope} + Dirt Intercept*

Equation 3-7

The default value of the window cleanliness ratio is just the time-zero ratio, but a provision exists to apply further corrections based on the recipe conditions.

3.5.2. Gloss calculations

The *Uncorrected Gloss* value, which refers to the window cleanliness, is calculated using the *Gloss Ratio*:

*Uncorrected Gloss = SLOPE * (Gloss Ratio) + INTERCEPT*

Equation 3-8

SLOPE and *INTERCEPT* are determined from recipe-dependent calibration, as described in Chapter 6.

This *Uncorrected Gloss* value is displayed in the **Maintenance Op Results** area on the **Sensor Maintenance** display (see Figure 4-4).

When multiplied by the same slope used in the preceding gloss calculation, *Dirt Correction* yields the following term:

*Dirt Correction = SLOPE * Dirt Ratio*

Equation 3-9

The provision exists to further add to the correction for temperature and the KCM correction, but these are not used with the Gloss Measurement.

When this total correction constant that has a negative value is added to the *Uncorrected Gloss* value, the final value of the gloss is obtained:

Gloss = Uncorrected Gloss + Dirt Correction

Equation 3-10

3.5.3. Limit checks

During onsheet operations, the sensor performs slice limit checks for each scan. Slice values are checked against nominals and tolerances stored in the database. Corresponding limit checks are made during a sample operation. If any values exceed their limits, this warning alarm is displayed and printed:

GLOSS: xx PCT GOOD

Typically, more than 80 percent of the onsheet slices must be within the limits for the scan to be considered good. The values of these limits can be viewed or modified using the **Sensor Maintenance** display.

3.6. Database

The values for the parameters and limits are stored in the database, and can be accessed through several different Experion MX displays. These limits are established when the system is built.

The display most commonly used for accessing the database values is the **Sensor Maintenance** display (see Figure 4-3, also see Subsection 4.1.6). It is typically found under the **Scanner/sensor** selection tab of Experion MX. However, some of the values can be accessed only through other Experion MX software (other displays, such as the **MSS Maintenance** display, or accessory software such as the **Database Browser**). For more information, see Related reading.

During installation or troubleshooting, the limits for the database are set to values that have a broader range than the normal operating limits. Limit values for normal operation are listed in Appendix B.

In addition to the limit checks, the database items fall into the following two categories:

- Recipe-independent constants for individual sensors on their scanners.
- Recipe-dependent constants (calibration constants) for the individual sensors. Each recipe or recipe group has its calibration constants. For an installation with more than one Gloss Measurement, these sensors are normally similar, so, the calibration constants are nearly the same for a given recipe for each sensor. It is customary to calibrate each recipe for all of the sensors, even though a particular sensor may not normally *see* that recipe.

4. Displays

This chapter describes how to use Experion MX to operate the Gloss Sensor by providing descriptions of displays relevant to Gloss Sensor operation, an overview of how to navigate through the displays, and instructions for using Experion MX to operate and maintain the system.

This manual assumes that you are familiar with such basic operations as using the Experion MX system to control the scanner and maintain the paper recipe database. In addition, it is assumed that you are generally familiar with calibration and configuration procedures for paper sensors.

The most important displays, relevant to the Gloss Measurement, such as the **Profiles** display and the **Quality Summary** display are described briefly in this Chapter.

For detailed information on the features of the displays, refer to the *Experion MX Operators Manual*, (p/n 6510020442).

4.1. Navigating Experion MX

The Experion MX system is provided with displays that can be configured to show process variables of most sensors, including the Gloss Measurement.

Navigation through the Experion MX displays is controlled by first selecting a navigation category, then clicking the applicable button on the navigation bar of the display. Which categories and display buttons are available depends on the level at which you log on. This manual assumes that you can log on at the *Control Engineer* or *Developer* level.

It is also possible to enter or modify the same values in the system database from different Experion MX displays. For example, many of the configuration parameters for the Gloss Sensor can be accessed through the **Recipe Setup** display, the **Recipe Maintenance** display, or the **Sensor Maintenance** display.

4.1.1. Profiles display

The **Profiles** display (see Figure 4-1) is the display that is most commonly used to track gloss values. Use the **Profile Select** display to configure the graphs in the **Profiles** display.

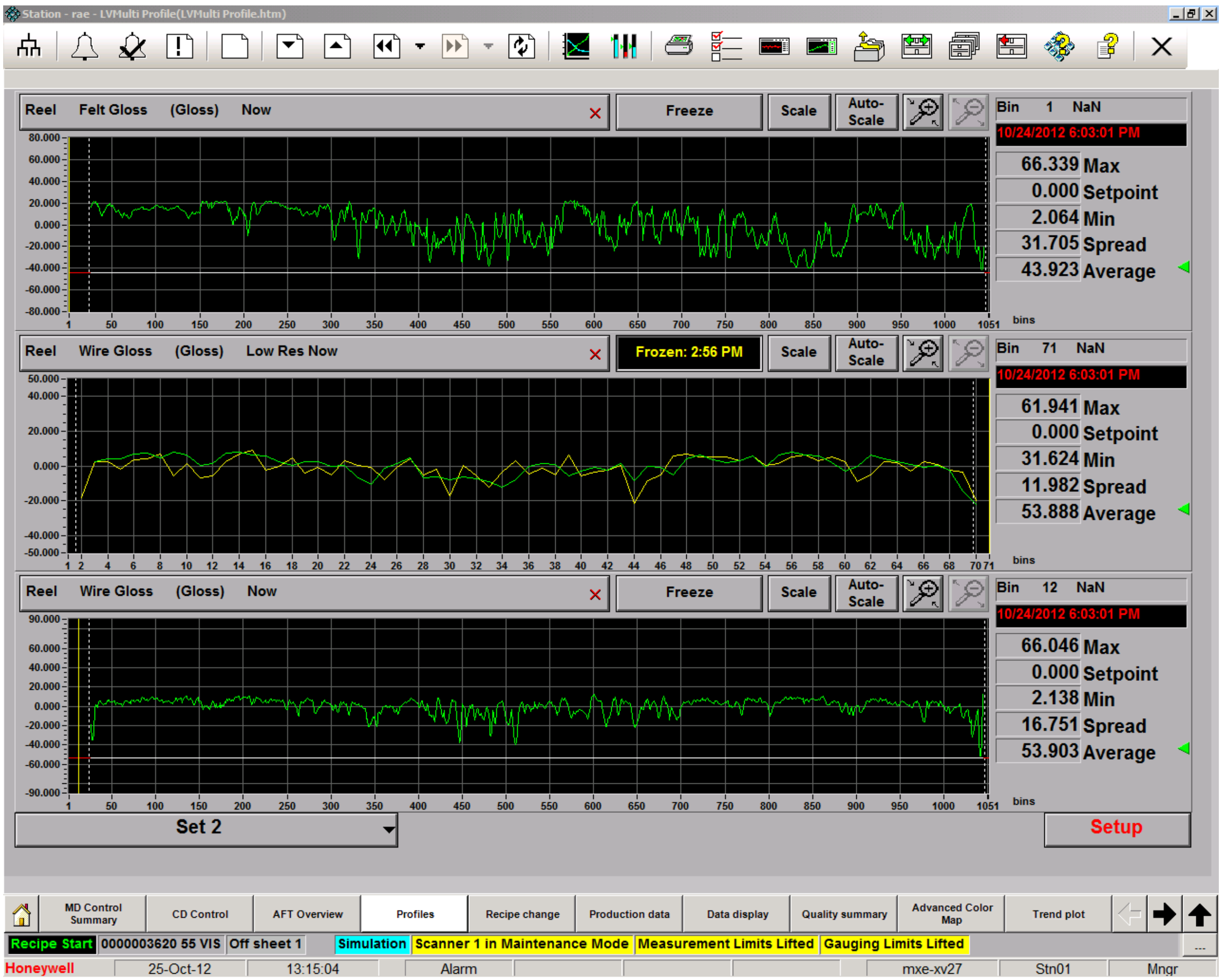


Figure 4-1 LVMulti Profile Display

Several options are available for processing the gloss data shown on the profiles graphs. These include trended data, and low and high resolution sampling.

4.1.2. Quality Summary display

The **Quality Summary** display provides a view of current sensor values and the last averages, which are distinct from the trended averages. This display gives a quick, basic overview of performance.

4.1.3. Recipe Change display

This **Recipe change** display (see Figure 4-2) is used to make simple changes to the values of nominals and alarm limits for an existing recipe.

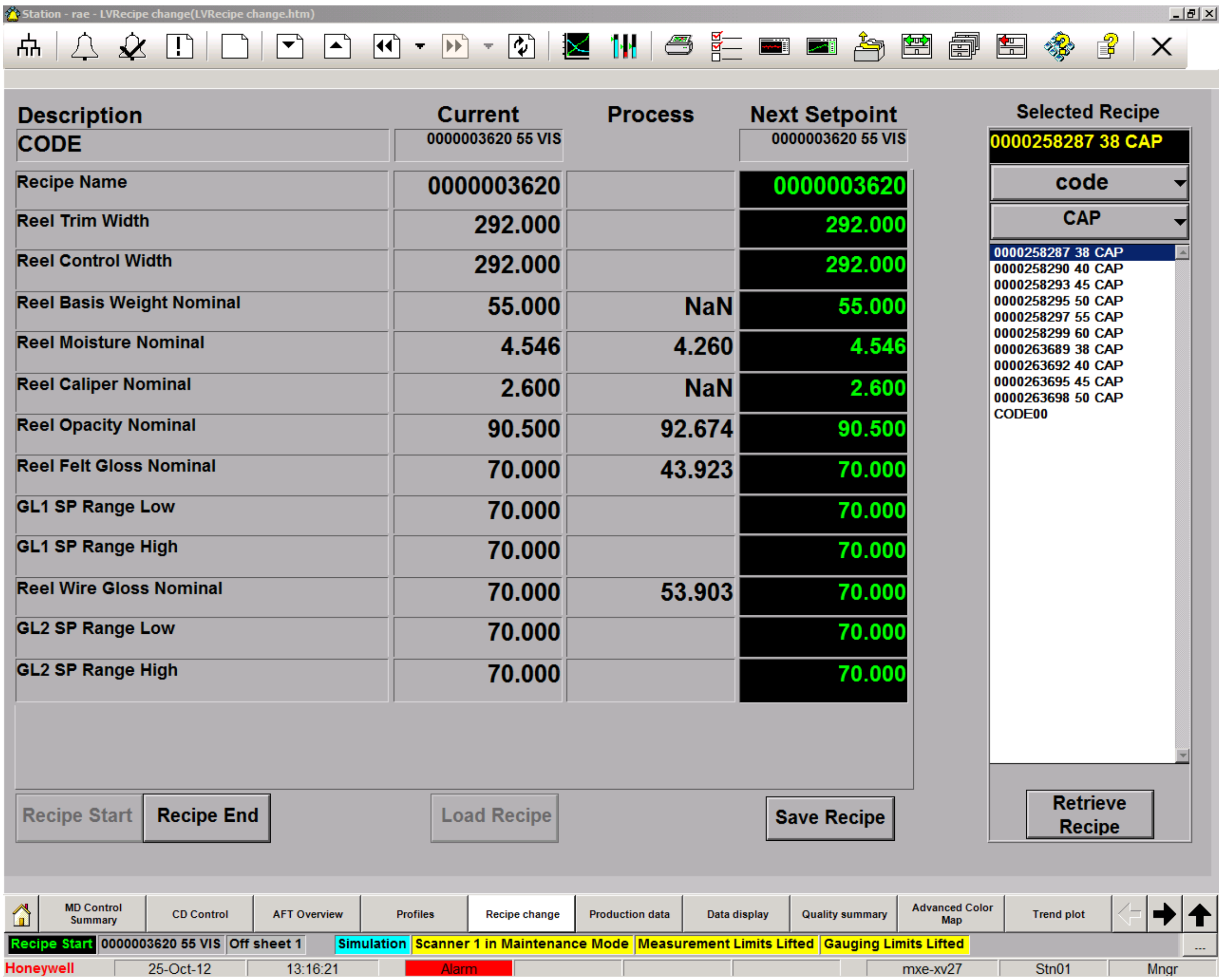


Figure 4-2 LVRecipe change Display

From the drop-down arrow on the upper right of the display, select the code, then select the recipe of interest. Click **Retrieve Recipe** below the list to display the recipe parameters that can be modified using this display. The **Recipe Start** and **Recipe End** buttons at the lower left of the display will be accessible when the selected recipe is used, for example, when a reel report is generated for this recipe. The buttons do not initiate or stop a measurement.

To modify a parameter, highlight the green number with the cursor, and type in the new value. Click **Load Recipe** to begin using the modified recipe in the Gloss Measurement. Click **Save Recipe** to save the modified recipe to the database.

4.1.4. Recipe Setup display

This advanced database management tool is used to set configuration parameters when the database is first being built for the sensor. Modifications to the database should be made and tested using different displays, typically, the **Recipe Change** display or the **Recipe Maintenance** display.

The **Recipe Setup** display, or the **Database Browser** utility, might be needed for some operations such as changing the name of a variable. Refer to the documentation listed in Related reading.

4.1.5. Recipe Maintenance display

The **Recipe Maintenance** display is an important tool for creating, modifying, or deleting a paper recipe, also referred to as a paper *grade*. The **Recipe Maintenance** display should be used to create the initial sensor calibration entry.

Select the appropriate code from the drop-down menu that appears underneath the **Initialize** button near the bottom of the display. Then click on the name of the desired recipe from the selected recipe list. The code table shows a set of nominal values for the selected recipe, and a list of names for the tables containing calibration, configuration, time-zero, standard, and MSS setup values.

To access one of the calibration or configuration tables, select the table from the drop-down menu that appears immediately to the left of the **Initialize** button. The parameters in this table will appear in the description list, with the corresponding values listed under **File Data** and **Current Data**.

