# Instant Moisture Profiling System

# IMPS-4400
# User Manual



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# 2 Minimum System Requirements

IMPS-4400 Controller (full size tower IBM compatible)

- Windows XP / Windows 7 home or professional
- Pentium 4/3.00 GHz. or better processor
- 2GB System RAM (DIMM)
- 250MB hard drive
- CD/DVD drive
- Graphics card with 128MB Video RAM with VGA port
- Ethernet card 10/100 (for network interface) - see note 1
- Open (no card installed) IMPS-4400 PCI slot for optional IMPS-4400 I/O card option - see note 2
- Standard Mouse and Keyboard
- 19 inch Color Monitor 1280 X 1024 resolution, with VGA port

Note 1: The IMPS-4400 Controller should have a separate internal Ethernet port which is used for direct connection to the IMPS-4400 Concentrator Unit. The additional Ethernet card is used as a second Ethernet port to connect to the users LAN (intranet). The IMPS-4400 Concentrator Unit cannot be connected to a LAN (thru an Ethernet switch or hub) due to the high bandwidth traffic between the IMPS-4400 Controller and IMPS-4400 Concentrator Unit.

Note 2: The IMPS-4400 Controller should have a separate, unpopulated PCI slot that would contain a full physical height card for the IMPS-4400 I/O option. This card is used to provide the 4-20mA and voltage outputs for moisture and deck ID info to the customers PLC.

Important: The IMPS-4400 program is display intensive. If the IMPS-4400 Controller cannot update the displays fast enough, the graphic info may not refresh in a seamless visual manner.

# 3 Software Installation

Windows 7 users:

1. Insert the Sensortech USB Drive into the IMPS-4400 Controller USB port.

2. Run the Setup.exe file and follow the displayed instructions.

## 3.1 IMPS-4400 Controller Language Setup

While the user may select the language for the IMPS-4400 Controller, the IMPS-4400 software is designed to use the English numbering system (not the European numbering system) where the number one thousand is represented as 1,000.00 and not as 1.000,00 and where the time and date for February 1, 2013 8:25:11 AM are displayed as 2/1/2013 8:25:11 AM and not as 2013.2.1 8:25:11 AM

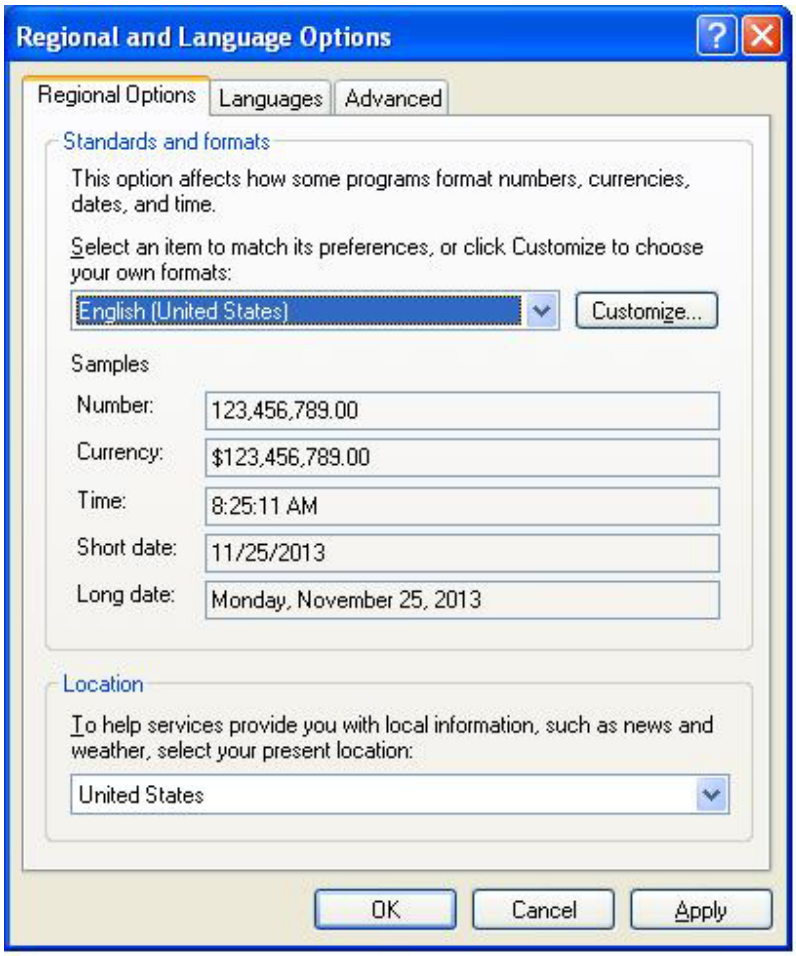
To change the number, date and time settings on the IMPS-4400 Controller perform the following:

Select the “START” button

Select Control Panel icon

Select Regional and Language Settings icon

Set the Number, Time and Short Date fields to match the example below.



## 3.2 Initialization Files

User settings for the IMPS-4400 program are stored in files located in the C:/Sensortech/IMPS subdirectory. It is STRONGLY recommended that the initialization files are backed up to the USB Drive or users archive.

| | |
|---|---|
| C:/Sensortech/IMPS/IMPS.ini | Program settings such as the number of concentrators |
| C:/Sensortech/IMPS/Data/Multiplexers.csv | The calibration settings for all the Sensors |
| C:/Sensortech/IMPS/Data/Product Data.csv | The product table and global calibration settings |

## 3.3 Configuring the IMPS-4400 Controller

The values shown are the default values that the concentrators are expecting:

IP Address 192.168.98.220

Local Port 2002

If you use different values, the concentrators will need to be configured. The concentrators need the IMPS-4400 Controller to have a fixed IP address, so DHCP cannot be used on that Ethernet card.

While each version of Windows is different, here is how to configure an IMPS-4400 Controller running Windows 7 Professional.

Open the Control Panel

Double click on Network Connections

Double click on the correct Local Area Connection

Highlight TCP/IP. Verify the check box is selected

Select Properties

Select Use the Following IP Address

Fill in the following values:

IP Address 192.168.98.220

Subnet Mask 255.255.255.0

Default Gateway 192.168.98.1

Leave Preferred DNS Server empty.

Leave Alternate DNS Server empty.

Select OK

Select OK

# 4 Basic IMPS-4400 Operation

## 4.1 IMPS-4400 Program Operation

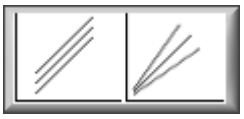
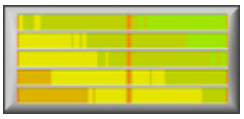
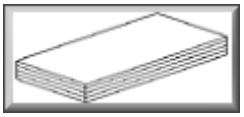
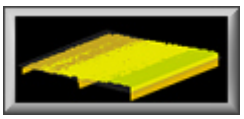
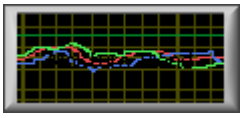
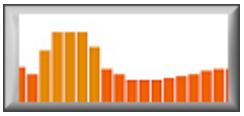
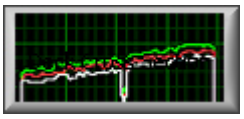
The program continuously reads an array of Sensors across the line and calculates the moisture based on individual Sensor calibrations and global calibrations based on the particular product. The program creates a 3D array of moisture values across the surface of the board. These values are displayed in a variety of charts and graphs.

The moisture data for each board are saved in memory. They are also saved in a comma-delimited file called "IMPS LOG.CSV". Five boards are accumulated in the program's buffer before they are written to the file. If a board passes every five seconds the file is updated every 25 seconds.

When the file size reaches a user-programmed size is renamed to according to the current time and date. For example, a file renamed at 3:34PM on May 6, 2013 will have the name "IMPS Log 5-6-2013 3-34PM.csv". When the program starts it reads the history data from this file.

# 5 Main Screen

The main screen starts with the main program. It is the interface to the rest of the program.

| | | | |
|---|---|---|---|
|  | Calibrate |  | Multi-Deck |
|  | Product Table |  | 2D Contour |
|  | Setup |  | 3D Contour |
|  | Diagnostics |  | Trend Chart |
|  | Split Log File |  | Bar Graph |
|  | Exit |  | Deck Cross Reference |
|  | Administrator Mode |  | Running |

## 5.1 Administrator Mode

To enter Administrator Mode, flip the operator switch and enter the password. To leave administrator mode, flip the switch to Operator. The program starts in Operator Mode.

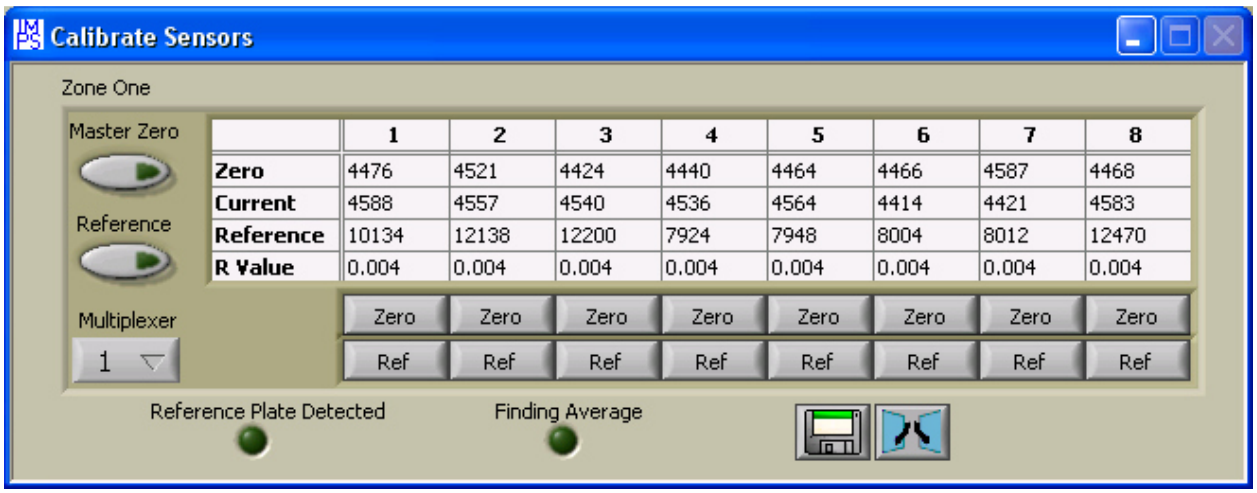
All controls except the graph controls and product selection menus are disabled in Operator Mode, and the program cannot be closed.

For clarity all the screens and controls in this manual are shown in Administrator Mode.

## 5.2 Running Indicator

The blue level rises and falls as the program runs. If it stops, the program or IMPS-4400 Controller has locked up.

# 6 Calibrate Sensors Screen




| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Zero | 4476 | 4521 | 4424 | 4440 | 4464 | 4466 | 4587 | 4468 |
| Current | 4588 | 4557 | 4540 | 4536 | 4564 | 4414 | 4421 | 4583 |
| Reference | 10134 | 12138 | 12200 | 7924 | 7948 | 8004 | 8012 | 12470 |
| R Value | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 |
| | Zero | Zero | Zero | Zero | Zero | Zero | Zero | Zero |
| | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |

## 6.1 Zone One

This is where the individual Sensors are calibrated. These values are stored in Multiplexers.csv when the Save Settings button is pushed.

