

Moisture Monitor Pro



Product Manual

Moisture Monitor Pro

Product Manual

Version 3.4

June 28, 2020

Prepared by: Dryer Master Inc.

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To Our Customer

Thank you for purchasing the Moisture Monitor Pro from Dryer Master®. The Moisture Monitor Pro is a robust system which is simple to use and can be applied to many grain moisture measurement applications.

The Moisture Monitor Pro is part of the Dryer Master family of moisture monitoring and moisture control systems that have at their heart Dryer Master's stainless-steel fin type capacitance-based moisture sensors. These sensors were initially developed to drive Dryer Master's industry leading computerized drying control systems, where they are placed at the inlet and the outlet of the dryer. With over 30 years of field proven experience the sensors are now being offered as part of the Moisture Monitor Pro moisture monitoring solution.

We trust that you will be pleased with the operation of the Moisture Monitor Pro and that you will enjoy benefits similar to those provided by the world-renowned Dryer Master® moisture control system.

Dryer Master Inc.

1 Introduction

This document provides the operational specification for a moisture monitoring system which displays product moisture and product temperature. The system consists of a display unit and either one or two moisture sensors. Both the display unit and the sensors require less than 15 watts of power and are powered from a low voltage 24-volt direct current instrumentation power supply. Depending on the options chosen, the system may include other components and devices.

1.1 Moisture measurement technology

The Dryer Master moisture sensor measures the dielectric properties, in effect the capacitance of the product, in the vicinity of the sensor fin. This method is the most effective in measuring the total water in a given volume of product. The installation ensures a large sample of product is presented to the sensor at all times. This large sample contributes to a better product moisture representation than other methods and generally provides a very good representation of the product in the total sample stream. This technology is particularly suited to the measurement of product with moisture gradients. A moisture gradient occurs any time product is processed such as by heating or cooling but not limited to either. The sensor's robust construction and conservative installation specifications ensure long product life.

1.2 Information display

The information display is a micro PLC (Programmable Logic Controller) with an integrated graphics color LCD display and touchscreen keypad. This combination of integrated items is also referred to as an OCS (Operator Control Station). The Dryer Master moisture sensor calibration software embedded in this device provides the same reliability and accuracy as that in Dryer Master computerized drying control systems.

2 System Overview

2.1 Display Unit/Enclosure

The display unit is the information provider. Real time product moisture and product temperature information, as well as alarms and moisture trends, can be shown. Product selection, sensor calibration, alarms and system setup are all functions accomplished through menus accessed via the touch screen keypad

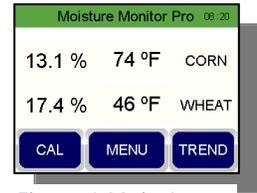


Figure 1 Main Screen

2.2 Moisture Sensor(s)

The Moisture Monitor Pro can be used with either one or two moisture sensors. Each moisture sensor should be located in what is called a “compacted product flow” situation. Flow past the sensor should be no faster than 1” per second (2.5 cm/second). Even and consistent product flow is key to obtaining stable moisture readings.



Figure 2 Moisture Sensor

2.3 Rotary feed sensor chute (optional)

Two versions (bypass or inline) of the optional Dryer Master rotary feed chutes are available to simplify sensor installation. The chutes provide a compacted metered flow past the sensor and are particularly useful if sampling product exiting a dryer.



Figure 3 Rotary Feed Chute (bypass)

2.4 Calibration button (optional)

An optional illuminated calibration push button may also be used to standardize and simplify calibration. When the operator presses the push button, the lamp will flash and gather information during the period the button lamp is flashing (30 seconds). The operator simultaneously takes a gradual sample during the period the lamp is flashing. The operator then obtains the bench top value of the sample and enters it into the Moisture Monitor Pro. The system then updates the sensor calibration using the operator value and the value it calculated as the average moisture reading for the sample period.

2.5 Smartphone access

The Moisture Monitor Pro comes with a built-in web server allowing process data to be forwarded to a smartphone via a network connection. The smartphone display shows process information as well as process history, alarms and graphs.

2.6 Data storage

Data is stored on a micro-SD card inside the enclosure. For easy data access there is a USB port on the bottom of the enclosure. Using a USB the operator can download historical process data (in .csv format) for later insertion into a spreadsheet program.

3 System Operation

The Main Screen of the Moisture Monitor Pro displays product moisture(s), product temperature(s) and product name(s). The system self-configures depending upon whether there are one or two sensors being used. If there are two sensors connected, the display shows both sensors. If only one is connected, then only one is displayed.

The Moisture Monitor Pro user interface is via the touch screen. The F(unction) keys are generally not used in daily operation.

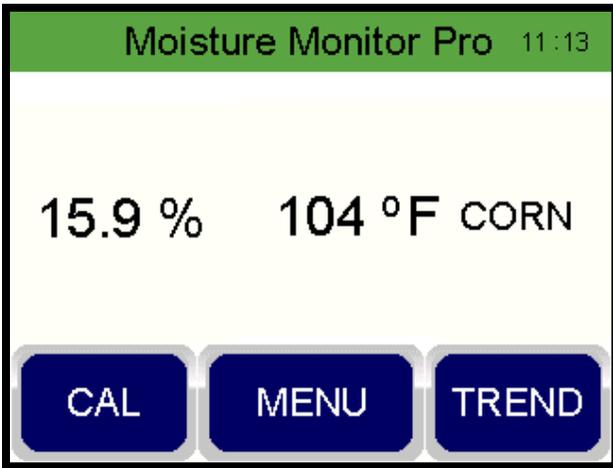


Figure 4 Main Screen - single sensor

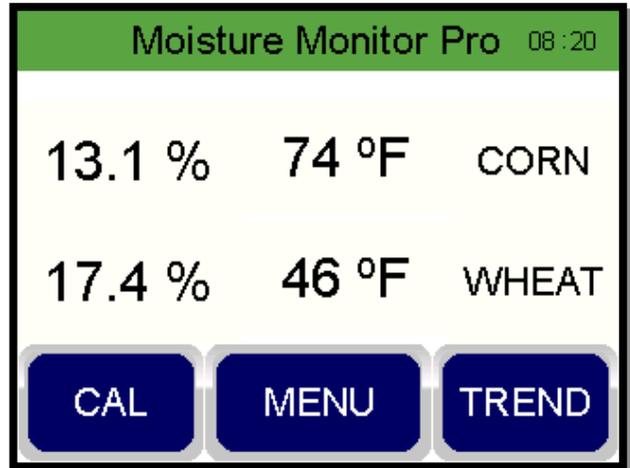


Figure 5 Main Screen - two sensors

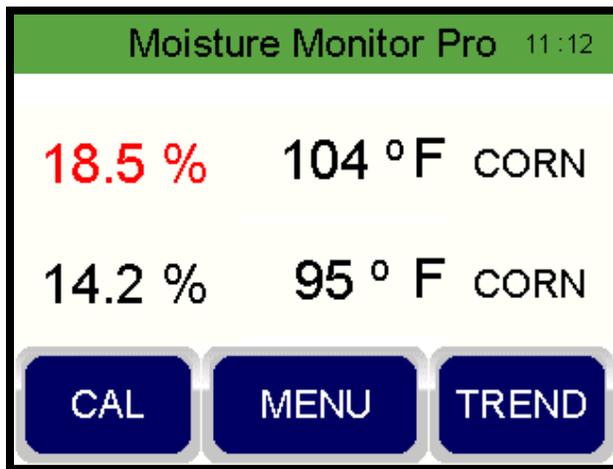


Figure 6 Main Screen with 2 sensors - showing one sensor in alarm (red numbers)

3.1 Main Screen display:

1. Product moisture
2. Product temperature
3. Product name

3.2 Menu Buttons:

Buttons are activated by touching the button on the screen.

CAL: to go to the moisture calibration screen.

TREND: to bring up graphs.

MENU: to bring up the extended menu.

3.3 Sensor Calibration: (CAL button)

There are two sensor calibration methods: basic and advanced. The selection of the method is made in the **SYSTEM SETUP** section under **calibration** settings (**SYSTEM SETUP** is reached by pressing the **MENU** key). If two sensors are connected, pressing the **CAL** button will bring up the choice of sensors.

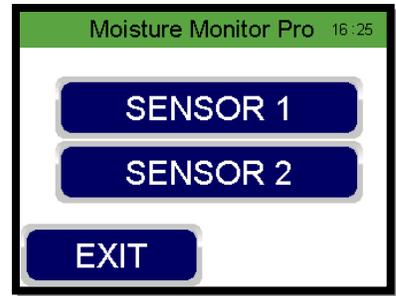


Figure 7 Sensor Selection

3.3.1 Basic Method

The Standard calibration method permits quick adjustment of the displayed moisture by directly adjusting the displayed moisture. For best results, calibrate when the displayed reading is relatively stable. You don't want the moisture to be changing up and down too much while you are doing your test.

Steps:

1. Note the displayed moisture.
2. For best results collect product by taking a number of small product samples over a 30 second period.
3. Mix this large product sample and perform a number of off-line manual tests. It is suggested that 3 manual tests should be taken and averaged to get an average reading.
4. Again note the displayed moisture. If the change displayed is less than 0.5%, adjust the value in the calibration screen to reflect the test average, using the "+" and "-" keys.
5. When done, press the **SAVE** key, and a **CALIBRATION COMPLETE** button will appear.
6. If the difference in moisture between step 1 and step 4 is greater than 0.5% use discretion in adjusting.
7. Repeat as necessary.

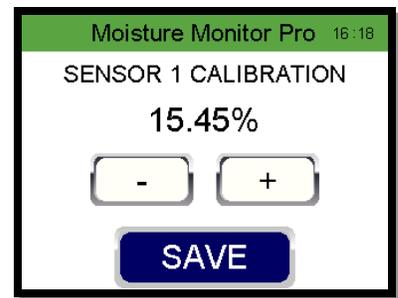


Figure 8 Calibration Screens - Basic Method

3.3.2 Advanced Method

The advanced method can be used with or without an optional calibration push button.

Without the calibration button:

1. Press **CAL** and select the sensor if there are two sensors
2. Press **START**. The Moisture Monitor Pro will calculate an average moisture reading over the next 30 seconds. The display will initially return to the Main Screen, and you will see the **CAL** button flashing.
3. After 30 seconds it will return to the calibration entry screen.
4. During this 30 second time period, take a number of small product samples at the sensor.
5. Mix this large product sample and perform a number of manual tests. It is suggested that 3 manual tests should be taken and averaged to get an average reading.
6. The MMP screen will now show the calculated 30 second average (ONLINE SAMPLE).
7. Press the highlighted "Manual Sample" and a keypad will come up. Using the keypad, enter the MANUAL SAMPLE reading from step 4, and then press ENTER.
8. Once the calibration is accepted a **CALIBRATION COMPLETE** button will appear. Press the button to clear it and return to the Main Screen.

Note:

To cancel a calibration, Press **CANCEL** on the sample entry screen.

To return to the Main Screen until you have finished running your tests, press **EXIT**. On the Main Screen the **CAL** button will be solid green. To return to the sample entry screen press **CAL**.

There is an additional setting available if you need a long period in which you want to run your sample before entering the value and want to be automatically returned to the sample entry screen after a period of time. Under **SYSTEM SET-UP**, go to Calibration Settings, and enter a value for Cal Return Time. If you enter for example 300 seconds, the calibration entry screen will automatically load after 300 seconds, without you having to push the **CAL** button.

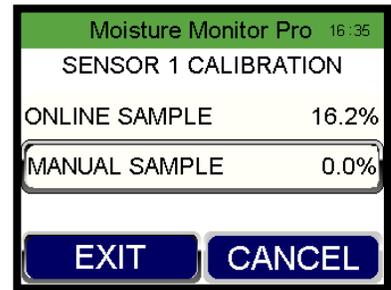
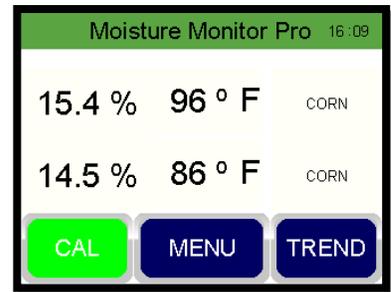


Figure 9 Advanced method without calibration button

With the calibration button

1. Press the calibration button at the sensor.
2. The button lamp will flash for 30 seconds and the Moisture Monitor Pro will calculate an average moisture reading over the next 30 seconds.
3. During this 30 second time period take a number of small product samples at the sensor.
4. Mix this large product sample and perform a number of manual tests. It is suggested that 3 manual tests should be taken and averaged to get an average reading.
5. The MMP screen will now show the calculated 30 second average (ONLINE SAMPLE).
6. Press the highlighted "Manual Sample" and a keypad will come up. Using the keypad, enter the MANUAL SAMPLE reading from step 4, then press ENTER.
9. Once the calibration is accepted a **CALIBRATION COMPLETE** button will appear. Press the button to clear it and return to the Main Screen.

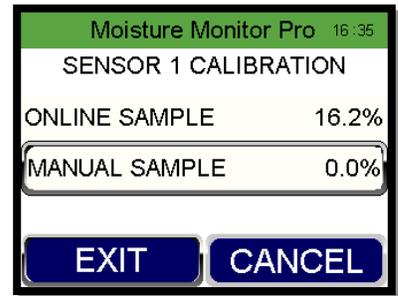


Figure 10 Enter Manual Sample Reading

Note:

To cancel a calibration, Press **CANCEL** on the sample entry screen.