To change the value of a parameter, highlight the green number with the cursor and type in the new value. The table names may be longer than the edit field. To see the rest of a table name, place the cursor in the **File Data** or the **Current Data** field and press the **`END`** key on your keyboard. To create a new recipe based on an existing recipe, modify the parameters as necessary, and click **Save as**. Give the new recipe a unique name, and save it to the database.

4.1.6. Sensor Maintenance display

The **Sensor Maintenance** display is the main display used for performing the most common sensor maintenance operations. It has two modes of operation:

- production mode
- maintenance mode

The default is production mode. The system opens this display in the mode that was last selected during the current session. Select the sensor and scanner from the drop-down arrow in the upper left area of the display.

Refer to the manuals listed in Related reading for directions on how to select production or maintenance mode for the Experion MX and Da Vinci systems.

4.1.6.1. Production mode

As shown on the **Sensor Maintenance** display, in production mode (see Figure 4-3), the tables in the upper half of the display show the input (configuration and calibration) parameters used for measurements. The output of the system appears in the bottom half of the display.

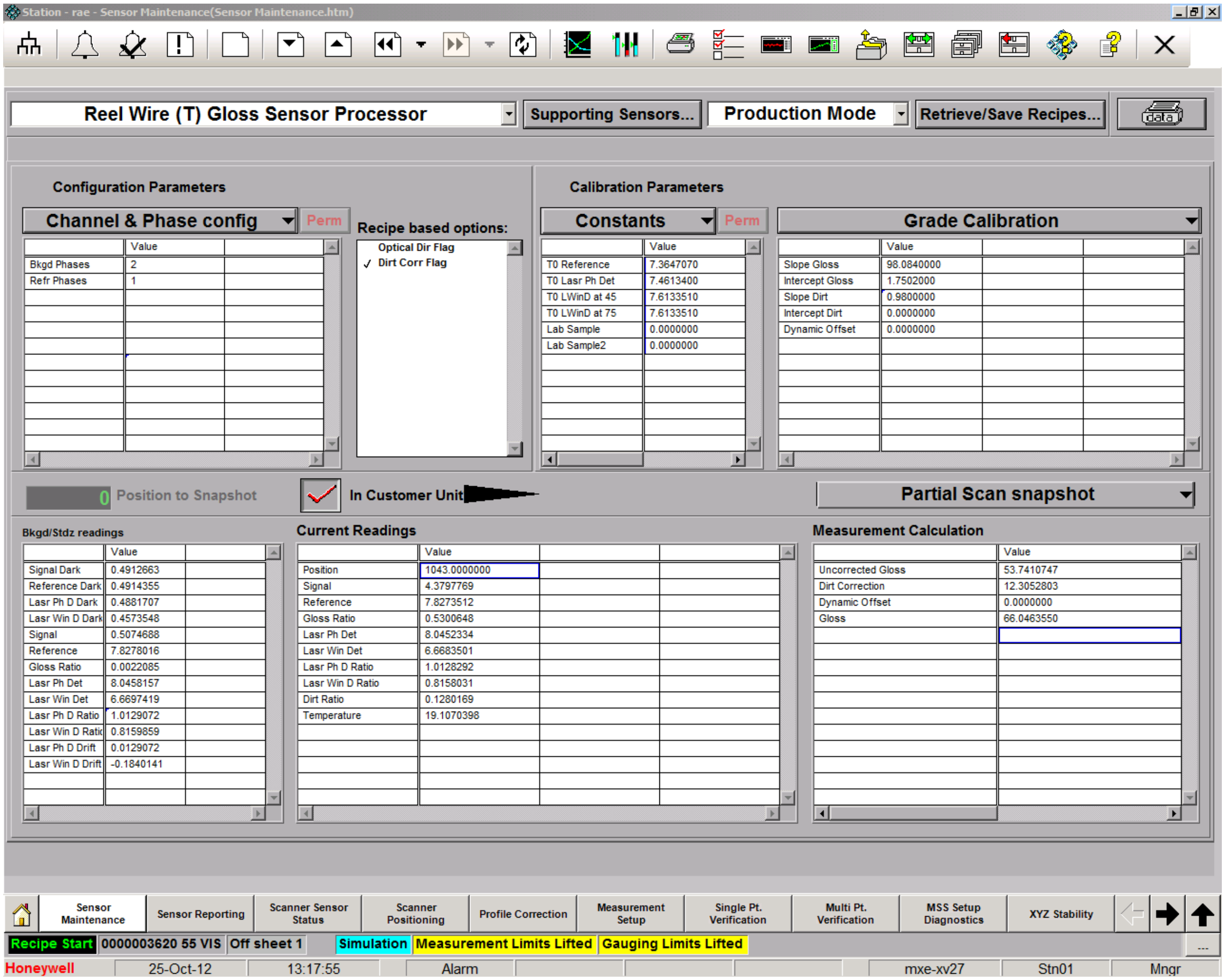


Figure 4-3 Sensor Maintenance Display (production mode)

The **Sensor Maintenance** display is a convenient tool for viewing all the input parameters for the sensor in one location. To print out the parameters, click on the printer icon button in the upper right of the display. Different sets of input parameters can be selected from the drop-down arrows for each upper table. For example, in addition to **Refr\Stdz T0** data, limits stored in the database can also be displayed. See Appendix B for a listing of the default values for database constants.

Except for the options listed under **Recipe-based options**, the configuration and calibration parameters cannot be changed while the system is in production mode. Enter maintenance mode to change those parameters.

The drop-down arrow selection, **Periodic Snapshot**, can be used to select which data is selected while the sensor is making online measurements:

- **Periodic Snapshot**: data is collected and sent every 100 ms
- **Single Point**: the sensor does not scan, but measures the sheet in one selected location, and values are collected and sent every 100 ms; data is averaged every 50 measurements (every 5 seconds)
- **Position Snapshot**: measurements taken at the same position of a scan
- **Partial Scan Snapshot**: measurements made at the end of each partial scan (the sheet is divided into several parts for measurement)

4.1.6.2. Maintenance mode

The values that appear in the upper half of the display can be changed by placing the **Sensor Maintenance** display in maintenance mode (see Figure 4-4).

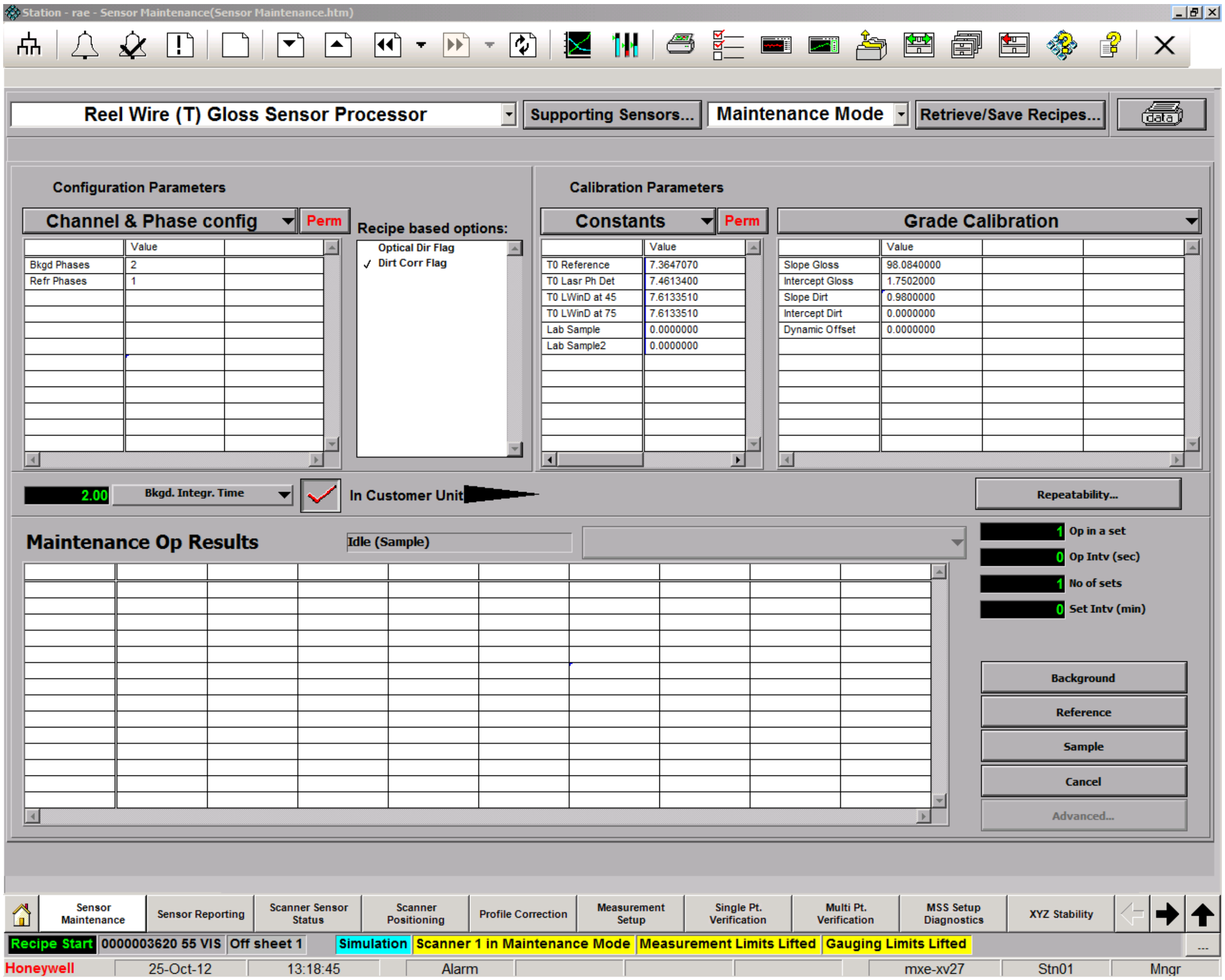


Figure 4-4 Sensor Maintenance Display (maintenance mode)

These changes can be saved to the database by clicking on **Perm** next to each table.

Maintenance mode also allows you to perform a reference or a sample. The **Maintenance Op Results** table shows the results of maintenance operations. Use the horizontal scroll bar below the table to view all of the results of a reference. Statistical averaging is also performed and displayed in the table.

Operations, for example, taking a sample, can be performed in sets. The number of operations in a set, and the intervals for operations and for sets, can be changed by clicking on the corresponding number (in green), and entering the new value. The duration of a reference or a sample operation is determined by configuration parameters in the database. These durations can be modified using the **Database Browser** utility (refer to the Da Vinci system manuals listed in Related reading).

CAUTION

Be very careful when saving, to the database, any changes to the input parameters available through the **Sensor Maintenance** display. Be certain that you want to permanently alter the database before making changes.

To view the status and database parameters for the temperature measurements in the sensor head, click **Supporting Sensors**. You can view temperature drift, set limits, and so on, using the **Support Sensor Monitor** pop-up dialog (see Figure 4-5).

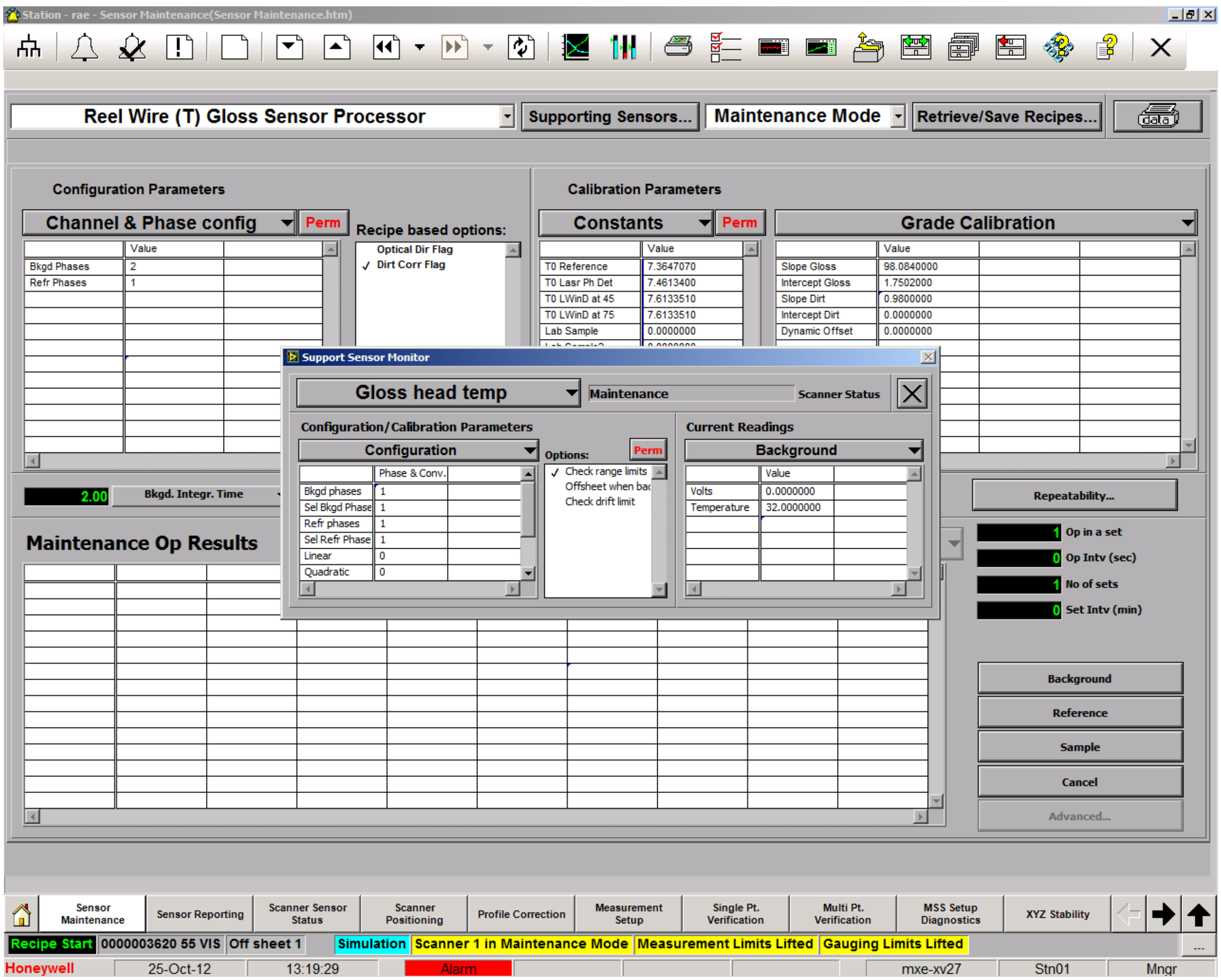


Figure 4-5 Support Sensor Monitor Pop-up (Gloss head temp)

4.1.7. Sensor Reporting display

The **Sensor Reporting** display allows you to view the last 100 reports collected from the Gloss Measurement (for example, reference reports, standardize reports, or sample reports).