### 6.1.1 Master Zero Button

This "zeros" all of the Sensors at once.

### 6.1.2 Zero Buttons

These zero the individual Sensors.

### 6.1.3 Reference Buttons

These perform a reference calculation on an individual Sensor. While this calculation is being performed, all controls on this screen are disabled.

### 6.1.4 Zero

These are the values stored in memory when the "Zero" or "Master Zero" buttons are pushed or when an Auto Zero has been performed.

### 6.1.5 Current

These are the raw numbers coming from the concentrator.

### 6.1.6 Reference

These are the values stored in memory when the "Ref" button is pushed. A calibration plate must be on the Sensor.

### 6.1.7 Ref Plate Detected

The program will only perform a reference if it detects an object over the Sensors. This lights as the Standardization Plate is detected.

### 6.1.8 Finding Average

This lights while the program is calculating the reference value. If many averages are selected, it could take several seconds.

### 6.1.9 R Value

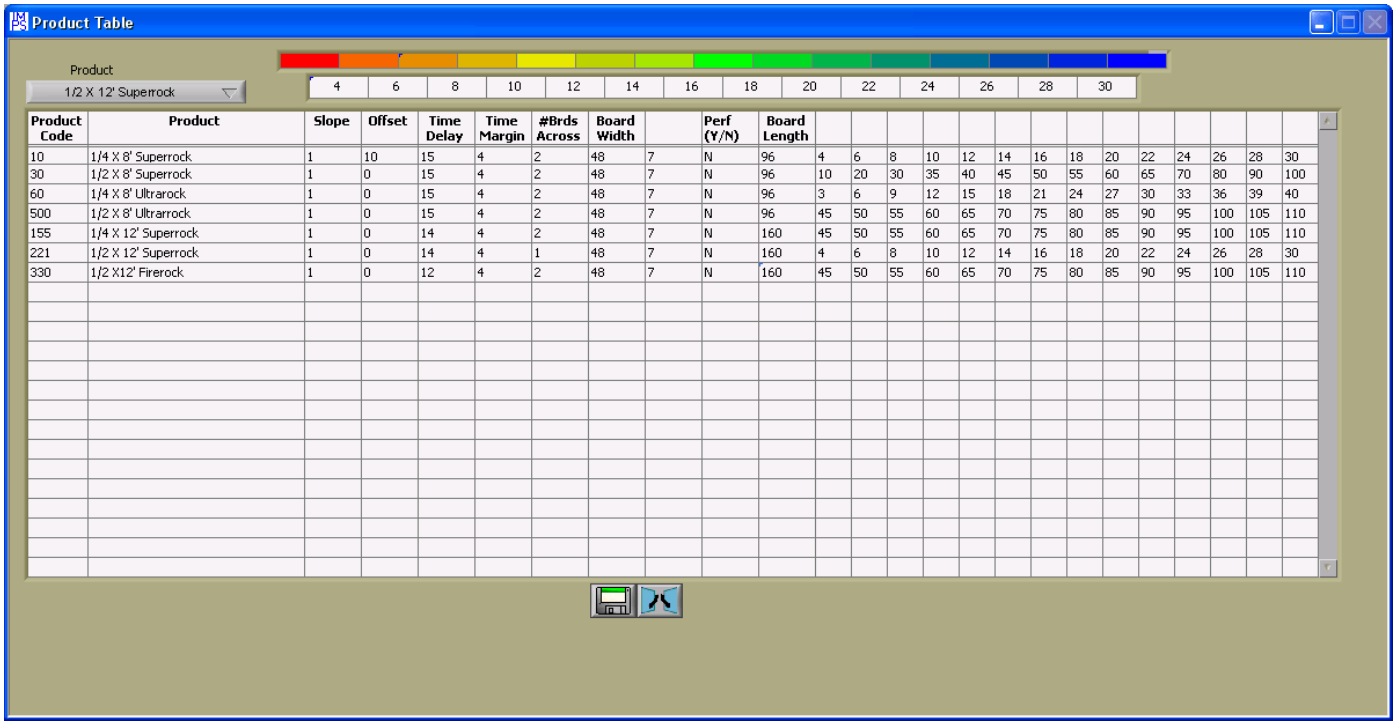
This is the result of the reference calculation:

R Value = 25 / (Current - Zero).

### 6.1.10 Multiplexer Selection

Each concentrator has 16 multiplexers with eight Sensor inputs each. This button chooses which group of eight Sensors to view.

## 7 Product Table Screen




| Product Code | Product | Slope | Offset | Time Delay | Time Margin | #Brds Across | Board Width | | Perf (Y/N) | Board Length | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | 1/4 X 8' Superrock | 1 | 10 | 15 | 4 | 2 | 48 | 7 | N | 96 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | |
| 30 | 1/2 X 8' Superrock | 1 | 0 | 15 | 4 | 2 | 48 | 7 | N | 96 | 10 | 20 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 80 | 90 | 100 | |
| 60 | 1/4 X 8' Ultrarock | 1 | 0 | 15 | 4 | 2 | 48 | 7 | N | 96 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 30 | 33 | 36 | 39 | 40 | |
| 500 | 1/2 X 8' Ultrarrock | 1 | 0 | 15 | 4 | 2 | 48 | 7 | N | 96 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | |
| 155 | 1/4 X 12' Superrock | 1 | 0 | 14 | 4 | 2 | 48 | 7 | N | 160 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | |
| 221 | 1/2 X 12' Superrock | 1 | 0 | 14 | 4 | 1 | 48 | 7 | N | 160 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | |
| 330 | 1/2 X12' Firerock | 1 | 0 | 12 | 4 | 2 | 48 | 7 | N | 160 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | |

This screen shows the global calibration numbers for each product. .

### 7.1 Product Code

This is the product code for a product. Valid ranges are 0-65535.

### 7.2 Product

This is the description of each product

### 7.3 Slope

This value will be multiplied to every reading to calculate the moisture.

### 7.4 Offset

This value will be added to every reading (after multiplying by the slope) to calculate the moisture.

### 7.5 Time Delay

This is the nominal time it takes the board to travel from the take-off to the Sensors, in seconds.

### 7.6 Time Margin

This is the error band in the time delay. If the time delay is 14 seconds and the Time Margin is three seconds, then the program expects a board to appear between 11 and 17 seconds after the deck ID

### 7.7 # Brds Across

This is the number of boards that are across the line.

### 7.8 Board Width

This is the width of each board in units such as millimeters or inches. The particular units are assigned on the Setup screen. If each board is four feet across the number would be four if feet are selected as the units. The number would be 48 if inches are selected.

### 7.9 Perf (Y/N)

Answer Y if the boards are perforated as rafts. Answer N if they are made individually. This function is not yet implemented.

### 7.10 Board length

This is the length of each board in samples and needs to be calculated.

The equation is: S * B / L

where:

L – Take-off line speed in units per second

S – Sample Rate in samples per second (The default is 33.)

B - Board Length in units

### 7.11 Next Columns

These are the numbers used for color-coding the Sensors. They are inserted into the color-coded Comparison Array at the top of the screen.

### 7.12 Product Menu

This menu is used to select the current product. It is disabled if OPC is used.

### 7.13 Save Settings

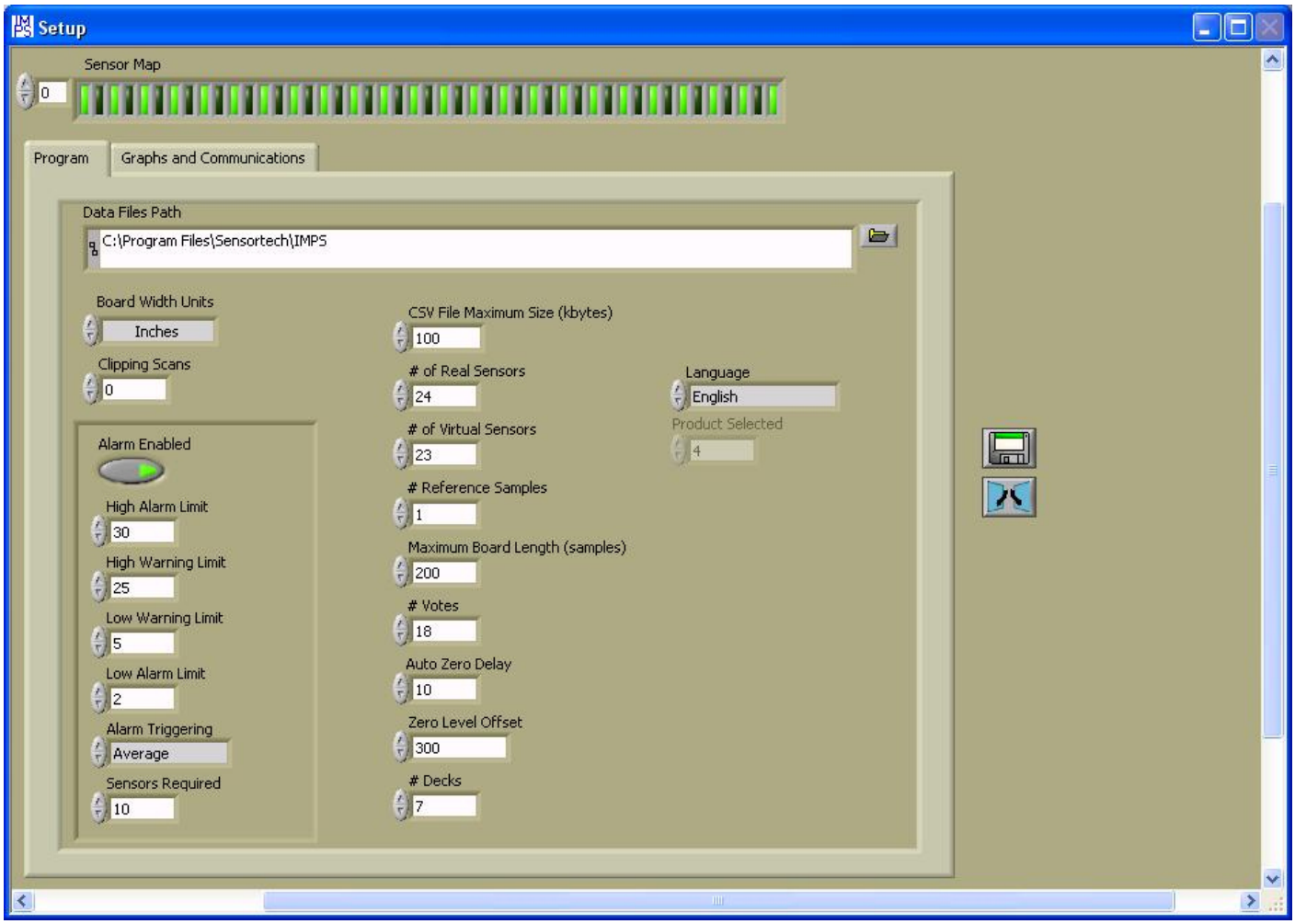
This saves all the settings to the Product Data.csv file. This file is a comma delimited text file that can be opened in most spreadsheet programs such as Excel. This is convenient for the initial setup when cutting and pasting could save a lot of time.

### 7.14 EXIT

This exits the Product Table.

# 8 Setup Screen

These screens display most of the settings for the program.




## 8.1 # Decks

This tells the program how many decks are in the kiln.