To return to the Main Screen until you have finished running your tests, press **EXIT**. On the Main Screen the **CAL** button will be solid green. To return to the sample entry screen press **CAL**.

There is an additional setting available if you need a long period in which you want to run your sample before entering the value and want to be automatically returned to the sample entry screen after a period of time. Under **SYSTEM SET-UP**, go to Calibration Settings, and enter a value for Cal Return Time. If you enter for example 300 seconds, the calibration entry screen will automatically load after 300 seconds, without you having to push the **CAL** button.

3.4 Trend: (TREND button)

Pressing the **TREND** button brings up the moisture graph. If two sensors are being used, the moistures of both sensors will be displayed. To view the temperature graph, press the **TEMPERATURE** button. The scales for the graphs are set under **System Setup**, Trending options.

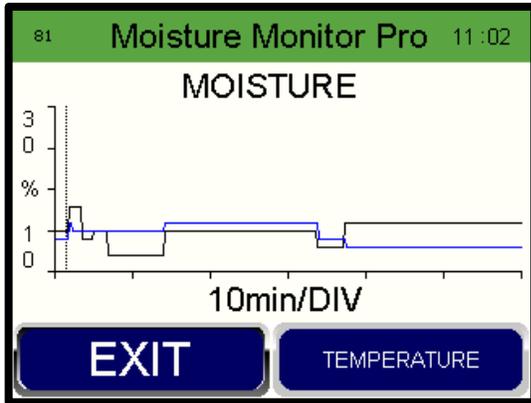


Figure 12 Moisture Trend Graph

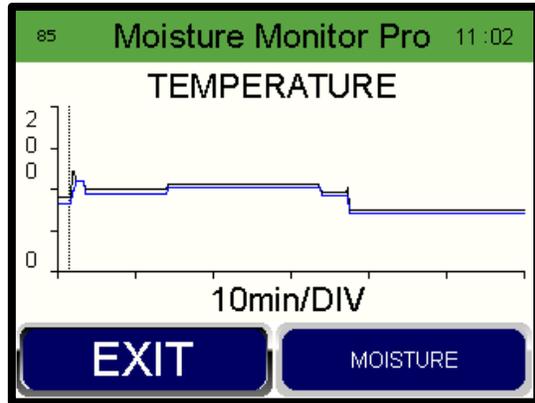


Figure 11 Temp Trend Graph

3.5 Expanded Menu Screen: (MENU button)

Pressing the **MENU** button brings up the expanded menu screen. The six additional buttons allow the operator to access all the key settings for the system. The key setup settings are accessed through the **SYSTEM SETUP** button. These settings are password protected and should be reviewed before operating the system. They are addressed in section 4.

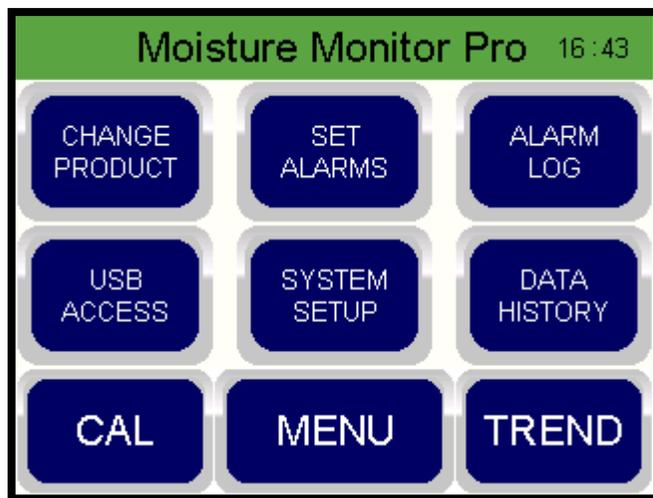


Figure 13 Extended Menu

3.5.1 Extended Menu Items

If two moisture sensors are being used, the settings that are applicable to each sensor separately, will start with a sensor selection screen. Simply select the sensor you want to adjust.

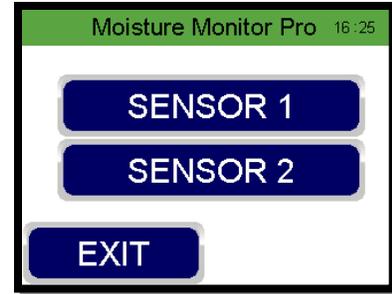


Figure 14 Sensor Selection Screen

3.5.2 Change Products:

Press **CHANGE PRODUCT** on the extended menu screen. To change the product, press the **CHANGE** button until you reach the product you want. Press **EXIT** to save and return to the Main Screen.

There are 16 product names available (Corn, Wheat, Beans, Canola, Barley, Malt Barley, Oats, Rice, Sorghum, Sunflower, Lentils, Chickpeas, Peas, Other 1, Other 2, Other 3). If you are measuring a different product, you can use any of the product names as long as you configure the parameters for the product correctly in the **system setup**.



Figure 15 Change Product Screen

3.5.3 Set Alarms:

Press **SET ALARMS** on the extended menu screen. The first screen is to choose which product alarms to set. Press **↩** for the next screen that is for selecting the moisture or temperature alarm menu. Within those menus there are four levels of alarms that can be set for each sensor:

- CH -> Critical High Moisture Limit
- WH -> Warning High Moisture Limit
- Normal Moisture Range
- WL-> Warning Low Moisture Limit
- CL -> Critical Low Moisture Limit

- CH -> Critical High Temperature Limit
- WH -> Warning High Temperature Limit
- Normal Temperature Range
- WL-> Warning Low Temperature Limit
- CL -> Critical Low Temperature Limit

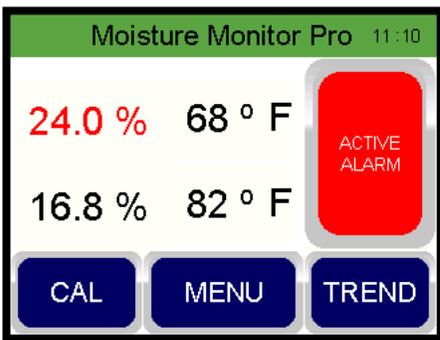


Figure 16 Active Alarm Notification

Alarms are used as a tool to alert the operator to a situation deemed important.

An active alarm will trigger the sonalert. To acknowledge the alarm and stop the sonalert, press the **ACTIVE ALARM** button.

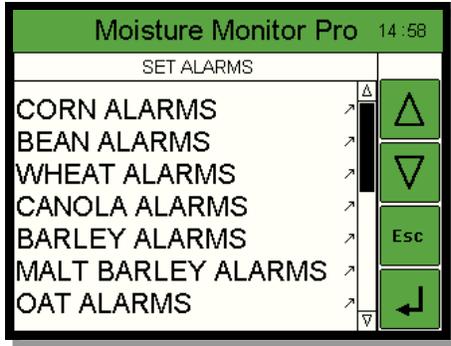


Figure 18 Select Product Alarms

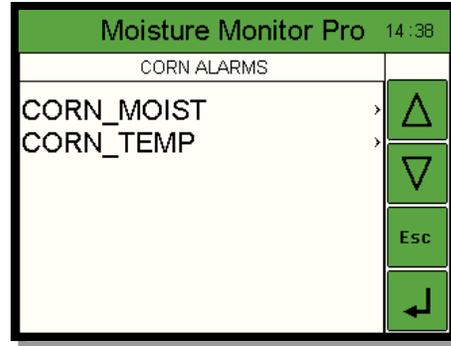


Figure 17 Select Moisture or Temperature Alarms

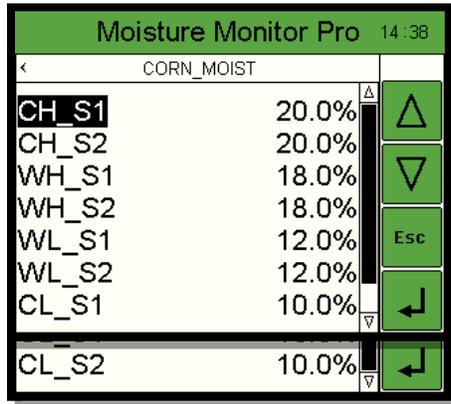


Figure 20 Set Moisture Alarm Limits

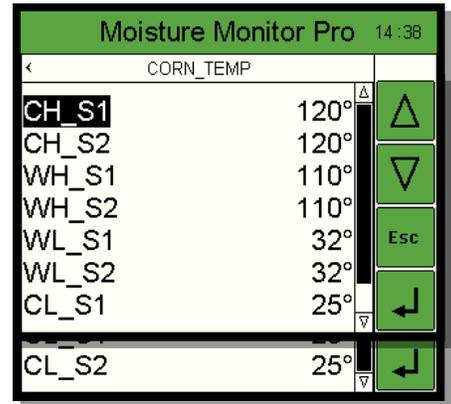


Figure 19 Set Temperature Alarm Limits

When a warning alarm limit is reached, the display on the Main Screen will turn red and a red **ACTIVE ALARM** button will appear.

When a critical alarm limit is reached, the displayed value will be in red and will also be flashing.

3.5.4 Alarm Log/Active Alarms

Press the **ALARM LOG** button on the extended menu to see a time stamped log of alarms. To see a list of active alarms, press the **ACT ALM** button. From the Active Alarms Screen, press **ALARM** to return to the log, or **EXIT** to return to the Main Screen

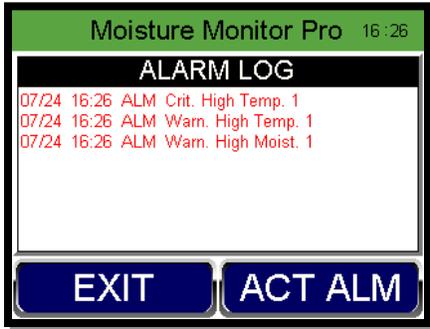


Figure 21 Alarm Log

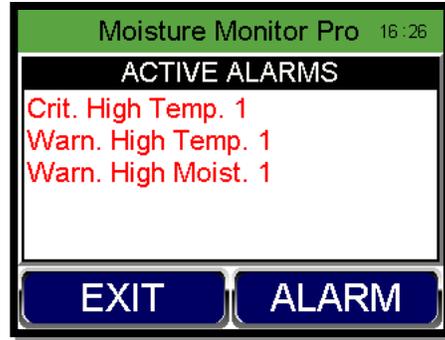


Figure 22 Active Alarm Listing

3.5.5 Download files to a USB

Historical moisture and temperature information along with historical calibration information is stored on a micro-SD card within the cabinet. For easy access to this information, the operator can first insert a USB device into the USB slot on the bottom of the cabinet. From the Main Screen press **MENU** for the extended menu and then **USB ACCESS**.

From the menu select either **COPY CAL FILES** to get the calibration history, or **COPY DATA FILES** to get the moisture and temperature history. The files will be downloaded to the USB device in .csv format for easy transfer to a spreadsheet program. Once the files have been downloaded a **TRANSFER COMPLETE** button will appear. Touch the button to acknowledge or **EXIT** to exit.

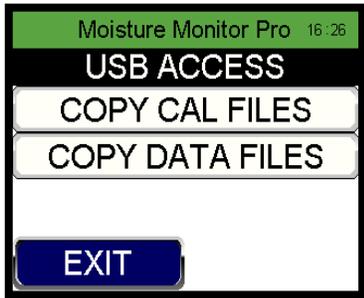


Figure 23 USB Download Option Screen

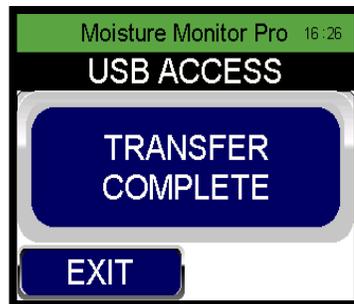


Figure 24 Transfer Complete

Data History

Press the **DATA HISTORY** button to get 10 minute average readings for the last 2 hours of operation.

Each screen gives 30 minutes of operation. Use the **NEXT** button to go to the next screen.

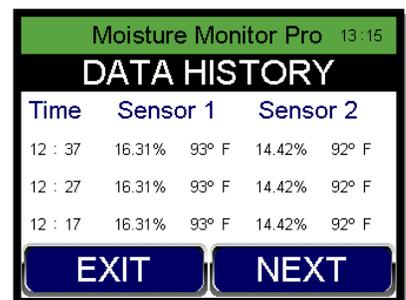


Figure 25 Sample Data History

4 System Setup:

Pressing **MENU** and then **SYSTEM SETUP** brings up a password entry screen. Enter the password (**6853**) to access the scrollable sub menu with the main system settings. Use the Up / Down keys to scroll, the **ENTER** key to select and the **ESC** key to exit. In addition, you can also use touch to select an option.