4.2. Common gloss measurement operations

This section describes how to perform sensor operations typically needed by the Gloss Measurement.

4.2.1. Sample procedure

To run a sample procedure:

1. Load the sample into the external tile fixture. Ensure that the machine direction for the sample is lined up with the machine direction for the paper machine if relevant for the sample to be measured. See Figure 5-6.

2. Use the **SAMPLE** switch on the scanner. The amber **SAMPLE** light indicates that the sample is being read.

3. When the **SAMPLE** light goes out, load another sample into the paddle.

4. For each recipe, shoot 10 samples (5 pairs) if part of a calibration; otherwise, choose an appropriate number.

5. When all of the sampling is complete, remove the fixture. Visually check that nothing can break the sheet before setting the heads to scan.

4.2.2. Checking sensor stability

To check sensor stability:

1. Install the external tile fixture containing a standard tile with a known gloss value.

2. Set the sampling time in the system computer to a value between 3000 and 5000 milliseconds on the **Scanner Setup** display (for more details, refer to the manuals listed in Related reading).

3. Call up the **Sensor Maintenance** display for the appropriate Gloss Sensor and scanner, and enter maintenance mode.

4. Perform two backgrounds. The dark values, for example, *Reference Dark*, should repeat within two percent.

5. While still using the **Sensor Maintenance** display in maintenance mode, set up a cycle of 30 references over a 10-minute period. The values of all channels should be within five percent of each other. The standard deviations of the ratios *Lasr Ph D Ratio* and *Lasr Win D Ratio* should be within the following limits:

   2 Sigma (Lasr Ph D Ratio) /Avg (Lasr Ph D Ratio)] < 0.005

6. When the sensor has passed the stability checks, note the values and ratios from the last empty gap reference, and enter them in the database.

4.2.3. Checking the optical path

The Gloss Measurement (TAPPI gloss measurement) has a fixed 75 degree optical path that cannot be changed.

The optical direction parameter in the **Sensor Maintenance** display is meant for changing the optical path of the Gloss Sensor (DIN gloss measurement) from 45 degrees to 75 degrees, or the other way around. The values of the optical direction parameter are:

- *checked* (0 database value) = 45 degrees
- *unchecked* (1 database value) = 75 degrees.

5. Installation

The hardware installation of the Gloss Measurement described in this chapter is for use in the Experion MX system only. Check the engineering systems documentation supplied with the Gloss Measurement for the specifics of your system. Consult with Honeywell QCS TAC for information on installing the Gloss Measurement on different systems. References in this chapter are for a typical installation on an Experion MX scanner.

5.1. Preparation

Install the Gloss Measurement head on the scanner at least one week prior to system installation to allow time for system and sensor checkout. To retrofit the Gloss Measurement to an existing system, allow 8–12 hours of downtime to complete the retrofit installation.

The Gloss Measurement can be mounted to the sheetguides of the scanner head in either the cross direction (for machine direction measurements), or in the machine direction (recommended). The Gloss Measurement can face upwards or downwards. The dimensions of the unmounted sensor are approximately 45.72 cm wide x 30.48 cm high x 12.7 cm deep (18 in. wide x 12 in. high x 5 in. deep), not including the sheetguide that extends out from the sensor measurement face.

A separate, matching sheetguide for the Gloss Measurement mounts to the scanner head sheetguide opposite the sensor head.

The Gloss Measurement electrical requires + 24 V DC at approximately 3 Amps. Electrical connections to the sensor heads are made through hermetically sealed, military style connectors that are mated to the Experion MX wiring harnesses.

The Gloss Measurement requires cooling water (or coolant) at less than 2 L/min (0.5 gpm), and at a maximum temperature of 20 °C (68 °F). This water should be filtered to remove fiber. The water can be supplied with a tee-connection from the

Experion MX water input. Specifications for water quality, including cleanliness and pH, are the same as for the Experion MX sensor heads.

The Gloss Measurement requires clean pressurized air that is free of oil and water. Specifications for air quality are the same as for Experion MX heads.

Installation requires:

- two open-end 0.5-in. wrenches
- crescent wrench
- miscellaneous screwdrivers
- tweaker screwdriver
- diagonal cutter
- wire stripper
- pliers
- miscellaneous Allen wrenches and drivers (U.S., not metric)
- electrical tape
- crimper for spade lugs
- DVM
- oscilloscope

5.1.1. Pre-installation values of system constants

Before proceeding with the installation of the hardware, confirm that the pre-installation values of the various system constants and limits are entered in the database. These include:

- recipe-dependent setup constants
- pre-installation values for constants in *Recipe Maintenance*
- database limits and constants

5.2. Installation (retrofit)

Table 5-1 lists parts for a retrofit installation of the Gloss Measurement.

Table 5-1 Retrofit Parts List

Part Number	Description	Quantity
09420802	Gloss sensor (TAPPI)	1
16000006	Pipe compound	1
41000001	Hose, air, 0.25 in.	100 ft
61000002	Coupling, pushlock, 0.25 in. barb	3
61000041	Coupling, hose mender	2
61000056	Flow meter	1
61000091	Bushing	2
61000150	Bushing	2
61000286	Filter assembly	1
6580801783	Cable assembly, porosity Q4000	1
6581800235	Kit, gloss sensor mounting, cross direction	1
6581800236	Kit, gloss sensor mounting, machine direction	

5.2.1. Head mounting

The Gloss Measurement is mounted to the Experion MX head by using brackets (see Figure 5-1).

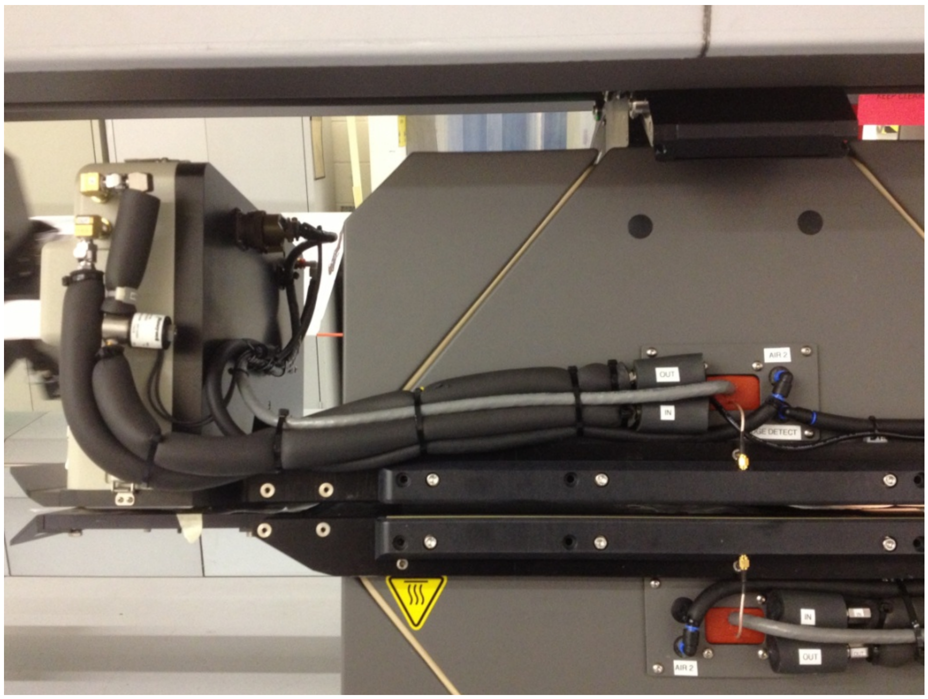


Figure 5-1 Head Mounting

Improper mounting of the sensor can result in sheet flutter that will affect readings. The measurement face of the sensor should be parallel to the sheet. Only the sheetguides can contact the sheet. A tilt in the sensor head may cause a corner of the sensor to contact the sheet.

ATTENTION

All bolts should be lightly coated with a copper-based, anti-seize compound.

Because of the advanced optics of the Gloss Measurement, the sheetguides do not have to touch the web during on-line measurement. The recommend gap between the sheetguide plate and the ring (see Figure 5-2) can be a maximum of 8 mm (0.31 in.).

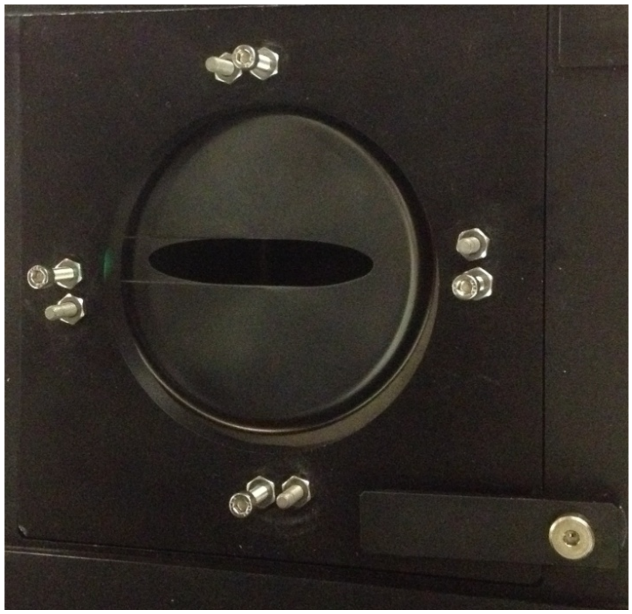


Figure 5-2 Sheetguide Cap Adjustment Screws

5.2.2. Wiring harness

Use a cable assembly for electrical connections from the Gloss Measurement to the Experion MX sensor head (see Figure 5-3).

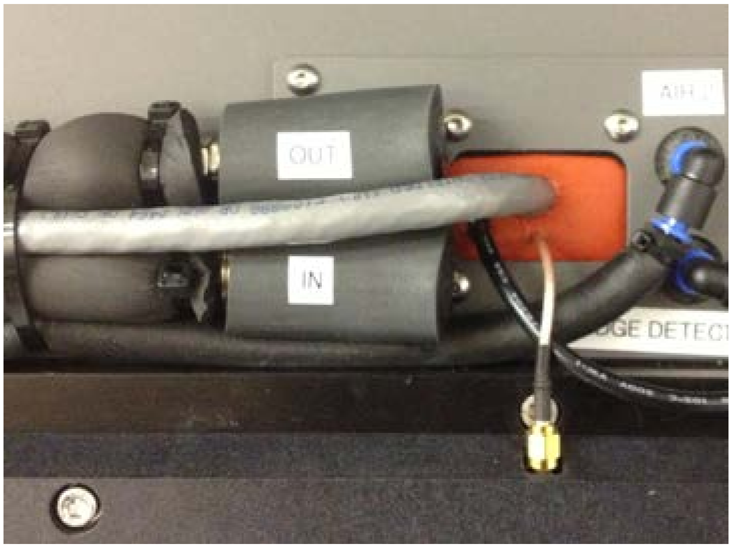


Figure 5-3 Cables Routed Into the Head

Connections from the sensor to the head will pass through the external sensor manifold. The cables are routed through the seal in the rectangular opening, and connect to an EDAQ and to the power distribution board (see Figure 5-4).

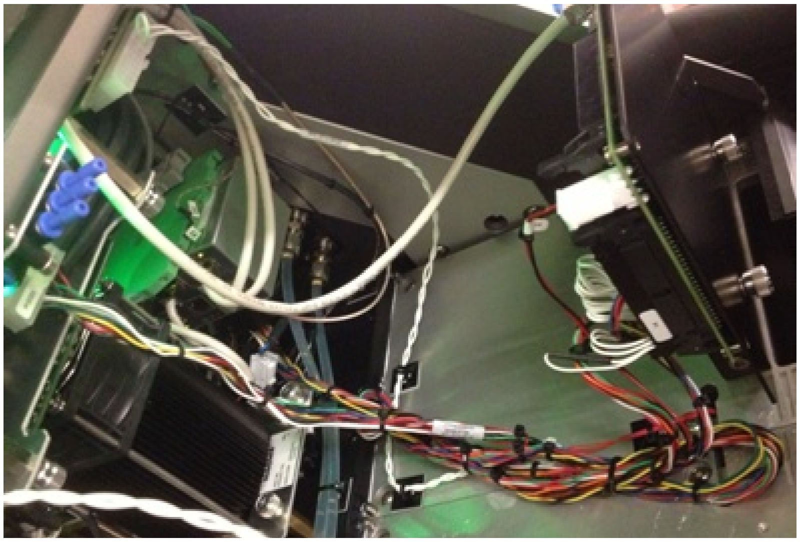


Figure 5-4 Cable Connection to the EDAQ

5.2.3. Plumbing

Coolant is taken from the alley platform assembly by replacing the pipe plugs with the fittings. Then it goes to a fitting in the external sensor manifold and connects to the sensor by a hose (see Figure 5-3).