## 8.2 Log File Sub Directory

This is name of the directory in which the moisture log file is kept.

## 8.3 Clipping Scans

This is the number of samples across the beginning and end of the boards that are "thrown away" and are not used in any measurements. This cleans up the ends of the boards, which tend to bounce a lot. The clipped scans appear as black in any graphs that display the length of the board.

For example, if the board is 100 samples long and Clipping scans is set to 12, the 2-D graph will still show samples 0-100 on the x-axis. However, the board itself will only appear between samples 12 and 88.

## 8.4 CSV File Size

This is the maximum size of the moisture log file. When the file size reaches this, the file is renamed to according to the current time and date. For example, a file renamed at 3:34PM on May 6, 2003 will have the name "IMPS LOG 5-6-2003 3:34PM.csv".

A larger file size means fewer files, but the number of rows in each one gets larger. Many spreadsheet programs can only read a limited number of rows. Excel can only read about 65,000 rows

### 8.5 High Alarm

This is the threshold value for the maximum moisture limit allowed. A pop-up screen will appear when the limit is exceeded on the IMPS-4400 Controller screen. On the I/O hardware option, a Logic 1 is asserted when N Sensor(s) moisture measurement is above threshold value. Logic 0 is present when below the threshold value.

### 8.6 High Warning

This is the threshold value for a warning that the moisture is getting too high. A pop-up screen will appear when the limit is exceeded on the IMPS-4400 Controller screen. On the I/O hardware option, a Logic 1 is asserted when N Sensor(s) moisture measurement is above threshold value. Logic 0 is present when below the threshold value.

### 8.7 Low Warning

This is the threshold value for a warning that the moisture is getting too low. A pop-up screen will appear when the limit is exceeded on the IMPS-4400 Controller screen. On the I/O hardware option, a Logic 1 is asserted when N Sensor(s) moisture measurement is below threshold value. Logic 0 is present when above the threshold value.

### 8.8 Low Alarm

This is the threshold value for the minimum moisture limit allowed. A pop-up screen will appear when the limit is exceeded on the IMPS-4400 Controller screen. On the I/O hardware option, a Logic 1 is asserted when N Sensor(s) moisture measurement is below threshold value. Logic 0 is present when above the threshold value.

### 8.9 STD Constant

This value is always 25. It is used for calculating the reference values during calibration

### 8.10 Config Password

This is the password used to put the IMPS-4400 software in Administrator mode.

### 8.11 # of Real Sensors

This is the number of physical Sensors across the board.

### 8.12 # of Virtual Sensors

This is the number of virtual Sensors across the board. Virtual Sensor values are the average of two adjacent real Sensors. In most installations every other Sensor is a virtual Sensor while the two Sensors at each end of the array are real Sensors.

There must always be a total of 1 less virtual Sensor than the total number of real Sensors.

### 8.13 Sensor Map

This shows the relationship between real Sensors and virtual Sensors and tells the program which is which. The number of indicators is the sum of real and virtual Sensors. Click on an indicator to turn it on to show that it is real. Click on it again to turn it off to show it is virtual.

### 8.14 # Ref Samples

When the Ref button is pushed, this is the number of samples to average together to calculate the R Value.

### 8.15 Product Selected

This shows which product selection was retrieved from the IMPS.ini file when the program was started.

### 8.16 Max Board Length

This is the maximum length of the internal memory array used to store the moisture values for ALL products. There will be strange results if a board length exceeds this value.

### 8.17 # of Votes

When a Sensor's values rise above the zero value plus the Zero Level Offset, the program records this as a vote.

For example, this is set to 11. As a boards first passes over the Sensors, an increasing number of votes are detected. Once there are 12, the program decides that this is the start of the board. As the end of the board passes over the Sensors, the number of votes decreases. Once there are less than 12, the program decides that this is the end of the board.

### 8.18 Auto Zero Delay

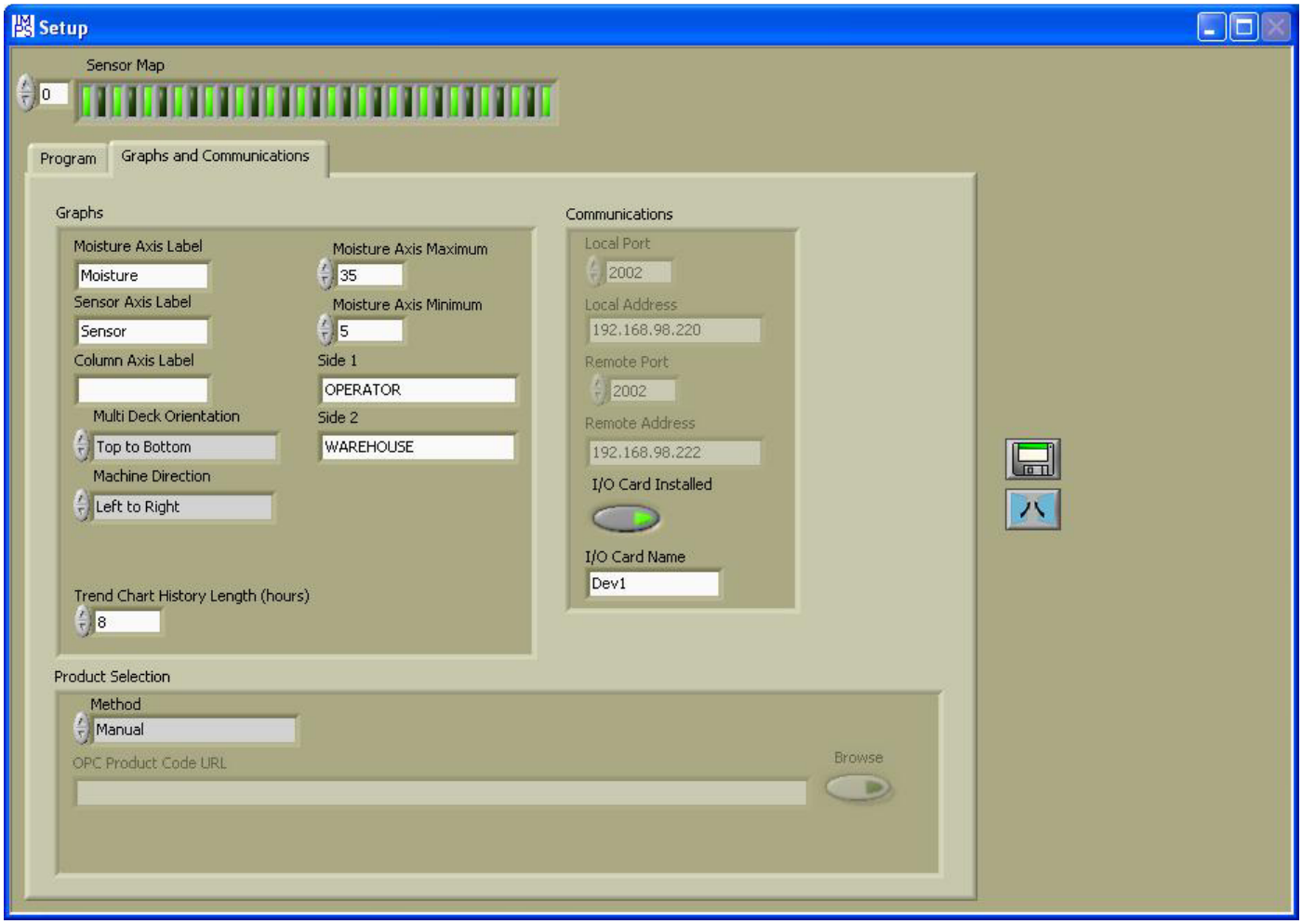
After the end of a board is detected the software waits this number of samples before re-zeroing the Sensors. This value must be large enough so that all the Sensors are clear of both the end of the current board and the start of the next board, no matter how crooked the boards are.

### 8.19 Zero Level Offset

Threshold value for the increase in moisture measurement value required to trigger a ‘Vote’. Typical value range is 500 to 800. See # of Votes.

### 8.20 # Decks

This is the number of decks in the kiln.




## 8.21 Moisture Axis Label

This is the name that is applied to a chart axis that represents moisture. The Bar Graph, Moisture Trend Chart, and 3D Contour Graph have these axes.

## 8.22 Sensor Axis Label

This is the name that is applied to a chart axis that Sensors across the board. The Bar Graph, Multi Deck Display, 2D Contour Graph, and 3D Contour Graph have these axes.

## 8.23 Column Axis Label

This is the name that is applied to a chart axis that represents the samples along the boards. The 2D Contour Graph and 3D Contour Graph have these axes.

"MD⟶" or "MD⟵" will be added to the label depending on the machine direction selected.

## 8.24 Multi Deck Orientation

This selects whether the decks are numbered with deck one on the bottom or on the top.

## 8.25 Machine Direction

This tells the program in which direction the product is traveling, relative to the operator. It determines on which end of the Column Axis sample "0" will appear.

### 8.26 Trend Chart History Length

This sets the trend chart history length. When the program starts, it reads historical data from the log file. If the log file history is larger than this value it keeps only this amount of data in memory.

As the program runs the new data is added. Data older than specified is deleted.

### 8.27 Moisture Axis Maximum

This value is the maximum is applied to a chart Y axis displayed that represents moisture. The Bar Graph, Moisture Trend Chart, and 3D Contour Graph have these axes.

### 8.28 Moisture Axis Minimum

This value is the minumum is applied to a chart Y axis displayed that represents moisture. The Bar Graph, Moisture Trend Chart, and 3D Contour Graph have these axes.

### 8.29 Side 1

This is the name that is applied to a chart axis that represents the user defined label for the side of the line.

### 8.30 Side 2

This is the name that is applied to a chart axis that represents the user defined label for the side of the line.

### Product Selection Box

This tells the program how the current product is selected, either Manual or automatically using OPC protocol.

### 8.30.1 Method

There are two ways to tell the program the current product: Manual and OPC. In manual mode operator selects the product from one of the product menus. In OPC Mode the program reads an OPC tag off the OPC Server that tells it the current product.

### 8.30.2 OPC Server Product Code URL

This shows the URL for the Product Code on the OPC server. The product code retrieved from the OPC server tells this program which product is selected. The Product Code is an unsigned integer corresponding to the numeric entry in the Product Table.

### 8.30.3 Browse

This starts a browser window in which all the available OPC servers are listed. It may take a minute to log on to all the servers, so be patient.

### Communications Box

These are the IP settings for the IMPS-4400 Controller and the IMPS-4400 data concentrator

### 8.30.4 Local Port

This is the port number for the network card in the IMPS-4400 Controller that is connected to the concentrators.

### 8.30.5 Local Address

This is the IP address for the network card in the IMPS-4400 Controller that is connected to the concentrators.

### 8.30.6 Remote Port

This is the port number for the data concentrator.

### 8.30.7 Remote Address

These show the IP addresses of the IMPS-4400 Concentrator Unit.