Figure 26 Password Entry Screen

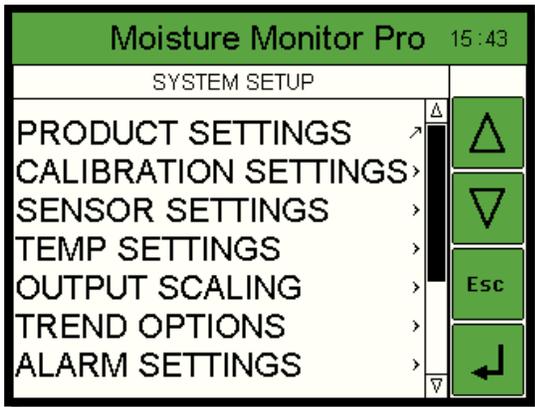


Figure 28 System Set-Up Screen (Top portion)

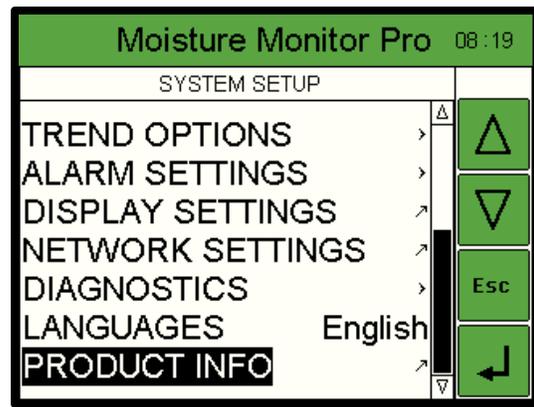


Figure 27 System Set-up Screen (Bottom portion)

4.1 Product Settings:

There are 16 product names available on the system. Each product has its own settings/parameters. In addition, there are settings for the second sensor if one is installed. The notation after the parameter (either S1 or S2 refers to the number of the sensor – i.e. sensor 1 or sensor 2). If you are monitoring a product not listed, you can use one of the products listed and simply update the parameters to those that match your product.

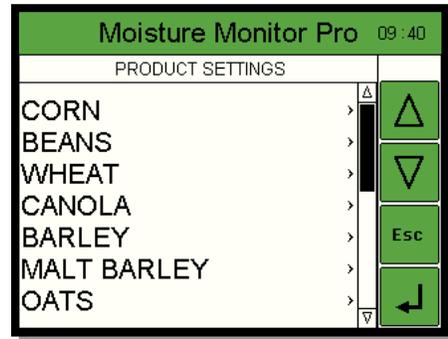


Figure 29 Products

The product slope is the key number. The slope for any product is density dependent. Products with higher densities will have a lower slope and vice versa. Corn typically has a slope of 5.0. There is a list of starting product slopes for products of different densities in the appendix. The product offset is typically adjusted by calibrations of the sensor. The TC or temperature compensation should be set at 0, unless instructed by the Dryer Master Support Center to use another value. Standard temperature compensation is done on board at the moisture sensor, so additional TC is rarely if ever required.

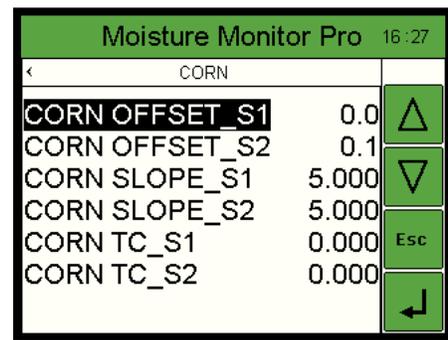


Figure 30 Product specific settings

4.2 Calibration Settings:

There are two calibration methods; standard and advanced. Using the standard method, the operator simply adjusts the displayed reading to match the manual sample. With the advanced method a 30 second average of the Moisture Monitor Pro reading is used to compare to the manual test and an automatic adjustment is made. (See the calibration section for more information).

To change methods, highlight **CAL METHOD**, then press the **ENTER** key. This brings up a keypad. Use the arrow key to scroll between the two options, then press **ENTER** to save.

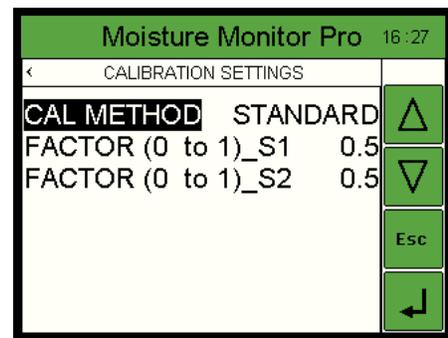


Figure 31 Calibration Settings

The “Factor” is the percentage adjustment of the difference between the manual test and the 30 second sample. Typically, this is set at .5 (50%). This means on any calibration only one ½ of the difference is adjusted for. Since there is inherent variability in samples this avoids excessive calibration adjustments. To fully adjust for any difference, set this to 1.

4.3 Sensor Settings:

S1 refers to Sensor 1, and S2 to Sensor 2.

MOIST FF & TEMP FF: FF stands for filter factor. This adds a small filter to the displayed value so that the readings do not fluctuate too rapidly. The default is .85.

MOIST VOLTAGE & TEMP VOLTAGE: Moisture and temp voltages are used for diagnostic purposes.

The *EMPTY VOLTAGE* is the voltage at which the sensor will read empty. This is typically 0.9. Below 0.9 volts the reading on the Main Screen will display "Empty".

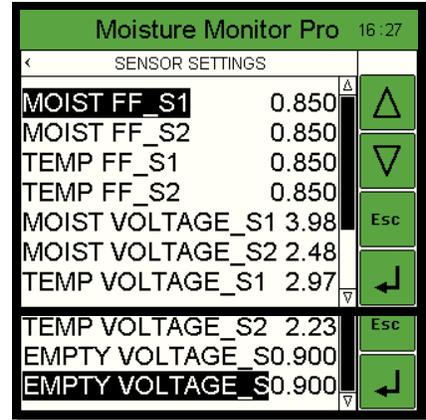


Figure 32 Sensor settings

4.4 Temperature settings:

The first line is the current temperature scale.

The second line lets you change between Fahrenheit and Celsius. If you change the scale, you should review your alarm limits for temperature.

These remaining settings are rarely if ever adjusted. The default values are:

C (Celsius): Slope 40, Offset -40

F(Fahrenheit): slope 72, Offset -76

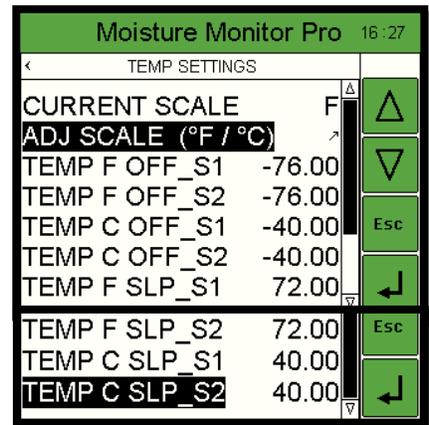


Figure 33 Temperature settings

4.5 Output Scaling

The Moisture Monitor Pro is able to output an analog signal for the moisture and temperature readings of each sensor. This menu section allows for the analog outputs to be scaled to a specified output range.

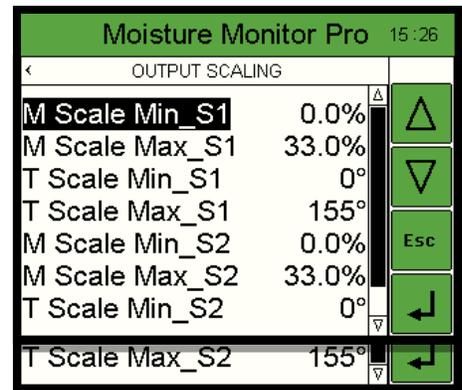


Figure 34 Output scaling

4.6 Trending options:

There are three configurable options:

TIME SCALE: either one or two hours

MOISTURE RANGE: Highlight the value and use the Up and Down keys to scroll through the available scales.

TEMP RANGE: Highlight the value and use the Up and Down keys to scroll through the available scales.

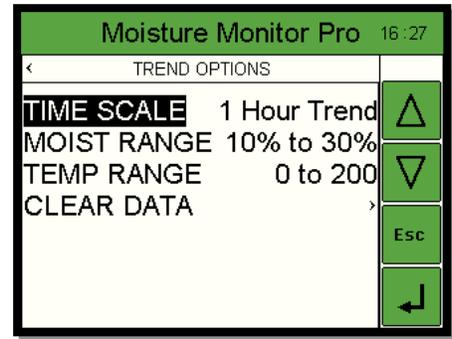


Figure 35 Trend Options

4.7 Alarm settings:

ALARM DELAY is the time (in seconds) between an alarm condition being triggered and the alarm being signaled. The short time delay is to avoid nuisance alarms where a level is triggered for only a couple of seconds.

RMT ALARM is the ability to trigger a remote alarm that has been setup away from the display.

RMT ALARM delay is the time lag (in seconds) between an alarm condition being triggered and the alarm sounding.

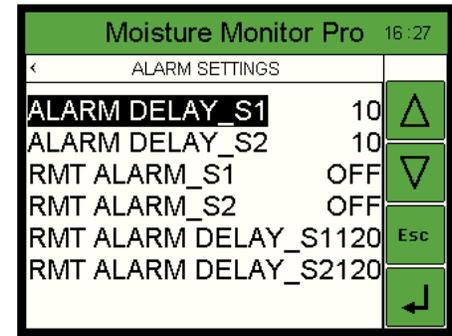


Figure 36 Alarm Settings

4.8 Display Settings

SCREEN SAVER lets the operator turn on or off the screen saver as well as the timeout interval.

DATE/TIME lets the operator adjust the displayed time.

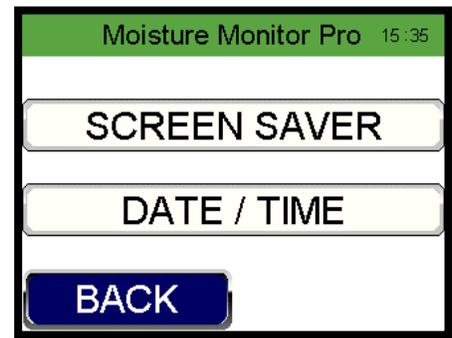


Figure 37 Display Settings

4.9 Network Settings

The network settings are used when setting up the Web App. Enter the values from your network setup, as described in Appendix 1, to save them on the system.

4.10 Languages

The MMP can be configured in either English or Spanish. Scroll down to the “Languages” line and press ENTER. Use the arrow keys to alternate between languages. Press Enter to select. Press ESC to return to the main screen.

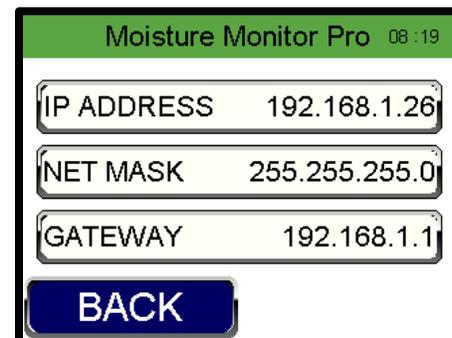
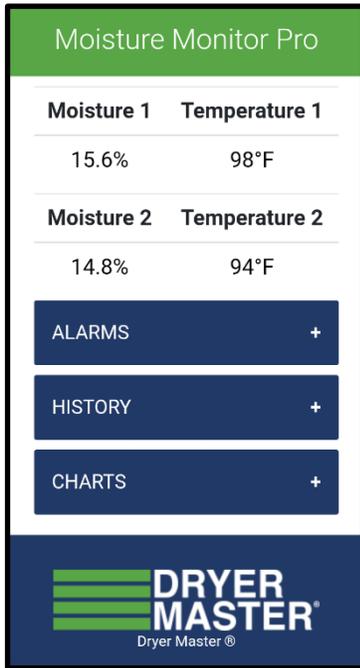


Figure 38 Network Settings

5 Network Set-Up



To set up the MMP so that you can see it on your phone or network refer to the tutorial in Appendix 1 of this manual.

The phone app displays the moisture and temperature from 1 or 2 sensors. This is automatically configured based on the number of sensors being used.

The language used depends upon the language set on the device.

Alarms, History and Charts are accordion type displays. Click on the box to open the display and click again to close.

“Alarms” shows alarm history. History shows ten minute averages.

“Charts” shows the most recent history in graphical form.