Connect the water supply and the return lines for the Gloss Measurement head by using tees and the in-line solenoid assembly (see Figure 5-5). Insulate the hoses to prevent condensation from dripping on the sheet or the heads.

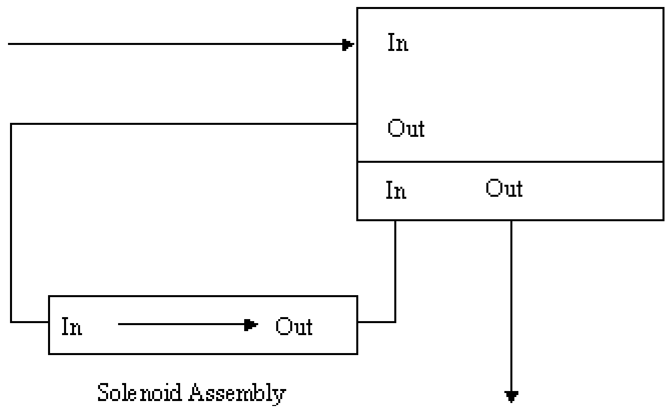


Figure 5-5 Solenoid Hose Diagram

5.2.4. Air purge

Air and water connections are provided through the round holes. Air is provided from the manifold inside the scanner head, and 6 mm (0.24 in.) tubing is routed to a bulkhead fitting, and then to the sensor (see Figure 5-3).

Install the air hose, and check by air flow that air purge inside the sensor works. Very slow air flow is enough to over-pressurize the closed sensor housing.

If vortex clamps are needed to add passline stability of the web, suitable air flow can be found and adjusted with sample pieces of the product when the sensor is offsheet. Fine tuning of the flow can be done after observations of on-line measurements. In some cases, using vortex clamps increases the need for cleaning the windows due to increased dust raised by the vortex air flow.

5.2.5. Gloss sensor sample holder

The Gloss Sensor sample holder kit is used to hold the external standard tile for sensor calibration (see Figure 5-6, and Figure 6-1). It can also be used to hold a sample for the sample operation.

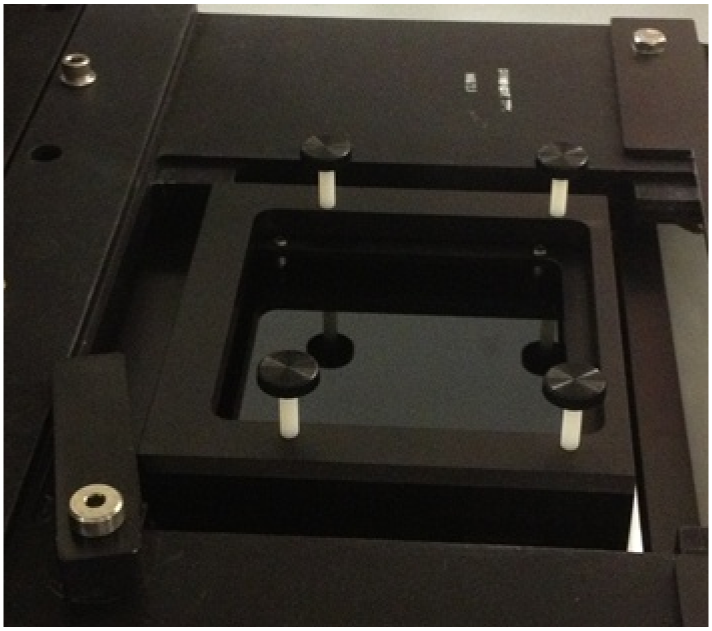


Figure 5-6 Sample Holder

5.2.6. Wiring check

To check the wiring:

1. Turn on scanner power.
2. On the connector to the upper head, check for + 24 V DC and the 24 V return (+24 VDC = pins t,s; 24VDC return = pins r,q).
3. When all voltages are correct, plug the connector into the Gloss Measurement head.

5.2.7. Installation cable (retrofit only)

Plug the pins on the free-pin end of the cable into the connectors in the upper head wiring harness. For wiring specifications, refer to the *Installation Wiring List*, located in the engineering systems documentation.

5.3. Alignment

Figure 1-1, and Figure 1-2 represent simple block diagrams for the sensor. For the physical location of the electrical and optical components, see Figure 1-3. The alignment procedure starts with the laser driver PCB and proceeds through to the fastcard amplifier PCBs.

As a preliminary check, power on the Gloss sensor, and check that the gloss LED is lit up.

5.3.1. LED driver alignment

Figure 5-7 shows an illustration of the gloss LED driver PCB.

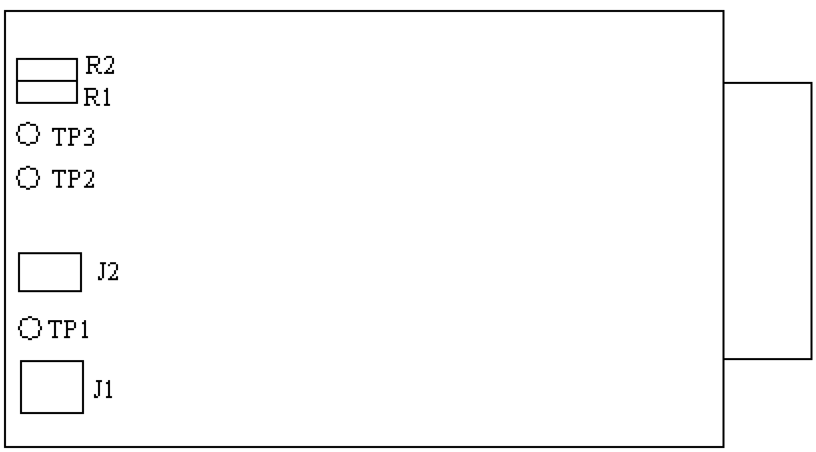


Figure 5-7 LED Driver PCB

Alignment:

1. Connect the oscilloscope ground to test point TP1, and the oscilloscope input signal to TP3. The TP3 waveform should be a sine wave that is entirely on a positive DC level. Adjust R1 (offset adjustment) to make the sine wave trough have a minimum positive offset (as close to zero as possible, but still positive).

2. Monitor TP2. The sine wave amplitude should be displayed on the scope. Adjust R2 (amplitude adjustment) to obtain a slightly saturated sine waveform (the peaks and troughs are slightly flattened).

J1 is connected to the Unigauge backplane, and J2 is connected to the gloss LED. If the LED driver is replaced, ensure that you reconnect these connectors.

5.3.2. Detector/preamp assembly

There are no pin-outs on the detector/preamp assembly. The signals must be checked on the associated fastcard amplifier or on the dirt correction PCB. For the dirt correction PCB signals, see Subsection 5.3.6.

To check the signal on a fastcard amplifier, insert the external tile (see Subsection 6.1.2). Check the output of each detector preamp by connecting the oscilloscope probe to TP2 (signal) and TP1 (GND) of the corresponding fastcard PCB (see Figure 5-10). The signal should be a 570 Hz sine wave of amplitude between 0.3 V and 3 V peak-to-peak.

5.3.3. Backplane assembly

For an illustration of the Unigauge backplane, see Figure 5-8. The version of the backplane used in the Gloss Measurement uses jumper W5, but *does not* use RP1.

A backplane has many connectors, and the mating cables can easily be mismatched to these connectors. Ensure that all cables are connected properly before loading the boards into the backplane.

5.3.3.1. Backplane voltages

Two voltages are supplied by the DC–DC converters attached below the backplanes. To check these voltages:

1. Remove the temperature control PCB, the LED driver PCB, and the two fastcards.

2. Use TP1 as ground. Check the ± 15 V. The values should be +15 ± 0.2 V DC and -15 ± 0.2 V DC. Test points are marked to the backplane.

3. Return the boards to their appropriate slots.

4. Replace the backplane if voltages are out of range.

Figure 5-8 shows a graphic of a Unigauge backplane board.

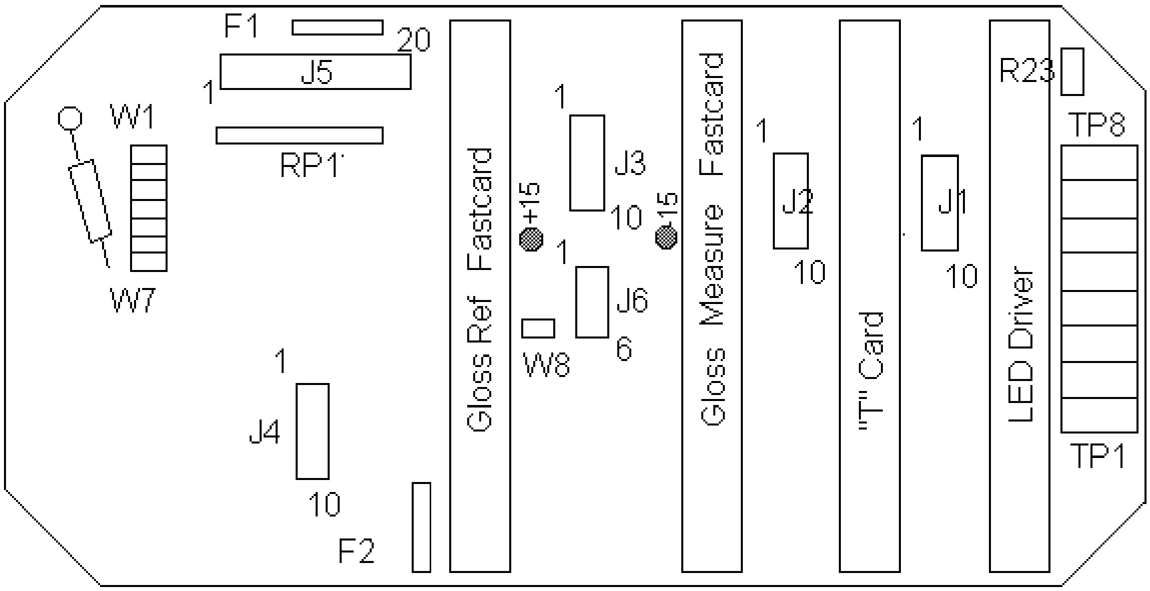


Figure 5-8 Unigauge Backplane PCB

Table 5-2 lists and describes the items shown in Figure 5-8.

Table 5-2 Unigauge Backplane PCB Items

Item	Description
Connectors	
J1, J2, J3	Feeds detector preamp signal B to Gloss Measurement B, C to Gloss Ref C
J4	Provides phase, gain to backplane from harness
J5	Provides 24 V from harness and signals to harness
J6	Not used
Test points	
TP1	Electrical Ground
TP2	Phase signal, 0 to +5 V, 570 Hz
TP3	Phase signal, 0 to +5 V, 180 degrees out of phase with TP2
TP4	Gain 1 indicator (+14 V when on)
TP5	Gain 2 indicator (+14 V when on)
TP6	Edge level: Adjust R23, p/n 05401100, or R7 p/n 052991XX, to approximately 5 V
TP7	Edge signal: 0V onsheet, +14 V offsheet
TP8	Not used
Configuration Jumpers	
W1, W2, W3	Never have more than 1 in at same time to use A, B, or C signal for edge detect. Normally use W1 to select A signal.
W4, W5	Gain jumpers: W4 is out; W5 is in

Item	Description
W6	Jumper is out at all times
W7	Not used
W8	Jumper is out at all times; if in, it will cross-connect B and C signals
RP1	Resistor pack is not used for the Gloss Sensor
Other	
DC–DC converters	+6–8 V below left, ± 15 V below center
Fuses	F1 and F2 are both 1.5 A on 24 V in line

5.3.3.2. Phase reference

Check that the phase reference signal in the backplane is present at TP2 and TP3, relative to TP1 (GND). Each signal should be a square wave, 0–5 V, at approximately 570 Hz. Signals at TP2 and TP3 are 180 degrees out of phase with each other.

5.3.4. Temperature control PCB

The temperature control PCB in the Gloss Measurement is used to read the head temperature. The location of the temperature control PCB is shown in Figure 5-8.

For the temperature control to work, both detector preamps must be plugged into their proper places on the backplane.

To check the control voltages (they should all be greater than 0.8 V DC):

- B channel, TP8(+) to GND (TP1 of backplane)
- C channel, TP6(+) to TP7

The temperature control PCB has a circuit to read a thermistor and convert its resistance to a temperature. Ensure that there is a 10 kΩ termination resistor across the ADC or VFC input where the temperature is being read. Remove the first fastcard so that R14 can be adjusted. Table 5-4 provides a temperature-to-voltage list. Adjust R14 until the voltage between TP1 and TP2 agrees with the list. Return the first fastcard to its slot.

Figure 5-9 shows a graphic of a temperature control PCB.

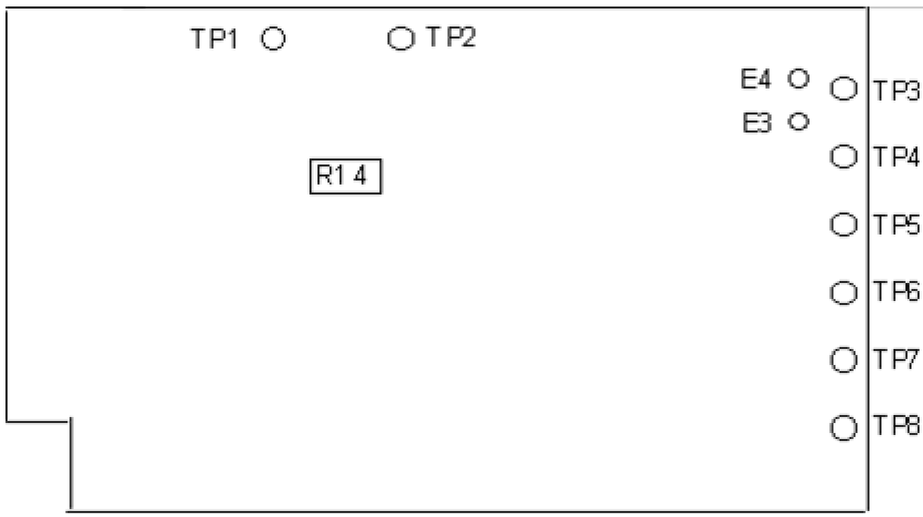


Figure 5-9 Temperature Control PCB

Table 5-3 lists and describes the items shown in Figure 5-9.