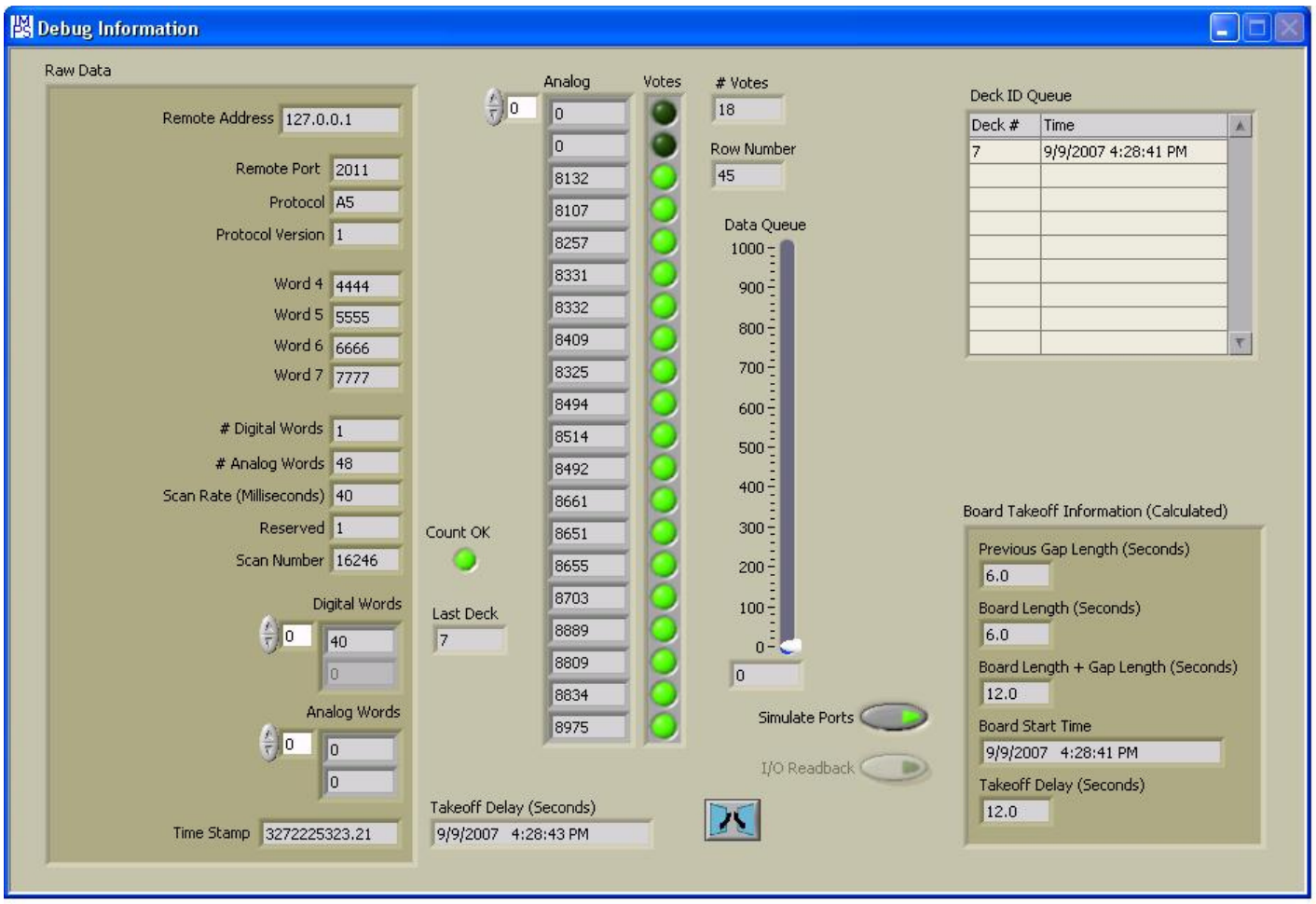
### 8.30.8 I/O Card Installed

This button turns “green” when the IO Option is enabled. Click the button to turn the IO option on or off.

### 8.30.9 I/O Card Name

This is the device name for the IO option card installed in the IMPS Controller. “Dev1” is the default value for this field.

# 9 Diagnostics Screen




This screen shows information about the general operation of the system.

## 9.1 Raw Data

This shows the information from the latest data packet sent by the IMPS-4400 Concentrator Unit embedded processor.

### 9.1.1 Remote Address

This is the address of the IMPS-4400 Concentrator Unit embedded processor.

### 9.1.2 Remote Port

This is the port number of the IMPS-4400 Concentrator Unit embedded processor.

### 9.1.3 Protocol

This is the data protocol sent by the IMPS-4400 Concentrator Unit embedded processor. This should always be "A5".

### 9.1.4 Protocol Version

This is the version of the data protocol sent by the IMPS-4400 Concentrator Unit embedded processor.

### 9.1.5 Word x

These values are not currently used.

### 9.1.6 # Digital Words

This is the number of digital data packets sent by the IMPS-4400 Concentrator Unit embedded processor. There are usually no digital words.

### 9.1.7 # Analog Words

This is the number of analog data packets sent by the IMPS-4400 Concentrator Unit embedded processor.

### 9.1.8 Scan Rate

This is the rate at which the IMPS-4400 Concentrator Unit embedded processor is sampling data in milliseconds.

### 9.1.9 Reserved

This number is not currently used.

### 9.1.10 Scan Number

This is the sequential scan number sent by the IMPS-4400 Concentrator Unit embedded processor. It starts at 0, increments to 65,535, and then rolls over to 0.

### 9.1.11 Digital Words

These are data packets with the digital data.

The first word is the deck ID in hexadecimal. It is a 16-bit word with the deck ID as a 1 and all other bit are 0s. Note that the codes only appear for installed decks. Decks above that are undefined. For example, in a 12-deck system, codes for decks 13-16 should not appear.

| Cod | Deck | Code | Deck |
|---|---|---|---|
| 1 | 1 | 100 | 9 |
| 2 | 2 | 200 | 10 |
| 4 | 3 | 400 | 11 |
| 8 | 4 | 800 | 12 |
| 10 | 5 | 1000 | 13 |
| 20 | 6 | 2000 | 14 |
| 40 | 7 | 4000 | 15 |
| 80 | 8 | 8000 | 16 |

### 9.1.12 Analog Words

These are data packets with the analog data from each Sensor in hexadecimal format.

### 9.1.13 Time Stamp

This is the time that the data was received in the number of seconds since 12:00 January 1, Friday, 1904, Universal Time.

## 9.2 Count OK

This lights when the Scan Number increments correctly. It turns off when a Scan Number is skipped. The usual cause is if the Controller is overloaded or there is a network problem between the IMPS-4400 Controller and the concentrator.

### 9.3 Last Deck

This is the decoded deck ID.

### 9.4 Last Packet Date and Time

This is the decoded time and date from the Time Stamp. This time is an integer value while the Time Code is a fractional value. Thus it does not keep up with every packet, but it is useful for troubleshooting.

### 9.5 Simulate Ports

This enables the data simulator so the program may be used without the IMPS-4400 Concentrator Unit embedded processor Ethernet connected. The simulator generates data that slowly oscillates up and down and has a small slope so that Sensor 0 is slightly dryer than Sensor 50.

The data generated are based on the number of Sensors across, the number of boards across, and the board length of the selected product. The product selected while using this function must have a delay of 15 seconds.

This is intended as a troubleshooting and training aid. The data generated, while useful for the intended purposes are by no means a perfect, or even close to a perfect representation of any real data.

There will be very strange results if this is enabled while real data are also coming into the program from the IMPS-4400 Concentrator Unit embedded processor.

### 9.6 Simulating Ports

This verifies that the data simulator is functioning. Do not enable during normal operation.

### 9.7 Analog

These are the Analog Words in decimal format. They should match those in the Current row in the Calibrate screen. The scroll button determines which word is in the top row. The words are numbered starting from zero.

### 9.8 Votes

The indicators turn green when a Sensor moisture value exceeds the ZERO plus the Zero Level Offset value (value entered in Setup screen) shows which Sensors the program thinks are not zero. It the indicator is lit, the value is considered non-zero. These are locked to the Analog indicator, so when the Analog indicator is scrolled, this one is, too. value (i.e.5,200 in Calibrate Sensors screen)

### 9.9 # Votes

This indicator shows the program's vote counter. The program stops counting when this value equals the # Votes control on the Setup Screen.

### 9.10 Votes

These turn on to show which Sensor is counted as a vote.

### 9.11 Data Queue

As the data are received from the concentrator it is put in a queue for processing. This shows how many data packets are in the data queue. It should usually be below two. If it starts rising, the Controller may be overloaded with other tasks or low on memory.

### 9.12 Deck ID Queue

As boards are sent out of the dryer onto the takeoff line, the dryer sends the deck ID to the IMPS-4400 Concentrator Unit isolator modules. However there is a delay between the time the deck ID is assigned by the IMPS-4400 Concentrator Unit and when the board arrives at the Sensors. These boards are put in a

queue until the program can link a board with a deck ID. It does this by looking at the board detect time at the Sensor and comparing that time to the times of the boards in the data queue using the Delay time in the Product Table.

### 9.13 Board Takeoff Information

This is calculated information based on the times the boards are detected. This is useful for troubleshooting and verifying that the boards are properly detected and spaced. This information is calculated from the sampled information that could have an error of several sample intervals. It is not intended for precise timing information, but rather for gross timing analysis.

#### 9.13.1 Previous Gap Length

This is the new start time minus the previous board's end time

#### 9.13.2 Board Length

This is the board's end time over the Sensors minus the start time.

#### 9.13.3 Board Length + Gap Length

This is the Board Length plus the Previous Gap Length

#### 9.13.4 Board Start Time

This is when the board is detected over the Sensors

#### 9.13.5 Takeoff Delay (Sec)

This is the calculated delay between when the board leaves the dryer and is detected over the Sensor.

For this function to work properly, this time must be correctly set in the Product Table. It will only be correct if the boards are arriving in this window. If the delay is set to 15 seconds +/- 3 seconds, and the boards actually take 16 seconds, it will read 16 seconds. If this time is consistently different that the nominal programmed delay, the delay may need to be changed to this value. However, if the boards are 7 seconds apart and they are taking 21 seconds to arrive, the delay may say 14 seconds, but the boards will be assigned to an incorrect deck.

### 9.14 Save Settings

This saves all the settings to the IMPS.INI file.