Figure 39 Web App Display

6 Electrical connections

6.1 Device Connections

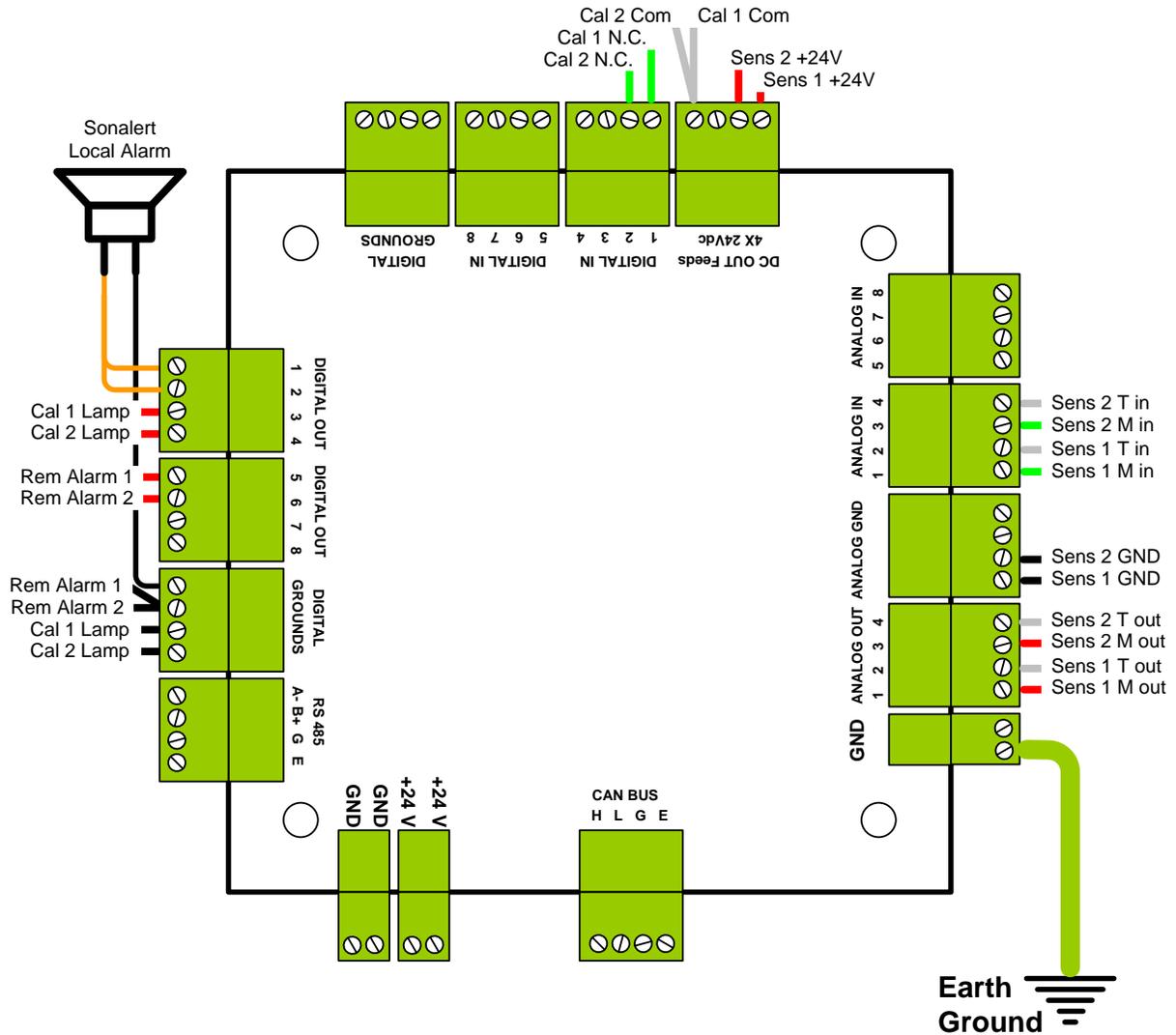


Figure 40 Connections

IMPORTANT:

1. All digital inputs are rated for low voltage (30 VDC maximum).
2. All digital outputs are 24vdc. 100mA per channel, to a combined total of 500 mA.
3. **The unit is powered from an ungrounded plug-in power supply. The unit must be grounded to an electrical earth ground via a separate wire at the time of installation.**

6.2 Device Connections, Sensors & Calibration Buttons

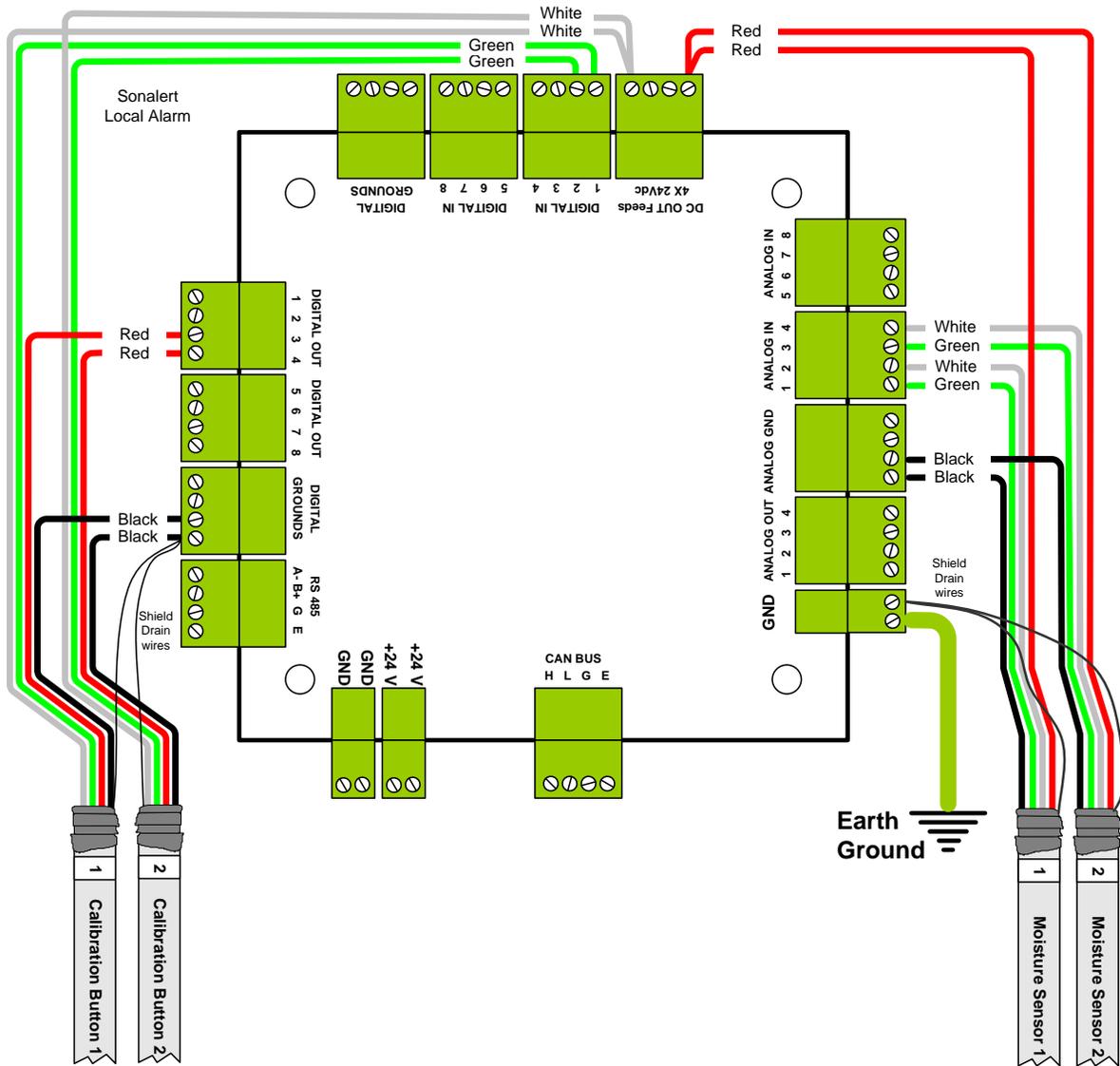


Figure 41 Device connections, sensors & calibration button

6.3 Device Connections, Alarm Output & Analog Output

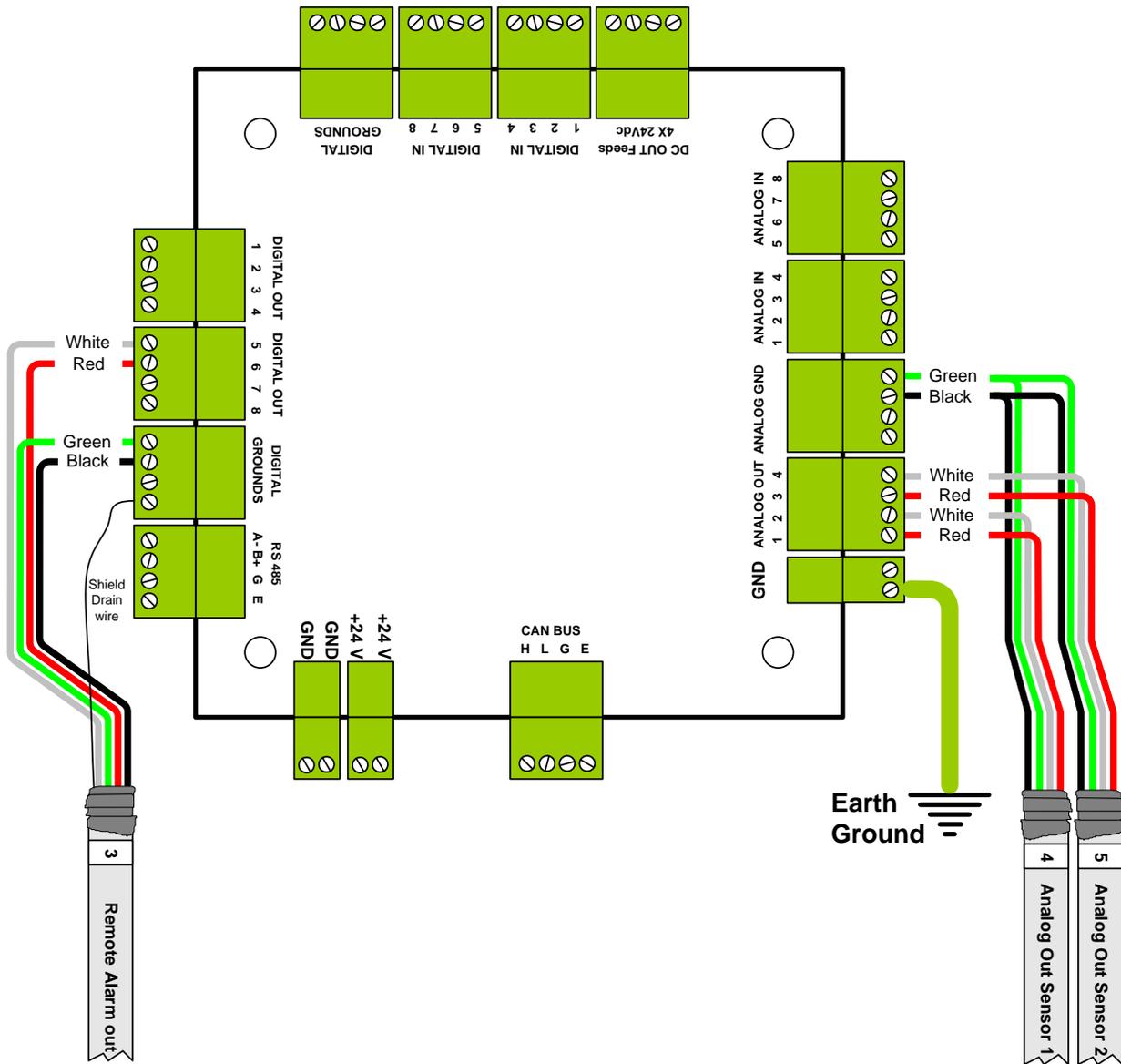


Figure 42 Device connections, Alarm Output & Analog Output

6.4 Field Connections.

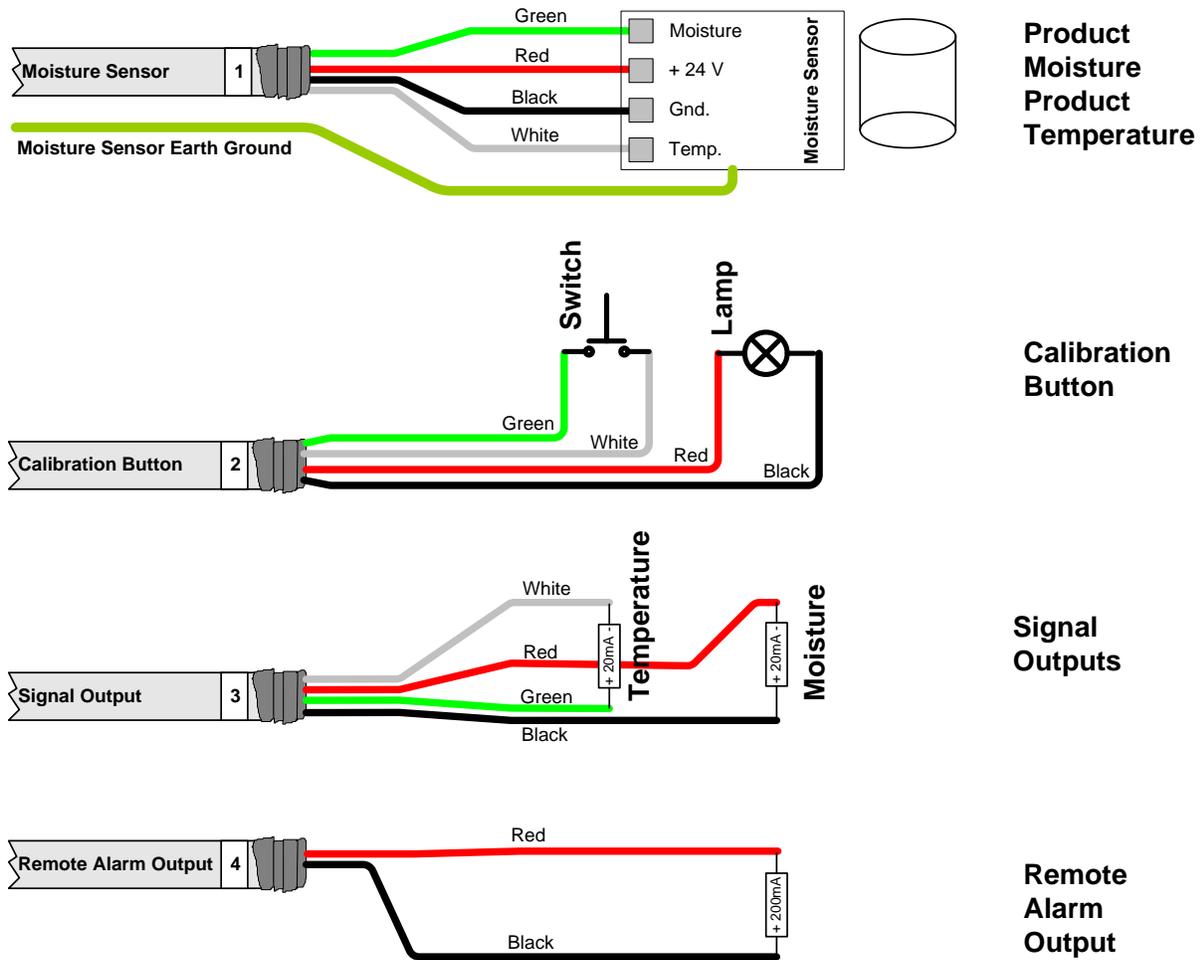


Figure 43 Field connections.