Table 5-3 Temperature Control PCB Items

Item	Description
TP1 to TP2	For temperature output, see Table 5-4
TP3 to TP4	Peltier cooler voltage for A signal
TP5 to TP6	Peltier cooler voltage for C signal if 3 channels
TP7 to TP8	Peltier cooler voltage for B signal
E3 to E4	If jumper in, then TP5 to TP6 shorted

Table 5-4 provides a temperature-to-volts list.

Table 5-4 Temperature-to-volts

Temperature	Volts
15 °C (59 °F)	2.24
16.7 °C (62 °F)	2.08
18.3 °C (65 °F)	1.94
20 °C (68 °F)	1.8
21.7 °C (71 °F)	1.68
23.3 °C (74 °F)	1.57
25 °C (77 °F)	1.46
26.7 °C (80 °F)	1.36
28.3 °C (83 °F)	1.27
30 °C (86 °F)	1.18

Temperature	Volts
31.7 °C (89 °F)	1.10
33.3 °C (92 °F)	1.03
35 °C (95 °F)	0.96
36.7 °C (98 °F)	0.90
38.3 °C (101 °F)	0.84
40 °C (104 °F)	0.78
41.7 °C (107 °F)	0.73

5.3.5. Fastcard amplifier PCB

Fastcards amplify AC signals from detector preamps, convert them to DC signals, and send the DC signals to the VFCs (see Figure 5-10) The fastcard for *Gloss Reference* signals is positioned in slot C on the Unigauge backplane, and the Gloss Measurement fastcard is positioned in slot B.

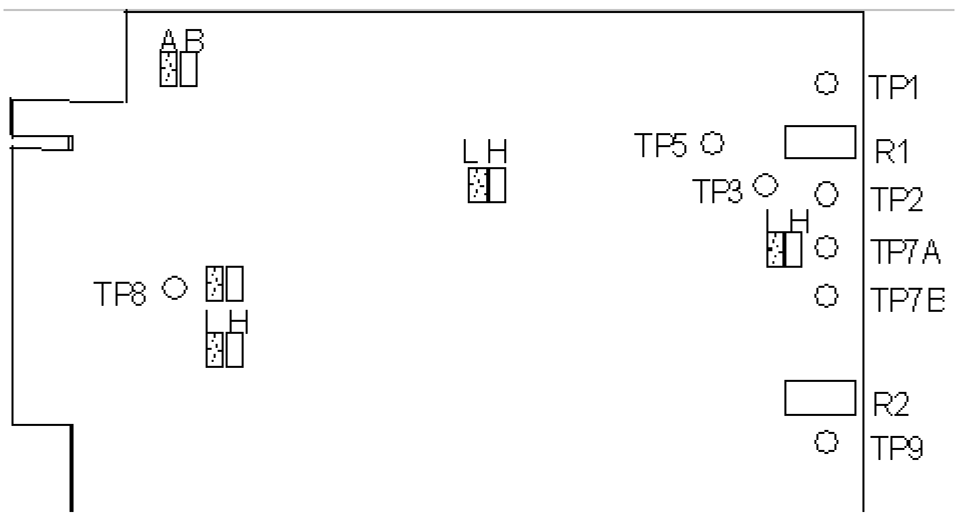


Figure 5-10 Fastcard Amplifier PCB

Table 5-5 lists and describes the items shown in Figure 5-10.

Table 5-5 Fastcard Amplifier PCB Items

Item	Description
TP1	Signal GND
TP2	Preamp signal in -0.3–3 V peak-to-peak, 570 Hz
TP3 and TP5	Larger 570 Hz signals
TP7A and TP7B	Half-wave rectified 570 Hz signals; R2 adjusts phase
TP9	Output volt; adjust with R1 to 7.5 or 8 V, all channels

The jumper for the phase should be in position A. The jumper for the gain should be in position L (low gain). Adjustment for the Gloss Measurement fastcard in position B must be done in the presence of the calibrated external standard tile.

Connect the oscilloscope probes to TP7A and TP7B (GND to TP1). Adjust the phase timing with R2 per Figure 5-11, Figure 5-12, and Figure 5-13 (all signals shown are at TP7A or TP7B), which show the phasing of the fastcard. Adjust R1 again to bring the meter reading to 8.0 ± 0.05 VDC on TP9.

Figure 5-11 shows a graphic representation of proper phase in a fastcard.

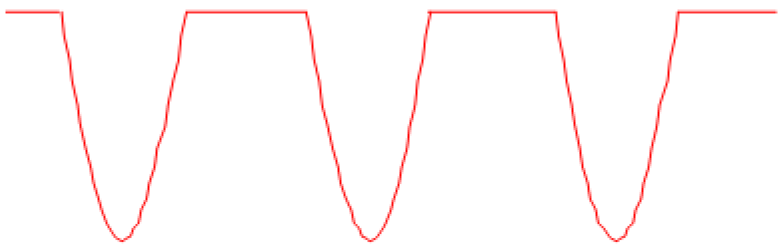


Figure 5-11 Proper Phase

Figure 5-12 shows a graphic representation of retarded phase in a fastcard. Turn R2 clockwise to correct.

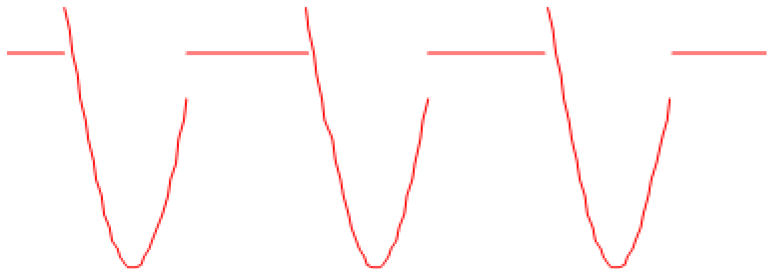


Figure 5-12 Retarded Phase

Figure 5-13 shows a graphic representation of advanced phase in a fastcard. Turn R2 counterclockwise to correct.

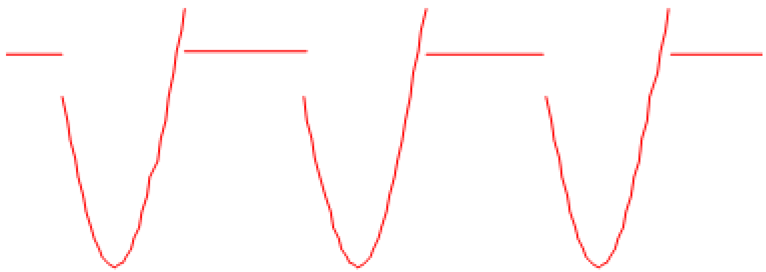


Figure 5-13 Advanced Phase

Note that when the signal is too high, the fastcard electronics may saturate and give an output on TP9 that is less than 10 V. To ensure that the signal is not saturated, it is always necessary to check the phase signal on TP7A when adjusting the fastcard gain. The fastcard might also have a severely distorted waveform at TP9, even when the voltage is less than 8 V. To be certain of the measurement, connect the oscilloscope probe to TP9 to check for the presence of a DC signal there. Perform those checks for both channels. Table 5-6 shows the relevant test points (with TP1 as GND).

Table 5-6 Fastcard Test Points

Test Point	Signal Description
TP2	0.3 to 3 V AC peak-to-peak
TP3	0.6 V AC peak-to-peak
TP4	
TP5	1.2 V AC peak-to-peak
TP6	
TP7A, B	4 V trough-to-peak half-sine wave
TP8	3.5 V trough-to-peak half-wave
TP9	8.0 V DC

None of the AC signals should be clipped. Activate the DARK relay by touching a clip lead between TP1 and the third contact of the board in its socket, or by initiating a background. The TP9 voltages should drop to between 0.45 V and 0.6 V for the fastcard.

5.3.6. Dirt correction PCB

This adjustment procedure assumes that the dirt correction PCB is installed in a sensor, and that the cables to the green LED and to both photodiodes are connected. All voltages and waveforms are measured with respect to TP2, which is the analog ground. An oscilloscope is required to monitor the waveforms.

Apply power to the board by plugging the interface connector into J3, adjust the LED reference detector (PD), and then adjust the 75 degree path measurement.

To adjust the LED reference detector (PD):

1. Ensure that both toggle switches, S1 and S2, are in their normal positions (up, toward J4).

2. Adjust R49 to provide approximately 15 V peak-to-peak at TP10 when TP2 is ground.

3. Adjust the PD signal demodulation by monitoring TP13. Adjust R92 to achieve a full wave rectified signal. A full wave rectified signal also provides the most positive DC voltage level at TP13.

4. Adjust R101 to provide 8 V DC at the PD out test point, TP12 (the label for R101 might be difficult to read–it is located next to J3).

To adjust the 75 degree path measurement:

1. Ensure that system output (OPTIC DIR) to the Gloss Sensor is set to 75 degrees (see Section 3.2).

2. Check that the 75 degrees dirt correction photodiode is coupled with connector J1.

3. Check that both toggle switches, S1 and S2, are in their normal positions (up, toward J4).

4. Turn R1 fully counterclockwise to lower the second stage as an adjustment starting point.

5. Monitor TP3 when TP2 is ground. The waveform should have a sine wave on a negative DC level. Adjust R44 to provide a level that is always more positive than -10 V (to avoid saturation).

6. Adjust R44 to provide 8 V DC at the signal-out test point, TP8. Repeat Step 5 and verify that the waveform at TP3 is not saturated.

7. Monitor TP4 The waveform should be a sine wave-centered around zero V. The output should not be saturated at either +15 V or -15 V.

8. Adjust R1, if necessary, to reach 8 V DC at TP8. Repeat Step 7 to verify that the waveform is not saturated at TP4.

After the installation of a new dirt correction PCB, the time-zero values in the database need to be updated. See Section 6.4 for the procedure on updating time-zero values.

Figure 5-14 shows a graphic representation of a dirt correction PCB.

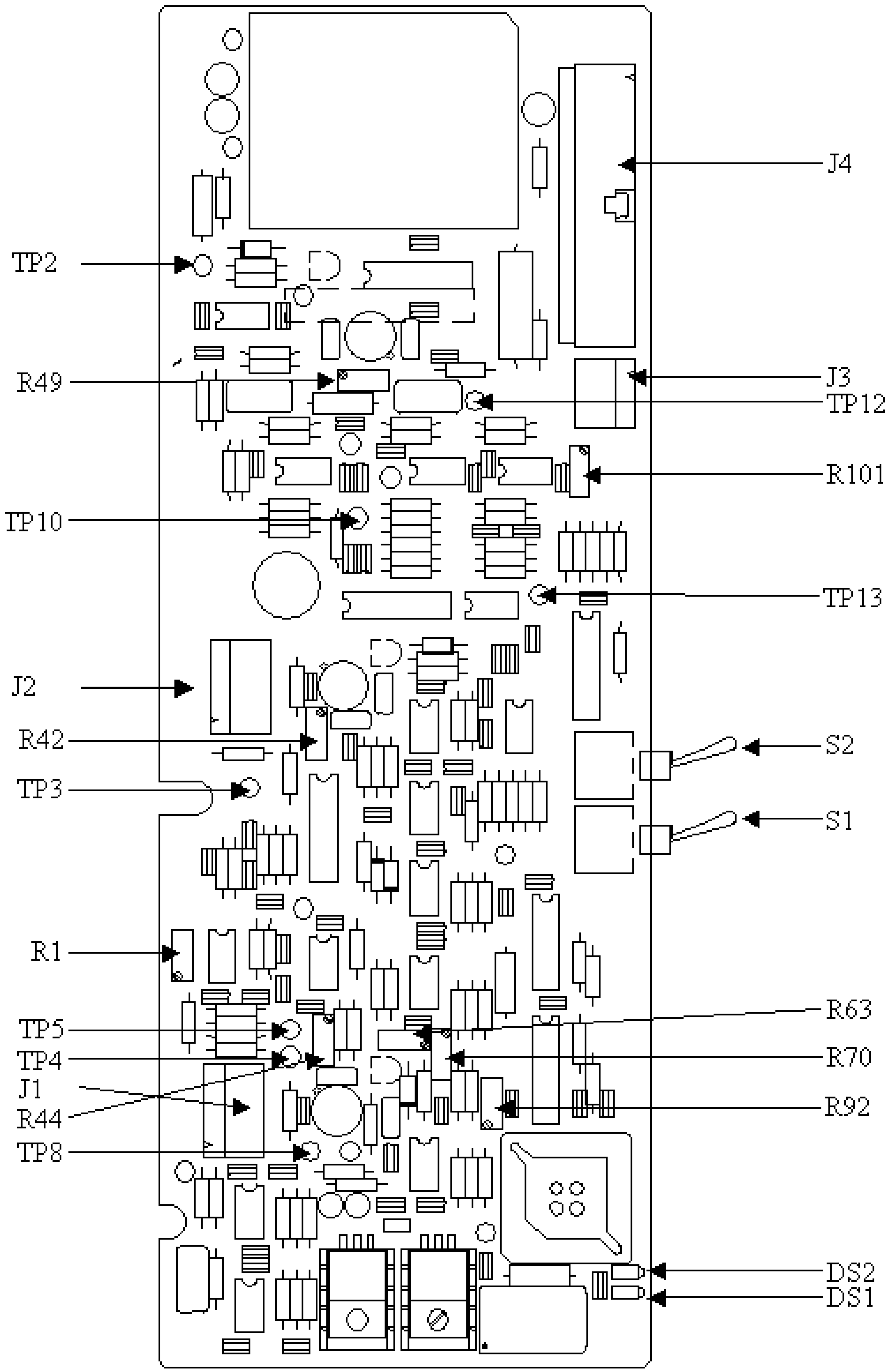


Figure 5-14 Dirt Correction PC Board

6. Calibration

This chapter describes calibration procedures used to determine the slope and intercept constants used by the Gloss Measurement to calculate gloss values from sensor measurements. Calibration is done by measuring the gloss value of a calibrated external standard gloss tile.