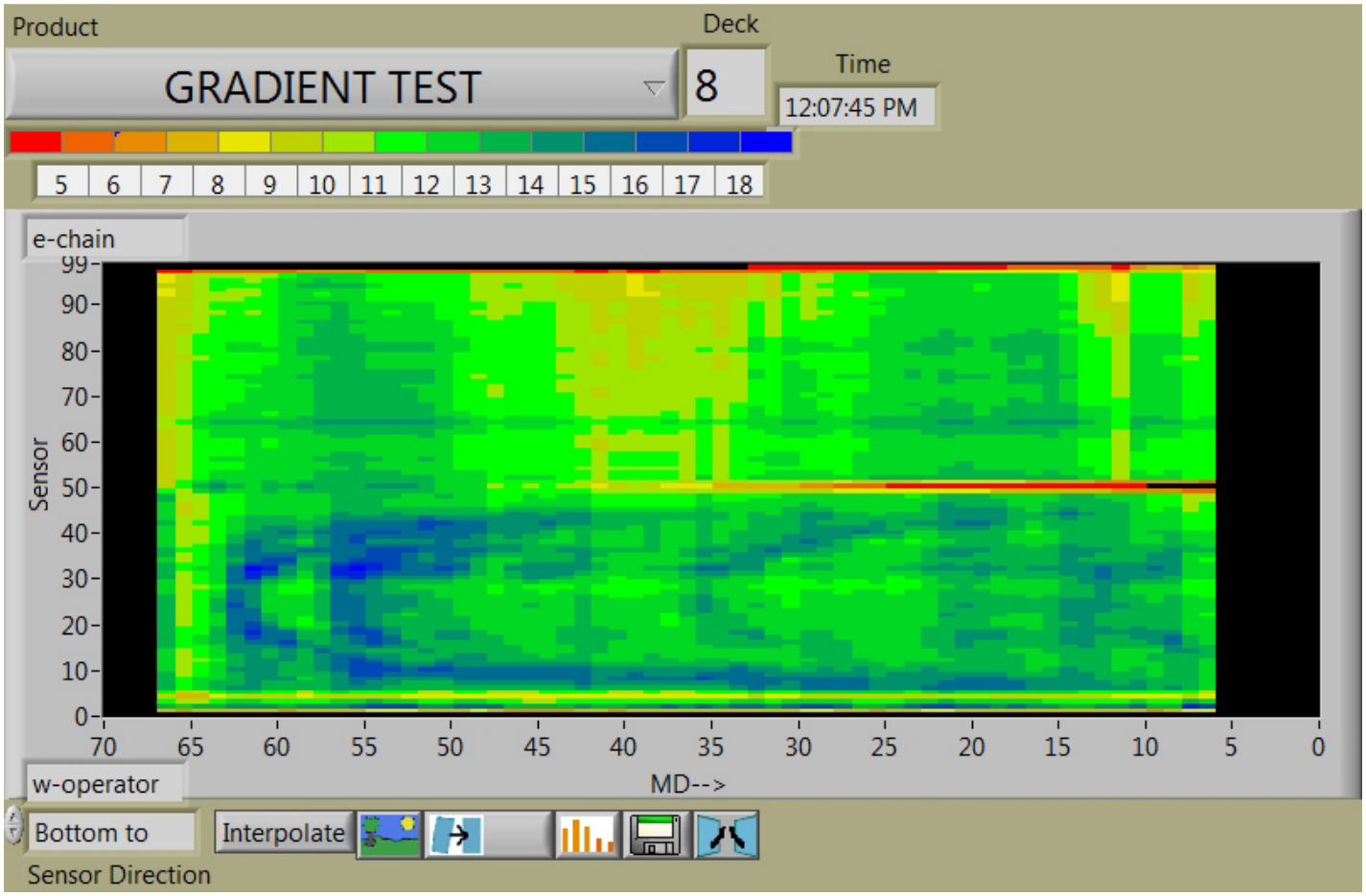
### 9.15 EXIT

This exits the Setup Program.

## 10 Split Log File

This function splits a log file into several files, each with a user-selectable number of rows. Each new file will have a sequential number appended to the file name. For example if “IMPS LOG” has 100,000 rows, and the user selects to split it into files with 40,000 rows, it will create three files named “IMPS LOG - 1”, “IMPS LOG – 2”, and “IMPS LOG - 3”. The first two files will have 40,000 rows, and the last file will have 20,000 rows.

# 11 2D Contour Screen




This graph shows a top view snapshot of the boards as they pass over the Sensors. In this example they are traveling from left to right. The Dewander/Deskew, Real Sensors, and Interpolate controls are all tied together between different graph modules. When one of these controls is enabled on any screen, it is enabled on all screens.

## 11.1 Dewander / Deskew

This control is for multiple boards across the line. It aligns the front of the boards and straightens them if they are skewed. Depending on conditions, this may sometimes work better than others

## 11.2 Real Sensors

The graphs show only the real Sensors with gaps where the virtual Sensors are usually located.

## 11.3 Product

This is a control to select the current product. It is disabled if automatic selection using OPC protocol is used.

## 11.4 Deck

This is the Deck ID for the current product.

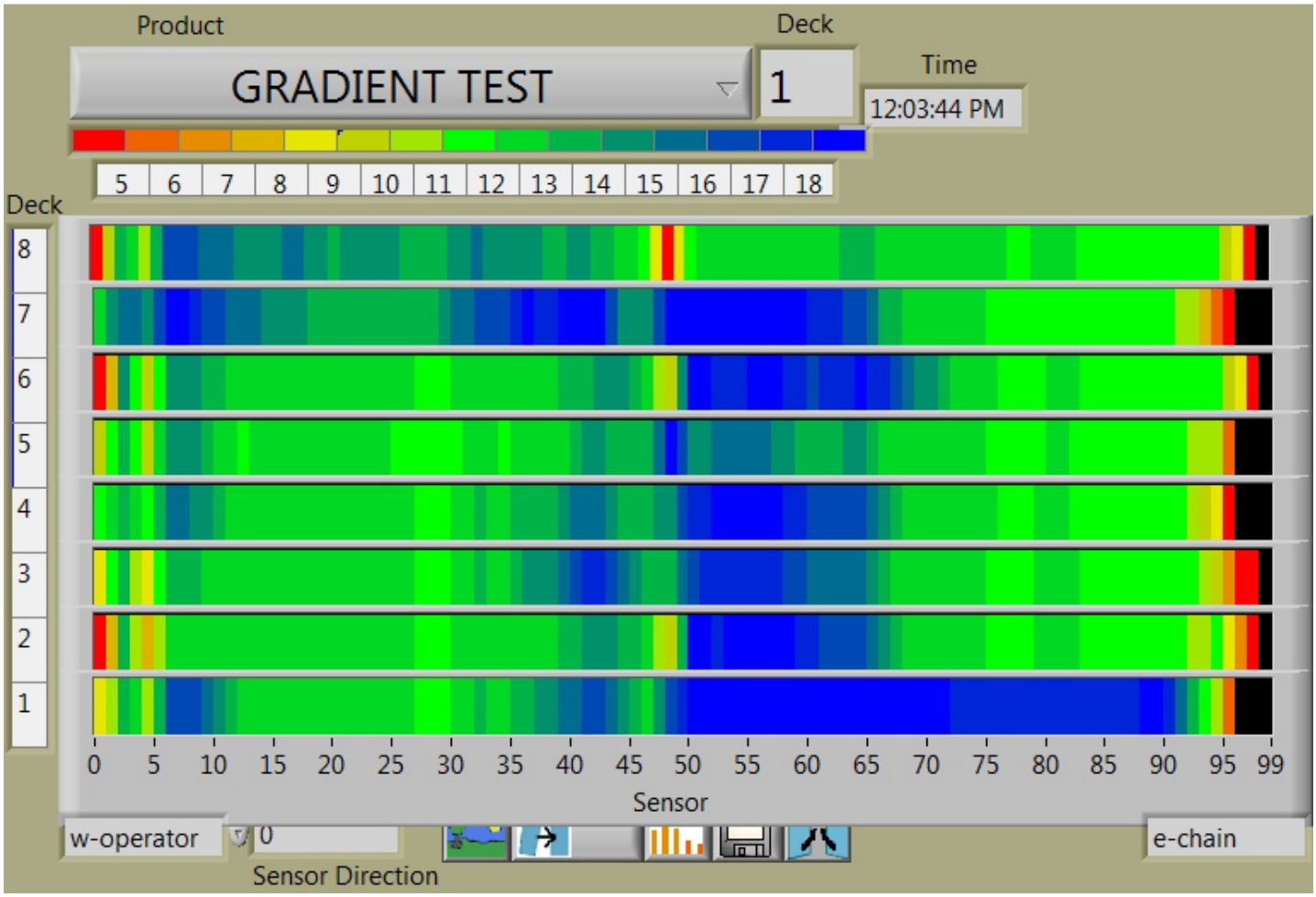
## 11.5 Time

This is the time when the board was detected.

### 11.6 Interpolate

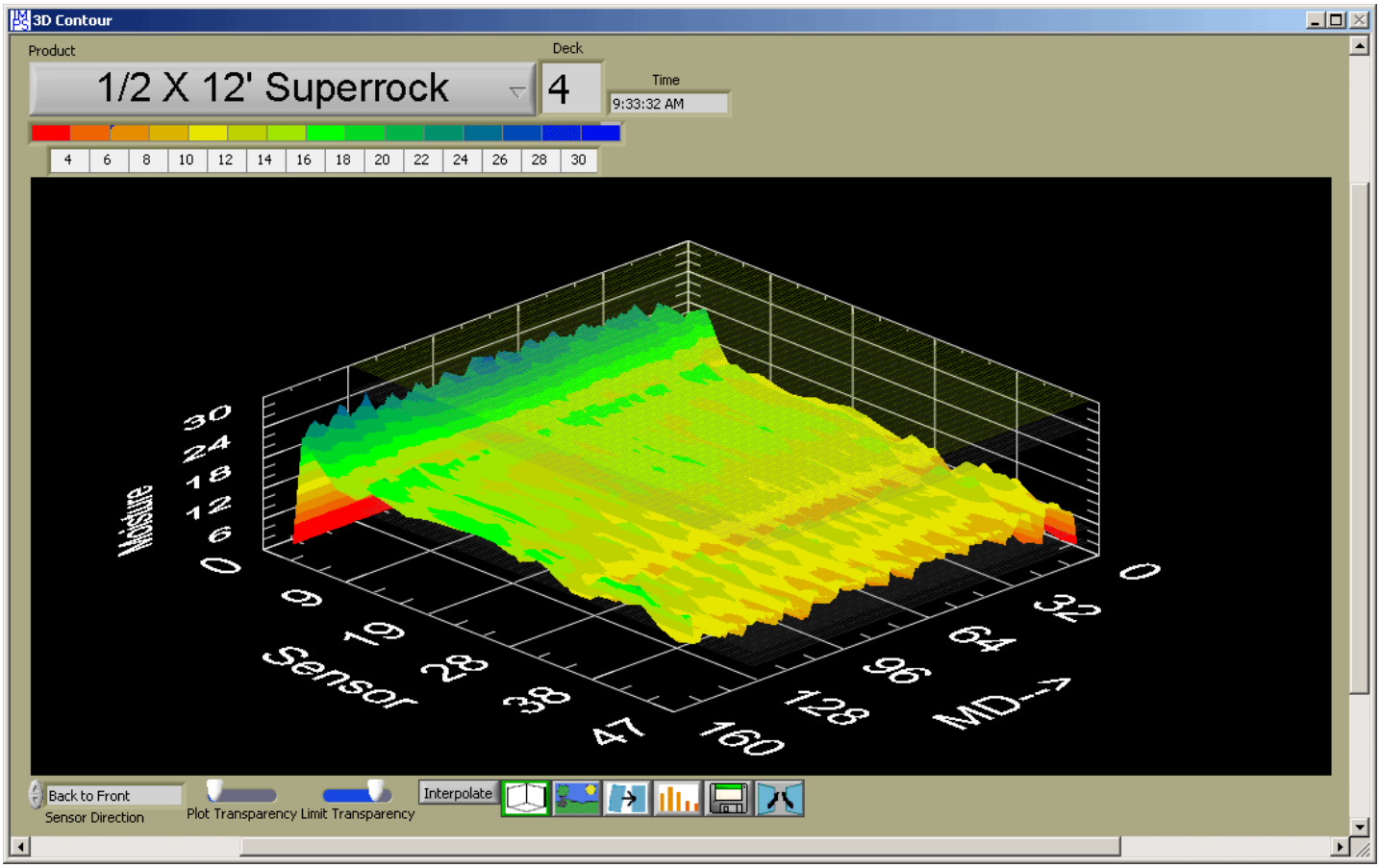
This interpolates the color values on the graph to show smoother transitions between the colors, but it takes more memory and Controller resources.