7 Moisture Sensor General Specifications

7.1 Moisture Sensor Installation

The moisture sensor, typically a Fin-style design, needs to be installed in a compacted flow situation. In most instances this will be in a chute or pipe in which the product flow is mechanically metered to a constant flow rate of less than 2.5 CM (1 inch) per second. The sensor must be mounted vertical to ensure proper product flow. Typically, the Fin sensor is mounted in a 15 – 20 cm (6 – 8 inch) square or round pipe into which a portion of the product stream is diverted. The exact dimensions of the pipe are not critical provided a good flow cross section is achieved. This pipe/chute should be completely full of compacted product during operation. The product is metered out of this pipe/chute with either a screw conveyor or a rotary valve. The speed of the conveyor or rotary valve should be such that the flow past the sensor is at less than 2.5 cm (1 inch) per second. In continuous operation with highly abrasive products, or less than 2000 lbs per hour flow, it is recommended that the flow rate be further reduced to 1 cm (0.4 inches) per second or less.

Product flow rates are approximate but must be no faster than 2.5 cm (1 inch) per second. Flow rates must be constant; change in the speed of flow will affect moisture sensor accuracy and performance.

7.2 Moisture Range & Temperature range.

The sensor's electronics typical operating temperature range is -10 degrees Celsius (14 degrees Fahrenheit) to 70 degrees Celsius (150 degrees Fahrenheit). Product temperature can range from -25 to 95 degrees Celsius (-13 to 200 degrees Fahrenheit) although verification of the actual product moisture at the temperature extremes becomes almost impossible. Moisture accuracy and repeatability is absolute product moisture and moisture gradient depended. Typical accuracy is +/- 0.2% moisture or 2% of scale.

The Moisture Range is a function of the product and product temperature. Sensors are available to cover moisture ranges from 0.5% to 45%, product densities from 0.15 g/cm³ (10 lbs/foot³) to 1.5 g/cm³ (95 lbs/foot³), and product temperatures from (negative) -25 to (plus) + 95 degrees Celsius (-13 to 200 degrees Fahrenheit).

7.3 Sensor signal conversion

The dielectric conversion formula is a function of the sensor and the specific product. For most products a linear conversion serves the narrow moisture range typically seen by the user. This conversion is done by the Moisture Monitor Pro system.

16 product names come preset in the Moisture Monitor Pro. However, alternate products can be measured by using one of the existing products and changing the relevant parameters under **SYSTEM SETUP** PRODUCT SETTINGS. The key setting is the product slope. The table in Figure 44 Recommended Starting Slopes, gives suggested starting slopes based upon the density of the product for which moisture is being measured.

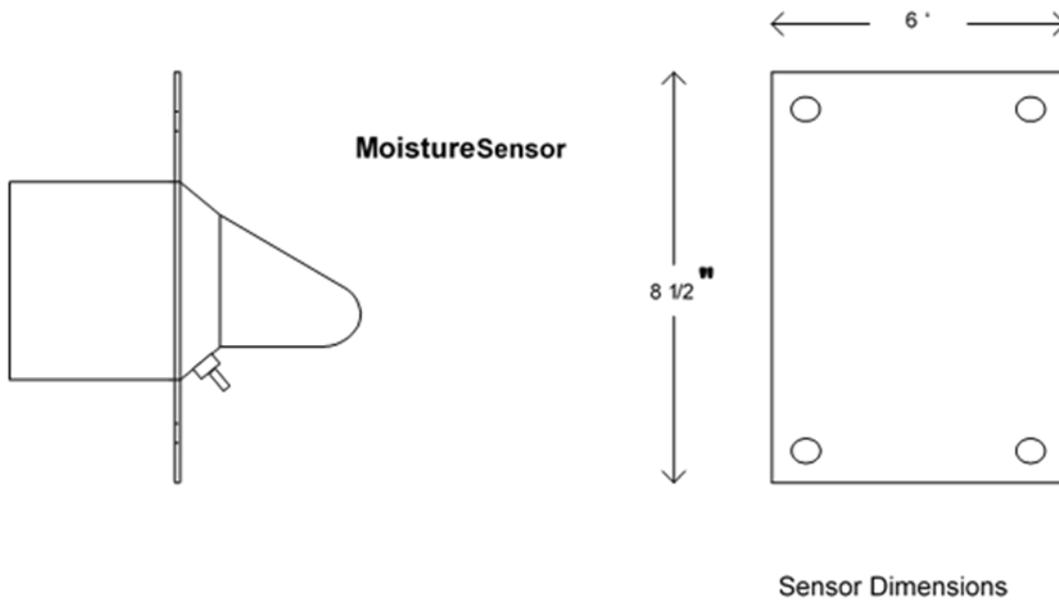
Material	(lb/ft ³)		lbs/bu		(kg/m ³)		recommended starting slope	recommended starting offset
	from	to	from	to	from	to		
Peanuts, unshelled	15	24	18.67	29.87	240.28	384.44	8	-2
Sunflower, unshelled	18	26	22.40	32.36	288.33	416.48		
Cat food	20	25	24.89	31.11	320.37	400.46	7	
Coffee bean, roasted	22	30	27.38	37.33	352.41	480.56		
Beans, coffee	22	40	27.38	49.78	352.41	640.74	6.5	-2
Oats	25	35	31.11	43.56	400.46	560.65		
Dog food, IAMS minichunk	26		32.36		416.48		6.5	
Corn, gluten	26	33	32.36	41.07	416.48	528.61		
Sesame seed	27	37	33.60	46.05	432.50	592.68	6	
Distillars grain	30		37.33		480.56			
Corn, ground	30	35	37.33	43.56	480.56	560.65	6	
Corn, meal	32	40	39.82	49.78	512.59	640.74		
Coffee bean, green	32	45	39.82	56.00	512.59	720.83	5.5	0
Peanuts, shelled	35	45	43.56	56.00	560.65	720.83		
Fullers earth	35	45	43.56	56.00	560.65	720.83	5.5	0
Barley, kernal	35	40	43.56	49.78	560.65	640.74		
Sunflower seed	36		44.80		576.67		5.5	
Flax seed	40	45	49.78	56.00	640.74	720.83		
Wood pellets	40	41	49.78	51.02	640.74	656.76	5.25	2
Corn, grits	40	45	49.78	56.00	640.74	720.83		
Sorghum seed	42	50	52.27	62.22	672.78	800.93	5.25	2
Rye	44		54.76		704.81			
Corn, whole kernel	45		56.00		720.83		5	0
Wheat, whole kernel	45	55	56.00	68.45	720.83	881.02		
Rape seed	45	50	56.00	62.22	720.83	800.93	5	0
Rice	45	50	56.00	62.22	720.83	800.93		
Popcorn, shelled	45	50	56.00	62.22	720.83	800.93	5	
Peas, dry	45	50	56.00	62.22	720.83	800.93		
Mustard seed	45		56.00		720.83		5	2
Beans, lima	45		56.00		720.83			
Beans, soy	45	48	56.00	59.73	720.83	768.89	4.5	2
Soybean, whole	47		58.49		752.87			
Navy beans, dry	48		59.73		768.89		4.5	
Millet seed	48		59.73		768.89			
Beans, navy	48		59.73		768.89		4.5	

Figure 44 Recommended Starting Slopes

7.4 Dryer Master 2220-11-series, Fin Sensor



Figure 45 Fin style moisture sensor



Caution:

Do not cut holes in the sensor. Use only the existing wire entry location. Entry at any other location voids the warranty.

The moisture sensor electronics are potentially sensitive to the electromagnetic energy from nearby welding. To reduce the risks of damage, remove the sensor before welding in the immediate area. Under no circumstances may the sensor housing or connecting bolts be used as a ground for welding

7.5 Sensor Power requirements

The sensor requires 18 to 30 volts DC at less than 20 mA. Two output signals in the 0 to 10 volt range provide the temperature and a measure of dielectric properties of the material passing by the sensor. The sensor power requirements are low enough to permit locating the sensor in class 2 and class 3 environments using Intrinsic Safety Barrier protection.

7.6 Grounding

The sensors require a good ground to function dependably. Run a ground wire from the sensor chassis ground to the signal-processing Panel. The sensor chassis must be at the same ground potential as the signal grounds. Large ground potential differences may contribute to erratic operation of the sensor and possible sensor failure.

7.7 Signal Output

The sensor output is 0 – 10 Volts, 2 signals, dielectric (moisture) and product temperature. Minimum recommended load resistance is 10k ohm for each output. The outputs are protected from shorts to ground and supply.

The output signal is a voltage to permit locating the sensor in class 2 and class 3 environments using Intrinsic Safety Barrier protection.

7.8 Sensor setup & diagnostics

Note: The sensor has been prepared to operate within the specification range of the product. The Sensor setup & diagnostics sheet serves as a diagnostics tool to verify the sensors operation and functionality and provide electrical connection locations. There is no need to calibrate a new sensor. It is permissible to note the signals by stepping through the calibration procedure. This will provide a base for comparison should the sensors function come into question at some time in the future. Adjusting the hardware calibration will negate the software calibration adjustments that have taken place over time. Hardware recalibration should only be attempted if the sensor no longer functions.

Moisture Sensor Model 2220 series

The diagram shows the internal layout of the sensor. Key components include:

- Connectors:** J1 (Power & Signal), J2 (TP 1, TP 2, COM), J4 (HIGH, LOW, STORE), J5 (COM), J6 (COM).
- LEDs:** D2 (Blue Power LED), D10 (Green MOIS LED).
- Jumpers:** P1, P2, P3, P4, and J7 PARK.
- Other:** A red arrow points to the J7 PARK jumper location, which is circled in red in the diagram.

Note:
The Dryer Master Capacitance Moisture sensor Field Test and set up procedure.

INSPECT & TEST

- Remove PARK jumper J7
- Inspect unit for physical damage. Broken off Fin, worn out temperature sensor requires the unit to be returned for service. There are no field serviceable components.
- Test sensor power. 18-28Vdc at location "24 V and 0 V (com)". Blue +24V power LED is illuminated. If voltage is present at "24 V and 0 V (com)" and Blue LED is not illuminated. Device has failed and must be returned for service.
- Signal levels above 5 Vdc at location MOIS OUT and 0 V (com) with the sensor empty and J4 jumper in the store position. Device has failed and must be returned for service.
- Signal levels at 0.5 to 0.8 Vdc at location MOIS OUT and 0 V (com) with the sensor empty and J4 jumper in the LOW or HIGH position. Device has failed and must be returned for service.

SETUP Note values will differ at different temperatures.

- With J4 jumper in the STORE position and sensor empty. Signal levels at 0.5 to 0.8 Vdc at location MOIS OUT and 0 V (com).
- With J4 jumper in the LOW position and sensor empty. Signal levels at 0.95 to 1.05 Vdc at location MOIS OUT and 0 V (com). (adjust P3 if required) **Adjust only At 22°C, 72°F.**
- With J4 jumper in the HIGH position and sensor empty. Signal levels at 4.95 to 5.05 Vdc at location MOIS OUT and 0 V (com). (adjust P4 if required). **Adjust only At 22°C, 72°F.**
- P3 and P4 are interactive. Repeat SETUP steps 2 and 3 as required. Return jumper to the STORE position when complete.
- Signal levels at location TEMP OUT and 0 V (com).
 V*40 - 60 = °C, thus 2.00 Vdc *40 - 60 = 20°C
 V*72 - 76 = °F, thus 2.00 Vdc *72 - 76 = 68°F
 (adjust P1 if required)

Legend:

- (green) MOIS OUT DC Voltage signal, 0-10Vdc (dielectric)
- (white) TEMP OUT DC Voltage signal, 0-10Vdc (temperature)
- (red) 24 V DC Voltage, 18-28Vdc, 20mA max, Sensor Power
- 0 V (COM) (black) Common point for all power and signal
- P1 Temperature offset adjustment Potentiometer
- P2 Temperature gain adjustment Potentiometer
- P3 Dielectric gain adjustment Potentiometer
- P4 Dielectric offset adjustment Potentiometer
- J1 Field connections
- J2 Test points
- J4 Calibration setup reference jumper block
- J5 Temperature sensor connections
- J6 Initial setup test block
- J7 Sensor PARK jumper. **Must be removed for operation.**
- D2 Power LED. **Blue** when power is applied.
- D10 Product detector LED, **Green** when sensor is detecting product.

Figure 48 Sensor Set-up and Test

Drawn by: WKS	Date: 06/07/14	 DRYER MASTER
Revised: WKS	Date: 06/22/15	
Revised: WKS	Date: 01/18/17	
CHKD: JR	Date: 01/18/17	Model 2220 Field test points
Approved:	Date:	2220test.vsd

8 Moisture Sensor Installation Options

If the moisture sensor is being installed at the inlet to a dryer it does not require any mechanical metering. Instead it should be installed vertically where it will be fully covered by grain, in compacted flowing grain, and where it will see a representative sample of the grain. It should also not be installed in the hot zone of the dryer where it may be exposed to excessive condensation.