6.1. Equipment required

The only hand tool required for calibration is a small hex-head driver. It is used to install the standard tile into the tile fixture.

6.1.1. Calibrated external standard tile

TAPPI test procedure *T 480 om-92* specifies that a flat, clean, highly polished surface of black glass having a refractive index of 1.540 for the sodium D line (589.3 nm) may be used to measure 100 gloss units.

The external standard tile required for this procedure is a 10 x 10 cm (4 x 4 in.) piece of black glass, 6–8 mm (0.24–0.31 in.) thick, with a flat, highly polished surface. The same tile can be used as 100 gloss unit standard for both procedures. The surface should be kept clean (for instructions on cleaning the tile, see Subsection 6.2.4). The tile must be labeled with the gloss value of the polished face. A standard tile is supplied with the Gloss Measurement. This external tile is a transfer standard, calibrated by Honeywell. It is possible to calibrate a customer tile for calibration purposes from measurements of the refractive index of the tile, or by using a calibrated gloss meter.

6.1.2. External calibration tile accessory kit

The calibration tile accessory kit contains an external black glass transfer standard tile. The kit includes an external tile fixture (see Figure 6-1). This fixture mounts to the sheetguide of the Gloss Measurement and holds the standard tile with its surface in the measurement plane of the sensor. Part of the external tile fixture is a U-shaped holder that holds the standard tile and slides into the fixture.

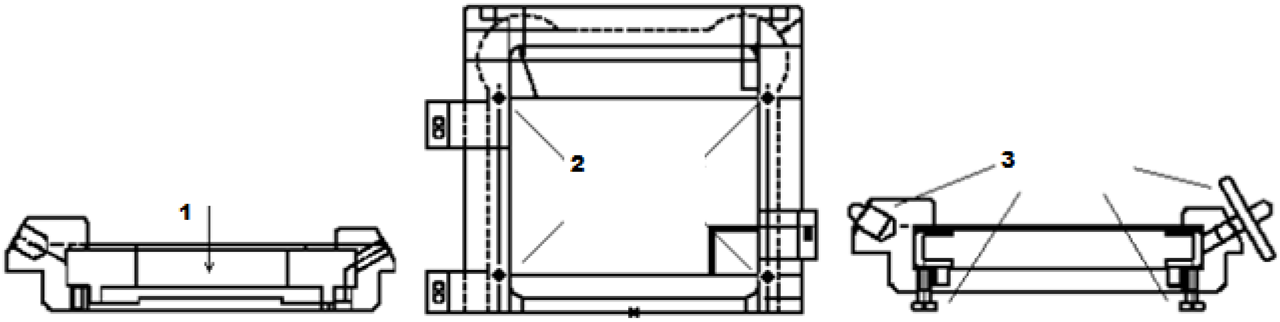


Figure 6-1 External Tile Fixture

Table 6-1 describes the items numbered in Figure 6-1.

Table 6-1 External Tile Fixture Items

Item	Description
1	Standard tile inserts into fixture
2	Four set screws hold the standard tile
3	Hardware mounts the fixture to the sensor

6.2. Stability check and calibration

6.2.1. Software settings for calibration

Use the **Sensor Maintenance** display in maintenance mode to set the dirt corrector (a check mark should appear next to **Dirt Corr Flag** in the **Recipe-based options** column (see Subsection 4.1.6). Reset the dirt corrector to the default value of off (no check mark) following calibration.

Correctors that appeared in previous versions of the Gloss Sensor are no longer used, including the parameters that correspond to the temperature corrector. Some labels in the database still exist for these correctors–these should be ignored.

After setting the software values, load a test recipe for use during calibration.

6.2.2. Stability check

Run a stability check before starting the calibration procedure:

1. Using the **Sensor Maintenance** display in maintenance mode, set the standardization and sample integration times to four seconds.
2. Perform a background.
3. Shoot 30 references on air at one minute intervals.
4. Remove the protecting plate that has a long oval slit. It is on the sensor side of the sheet stabilizer.
5. Insert the clean external tile into the U-shaped holder, and tighten the four small set screws at the corners of the holder until the tile is held snugly in the holder. The calibrated face of the tile will be facing the sensor.
6. Slide the U-shaped holder into the external tile fixture, and install the fixture onto the Gloss Measurement with the three large knurled screws. The fixture must be seated flat against the sensor.
7. Check that the *2-s* variation of the uncorrected gloss readings from the reference operations (as shown in the **Maintenance Op Results** area of the **Sensor Maintenance** display) is ≤ 0.75.

If the sensor fails the test, see Chapter 7 for procedures to help find the problem.

6.2.3. Calibration

Before calibration, ensure that the calibration tiles and sensor windows are clean. If not, clean the tiles (see Subsection 6.2.4). The window cleaning procedure is described in Section 8.2.

To perform the calibration:

1. Perform a reference on air.
2. Perform three samples on air.
3. Place a calibrated tile with a known TAPPI gloss value in the external tile fixture, and install the fixture in the sensor.

4. Using the **Sensor Maintenance** display in maintenance mode, perform a sample operation three times. Note and record the value of the gloss ratio on the **Maintenance Op Results** area of the display.

5. Repeat Step 3 and Step 4 for all calibration tiles.

6. Make a plot of dependence **TILE GLOSS** (Y-axis) of **SENSOR RATIO** (X-axis). Apply a linear approximation, and determine the slope and intercept.

7. Enter the values as *Slope Gloss* and *Intercept Gloss* in the **Grade Calibration** table under **Calibration Parameters** of the **Sensor Maintenance** display. Save the new values to the database.

6.2.4. Tile cleaning procedure

To clean the tile, if there is dust or fingerprints on it:

1. Hold the tile by the edges only.

2. Clean the tile with warm water and a mild detergent solution, brushing gently with a soft nylon brush. Do not use a soap solution because it will leave a residue.

3. Rinse the tile in hot running water, approximately 65 °C (150 °F), followed by a final rinse in distilled water.

4. Gently blot the tile with a lint-free absorbent material.

5. Dry the tile in a warm oven.

6.3. Verification

Verification is re-measuring the external standard tile to check that the calibrated sensor is measuring correctly:

1. Perform a reference on air.

2. Install the external tile fixture with the external tile.

Perform three samples on the external tile, and verify that the final corrected gloss readings displayed on the **Sensor Maintenance** display agree with the value marked on the external standard tile to within ± 0.5. If any of the sample operations fail this test, inspect the tile for dirt, and clean as necessary. If a clean tile fails a sample operation, contact Honeywell QCS TAC.

6.4. Resetting time-zero constants

It is sometimes necessary, for example, following the replacement of the dirt corrector PCB, to reset the time-zero values in the database. To reset time-zero values:

1. Using the **Sensor Maintenance** display, place the system in maintenance mode.

2. Perform a total of 10 background and 10 reference operations.

3. To determine the new time-zero reference value, determine the average of the 10 reference values and the average of the 10 values for reference dark. Subtract the average value of reference dark from the average value obtained for reference.

4. The value obtained in Step 3 is the new **T0 Reference** value. Enter this new value in the appropriate cell of the **Constants** table of the **Calibration Parameters** area of the **Sensor Maintenance** display.

5. Repeat Step 3 and Step 4 to obtain new time-zero values for each of the constants listed in Table 6-2. The names of the corresponding readings from the background and reference operations, which are to be averaged and subtracted, are indicated.

Table 6-2 Constants

New T0 Constant	= <Reference Value>	– <Background Value>
T0 Reference	= <Reference>	– <Reference Dark >
T0 Lasr Ph Det	= <Lasr Ph Det>	– <Lasr Ph Det Dark>
T0 LWinD at xx	= <Lasr Win D>	– <Lasr Win Det Dark>
T0 LWDled at xx	= <Lasr Win D LED>	– <Lasr Win D LED Dark>

6. Save the new constants to the database. You may want to measure the gloss of a known sample before saving the new constants permanently.

7. Preventive Maintenance

Preventive maintenance procedures are minimal. The frequency of preventive maintenance procedures is often defined by the operating environment.

In Table 7-1, *X* indicates recommended maintenance intervals. AR indicates *as required*.

Table 7-1 Preventive Maintenance Internal Checklist

Procedure	Daily	Weekly	Months		Years			Task Details
			1	6	1	2	5	
Inspect for wear		X						Section 8.1
Remove dirt build-up	AR	AR						Section 8.2
Check and align LED driver PCB				X				Section 8.3
Check and align fastcard amplifier PCB				X				Section 8.4
Check and adjust dirt correction PCB				X				Section 8.5

8. Tasks

This chapter contains procedures for maintaining optimal Gloss Measurement function and troubleshooting issues with the sensor.

8.1. Inspect for wear

The Gloss Sensor is non-contacting. The gap between the sensor bottom faceplate and the backing ring can be adjusted. The maximum positive value for the gap is 8 mm (0.33 in.). If required, adjust the gap in even, negative values 1–2 mm (0.05–0.10 in.). If the web contacts either of the sides during traversing, it slowly causes surface wear, so, inspect the sensor on a regular basis for wear and replacement of contacting components.

Activity Number:	Q4208-52-ACT-001		**Applicable Models:**		Q4208-52
Type of Procedure:	Inspect		**Expertise Level:**		Operator
Priority Level:	Average		**Cautions:**		None
Availability Required:	Scanner offsheet		**Reminder Lead Time:**		
Overdue Grace Period:			**Frequency (time period):**		1 week
Duration (time period):	2 minutes		**# of People Required:**		1
Prerequisite Procedures:					
Post Procedures:					
Required Parts:	Part Number	Quantity	Description		
Required Tools:					

8.2. Remove dirt build-up

Remove dirt build-up on the source and receiver windows on a regular basis. The Gloss Measurement is relatively maintenance-free; however, experience shows that some common problems with operation and measurements can be avoided by regular cleaning of the sensor.

Activity Number:	Q4208-52-ACT-002	**Applicable Models:**	Q4208-52
Type of Procedure:	Maintain	**Expertise Level:**	Operator
Priority Level:	Average	**Cautions:**	None
Availability Required:	Scanner offsheet	**Reminder Lead Time:**	
Overdue Grace Period:		**Frequency (time period):**	1 day
Duration (time period):	5 minutes	**# of People Required:**	1
Prerequisite Procedures:			
Post Procedures:			
Required Parts:	Part Number	Quantity	Description
Required Tools:	• isopropyl alcohol • clean cloth • cotton swabs		

Keep the window lenses clean. If they become dirty or wet:

1. Take the sensor offsheet.
2. Wipe the lenses with a clean, soft cloth, tissue, or cotton swabs dipped in isopropyl alcohol.
3. Dry the lenses with clean, dry tissue, ensuring that there is no film left on the lenses.
4. Check the cleanliness of the windows using a flashlight.
5. Depending on the amount of daily dirt build-up, low or high, adjust the cleaning schedule accordingly.

Inspect the *Daily Sensor Report* each day to check for the level of dirt and any indications of instability or failure. Frequent and reliable recordkeeping is indispensable for quick and accurate troubleshooting.

8.3. Check and align LED driver PCB

Measure and align the signals of the LED driver PCB.

Activity Number:	Q4208-52-ACT-003		**Applicable Models:**	Q4208-52
Type of Procedure:	Adjust		**Expertise Level:**	Technician
Priority Level:	Average		**Cautions:**	None
Availability Required:	Scanner offsheet		**Reminder Lead Time:**	
Overdue Grace Period:			**Frequency (time period):**	6 months
Duration (time period):	5 minutes		**# of People Required:**	1
Prerequisite Procedures:				
Post Procedures:				
Required Parts:	Part Number	Quantity	Description	
Required Tools:	• oscilloscope • DVM • very small flathead screwdriver (for trimming pots)			

Figure 8-1 shows an illustration of the gloss LED driver PCB.

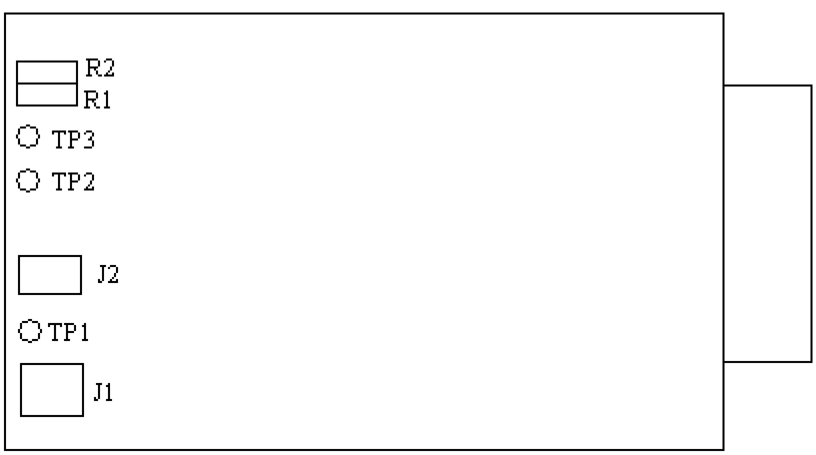


Figure 8-1 LED Driver PCB

Alignment:

1. Connect the oscilloscope ground to test point TP1, and the oscilloscope input signal to TP3. The TP3 waveform should be a sine wave that is entirely on a positive DC level. Adjust R1 (offset adjustment) to make the sine wave trough have a minimum positive offset (as close to zero as possible, but still positive).

2. Monitor TP2. The sine wave amplitude should be displayed on the scope. Adjust R2 (amplitude adjustment) to obtain a slightly saturated sine waveform (the peaks and troughs are slightly flattened).