## 12 Multi Deck Screen




The Multi Deck Display shows the moisture profile of the last boards measured for each Deck.

# 13 3D Contour Screen




The 3D Contour is similar to the 2D contour with a third axis representing moisture. The high and low alarms and warnings are shown as planes. It can be rotated in any direction to provide any view desired.

## 13.1 Plot Trans

This control adjusts the transparency of the plot.

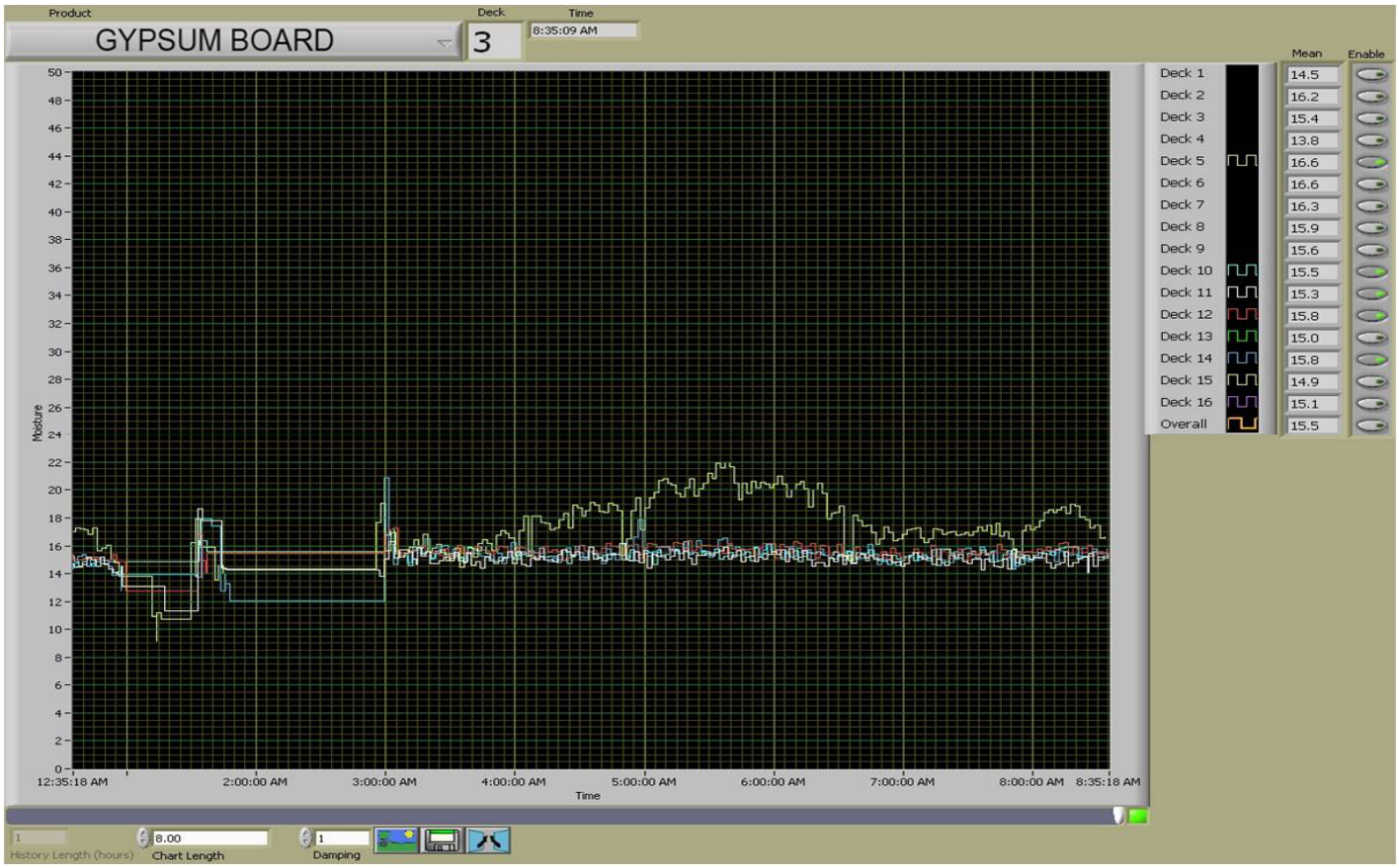
## 13.2 Limit Trans

This control adjusts the transparency of the alarms and warnings. They are shown as colored horizontal planes.

## 13.3 Axis Visible

This turns the axis on or off.

# 14 Trend Chart Screen




This shows moisture for each deck and average of all decks versus time for each deck and an overall average.

## 14.1 History Length

This is the length of the chart history, the maximum data length in memory.

## 14.2 Chart Length

This is the length of the chart from the current time backwards. The chart is like a window looking at a section of the history, which extends past the left side of the chart.

## 14.3 Damping

This is the number of boards to average together over time.

## 14.4 Scroll Bar

This controls what period of time is displayed on the chart. The right end is the current time and the left end is the beginning of the HISTORY. Moving the pointer changes the time that displays on the right side of the chart, scrolling the chart. If the pointer is not at the right end of the scale, the indicator turns off and the chart does not update, but the data are still captured. When the pointer is returned to the right end the chart updates and the indicator turns on.

## 14.5 Plot Legend

This shows the plots and what color they are for each deck. There is one plot per deck and an overall average of all the decks. The overall line is thicker than the others.

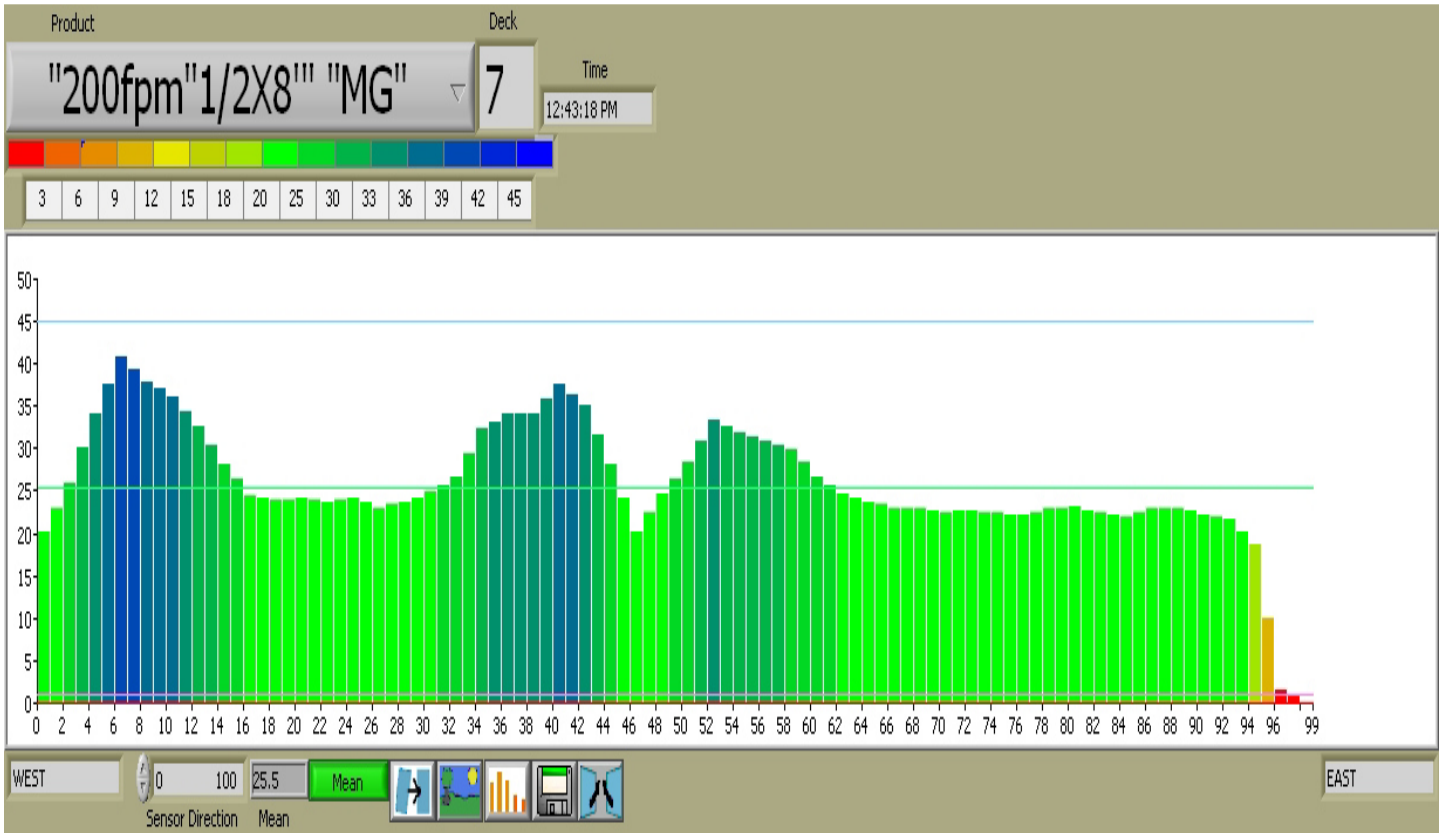
### 14.6 Deck AVG

This shows the last mean moisture measurement value for each deck.

### 14.7 Enable

This enables or disables each deck so only the desired ones are displayed.

## 15 Bar Graph Screen




The bar graph shows the column moisture average as each board passes over the Sensors

### 15.1 Mean Button

When this control is off, the graph shows the Sensors' readings in real time, rising and falling as the boards pass over. The deck ID changes at the start of the board.

When this control is on the graph shows the average of each column only after the entire board passes. The deck ID changes at the end of the board.