For other installations, Dryer Master offers 2 versions of its sensor chutes with rotary feed. One version is for bypass type situations and the other for inline type situations. The chutes are not required, but they can greatly help simplify installation and improve moisture measurement performance.

8.1 Option 1 By-Pass Method with Rotary Feed Chute – Details

With the bypass method, a portion of the grain leaving the dryer is bypassed from the main stream to where it passes by the sensor and then is returned to the main flow.

The Dryer Master rotary feed bypass chute accomplishes this. The chute requires 16 inches, 40.5 cm of vertical space.

Install the chute so that there will be a continuous flow of grain and the chute will remain full.

Ensure that the grain flowing through the chute is a good representative sample of the grain to be tested. Place the sensor in a location where it will NOT get an excess of fines or trash as this will contribute to errors or false readings. Inaccurate or false readings of the outlet sensor will adversely affect control of the dryer by the Dryer Master.

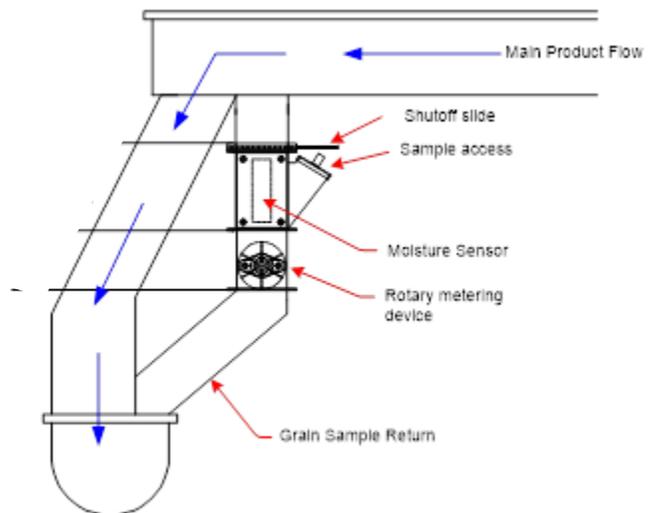


Figure 49 Bypass type installation

Locate the Sensor so it can be **safely** accessed for cleaning and taking grain samples.

Do not cut holes in the sensor. Use only the existing wire entry location. Entry at any other location voids the warranty.

Ensure the sensor chute empties completely when shutting down. If installed at the outlet to a dryer, make electrical connections such that the chute power is tied to the elevator control circuit. The elevator is typically the last item shut down in the shutdown sequence.

The Bypass Chute

- Dimensions: 18 1/2" L x 8 1/2" W x 16" H (46.3 cm X 21.6 cm X 40.5 cm)
- Upper mounting flange 8 1/2" x 8 1/2" (21.6 cm X 21.6 cm)
- Built in sampling access
- Motor is IP66, 25W, 115VAC single phase, 0.43FLA reversible motor with 180:1 gear reduction (230VAC also available if required)
- The panels for the four sides of the chute are interchangeable and can be mounted in any configuration without impacting flow (but the chute should be vertical)

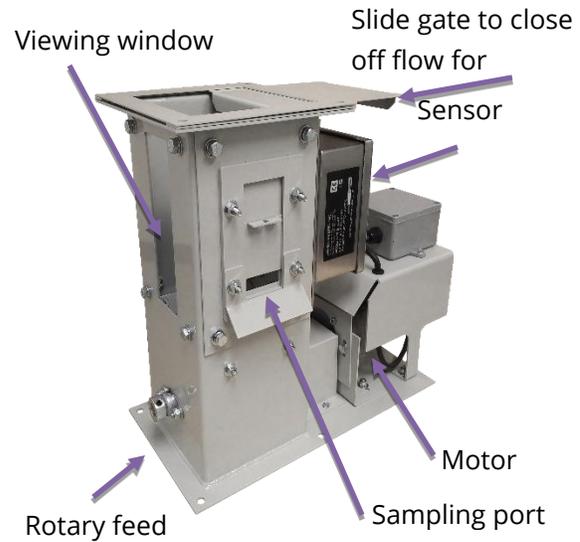


Figure 50 Outlet Fin in bypass chute

Installation Considerations:

1. There are 4 interchangeable panels for the four sides of the chute assembly (viewing window, sampling port, sensor install, and blank) which can be mounted in any configuration.
2. The calibration button is available mounted on a plate that can be attached directly to the chute.
3. Ideally the sensor housing and chute assembly should be free of grain when the dryer is not running. This avoids having stagnant grain gumming up the assembly. **To do this the motor for the rotary feed should be wired so that it is the last thing that shuts off after the dryer shuts down.** Having the motor turn on and off with the dry conveyor or elevator will usually accomplish this.
4. To ensure proper flow, the transition piece mounted to the bottom of the chute should be the same size as the hole leaving the chute (6"X6" or 15.25 cm X 15.25 cm).

Figure 51 Calibration button w/sensor



Installation Procedure

1. Remove the Outlet Sensor from the 6" square (15.25 cm square) chute before bolting the chute in place.
2. Make the necessary changes to the discharge system of the dryer so that there is room for the chute and rotary feeder.
3. Install the shut off slide gate above the sensor to shut off the flow to the sensor to allow cleaning out and or servicing the sensor.
4. Install bars across the opening to the sensor in the direction of grain flow. This will prevent large objects from entering the sensor.

5. Mount the chute in a vertical position.
6. Bolt the fin sensor back into the chute.
7. Attach the calibration button mounting plate to the bypass chute.



Figure 52 Example installations of bypass chute with rotary metering

8.2 Option 1a - Bypass Using Sampling Auger

The moisture sensor is installed in a by-pass where a portion of the grain is directed through the bypass. The grain flows through the sensor and then back into the system (Figure 13 - By-Pass auger installation). This method is used when there is less than 18" (46 cm) of vertical space at the bottom of the dryer. The fin sensor is installed in a square chute. A small slow-moving auger (30-60 bu./hr.) restricts the flow of grain so the chute remains full of compacted grain at all times.

1. Install the chute so that there will be a continuous flow of grain.
2. Make sure that the chute will always be full of grain.
3. Make sure that the grain flowing through the chute is a good representative sample of the grain to be tested. Placing the sensor in a location where it will NOT get an excess of fines or trash which will contribute to errors or false readings. Inaccurate or false readings of the outlet sensor will adversely affect control of the dryer by the Dryer Master.
4. The flow of grain through the chute should be less than one inch per second or less than 60 bu./hr. in a 6" by 6" chute (15.25 cm X 15.25 cm).
5. Locate the Outlet Sensor so it can be safely accessed for cleaning out and taking grain samples.

Table 1: Gear reductions for metering devices

A four-inch sampling auger is recommended. Several other options are available; see Table 1: Gear reductions for metering devices. All gear reductions given are based on a chute that is six inches by six inches. For the best flow characteristics, it is recommended that the auger be opened to the full width of the chute.

Metering Device	Approximate rpm	Gear reduction for 1500 rpm motor
6" screw conveyor standard pitch	5.5	270:1
6" screw conveyor ½ pitch	11	135:1
4" screw conveyor standard pitch	17	88:1
4" screw conveyor ½ pitch	39	44:1
4" flex screw conveyor	17	88:1

This will also reduce transition complexity. Verify the auger flow and gear box required. The table is an approximate guideline.

Installation Procedure

1. Remove the Outlet Sensor from the 6" square (15.25 cm square) chute while installing and welding the transitions
2. Make the necessary changes to the discharge system of the dryer so that there is room for the chute, sampling auger and slide gate.
3. Install the slide gate above the sensor to shut off the flow to the sensor to allow cleaning out and/or servicing the sensor
4. Install the Chute and Sensor so the operator can inspect and clean the sensor. It must be possible to do these tasks easily and safely while the dryer is operating.

5. Install bars across the opening to the sensor in the direction of grain flow. This will prevent large objects from entering the sensor.
6. Mount the chute in a vertical position.
7. For greatest sensitivity and accuracy, it is recommended to bolt the chute such that the fin of the sensor will be oriented in the same direction as the shaft of the auger.
8. Run grain through the sampling chute and ensure the grain flows evenly past the fin. Also ensure that the auger is drawing grain from all areas of the chute. The auger has to be at least 6" below the fin to ensure this happens.

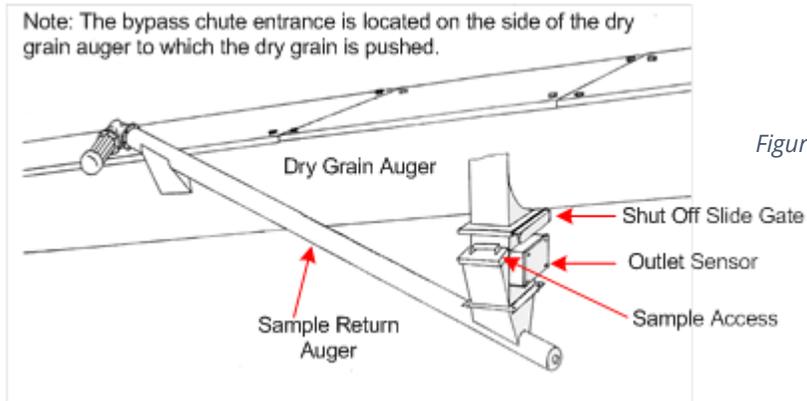
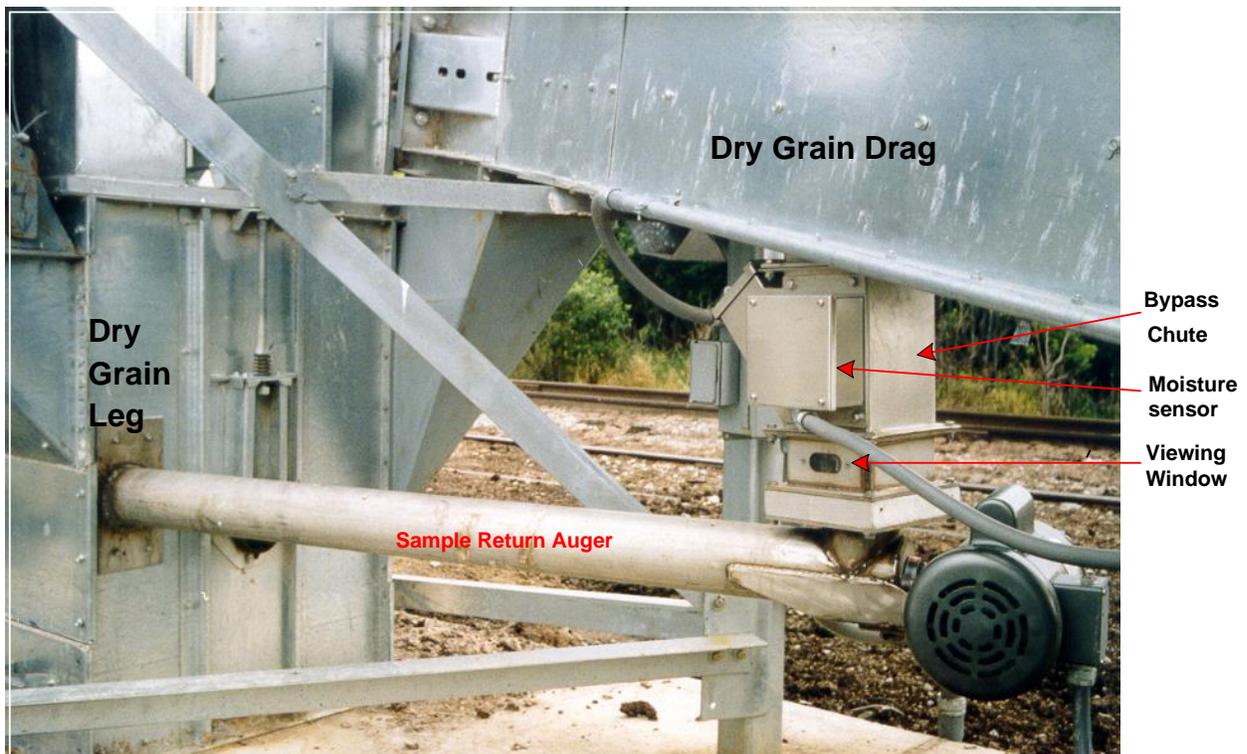


Figure 53 By-Pass auger installation

Figure 54 By-Pass auger installation



8.3 Option 2 In-Line Chute with Rotary Feed Method – Details

The Dryer Master In-Line chute with rotary feed is designed so that the moisture of the grain can be measured without having to divert a portion into a bypass. Some dryer manufacturers can supply a chute that will fit under their dryer to accommodate an outlet fin sensor to get a similar effect. A similar type device can be fabricated on site.