J1 is connected to the Unigauge backplane, and J2 is connected to the gloss LED. If the LED driver is replaced, ensure that you reconnect these connectors.

8.4. Check and align fastcard amplifier PCB

Measure and align the electronics of the fastcard amplifier PCB.

Activity Number:	Q4208-52-ACT-004		**Applicable Models:**	Q4208-52
Type of Procedure:	Adjust		**Expertise Level:**	Technician
Priority Level:	Average		**Cautions:**	None
Availability Required:	Scanner offsheet		**Reminder Lead Time:**	
Overdue Grace Period:			**Frequency (time period):**	6 months
Duration (time period):	5 minutes		**# of People Required:**	1
Prerequisite Procedures:				
Post Procedures:				
Required Parts:	Part Number	Quantity	Description	
Required Tools:	• oscilloscope • DVM • very small flathead screwdriver (for trimming pots)			

Fastcards amplify AC signals from detector preamps, convert them to DC signals, and send the DC signals to the VFCs in the upper head (see Figure 8-2) The fastcard for *Gloss Reference* signals is positioned in slot C on the Unigauge backplane, and the Gloss Measurement fastcard is positioned in slot B.

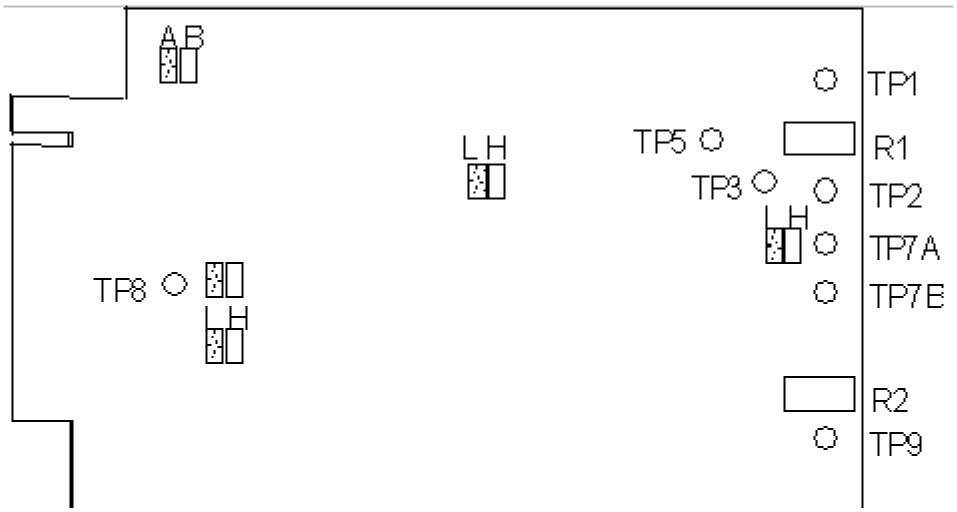


Figure 8-2 Fastcard Amplifier PCB

Table 8-1 lists and describes the items shown in Figure 8-2.

Table 8-1 Fastcard Amplifier PCB Items

Item	Description
TP1	Signal GND
TP2	Preamp signal in -0.3–3 V peak-to-peak, 570 Hz
TP3 and TP5	Larger 570 Hz signals
TP7A and TP7B	Half-wave rectified 570 Hz signals; R2 adjusts phase
TP9	Output volt; adjust with R1 to 7.5 or 8 V, all channels

The jumper for the phase should be in position A. The jumper for the gain should be in position L (low gain). Adjustment for the Gloss Measurement fastcard in position B must be done in the presence of the calibrated external standard tile.

Connect the oscilloscope probes to TP7A and TP7B (GND to TP1). Adjust the phase timing with R2 per Figure 8-3, Figure 8-4, and Figure 8-5 (all signals shown are at TP7A or TP7B), which show the phasing of the fastcard. Adjust R1 again to bring the meter reading to 8.0 ± 0.05 VDC on TP9.

Figure 8-3 shows a graphic representation of proper phase in a fastcard.

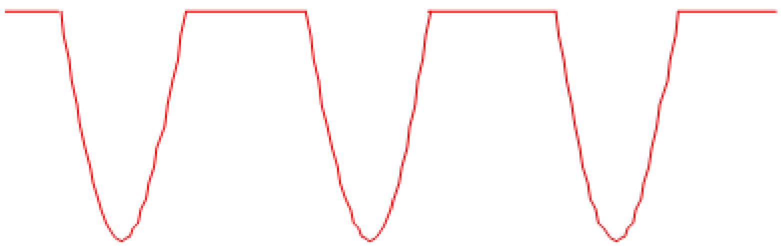


Figure 8-3 Proper Phase

Figure 8-4 shows a graphic representation of retarded phase in a fastcard. Turn R2 clockwise to correct.

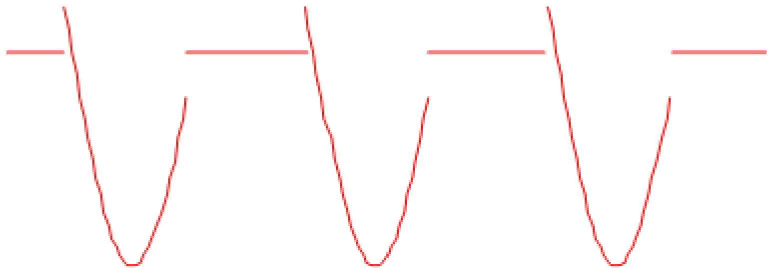


Figure 8-4 Retarded Phase

Figure 8-5 shows a graphic representation of advanced phase in a fastcard. Turn R2 counterclockwise to correct.

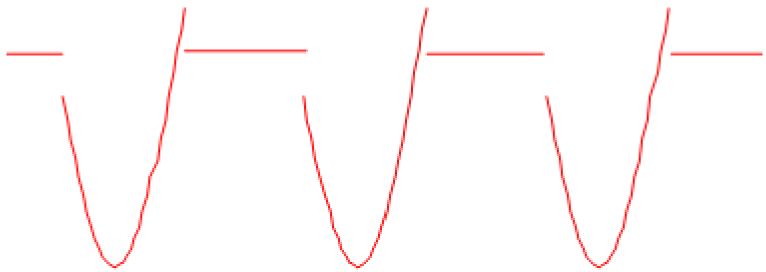


Figure 8-5 Advanced Phase

When the signal is too high, the fastcard electronics may saturate and give an output on TP9 that is less than 10 V. To ensure that the signal is not saturated, it is always necessary to check the phase signal on TP7A when adjusting the fastcard gain. The fastcard might also have a severely distorted waveform at TP9, even when the voltage is less than 8 V. To be certain of the measurement, connect the oscilloscope probe to TP9 to check for the presence of a DC signal there. Perform those checks for both channels.

Table 8-2 shows the relevant test points (with TP1 as GND).

Table 8-2 Fastcard Test Points

Test Point	Signal Description
TP2	0.3 to 3 V AC peak-to-peak
TP3	0.6 V AC peak-to-peak
TP4	
TP5	1.2 V AC peak-to-peak
TP6	
TP7A, B	4 V trough-to-peak half-sine wave
TP8	3.5 V trough-to-peak half-wave
TP9	8.0 V DC

None of the AC signals should be clipped. Activate the DARK relay by touching a clip lead between TP1 and the third contact of the board in its socket, or by initiating a background. The TP9 voltages should drop to between 0.45 V and 0.6 V for the fastcard.

8.5. Check and adjust dirt correction PCB

If dirt correction is used for buildup compensation with calculations of gloss values, it is important to measure and adjust the dirt correction PCB signal levels on a regular basis.

Activity Number:	Q4208-52-ACT-005		**Applicable Models:**	Q4208-52
Type of Procedure:	Maintain		**Expertise Level:**	Technician
Priority Level:	Average		**Cautions:**	None
Availability Required:	Scanner offsheet		**Reminder Lead Time:**	
Overdue Grace Period:			**Frequency (time period):**	6 months
Duration (time period):	10 minutes		**# of People Required:**	1
Prerequisite Procedures:				
Post Procedures:				
Required Parts:	Part Number	Quantity	Description	

Required Tools:	• oscilloscope • DVM • very small flathead screwdriver (for trimming pots)

This adjustment procedure assumes that the dirt correction PCB is installed in a sensor, and that the cables to the green LED and to both photodiodes are connected. All voltages and waveforms are measured with respect to TP2, which is the analog ground. An oscilloscope is required to monitor the waveforms.

Apply power to the board by plugging the interface connector into J3, adjust the LED reference detector (PD), and then adjust the 75 degree path measurement.

To adjust the LED reference detector (PD):

3. Ensure that both toggle switches, S1 and S2, are in their normal positions (up, toward J4).
4. Adjust R49 to provide approximately 15 V peak-to-peak at TP10 when TP2 is ground.
5. Adjust the PD signal demodulation by monitoring TP13. Adjust R92 to achieve a full wave rectified signal. A full wave rectified signal also provides the most positive DC voltage level at TP13.
6. Adjust R101 to provide 8 V DC at the PD out test point, TP12 (the label for R101 might be difficult to read–it is located next to J3).

To adjust the 75 degree path measurement:

7. Ensure that system output (OPTIC DIR) to the Gloss Sensor is set to 75 degrees (see Section 3.2).
8. Check that the 75 degrees dirt correction photodiode is coupled with connector J1.
9. Check that both toggle switches, S1 and S2, are in their normal positions (up, toward J4).
10. Turn R1 fully counterclockwise to lower the second stage as an adjustment starting point.
11. Monitor TP3 when TP2 is ground. The waveform should have a sine wave on a negative DC level. Adjust R44 to provide a level that is always more positive than -10 V (to avoid saturation).
12. Adjust R44 to provide 8 V DC at the signal-out test point, TP8. Repeat Step 5 and verify that the waveform at TP3 is not saturated.

13. Monitor TP4 The waveform should be a sine wave-centered around zero V. The output should not be saturated at either +15 V or -15 V.

14. Adjust R1, if necessary, to reach 8 V DC at TP8. Repeat Step 7 to verify that the waveform is not saturated at TP4.

After the installation of a new dirt correction PCB, the time-zero values in the database need to be updated. See Section 6.4 for the procedure on updating time-zero values.

Figure 8-6 shows a graphic representation of a dirt correction PCB.

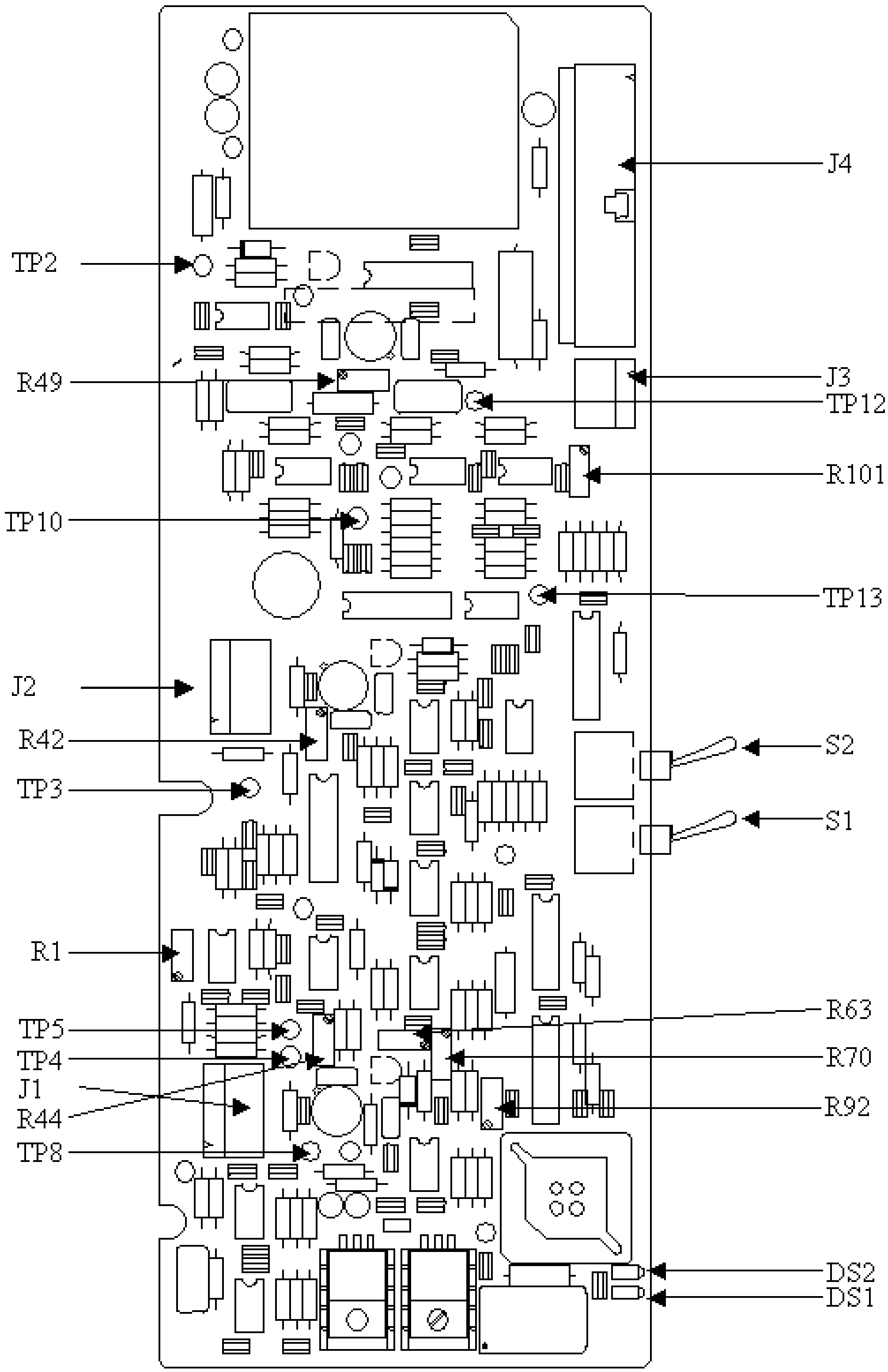


Figure 8-6 Dirt Correction PC Board

8.6. Align replaced parts

Activity Number:	Q4208-52-ACT-006	**Applicable Models:**	Q4208-52
Type of Procedure:	Adjust	**Expertise Level:**	Technician
Priority Level:		**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:			
Post Procedures:			
Required Parts:	Part Number	Quantity	Description
Required Tools:	• oscilloscope • DVM • very small flathead screwdriver (for trimming pots)		

Table 8-3 lists the sections from Chapter 5 that describe alignment procedures to be followed after replacing parts.