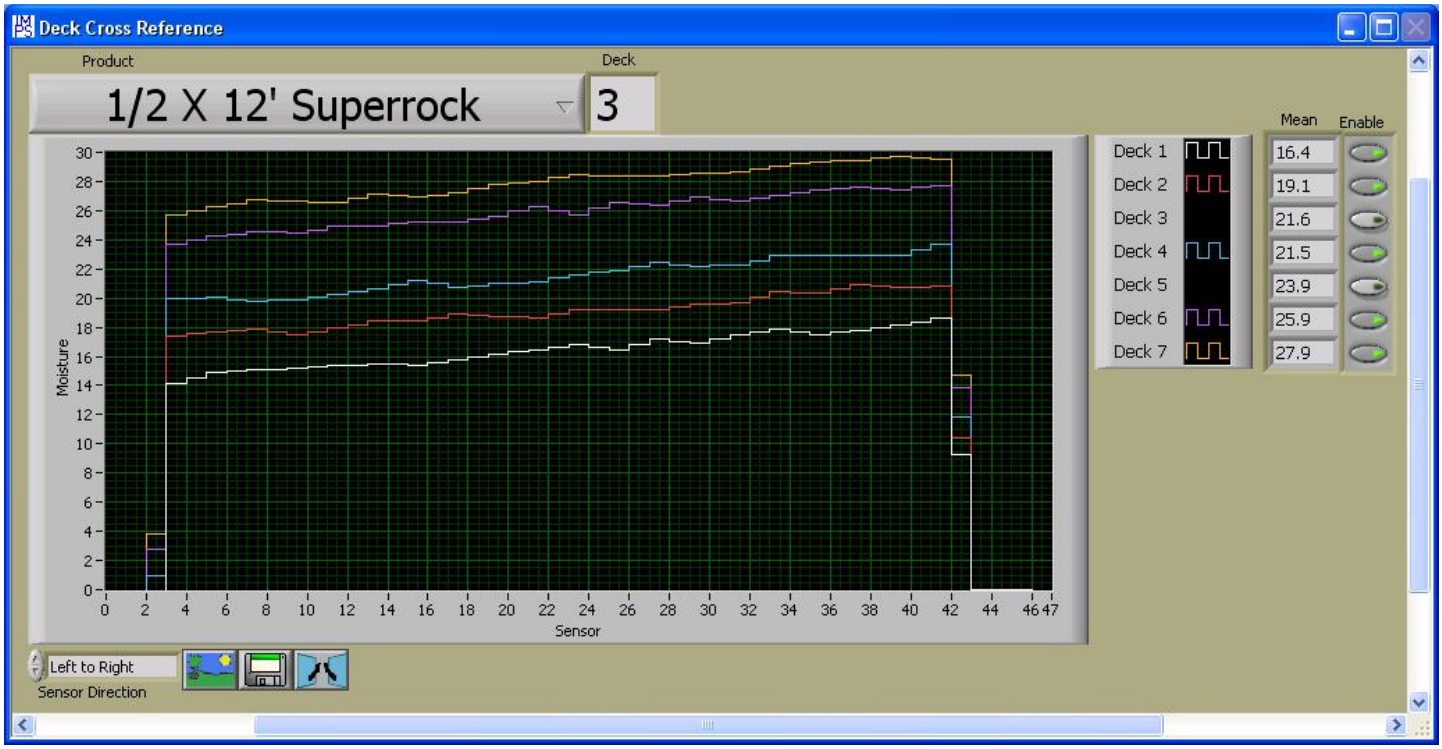
### 15.2 Mean Indicator

This shows the mean of all the Sensor readings. The mean is also shown on the graph as a green line indicating mean moisture value for the board(s) measured.

### 15.3 Alarms and Warnings

The alarms and warning thresholds are shown as colored horizontal lines.

# 16 Deck Cross Reference Screen




The deck cross reference shows the column moisture average for each deck overlaid on one another. This display is useful for comparing deck performance.

## 16.1 Enable

This enables or disables each deck so only the desired decks are displayed.

# 17 IMPS-4400 System Hardware Calibration

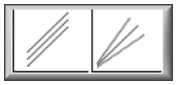
There are two calibrations that should be performed periodically for best measurement accuracy, Sensor Tuning and Sensor Standardization. These Sensor calibration procedures ensure that each Sensor on the array will produce the same moisture value for a specific dielectric value.

Tuning - is a preventive maintenance task which takes approx. 4 hours and is performed by the user during a down day. Each Sensor is tuned for correct frequency and voltage settings using a DVM and screwdrivers while under the Sensors mounted on the line.

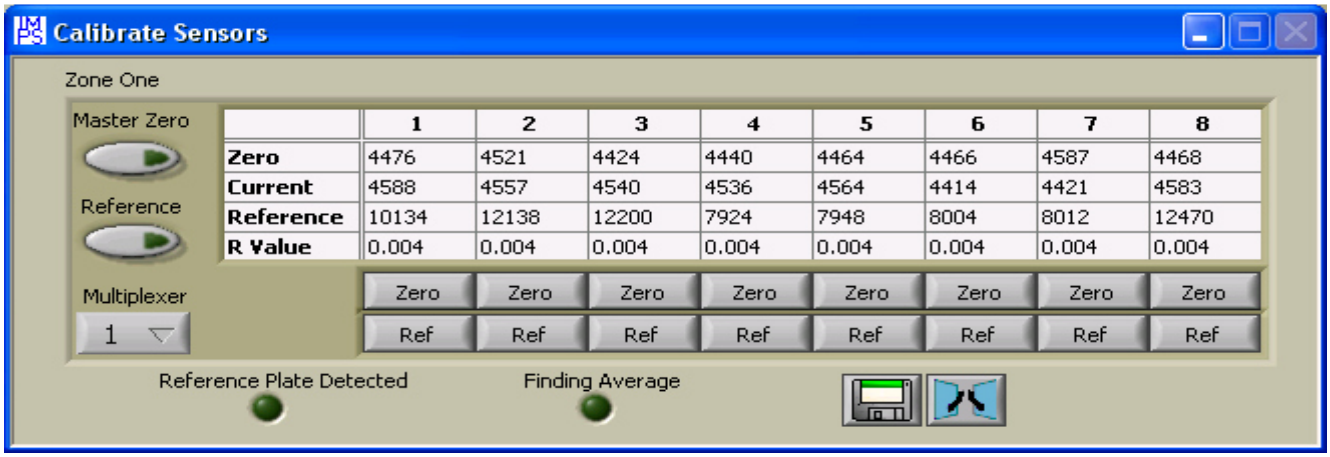
Standardization - is a preventive maintenance task which takes approx. 15 minutes and is performed by the user during a down day. A Standardization Plate is placed on the rollers adjacent to the Sensor array and a MUX is selected for up to eight Sensors that are to be Standardized to a known dielectric reference. The Standardization Plate is then moved to overlap each adjacent MUX selection of up to eight Sensors until the entire Sensor array has been Standardized.

## 17.1 IMPS-4400 Sensor Tuning (Sensor Calibration)

### Calibrate Sensors Screen Icon



### Calibrate Sensors Screen




| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Zero | 4476 | 4521 | 4424 | 4440 | 4464 | 4466 | 4587 | 4468 |
| Current | 4588 | 4557 | 4540 | 4536 | 4564 | 4414 | 4421 | 4583 |
| Reference | 10134 | 12138 | 12200 | 7924 | 7948 | 8004 | 8012 | 12470 |
| R Value | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 |
| | Zero | Zero | Zero | Zero | Zero | Zero | Zero | Zero |
| | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |

The purpose of the “Calibrate Sensors” screen is to display the raw data and stored values for each Sensor on the IMPS-4400 Sensor array. With no board material running on the line, a manual reset may need to be performed to initialize the IMPS-4400 system by performing a Master Zero upon start-up of the software. Master Zero is always performed when no boards are over the Sensors.

**IMPORTANT: Always perform a Master Zero when the IMPS-4400 program has been started after being shut-down or before Standardization is performed. Master Zero is always performed when no boards are over the Sensors (air only).**

An alarm message will be displayed, warning that the Board Length has been exceeded. This alarm can only be cleared by performing a Master Zero.

To perform a Master Zero, ensure that no board material or standard plate is over any of the Sensors on the line. The Master Zero should only be performed with open air over the Sensors for best measurement results.

After performing a Master Zero examine the ZERO values of each MUX. The ZERO values for a calibrated and Tuned Sensor should be approx. 5,200 +/- 1,000. If the values displayed for any Sensor are out of range the Sensors should be re-Tuned and standardized for proper operation.

Examine the REFERENCE values of each MUX. The REFERENCE values for a calibrated and Tuned Sensor should be approx. 12,000 +/- 5,000. If the values displayed for any Sensor are out of range the Sensors should be re-Tuned and standardized for proper operation.

**Checking Sensors:**

If any ZERO values are <3,000 the Sensor may be disconnected, damaged or out of Tune. Verify the Sensor is functional by placing your hand, a board or standard plate over the Sensor, the CURRENT value should increase when material is over the Sensor.

If any ZERO values are >16,000 the Sensor may be damaged or severely out of Tune. Verify the Sensor has no material or debris over the Sensor and is functional by placing your hand, a board or standard plate over the Sensor, the CURRENT value should increase when material is over the Sensor.

If the CURRENT value does not change > 1,000 when material is present, then the Sensor needs repair or cables are disconnected.

If the CURRENT value changes by >1,000 from Zero value the Sensor may need to be re-Tuned. Replace Sensor if unable to re-Tune.

If all the Sensors are functional perform Standardization. Standardization should be performed after the Sensors have been checked.

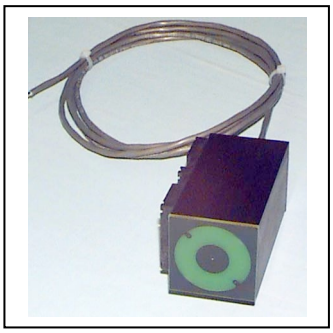
## 17.2 IMPS-4400 Sensor Tuning Procedure

**Tools Required:**
1. Digital voltmeter (DVM) with E-Z Hook leads.
2. Blue slotted screwdriver (tweeker) provided by Sensortech
3. Tan slotted screwdriver (tweeker) provided by Sensortech

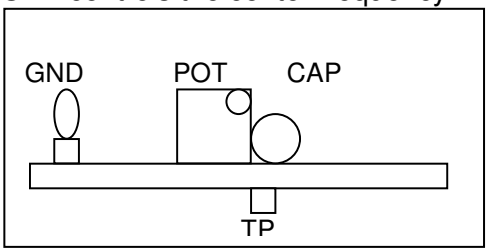
**IMPS-4400 SYSTEM SET-UP**
With IMPS-4400 3.10 application running, open the 'Calibrate Sensors' screen.
Select the multiplexer that is wired to the Sensors being Tuned.
Remove the hole-plug or end cap from Sensor base.
Keep objects away from the electrode at top of Sensor during Tuning.
Keep the Sensor as vertical as possible with the electrode end up to maintain Sensor temperature.

NOTE: Recommended Sensor warm-up time after power up is 24+ hours. Each Sensor contains an internal heater to reduce environmental effects and reduce moisture in the Sensor. While the Sensors will function and provide good moisture measurements 15+ minutes after power-up, the Sensors may not provide the best accuracy until the moisture is burned off and the temperature is stable.

**SENSOR TUNING PROCEDURE**
There are two Tuning controls, a potentiometer (POT) and a variable capacitor (CAP). The pot is a plastic cube. The CAP is accessed through the plastic tube. There are two test points, ground (GND) and TP. The GND is electrical ground and TP is the positive voltage going to the multiplexer in the concentrator unit.



POT controls the offset.
CAP controls the center frequency.




Connect DVM minus lead to the GND test point & plus lead to the TP test point & complete these steps:

| Detailed Description | Shortcut |
|---|---|
| 1. Adjust the POT to set voltage at TP to +5V +/- .1 | POT to +5V |
| 2. Adjust CAP until TP measures the minimum voltage possible for the CAP adjustment range (i.e. lowest adjustable value). Note: minimum CAP adjustment value is located around the center of the CAP screw adjustment range. | CAP to –V (adjust to lowest/most negative voltage) |
| 3. Re -adjust the POT as needed to set voltage at TP to +5V +/- 0.1V | POT to +5V |
| 4. Adjust the CAP **clockwise** to set voltage at TP to +5.5V +/- 0.1V | CAP **clockwise** to +5.5V |
| 5. Make the final adjustment to the POT to set TP to 0.8V +/-0.05V | POT to +0.8V |

On the 'Calibrate Sensors' screen, verify the 'Current' value for the Sensors are between 5,200 +/-1000. Replace the rubber plug and/or metal bottom plate on each Sensor to complete the Sensor Tuning procedure.