Figure 56 Inline Chute installation

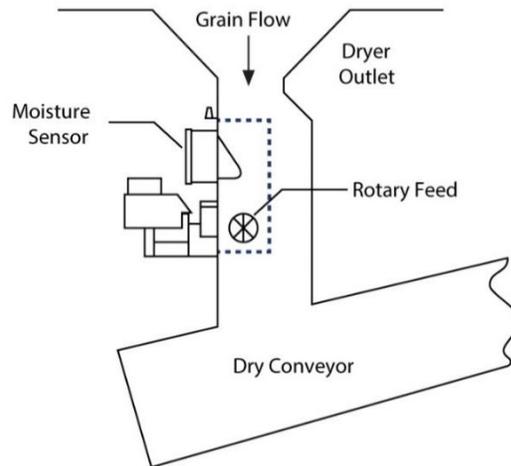


Figure 55 Inline Chute Graphic

A moisture sensor is installed in a 6" x 6" (15.25 cm X 15.25 cm) chute mounted within a larger chute that handles the full flow of grain from the dryer. The flow through the sensor chute is restricted and metered using a rotary feed. The grain that does not flow through the sensor chute flows past in the main part of the chute. This method requires a minimum of 16" of vertical space not including necessary transitions. Normally the sensor is installed under the dryer between it and the dry grain auger or drag.

Install the Chute and Sensor in a continuous flow of grain and **where the sensor will remain full**.

Install the Chute and Sensor so the operator can inspect and clean the sensor. It must be possible to do these tasks easily and **safely** while the dryer is operating.

Installation Procedure

1. If necessary, adjust the discharge system of the dryer so that a chute 16" high by (minimum) 16" square can be installed (Size will depend upon bushels being discharged).
2. Make sure that the centre of the flow of grain is directed at the Sensor's location and will keep the sensor full.
3. Weld or Bolt the main chute to the bottom of the dryer.
4. Create a transition between the bottom of the chute and the dry grain drag or auger.
5. Bolt the Sensor to the outside surface of the frame.
6. An access is provided for the operator to safely inspect flow and to take samples. To clear an obstruction the sensor or the chute will have to be removed.

**Do not cut holes in the outlet sensor. Use only the existing wire entry location.
Entry at any other location voids the warranty.**

The In-Line Chute

The chute is designed to be used in an inline type installation of the outlet moisture sensor. In an inline type installation a portion of the total product flow passes through the 6X6 chute with the rest flowing over the sides in the larger chute.

- Overall 18 1/4" X 10 1/4" X 18 1/2" (HXWxD) (46.3 cm X 25.4 cm X 47 cm)
- Inside chute 6"X6" (15.25 cm X 15.25 cm)
- Mounting plate is 18 1/4" X 10" (46.3 cm X 25.4 cm)
- Motor is IP66, 25W, 115VAC single phase, 0.43FLA reversible motor with 180:1 gear reduction (230VAC also available)
- Slide gate to close off flow
- Sampling port and viewing window

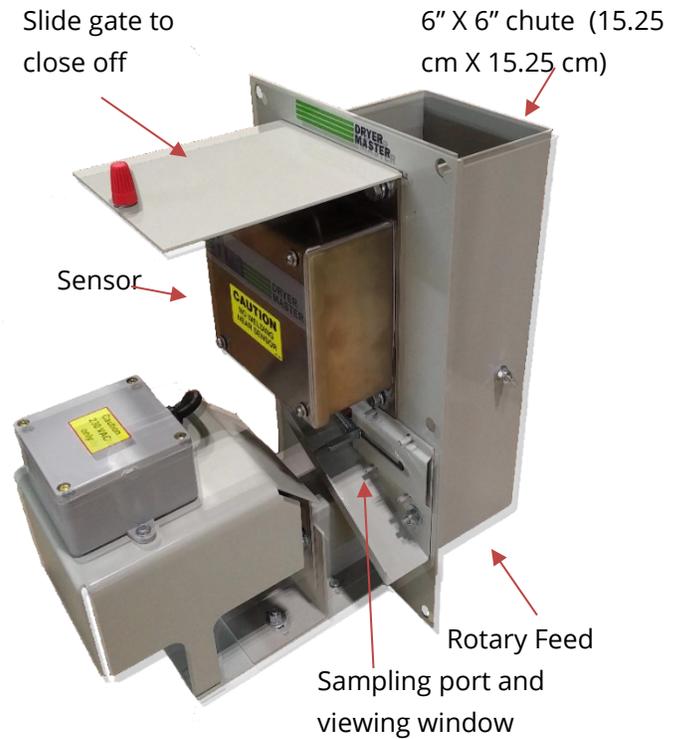


Figure 57 In-line Chute



Figure 59 In-line Chute installation example



Figure 58 In-Line chute in a Zimmerman chute

8.4 Inlet Moisture Sensor Installation

Sensor Location

For an inlet installation the sensor should be placed vertically at the inlet to the grain dryer (in or near the garner bin). There are two conditions that must be met for the sensor in an inlet location to operate correctly.

1. The Inlet Sensor must be completely covered by compacted grain at all times.
2. The Inlet Sensor must also receive a good (representative) sample of the grain.

These two conditions are usually met if the Inlet Sensor is located near the center of the longest vertical side of the garner bin.

However, DO NOT locate the Inlet Sensor directly under the inlet spout. Grain that is erratically compacted will dynamically change the relative readings of the inlet sensor contributing to false readings.

Installation should minimize the probability of steam reaching the sensor. Install the Inlet Sensor at a level higher above the hot zone than the width of the hot zone. For example, if the hot zone is a foot-wide leave at least a foot between the hot zone and the sensor. If this is not done, the static pressure in the hot zone can force moisture-laden air past the sensor. Due to the cold state of the sensor, moisture will condense from the air onto the sensor resulting in false readings.

If the sensor is placed in a location such that it will get an excess of fines or trash this will contribute to errors or false readings.

Install the Inlet Sensor in a place where water cannot run down the surface of the sensor. In the dryers which have an open top allowing rain to penetrate the grain (or excessive cold) will cause condensation to form on a fin sensor. The sensor needs to be moved to the surge hopper or other more appropriate location.



Install inlet (wet) sensor in vertical wall of roof section at least two ducts away from end wall and as low as possible.

Figure 60 Sample inlet sensor installation on a Grain Handler dryer

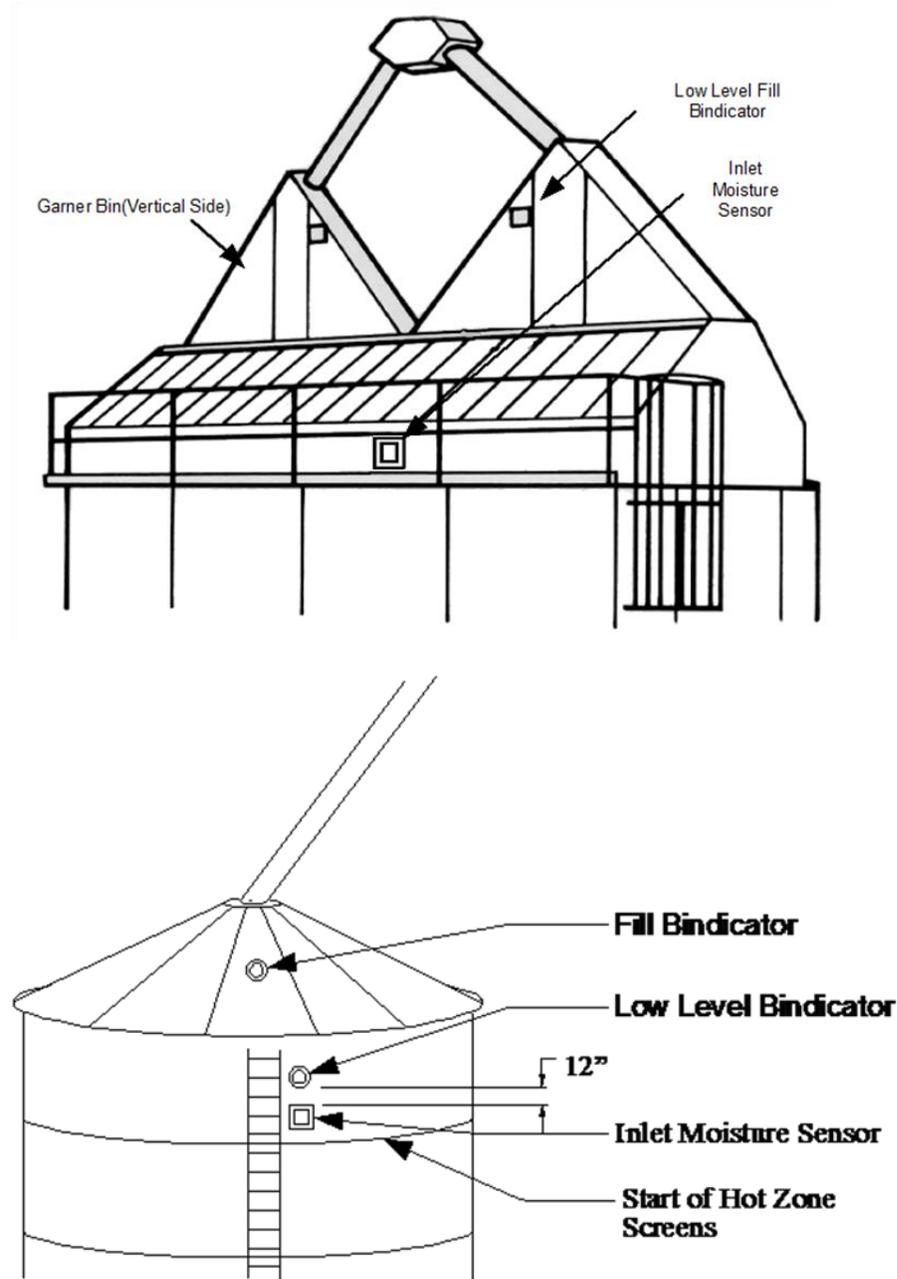


Figure 61 Sensor placement at inlet to the dryer

Appendix 1: Connecting to the web app

Moisture Monitor Pro Tutorial

Connecting to the Web App

Preface

The tutorial will provide step-by-step direction on Connecting to the Web App for the Moisture Monitor Pro.

Requirements

- Moisture Monitor Pro
- Ethernet cable (to connect the Moisture Monitor Pro to the local network)
- A device (such as a: tablet / phone / laptop) connected to the local network by Wi-Fi or Ethernet

Connect the Moisture Monitor Pro to the Local Network

- Use an Ethernet cable to connect the Moisture Monitor Pro to a local router or switch.

Find IP Address and Subnet Mask of the Local Network

Follow the section that is relevant to the device being used.

Sections include:

- Apple Device – Connect to local network via Wi-Fi
- Android Device – Connect to local network via Wi-Fi
- Windows Laptop – Connected to local network via Wi-Fi
- Windows Laptop – Connected to local network via Ethernet

Apple Device – Connect to Local Network via Wi-Fi

- CONNECT Apple device to the local Wi-Fi
- NAVIGATE to Apple Settings
- SELECT Wi-Fi and then SELECT the network being used
- LOCATE the section called as IPV4 Address
- RECORD the IP Address
 - For example, it will be four numbers separated by dots (e.g., 192.168.2.125)
- RECORD the Subnet Mask
 - For example, it will be another four numbers separated by dots (e.g., 255.255.255.0)
- SKIP forward in this tutorial to the section called 'Setting Up the Web App'

Android Device – Connect to Local Network via Wi-Fi

- CONNECT Android device to the local Wi-Fi
- NAVIGATE to Android Settings
- SELECT Wi-Fi
- On the top-right corner, PRESS ⋮
- SELECT 'Advanced'
- SCROLL DOWN to the bottom
- RECORD the IP Address
 - For example, it will be four numbers separated by dots (e.g., 192.168.2.125)
- RECORD the Subnet Mask
 - For example, it will be another four numbers separated by dots (e.g., 255.255.255.0)
- SKIP forward in this tutorial to the section called 'Setting Up the Web App'

Windows Laptop – Connected to Local Network via Wi-Fi

- CONNECT the windows device (e.g., a laptop) to Wi-Fi
 - If connected via Ethernet, then see the next section “Windows Device – Connected to Local Network via Ethernet”
- RUN Command Prompt
 - TYPE ipconfig and PRESS ‘Enter’
 - SCROLL DOWN until ‘Wireless LAN adapter Wi-Fi’ (example shown below)

```
Wireless LAN adapter Wi-Fi:
Connection-specific DNS Suffix . : router31b938.com
Link-local IPv6 Address . . . . . : fe80::f5fa:4a6e:5770:bb7e%13
IPv4 Address. . . . . : 192.168.1.113
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.1.1
```

- RECORD the IPv4 Address
- RECORD the Subnet Mask
- SKIP forward in this tutorial to the section called ‘Setting Up the Web App’

Windows Laptop – Connected to Local Network via Ethernet

- CONNECT the windows device (e.g., a laptop) to Ethernet
 - If connected via Wi-Fi, then see the previous section “Windows Device – Connected to Local Network via Wi-Fi”
- RUN Command Prompt
 - TYPE ipconfig and PRESS ‘Enter’
 - SCROLL DOWN until ‘Ethernet adapter Ethernet’ (example shown below)

```
Ethernet adapter Ethernet 2:
Connection-specific DNS Suffix . : router31b938.com
Link-local IPv6 Address . . . . . : fe80::e929:8005:8c94:9e7a%10
IPv4 Address. . . . . : 192.168.1.116
Subnet Mask . . . . . : 255.255.255.0
Default Gateway . . . . . : 192.168.1.1
```

- RECORD the IPv4 Address
- RECORD the Subnet Mask
- SKIP forward in this tutorial to the section called ‘Setting Up the Web App’

Setting up the Web App

- COMPLETE the steps in this section only once the IP Address of the Local Network has been obtained by one of the methods outlined above.
- **PRESS 'SYSTEM SETUP' on the Extended Menu of the Moisture Monitor Pro**
- ENTER the password (**6853**)
- USE the arrow keys to scroll down to Network Settings
- PRESS 'Enter'
- SELECT the 'IP Address:' section and enter the address. Then press Enter.