Table 8-3 Alignment Procedures

Replaced Item	Check
Gloss LEDs	LED driver PCB (see Subsection 5.3.1)
	Gain and phase of fastcards (see Subsection 5.3.5)
Window LEDs(or laser)	Dirt correction PCB (see Subsection 5.3.6)
LED driver PCB	See Subsection 5.3.1
	Gain and phase of fastcards (see Subsection 5.3.5)
Detector/preamp	See Subsection 5.3.2
	Gain and phase of fastcards (see Subsection 5.3.5)
Fastcard amplifier	See Subsection 5.3.5
Temp control PCB	See Subsection 5.3.4
Unigauge backplane	See Subsection 5.3.3
	Gain and phase of fastcards (see Subsection 5.3.5)
Dirt correction PCB	See Subsection 5.3.6

8.7. Replace a PCB

ATTENTION	The PCBs are *not* to be repaired in the field. Replace defective PCBs and return them to Honeywell for repair.

Activity Number:	Q4208-52-ACT-007			**Applicable Models:**	Q4208-52
Type of Procedure:	Replace			**Expertise Level:**	Technician
Priority Level:				**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:					
Post Procedures:	Align replaced parts				
Required Parts:	Part Number	Quantity	Description		
Required Tools:	• Static electricity discharge band • Gloves (optional)				

To replace a PCB:

1. Wear a static electricity discharge band on your wrist, and ground its wire.

2. Turn off the power to the head before removing or inserting a PCB.

3. Note the location of jumpers and/or switches in the original PCB before removing it to ensure that they are set correctly on the replacement PCB. If the detector preamp is being replaced, ensure that you place the jumper on the new preamp in the same position as it was on the old one.

4. Exchange only one PCB at a time.

5. If a replacement PCB does not solve the problem, reinstall the original PCB.

6. Tag the defective PCB with the suspected problem or symptom.

7. Handle all PCBs by the edges, or with clean gloves. *Do not* touch the edge connectors on PCBs.

8. Replacement of some parts requires the realignment of other parts, as described in Align replaced parts.

9. Troubleshooting

This chapter is divided into two sections listing possible issues with the Gloss Measurement:

- Section 9.1 Alarm based troubleshooting, listing steps to be taken in response to a specific alarm.
- Section 9.2 Non-alarm based troubleshooting, listing steps that may not be related to a specific alarm.

9.1. Alarm based troubleshooting

9.1.1. Bad Temperature Input

Symptom	Possible Cause(s)	Solution (Tasks)
Sensor temperature input required for processor is outside the A/D input range	Bad alignment of Temperature PCB	Temperature control PCB

9.1.2. Bad Gloss Reference Input

Symptom	Possible Cause(s)	Solution (Tasks)
Gloss Reference signal is outside the A/D input range	Weak LED or bad alignment of LED driver	LED driver alignment
	Bad alignment of Fastcard amplifier	Fastcard amplifier PCB

9.1.3. Bad Gloss Measurement Input

Symptom	Possible Cause(s)	Solution (Tasks)
Gloss Measurement signal is outside the A/D input range	Weak LED or bad alignment of LED driver	LED driver alignment
	Bad alignment of Fastcard amplifier	Fastcard amplifier PCB

9.1.4. Bad Window Cleanliness Reference Input

Symptom	Possible Cause(s)	Solution (Tasks)
Gloss Photo Detector signal is outside the A/D input range	Bad alignment of Dirt correction PCB	Dirt correction PCB

9.1.5. Bad Window Cleanliness Measurement Input

Symptom	Possible Cause(s)	Solution (Tasks)
Gloss Window Detector signal is outside the A/D input range	Bad alignment of Dirt correction PCB	Dirt correction PCB

9.1.6. Gloss Reference Signal Drifting

Symptom	Possible Cause(s)	Solution (Tasks)
Gloss Reference signal has drifted too far away from the Time Zero value	Aging of electronics	Resetting time-zero constants

9.1.7. Window Cleanliness Reference Drifting

Symptom	Possible Cause(s)	Solution (Tasks)
Photo Detector reading has drifted too far away from the Time Zero value	Aging of electronics	Resetting time-zero constants

9.1.8. Window Cleanliness Measurement Drifting

Symptom	Possible Cause(s)	Solution (Tasks)
Window Detector reading has drifted too far away from the Time Zero value	Aging of electronics	Resetting time-zero constants

9.2. Non-alarm based troubleshooting

Symptom	Possible Cause(s)	Solution (Tasks)
Gloss and reference signals are low, but gloss value make sense	Light source LED intensity has drifted	Check and align LED driver PCB (see Subsection 5.3.1)
		Check and align fastcard amplifier PCB (see Subsection 5.3.5)
Gloss and reference signals are low, and adjustment of LED driver PCB and fastcard amplifier PCB does not correct the operation	Light source LED is too weak	Replace source aperture assembly with a new one (see Section 8.6)
Laser Win Det signal is low	Dirt buildup on windows	Remove dirt build-up (see Section 8.2)
Lasr Ph Det signal is low	Drive voltage of *Dust Comp* source is low	Adjust driver voltage (see Subsection 5.3.6)
	LED of *Dust Comp* source is old	Replace Dust Comp source gloss sensor (see Section 8.6)

10. Storage, Transportation, and End of Life

This chapter summarizes Honeywell policy regarding the storage and disposal of the Gloss Measurement system components.

10.1. Storage and transportation environment

In order to maintain the 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 of using environmentally friendly methods. Contact the factory for further details and instructions.

11. Glossary

AC	Alternating current
ADC	Analog-to-digital converter
Bin (or measurement Bin)	The smallest measurement zone on the frame. Also called Bucket or Slice.
Bucket	See Bin.
Cable End	The end of the scanner opposite the distant end.
CCW	Counter clockwise
CH1	Gloss reference (reference)
CH2	Gloss measurement (signal)
CH3	Window cleanliness reference (= *Laser Ph Det*)
CH4	Window cleanliness measure (= *Laser Win Det*)
Cross Direction (CD)	Used to refer to those properties of a process measurement or control device that are determined by its position along a line that runs across the paper machine. The cross direction is transverse to the machine direction that relates to a position along the length of the paper machine.
CW	Clockwise
DC	Direct current
Dirt Ratio	{Gloss Ratio *[(Laser Ph D Ratio / Laser Win D Ratio) - 1] * Dirt Slope} + Dirt Intercept
Distant End	The end of the scanner opposite the cable end.
Drive Side (DS)	The side of the paper machine where the main motor drives are located. Cabling is routed from this end. Also called Back Side.

DVM	Digital voltage meter
Experion MX	A quality control system (see QCS)
Fastcard	Amplifies AC signals from Detector Preamps and converts them to DC signals
FC	Frequency converter
Gloss	Uncorrected gloss + dirt correction
Gloss Ration	(Signal - Signal Dark) / (Reference - Reference Dark)
gpm	Gallons per minute (= 3.785 liters / min)
Hz	Unit of frequency (Hertz)
Laser Ph D Dark	Dark values for Window Cleanliness Reference
Laser Ph D Ratio	(Laser Ph Det - Laser Ph D Dark) / T0 Laser Ph Det
Laser Win D Dark	Dark values for Window Cleanliness Measurement
Laser Win D Ratio	(Laser Win Det - Laser Win D Dark) / T0 Laser Win Det
Lasr Ph Det	See CH3
Lasr Win Det	See CH4
LED	Light source (light emitting diode)
Machine Direction (MD)	The direction in which paper travels down the paper machine
MSS	Measurement Sub System
OPTIC DIR	Optical direction selection 45 degrees or 75 degrees (Model 4208-0 only). Default is 75 degrees–flag is not set.
PCB	Printed circuit board
QCS TAC	Honeywell technical assistance center for QCS products
Quality Control System (QCS)	A computer system that manages the quality of the product
Real-Time Application Environment (RAE)	The system software used by the QCS to manage data exchange between applications
Recipe	A list of pulp chemicals, additives, and dyes blended together to make a particular grade of paper. In Experion MX, the recipe contains all sensor and actuator configuration and calibration parameters associated with a grade.

Reference Dark	Dark values for gloss reference
SDAQ	System data acquisition board
Sensor Set	The term used in sensor maintenance displays to describe a set of sensors working together on a scanner to perform one measurement
Setpoint (SP)	Target value (desired value). Setpoints are defined process values that can be modified by entering new values through the monitor, loading grade data, and changing a supervisory target.
Signal Dark	Dark values for gloss measurement
Slice	See Bin
Standardize	An automatic periodic measurement of the primary and auxiliary sensors taken offsheet. The standardize measurements are used to adjust the primary sensor readings to ensure accuracy.
Tending Side (TS)	The side of the paper machine where the operator has unobstructed access. Also called Front Side.
Time-zero	Values on start time (T0) of system
TP	Test point
Trend	The display of data over time
Uncorrected Gloss	SLOPE * (Gloss Ratio) + INTERCEPT
V DC	Voltage direct current
V FC	Voltage to frequency converter

A. Part Numbers

The Gloss Measurement component part numbers listed in Table A-1 are provided for reference purposes.

Table A-1 Gloss Measurement Part Numbers

Part Number	Name
086654XX	Solenoid assembly
05298100	Temperature control PCB
05358000	Gloss detector assembly
05401100	Unigauge backplane
05413200	Fastcard amp
05432600	Dirt correction PCB
05433600	LED driver PCB
06692500	Sensor bottom faceplate
07552400	External black glass transfer standard tile
07841800	Backing ring
08707121	Source aperture assembly
08771100	Dust comp. source gloss sensor
09420802	Gloss sensor (TAPPI)
09768000	Sample holder kit
16000006	Pipe compound
41000001	Hose, air, 0.25 in.
61000002	Coupling, pushlock, 0.25 in. barb
61000041	Coupling, hose mender
61000056	Flow meter
61000091	Bushing
61000150	Bushing
61000286	Filter assembly
6555240258	tubing / bulkhead fitting
6580500111	Power distribution board
6580801716	External sensor manifold
6580801723	Manifold

Part Number	Name
6580801731	Alley platform assembly
6580801783	Cable assembly, porosity Q4000
6581500030	EDAQ
6581800235	Kit, gloss sensor mounting, cross direction
6581800236	Kit, gloss sensor mounting, machine direction
08706700	Kit, (Calibration Tile Accessory) Sample Holder Assembly

It is recommended that the spare parts kit for the Gloss Measurement be kept with the sensor. Table A-2 provides a preliminary spare parts list. For more information, contact Honeywell QCS TAC.

Table A-2 Spare Parts List

Part Number	Name	Quantity
05358000	Gloss detector assembly	1
05401100	Unigauge backplane	1
05413200	Fastcard amp	1
05432600	Dirt correction PCB	1
05433600	LED driver PCB	1
08707121	Source aperture assembly	1
08771100	Dust comp. source gloss sensor	1

B. Gloss Measurement Database

Default values of setup constants

Table B-1 lists the default values for the setup constants (time-zero constants) for the Gloss Measurement. These values are found on the **Sensor Maintenance** display under **Calibration Parameters**, **Constants**. These values can be changed by using the **Sensor Maintenance** display to place the sensor in maintenance mode.

Table B-1 Default Values for Setup Constants (time-zero constants)

Name	Typical Value	Description
T0Reference	7.50	Gloss reference
T0Lasr Ph Det	7.50	Window cleanliness reference (detector calibration)
T0LWinD at 75	7.50	Window cleanliness measurement: 75 degrees

Default values of grade constants

Table B-2 lists the default values for the grade calibration constants for the Gloss Measurement. These values are found on the **Sensor Maintenance** display under **Calibration Parameters**, **Grade Calibration**. These values can be changed by using the **Sensor Maintenance** display to place the sensor in maintenance mode.

Table B-2 Default Values for Grade Calibration Constants

Name	Typical Value	Description
Slope Gloss	100.0	Adjustment factor for gloss slope
Intercept Gloss	0.000	Offset for gloss intercept
Slope Ratio Win	0.45	Adjustment factor for slope for window detector ratio
Intercept Ratio Win	0.000	Offset for intercept for window detector ratio
Dynamic Offset	0.000	Not used

Table B-3 lists the default values for the grade calibration limits for the Gloss Measurement. These values are found on the **Sensor Maintenance** display under **Calibration Parameters**, **Grade Calibration**. These values can be changed by using the **Sensor Maintenance** display to place the sensor in maintenance mode.

Table B-3 Default Values for Grade Calibration Limits

Name	Typical Value	Description
Reference Drift	0.20	Drift limit for gloss reference value from T0 value
Lasr Ph D Drift	0.20	Drift limit for window reference measurement from T0 value
Lower Limit	0.000	Lower limit of gloss measurement
Upper Limit	100.0	Upper limit of gloss measurement

In addition, there are two recipe-based options available for the Gloss Measurement, as shown in Table B-4.

Table B-4 Default Values for Recipe-based Options

Name	Typical Value	Description
Optical Dir Flag	0 or 1	Optical path direction; 0 = 45 degrees (model 09420800 only) 1 = 75 degrees
Dirt Corr Flag	0 or 1	Dirt correction for gloss calculation; 0 = not included; 1 = included