## IMPS-4400 Sensor Standardization (Calibrate Sensors to Reference)

Sensor Standardization ensures that the IMPS-4400 system and Sensors are calibrated correctly for the current environmental, electrical and mechanical conditions under which it is operating. Standardization can be performed any time the line is not running and can be completed in approximately 15 minutes by one operator using the Standardization Plate supplied by Sensortech.

### Standardization Procedure:

1. Clean top of Sensors by using a broom to sweep and/or air blast the Sensor surface clean.

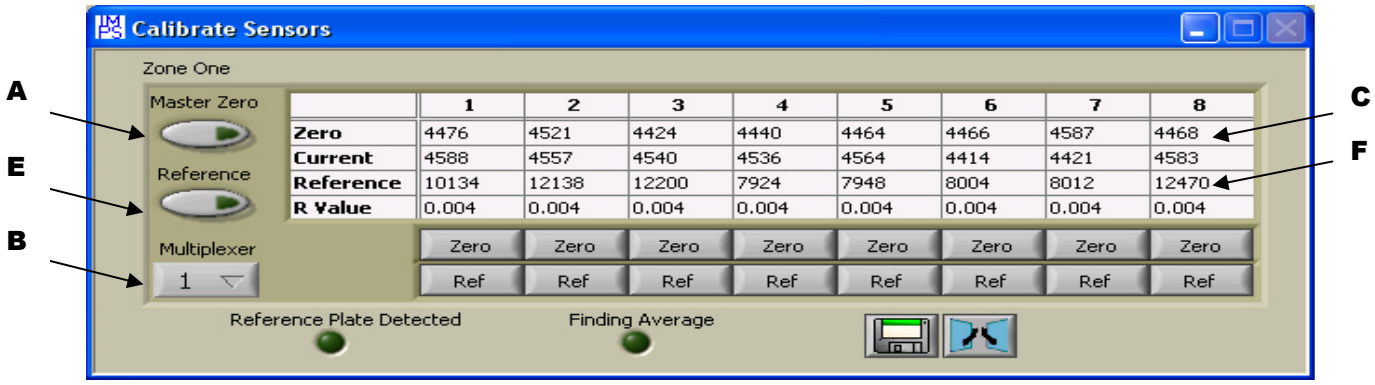
2. Log into the IMPS-4400 system as 'administrator' using the password on the IMPS-4400 Controller main screen.

3. Open the 'Setup' screen and record the value (typically 15) in # Votes box. Set the # Votes value to 50.

4. Open the 'Calibrate Sensors' screen and perform the following steps:
   a. Click on the 'Master Zero' button to perform a Master Zero to reset the Sensors.
   b. Select 'Multiplexer' drop-down button to select the group of 8 Sensors to be Standardized.
   c. Verify the values displayed in the 'Zero' row are 5,200 +/- 2000. If the values displayed for any Sensor are above or below 3200 and 7200 the Sensor number should be noted and the Sensor should be Tuned. See Sensor Tuning procedure.
   d. Place the Standardization Plate on the rollers adjacent to the Sensor array over the Sensors displayed. Ensure the Standardization Plate is clean and level with the Sensor surface.
   e. Click on the 'Reference' button to store the measured value of the Standardization Plate.
   f. Verify the values displayed in the 'Reference' row are between 7000 and 15000. If the values displayed for any Sensor are above or below 7000 and 15000 the Sensor number should be noted and a Sensor Tuning should be performed. See Sensor Tuning procedure section.

5. Repeat this procedure for all Multiplexers and Sensors on the array.

6. Open the 'Setup' screen and reset the # Votes value from 50 to the original value (typically 15).



## 17.3 Replacing Faulty Sensors

IMPS-4400 Sensors are temperature and humidity sensitive and may not stabilize for several days after power on due to changes in environment and temperature inside the Sensor enclosure. A new Sensor can be Tuned 15 minutes after power on, but the new Sensor Tuning will continue to change for a few days until the Sensor stabilizes. This can be seen on the IMPS-4400 "Calibrate Sensors" screen where a Sensor's "Current" value is displayed. A good Sensor will have a starting value of 5,200 +/- 2000 which may change over several days to a value of < 4,000. The new Sensor will need to be re-Tuned and the Sensor array Standardized for best measurement accuracy.

### Sensor Replacement Procedure:

1. Identify the Crystal number (1 thru 8) on the bad Sensor to match to the crystal number on the new Sensor. To avoid RF signal interference, the IMPS-4400 Sensors come in eight frequencies. The metal enclosure on each Sensor's is labeled with a number according to the frequency of its crystal oscillator. The crystal oscillator is also numbered on the Sensor board. The Sensors must be installed in crystal oscillator number order so that all eight numbers repeat in sequence as shown:

1-2-3-4-5-6-7-8-1-2-3-4-5-6-7-8…

2. On the array, loosen the compression fitting on the cable and remove the 2 screws securing the Sensor bottom metal plate to the Sensor enclosure. Support the cable while removing the metal plate and compression fitting.

3. Disconnect the Sensor cable by pulling down on the "red" MTA connector located on the bottom of the Sensor board.

4. Remove the bad Sensor by pressing up on the metal standoffs on the left and right side of the Sensor board.

5. Install the new Sensor by pressing down on the metal standoffs on the left and right side of on top of the Sensor board.

6. Connect the Sensor cable by inserting the "red" MTA connector into the black connector located on the bottom of the Sensor board.

7. Allow the new Sensor to warm up for >15 minutes. Sensor reading will change during temperature and humidity stabilization period.

8. Confirm Sensor is not changing by verifying the IMPS-4400 "Calibrate Sensors" screen "Current" value is 5,200 +/- 2000. If the "Current" value is not in the right range, check cable connections and/or re-Tune the new Sensor.

10. Install the Sensor bottom plate by supporting the cable while moving the metal plate and install the 2 screws securing the Sensor bottom metal plate to the Sensor enclosure. Hand tighten the compression fitting on the cable.

11. Standardize the Mux containing the new Sensor and verify IMPS-4400 "Calibrate Sensors" screen "Reference" values are in the same range +/- 10% on adjacent Sensors on other Mux positions.

### Sensor Measurement Accuracy

For the best Sensor measurement accuracy and stability always maintain AC power to IMPS-4400 Concentrator Unit.

During power outages and/or power shutdown

1. Allow the new Sensors to warm up for >60 minutes. Sensor readings will change during temperature and humidity stabilization period.

2. Confirm Sensors have stabilized by checking the IMPS-4400 "Calibrate Sensors" screen "Current" value is 5,200 +/- 2000 and are not changing over a 5 minute period.

3. Allow the new Sensors to warm up >24 hours before performing a Standardization or Sensor Tuning (a 1 week temperature and humidity stabilization period is recommended).

4. After 1 week, check the IMPS-4400 "Calibrate Sensors" screen "Current" value is 5,200 +/- 2000, re-Tune Sensors that have changed more that +/- 2000.

5. Standardize the Sensor array and check the IMPS-4400 "Calibrate Sensors" screen “Reference” value is 10,500 +/- 5000. All new Sensors should have a “Reference” value variation less than 10% from highest and lowest Sensor “Reference” value.

## 17.4 IMPS-4400 Preventive Maintenance Schedule

Standardize the IMPS-4400 Sensor array per the 1 to 6 month preventive maintenance schedule determined for your facility.

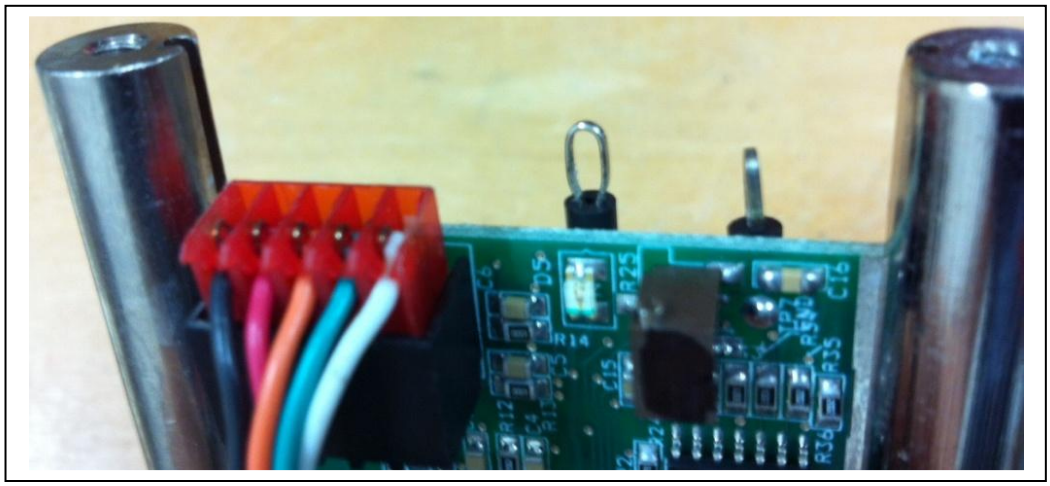
Tune the IMPS-4400 Sensor array every 6 to 12 months as needed.

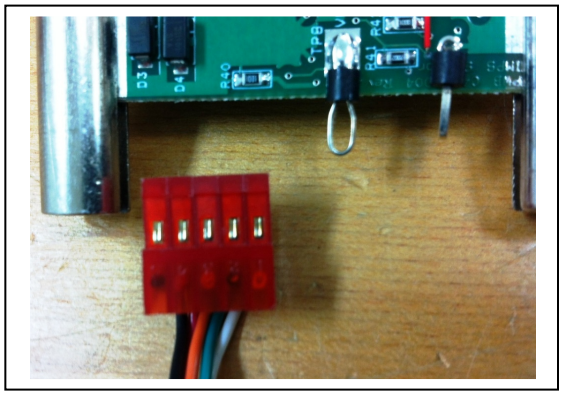
A quarterly Standardization and an annual Tuning of all Sensors is recommended to ensure best IMPS-4400 Sensor measurement accuracy.

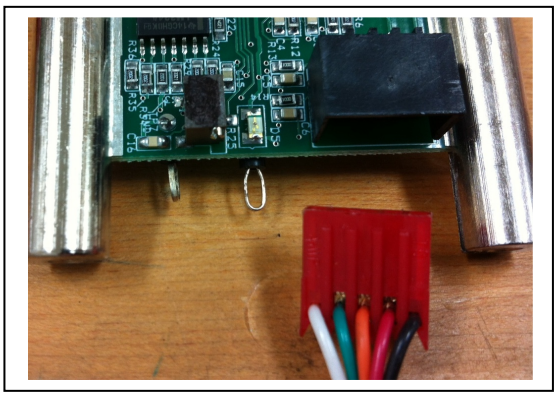
## 17.5 Reconnecting Sensor Cables

When reconnecting Sensor cables and bottom plates on a Sensors being replaced:

1. Inspect and clean all Sensor cables and connectors.
2. Remove the retaining screws and washers from the bottom of the new Sensor.
3. Connect Sensor cable labeled #1 to Sensor #1 by inserting the “red” MTA connector into the black connector located on the bottom of the Sensor board (see photos below).







4. Install the Sensor bottom plate by supporting the cable while moving the metal plate and install the 2 screws securing the Sensor bottom metal plate to the Sensor enclosure. Hand tighten the compression fitting on the cable.
5. Repeat for all remaining Sensors.