The IP Address recorded in the previous section has four numbers separated by dots.

- For example: 192.168.1.113

ENTER the first three numbers and REPLACE the fourth with the number 26.

- For example: 192.168.1.26

- Once the IP Address has been input, SELECT 'NET MASK'

ENTER the subnet mask obtained recorded in the previous section.

- For example: 255.255.255.0

- Once the Net Mask has been inputted, PRESS 'Enter'
- SELECT 'GATEWAY'

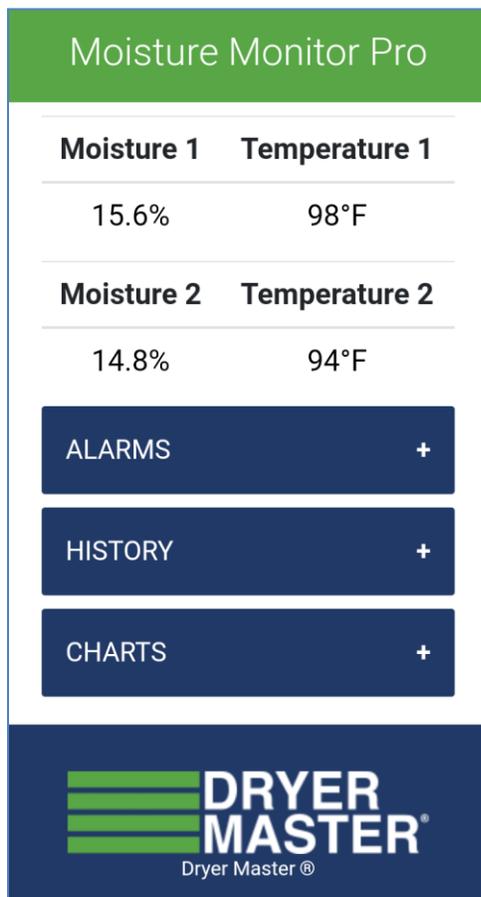
ENTER the first three numbers and REPLACE the fourth with the number 1.

- For example: 192.168.1.1

- Once the Gateway Address has been entered, press Back and then ESC to return to the extended menu.

Running the Web App

- OPEN any web browser on the device (e.g., tablet, phone, and laptop) that is connected to the local network by Wi-Fi or Ethernet.
 - **ENSURE the device is not connected to mobile data.**
- In the URL Address Bar of the browser, TYPE the same IP Address that was entered on the Moisture Monitor Pro, followed by: /mmp.html
 - Referring to the previous example, the URL would be: **192.168.2.26/mmp.html** . If you get an error after login, it may be because you did not add the "/mmp.html" after the IP address.
- A login screen will appear and then enter your login and password.
 - **Username: mmp**
 - **Password: dryermaster**
- The Web App should now be visible on the device:



Appendix 2: Setting up a SCADA Network

Moisture Monitor Pro Tutorial

Setting up a SCADA Network

Preface

The tutorial will provide step-by-step direction on a Client to the MODBUS TCP/IP Server that is made available on the PLC.

Requirements

- Moisture Monitor Pro PLC
- Ethernet cable (to connect the PLC to a local network router)
- A client device (such as a: an Allen-Bradley PLC) connected to a local network router by Wi-Fi or Ethernet

Step 1: Connect the Moisture Monitor Pro to the Local Network

- Use an Ethernet cable to connect the Moisture Monitor Pro to a local network router.
- On the Moisture Monitor Pro: **MENU > SYSTEM SETUP > NETWORK SETTINGS**
- Enter the IP Address, Net Mask and Gateway of the Local Network
 - For help on this, see Appendix 1: Connecting to the web app

Step 2: Configure Client to Request Data from the Server

Program the Client PLC to make requests according to one of these addressing schemes:

- **Modicon 6-Digit Addressing**
- **Decimal Addressing**
- **Hexadecimal Addressing**

Transmission bit ordering is Big-Endian (MSB first).

See Appendix A for TCP/IP Server Address Mapping.

Step 3: Setup Client-Side Data Logging

Typically, the Client PLC can be setup to display live data on a custom HMI unit or to log data files from the SCADA network. Common types of data logging may include:

- Historical Info Logger
 - Records sensor data at a predefined interval or based on an external trigger event.
- Sensor Calibration Logger
 - Records data based on the rising-edge of the server-side calibration completion trigger. This event signal can be accessed independently for each calibration routine (see Address Mapping Table at the end of this tutorial).

Example Client PLC Program

Screen One : Sensor 1 - Info Registers

MODBUS TCP/IP		11 : 16
SENSOR 1 - INFO REGISTERS		
403062 -- ProdName		CORN
403500 -- Moist_S1		16.5 %
403502 -- Temp_S1		98 °
003002 -- DegreeF		F
304046 -- RTC_HOUR		11
304045 -- RTC_MIN		15



Screen Two: Sensor 2 - Info Registers

MODBUS TCP/IP		11 : 16
SENSOR 2 - INFO REGISTERS		
414092 -- ProdName_s2		CORN
414014 -- Moist_S2		15.1 %
414026 -- Temp_S2		89 °
003002 -- DegreeF		F
304046 -- RTC_HOUR		11
304045 -- RTC_MIN		16





Screen Three: Sensor 1 - Alarm Registers

MODBUS TCP/IP 11 : 16

SENSOR 1 - ALARM REGISTERS

- 403311(b1) -- MHALbit (Moisture Critical High)
- 403311(b2) -- MHWLbit (Moisture Warning High)
- 403311(b3) -- MLWLbit (Moisture Warning Low)
- 403311(b4) -- MLALbit (Moisture Critical Low)
- 403311(b5) -- THALbit (Temperature Critical High)
- 403311(b6) -- THWLbit (Temperature Warning High)
- 403311(b7) -- TLWLbit (Temperature Warning Low)
- 403311(b8) -- TLALbit (Temperature Critical Low)

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Screen Four: Sensor 2 - Alarm Registers

MODBUS TCP/IP 11 : 16

SENSOR 2 - ALARM REGISTERS

- 403311(b9) -- MHALbit_s2 (Moisture Critical High)
- 403311(b10) -- MHWLbit_s2 (Moisture Warning High)
- 403311(b11) -- MLWLbit_s2 (Moisture Warning Low)
- 403311(b12) -- MLALbit_s2 (Moisture Critical Low)
- 403311(b13) -- THALbit_s2 (Temperature Critical High)
- 403311(b14) -- THWLbit_s2 (Temperature Warning High)
- 403311(b15) -- TLWLbit_s2 (Temperature Warning Low)
- 403311(b16) -- TLALbit_s2 (Temperature Critical Low)

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Screen Five: Sensor 1 – Calibration Registers

MODBUS TCP/IP 11 : 16

SENSOR 1 - CALIBRATION REGISTERS

003140 -- SCADA_CAL_TRIG	ON
403712 -- Online_Sample	13.2 %
403714 -- Manual_Sample	13.1 %
403202 -- tmp_VDC	2.4
403140 -- mst_slp	5.0
403100 -- mst_off	-0.2

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Screen Six: Sensor 2 – Calibration Registers

MODBUS TCP/IP 11 : 16

SENSOR 2 - CALIBRATION REGISTERS

003160 -- SCADA_CAL_TRIG_s2	ON
414212 -- Online_Sample_s2	15.1 %
414214 -- Manual_Sample_s2	15.3 %
414012 -- tmp_VDC_s2	2.3
414038 -- mst_slp_s2	5.0
414042 -- mst_off_s2	0.1

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MODBUS TCP / IP Server Address Mapping (Page 1 of 2)

Modicon 6-Digit Addressing	Decimal Addressing	Hexadecimal Addressing	Address Name	Address Description	Data Size	Bit Length	Live Data	History Data	Calibration Data
304046	ROR 04045	ROR 0FCD	RTC_HOUR	PLC Time - in hours	WORD	16	✓	✓	✓
304045	ROR 04044	ROR 0FCC	RTC_MIN	PLC Time - in minutes	WORD	16	✓	✓	✓
403062	RWR 03061	RWR 0BF5	ProdName	Sensor 1 - Product Number 0 = Corn 1 = Beans 2 = Wheat 3 = Canola 4 = Barley 5 = Malt Barley 6 = Oats 7 = Rice 8 = Sorghum 9 = Sunflower 10 = Lentils 11 = Chickpeas 12 = Peas 13 = Other 1 14 = Other 2 15 = Other 3	WORD	16	✓	✓	✓
403500	RWR 03499	RWR 0DAB	Moist_S1	Sensor 1 - Moisture Percentage	DOUBLE-WORD	32	✓	✓	-
403502	RWR 03501	RWR 0DAD	Temp_S1	Sensor 1 - Temperature Degree	DOUBLE-WORD	32	✓	✓	-
414092	RWR 14091	RWR 370B	ProdName_s2	Sensor 2 - Product Number 0 = Corn 1 = Beans 2 = Wheat 3 = Canola 4 = Barley 5 = Malt Barley 6 = Oats 7 = Rice 8 = Sorghum 9 = Sunflower 10 = Lentils 11 = Chickpeas 12 = Peas 13 = Other 1 14 = Other 2 15 = Other 3	WORD	16	✓	✓	✓
414014	RWR 14013	RWR 36BD	Moist_S2	Sensor 2 - Moisture Percentage	DOUBLE-WORD	32	✓	✓	-
414026	RWR 14025	RWR 36C9	Temp_S2	Sensor 2 - Temperature Degree	DOUBLE-WORD	32	✓	✓	-

MODBUS TCP / IP Server Address Mapping (Page 2 of 2)

Modicon 6-Digit Addressing	Decimal Addressing	Hexadecimal Addressing	Address Name	Address Description	Data Size	Bit Length	Live Data	History Data	Calibration Data
003002	RWB 03001	RWB 0BB9	DegreeF	Temperature Symbol 0 = C 1 = F	BIT	1	✓	✓	-
403311	RWR 03310	RWR 0CEE	MHALbit	Sensor 1 - Moisture - Critical High	WORD	16	✓	-	-
			MHWLbit	Sensor 1 - Moisture - Warning High			✓	-	-
			MLWLbit	Sensor 1 - Moisture - Warning Low			✓	-	-
			MLALbit	Sensor 1 - Moisture - Critical Low			✓	-	-
			THALbit	Sensor 1 - Temperature - Critical High			✓	-	-
			THWLbit	Sensor 1 - Temperature - Warning High			✓	-	-
			TLWLbit	Sensor 1 - Temperature - Warning Low			✓	-	-
			TLALbit	Sensor 1 - Temperature - Critical Low			✓	-	-
			MHALbit_s2	Sensor 2 - Moisture - Critical High			✓	-	-
			MHWLbit_s2	Sensor 2 - Moisture - Warning High			✓	-	-
			MLWLbit_s2	Sensor 2 - Moisture - Warning Low			✓	-	-
			MLALbit_s2	Sensor 2 - Moisture - Critical Low			✓	-	-
			THALbit_s2	Sensor 2 - Temperature - Critical High			✓	-	-
			THWLbit_s2	Sensor 2 - Temperature - Warning High			✓	-	-
TLWLbit_s2	Sensor 2 - Temperature - Warning Low	✓	-	-					
TLALbit_s2	Sensor 2 - Temperature - Critical Low	✓	-	-					
003140	RWB 03139	RWB 0C43	SCADA_CAL_TRIG	Sensor 1 - Calibration In-Progress 0 = OFF 1 = ON	BIT	1	-	-	✓
403712	RWR 03711	RWR 0E7F	Online_Sample	Sensor 1 - Online Sample	DOUBLE-WORD	32	-	-	✓
403714	RWR 03713	RWR 0E81	Manual_Sample	Sensor 1 - Manual Sample	DOUBLE-WORD	32	-	-	✓
403202	RWR 03201	RWR 0C81	tmp_VDC	Sensor 1 - Temperature Voltage	DOUBLE-WORD	32	-	-	✓
403140	RWR 03139	RWR 0C43	mst_slp	Sensor 1 - Moisture Slope	DOUBLE-WORD	32	-	-	✓
403100	RWR 03099	RWR 0C1B	mst_off	Sensor 1 - Moisture Offset	DOUBLE-WORD	32	-	-	✓
003160	RWB 03159	RWB 0C57	SCADA_CAL_TRIG_s2	Sensor 2 - Calibration In-Progress 0 = OFF 1 = ON	BIT	1	-	-	✓
414212	RWR 14211	RWR 3783	Online_Sample_s2	Sensor 2 - Online Sample	DOUBLE-WORD	32	-	-	✓
414214	RWR 14213	RWR 3785	Manual_Sample_s2	Sensor 2 - Manual Sample	DOUBLE-WORD	32	-	-	✓
414012	RWR 14011	RWR 36BB	tmp_VDC_s2	Sensor 2 - Temperature Voltage	DOUBLE-WORD	32	-	-	✓
414038	RWR 14037	RWR 36D5	mst_slp_s2	Sensor 2 - Moisture Slope	DOUBLE-WORD	32	-	-	✓
414042	RWR 14041	RWR 36D9	mst_off_s2	Sensor 2 - Moisture Offset	DOUBLE-WORD	32	-	-	✓

